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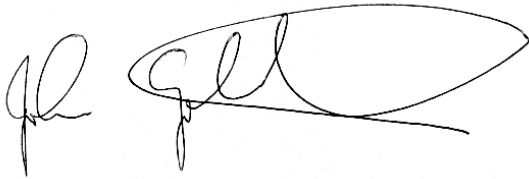
**Cosmos, culture and landscape:  
Documenting, learning and sharing Aboriginal  
astronomical knowledge in contemporary society**

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This thesis is presented for the Degree of  
Doctor of Philosophy  
of  
Curtin University

**1st May 2014**

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgement has been made. This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

A handwritten signature in black ink, consisting of a small 'JG' on the left and a larger, more stylized 'Goldsmith' on the right, all written in a cursive script.

Signed: John Goldsmith

Date: 1 May 2014

## Dedication

To our Elders,  
past, present and future,  
of both Aboriginal and non-Aboriginal communities,  
who wish to share their knowledge for the benefit of  
today's and tomorrow's  
generations.

## Notice

Aboriginal and Torres Strait Islander people are respectfully advised that this document and its appendices contain the names and images of persons who have passed away, which may cause distress.

# Abstract

This PhD thesis presents Australian Aboriginal astronomical knowledge, its documentation, sharing and communication, with an emphasis on contemporary collaborations. The research is primarily focussed on the Murchison region (associated with Murchison Radio-astronomy Observatory), East Kimberley (Wolfe Creek Crater) and the South West of Western Australia.

Issues regarding the communication and sharing of Aboriginal astronomical knowledge are identified and addressed. The main issues relating to this study include: (1) the night sky as a means of bringing people together; (2) maintaining and passing on valued knowledge; (3) research ethics/permissions; (4) sharing knowledge beyond Aboriginal communities; (5) interviews in language or English; (6) interpretation; (7) facilitating Aboriginal people to speak for themselves; (8) the dynamic nature of stories and knowledge; (9) dealing with sensitive or restricted cultural information; (10) issues relating to recently deceased people; (11) management of intellectual property; and (12) practical issues / travel / logistics. Twenty eight examples in nine categories illustrate the ways in which people engage with Australian Aboriginal astronomical knowledge. Contemporary examples include art exhibitions, artworks and performance events, films and documentaries, cultural experiences, monuments, planetarium programs, conferences, strategic documents and prizes, educational programs, currency, symbolic applications and global initiatives.

Culturally appropriate collaborations have been implemented to document contemporary Aboriginal astronomical knowledge, based on video interviews with 27 Aboriginal elders, artists, scientists, researchers and people with a key interest in Aboriginal sky knowledge. Previously unrecognised Aboriginal knowledge of the night sky is documented. The ICRAR / Yamaji Art collaboration, *“Ilgarijiri- Things Belonging to the Sky”*, is presented as a case study, featuring astronomically themed Aboriginal art. The research has applied data mining techniques to investigate online catalogues of Western Australian Aboriginal art. New and original results from the review of almost 6000 online artworks from nineteen Western Australian online galleries shows that about 2% of Western Australian Aboriginal art contains readily identifiable astronomical themes, and of those (n=119) the main themes are Seven Sisters/Pleiades (76%), meteorite craters (6%) and the moon (6%). The use of online data mining represents an innovative and highly efficient way of data collection for this research.

Chapter 3 examines and applies the use of survey methodologies to assess knowledge, attitudes & beliefs relating to astronomy, and awareness in relation to Aboriginal Astronomy initiatives, with a focus on Western Australian populations. The three surveys applied are: (1) The Post International Year of Astronomy (IYA) 2009 Survey (n=97); (2) The Sky in Our Lives Survey (n=45); and (3) The Aboriginal Astronomy Symposium survey (n=13), where n is the number of survey respondents. Whilst the survey response rates have precluded detailed statistical analysis, the survey results provide

useful insights, derived from the quantitative and qualitative data. These surveys indicate a generally low level of awareness of Aboriginal astronomical knowledge in the survey respondents, indications that such knowledge is valued, and beliefs that such knowledge should be recorded for the benefit of future generations.

The Post IYA 2009 Survey investigated astronomical knowledge (in general) and the awareness of respondents regarding Aboriginal astronomy, during the International Year of Astronomy (IYA) 2009. The survey found that more than half of the Western Australia adults surveyed (53.8%) knew that 2009 was the International Year of Astronomy, however, the awareness of WA students was much lower, at 28.1%. Of the 97 respondents, 17.5% gave specific details regarding their knowledge of Aboriginal astronomy. Of those people who participated in Aboriginal astronomy events during IYA 2009, 85% reported that their awareness of Aboriginal astronomy was raised.

This research has conducted the largest known application in Australia of the international survey “The Sky in Our Lives”, to date. The survey assesses demographics, direct experience with the night sky, attachment to the sky, astrology and an astronomy attitude survey. Data from South Africa is analysed with the Australian survey results, for comparative purposes, and the Australian survey (n=45) is approximately double the size of the South African survey data (n=23). Due to the small response rate for both surveys, detailed statistical analysis has been precluded and the results are applicable to the survey populations only. Results are not generalised to broader populations.

A total of 60.8% of the Australian survey respondents correctly named eight planets, and 15.5% correctly named three or more asteroids (contrasting to 8.7% and 0.0% of the African survey respondents respectively). The extent to which spiritual/religious and cultural beliefs shape respondents was assessed via summed likert scales. Australian survey respondents indicated that 77.2% were not affected at all, or very little, by spiritual/religious beliefs in relation to attitudes, practices, stories and knowledge about the night sky (contrasting to 32.6% of the African survey respondents). Likewise, the Australian survey respondents indicated that 74.5% were not affected at all, or very little, by cultural beliefs (compared to 32.6% in the South African survey).

The Aboriginal Astronomy Symposium survey (n=13) surveyed participants who are well informed “expert” people, with a strong interest in Aboriginal culture. The survey results demonstrated that respondents (92.3%) greatly valued cultural and Aboriginal knowledge relating to the night sky and believed that Aboriginal sky knowledge should be recorded for the benefit of future generations. 84.6% believe most people have little understanding of Aboriginal sky knowledge. The views should be taken as a strong indicator regarding the value of cultural knowledge associated with the night sky, and the need to document, investigate and appreciate it further.

The Post IYA 2009 survey, The Sky in Our Lives survey and the Aboriginal Astronomy Symposium surveys successfully identified several examples of Aboriginal sky knowledge or cultural astronomy

knowledge. However, survey responses were typically concise. The inherent methodological constraints of survey based quantitative data collection are acknowledged. Qualitative data collection methods are used in Chapters 4 and 5, with methodology that enables in-depth investigation of Aboriginal astronomy knowledge, attitudes and beliefs.

Chapter 4 presents the most extensive firsthand accounts (based on video interviews) of Aboriginal people in Western Australia, related to astronomical knowledge, and the collaborative initiatives associated with the Murchison Radio-astronomy Observatory. New insights into Aboriginal astronomical knowledge associated with Wolfe Creek Crater are presented, and a unique account of the *Ilgarijiri* interaction between scientists and Aboriginal artists and elders. In relation to Wolfe Creek Crater, the study has found evidence of contemporary Aboriginal cultural knowledge specifically relating to the crater, and more generally, of personal knowledge by Aboriginal people of the night sky. The study has documented evidence of Aboriginal people aware of rare astronomical phenomena (acoustic effects associated with large meteors) and the active observation of such events, by deliberate listening for the “coolungmurru” after a large meteor has been seen. Cultural beliefs associated with the Large and Small Magellanic Clouds have been documented, in addition to evidence of several star patterns, including the Emu, the Man (hunting), the Kangaroo, Yilgarn, and the desert lizard footprint (“kalarkarr”) which corresponds to Orion's belt and Great Orion Nebula, as well as evidence of the adoption of a relatively new star pattern, called the “camel”. Accounts are presented regarding East Kimberley beliefs associating the sight of a large meteor, and the immanent passing of a community member.

This research has documented numerous examples of publically available Aboriginal knowledge of the night sky. The evidence and findings, particularly arising from the *Ilgarijiri* collaboration, demonstrates that Aboriginal sky knowledge provides cross-cultural educational and reconciliation opportunities between Aboriginal and non-Aboriginal people. Aboriginal artists and Elders participating in *Ilgarijiri* reported numerous positive benefits with their experience in collaborating with radio astronomy scientists, and cross-cultural sharing of knowledge. The research identified several examples of Aboriginal leaders encouraging Aboriginal people to document and share their own knowledge, with non-Aboriginal communities in Australia. The ICRAR/Yamaji Art collaboration *Ilgarijiri- Things Belonging to the Sky* has acted as an important catalyst to link Aboriginal and non-Aboriginal cultures.

Factors that contribute toward successful collaborations and communication of Aboriginal sky knowledge are identified; including: (1) leadership and motivation; (2) consultation and collaboration; (3) interdisciplinary skills amongst the project team; (4) project scale; (5) utilisation and harnessing of emerging technologies; (6) orientation towards education and research; (7) multi-format productions; (8) alignment to “big issues”; and (9) logistics and resourcing. Australian and international case studies are examined in relation to contrasting examples of the communication of Aboriginal sky knowledge.

Digital imaging technology has been harnessed as both a documentary tool and to develop new visual resources. Methods including conventional digital photography, astronomical timelapse, and 360° virtual reality imaging have created extensive digital imaging resources of Wolfe Creek Crater, the Murchison Radio-astronomy Observatory, Wave Rock, Mulka's Cave, the Claisebrook “Bibbulmun Dreaming” site and other sites of contemporary importance relating to Aboriginal sky knowledge. These new and original resources provide innovative ways of documenting and sharing Aboriginal knowledge of places that have astronomical significance.

The digital imaging resources have been applied to create three new and original educational resources. The first presents Aboriginal and scientific views relating to Wolfe Creek Crater. The production has been developed as a public video exhibit for the Cosmology Gallery (via support from the inaugural 2011 De Laeter Science Engagement Scholarship). The exhibit features innovative digital image documentation methods of Wolfe Creek Crater. The second resource is a video production featuring Aboriginal artists involved in the *Ilgarijiri- Things Belonging to the Sky* collaboration (and accompanied the 2012 European tour of *Ilgarijiri* to the Netherlands, Belgium and Germany). The third original and new resource is the *Cosmos, Culture and Landscape* virtual tour of Western Australian landscapes that feature prominently in relation to Aboriginal knowledge of the night sky. The virtual tour featured in a national video link up with remote schools, used as an educational tool.

Research findings are presented in 130 figures, 89 tables, 18 appendices, three surveys, transcribed interviews with 27 participants, several case studies, three video productions and one virtual tour (supplied on DVD disk).

The lessons learnt, insights gained, awareness of sensitivities and collaborative approaches explored via this study, offer a collaborative way forward for effective and successful cross-cultural Aboriginal sky knowledge research.





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## Statement of Candidate Contribution

Chapter 1: Information regarding radio astronomy developments in Australia are sourced from research and publications from ICRAR, CSIRO and the Commonwealth of Australia. The conference poster (Goldsmith, 2010) was based upon Chapter 1 and Chapter 2. Figure 1 (AIATSIS / Horton 1996) is reproduced with permission of AIATSIS.

Chapter 2: Provides an extensive review and discussion of various projects that have presented, shared and communicated various aspects of Aboriginal astronomical knowledge. Copyright content (reproduced with permission) includes ICRAR, Gravity Discovery Centre Foundation, Horizon Planetarium, CAAMA / Ronin Films, Australian Academy of Science & Barnaby Norris. Section 2.3.1 presents new data generated from a data mining exercise of online Aboriginal art galleries (primarily commercial galleries). The specific online galleries are detailed in section 2.3.1. and Appendix 2. The conference poster, Goldsmith, Tingay and Hamacher (2011), is largely (>80%) based on Chapter 2, with contributions by Tingay and Yamaji Art including the “*Ilgarijiri*” poster, and presentation (conference talk) by Duane Hamacher at the 9th “Oxford” International Symposium of Archaeoastronomy, Peru.

Chapter 3: Jarita Holbrook's work in the development and application of “The Sky in Our Lives” survey is acknowledged. It forms the basis of section 3.4. This research applies the survey to a primarily Australian context, and is the largest known application of the survey in Australia to date. Jarita Holbrook provided survey data collected in South Africa and this is used and analysed here to provide comparative data. The IYA 2009 and Aboriginal Astronomy Symposium surveys were developed as part of this research, with primary guidance from Professor Steven Tingay. AIATSIS provided administrative support for the application of the Aboriginal Astronomy Symposium survey at AIATSIS, 2009.

Chapter 4: Some content in Chapter 4 provides the basis for the conference poster, Goldsmith, Tingay and Hamacher (2011). The majority of the paper was developed by John Goldsmith, and presented by Duane Hamacher at the Oxford Symposium, Lima, Peru (January 2011).

Chapter 5: The new and original digital imaging resources, including timelapse and 360° imaging presented in Chapter 4, is used to develop visual resources for the production of three new Aboriginal astronomy resources (gallery exhibit video, exhibition video and virtual tour). Results were presented in a conference poster at the 34th International Geological Congress, Brisbane, Australia in August 2012 (Goldsmith & Brocx, 2012). Margaret Brocx contributed the poster content regarding geoheritage. Appropriate acknowledgements are included throughout Chapter 5.

Chapter 6: Conference posters Goldsmith, Tingay and Hamacher (2011), and Goldsmith & Brocx (2012) are based upon the concluding contents of Chapter 6.



**This research has produced several papers, conference posters  
and a book chapter. Examples include:**

Goldsmith, J. 2010, "Sharing and communicating Indigenous astronomical and sky knowledge". Poster presented at the Astronomical Society of Australia annual science meeting, Hobart, July 2010.

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Goldsmith, J., Tingay, S., & Hamacher, D. 2011, "Building bridges between cultures, communicating and sharing Australian Indigenous sky knowledge". Poster presented at the ninth "Oxford" International Symposium on Archaeoastronomy, Lima, Peru, January 2011.

Goldsmith, J., & Brocx M. 2012, "A virtual tour exploring Wolfe Creek Meteorite Crater's geoheritage, cultural and educational values". Poster presented at the 34th International Geological Congress (IGC): Brisbane, Australia, 5 – 10 August 2012.

# Chapter 1

## Introduction and motivation

*“Our Universe is rich, fascinating, and meaningful,  
and in it we humans occupy an extraordinary place”.*

“The View from the Centre of the Universe”,  
Primack & Ellen Abrams (2006, 3).

Research from Chapter 1 has been presented as a conference poster:

Goldsmith, J. 2010, “Sharing and communicating Indigenous astronomical and sky knowledge”. Poster presented at the Astronomical Society of Australia annual science meeting, Hobart, July 2010.

### 1.1 Introduction

This PhD research project presents the results of “Cosmos, culture and landscape: Documenting, learning and sharing Aboriginal astronomical knowledge in contemporary society”. This study investigates the ways in which Aboriginal astronomical and sky knowledge is documented and ways in which this knowledge is learned and shared in contemporary society. This thesis presents a significant contribution towards the emerging field of research into contemporary Aboriginal astronomical knowledge. The thesis research is based upon and has developed from a unique context, with increased public attention relating to astronomy arising from the International Year of Astronomy (2009), the first national symposium on Aboriginal astronomy, held in 2009, and major new radio astronomy developments taking place in Western Australia, in collaboration with local Aboriginal communities. The study focuses on three geographic areas in Western Australia, namely the South West of Western Australia, the Murchison Region and the vicinity of Wolfe Creek Crater, Kimberley.

This study comes at a time in which major astronomy research projects are being developed in Western Australia, such as the Australian Square Kilometre Array Pathfinder (ASKAP) (Johnston et al., 2007) and the Murchison Widefield Array (MWA) (Tingay et al., 2012, Lonsdale et.al. 2009), the fore-runners for the \$2 billion Square Kilometre Array radio telescope project (Dewdney et al. 2009), which will be shared between Australia and Southern Africa.

At the same time, local Aboriginal communities in Western Australia, in the vicinity of the ASKAP and MWA radio telescope projects, have maintained cultural knowledge relating to the night sky and

astronomy, from both urban and regional communities. However, this knowledge is generally poorly understood by the broader community. As a result, there is a unique opportunity to engage with, share and learn about Aboriginal cultural views of the night sky, and understand these views alongside scientific approaches. Learning about our fellow cultures, collaborating together, and respecting Aboriginal and scientific knowledge are examples of practical efforts towards Reconciliation between Aboriginal and non-Aboriginal people in Australia (National Capital Authority, n.d.). From a global perspective, these approaches of sharing astronomical knowledge between the world's cultures formed the basis of the International Year of Astronomy 2009 and this has played a critical role in the current research, which we will explore in greater detail later.

There are numerous ways in which people can engage with and learn about the different cultural views of the cosmos in general, and Aboriginal astronomy in particular. These include exhibitions, art projects, story-telling and site visits to name just a few. Examples include Aboriginal astronomy research (Norris & Norris 2009, Cairns & Harney 2003, Norris 2010) and public art exhibits based on Aboriginal astronomy such as exhibits held at the Cosmology Gallery, Gravity Discovery Centre (GDCE, 2008). The sharing of Aboriginal creation stories, which include elements of astronomical knowledge, is highlighted by the work of Noel Nannup (2004, 2006). There are also several international examples which focus on the link between culture (including Aboriginal culture) and the astronomical. A contemporary example of this is “The World At Night” initiative, which uses astronomical photography to document astronomical events together with culturally significant places (Simmons & Tafreshi, 2008).

Aboriginal knowledge is complex and multifaceted. It draws upon an ancient history of Aboriginal cultures in Australia, and is based on knowledge gained from personal experience and shared community based knowledge. Such knowledge is influenced by a number of factors, including the historical context of a given community, and the attitudes and beliefs of community members. In some cases, such knowledge is passed down from generation to generation, shared within families and communities, and reinterpreted in our contemporary environment. It is a dynamic field of knowledge, not static, and one that can provide insights into how people interpret and make sense of the various aspects of our natural and cultural world. Aboriginal astronomical and sky knowledge is the focus of the current research, and is the field of knowledge that relates primarily to:

- **Astronomical objects.** The Sun, Moon, Milky Way, planets, stars, meteors, comets and other astronomical objects.
- **Astronomical phenomena.** Transient events including eclipses, aurora (southern lights), meteor showers.

and to a lesser extent:

- **Atmospheric effects.** Non-astronomical sky phenomena (e.g. weather and atmospheric effects).

Of particular interest here is the opportunity of documenting, and better understanding, Aboriginal knowledge associated with the night sky, and the landscape from which such knowledge is intimately bound and related to. Traditional scientific approaches regarding astronomy tend to establish the

astronomical subject as the object of study, which is inherently something distant and remote from the “observer” and terrestrial landscapes on which we live. However, many Aboriginal communities (in Australia and elsewhere), tend to have a more relational and holistic approach to both the terrestrial landscape and the astronomical “sky-scape”. It is this territory of the land and sky and its intimate relation that I will explore in this thesis. I examine how Aboriginal knowledge of the night sky is being communicated and shared. I document such knowledge, in culturally appropriate ways and in collaboration with Aboriginal Elders, artists and community members. I examine the interactions and collaboration between Aboriginal and non-Aboriginal people working together, in which both gain a greater appreciation of scientific and Aboriginal sky knowledge. The insights of the *“Ilgarijiri- Things Belonging to the Sky”* project, and its relation to major radio astronomy development in Western Australian is examined. I harness the capabilities of advanced digital imaging, to create new and substantial documentary resources of landscapes that have special significance in relation to Aboriginal sky knowledge. Finally, I apply insights gained from this original research, to the development of new resources, that help to document and communicate Aboriginal sky knowledge.

## **1.2 Background and context**

Firstly, a context is established regarding contemporary Aboriginal culture in Australia, then a context is provided for contemporary astronomy, from international, national and Western Australian perspectives, and finally, research into Aboriginal astronomical and sky knowledge in Australia is introduced.

### **1.2.1 Australian Aboriginal culture**

#### **1.2.1.1 Historical context**

Research into the dating of the first Australians indicate that Australian Aboriginal culture is at least 42,000-48,000 years old (Gillespie, 2002). Aboriginal culture in Australia represents what could be the longest continuous culture in the world. Considerable research on many aspects of Aboriginal culture has been conducted in Australia. The primary repository of such knowledge is the Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS) located in Canberra. The first contact between early European explorers, and the subsequent colonisation of Australia by the British, in 1788, has resulted in profound and far reaching changes to virtually all aspects of Aboriginal life. Popular accounts of Aboriginal culture and the changes brought on by colonisation have been presented in the SBS documentary “First Australian's” (SBS, first broadcast in 2008). These impacts have included dispossession of land, impact by disease, and overt conflict. These have resulted in profound and long lasting impacts on Aboriginal communities to the present day. One indicator of such impacts is the 20 year discrepancy in life expectancy, between Aboriginal and non-Aboriginal Australians (Australian Bureau of Statistics, 2002 & 2010).

#### **1.2.1.2 Aboriginal population and diversity in Australia**

The Aboriginal population of Australia (Aboriginal and Torres Strait Islander people) accounts for some 517,000 people, or 2.6% of the total Australian population (ABS, 2010). There is a considerable diversity

of language groups within the Australian Aboriginal population. This diversity is illustrated by the large number of language groups recognised within Australia, as shown in Figure 1.

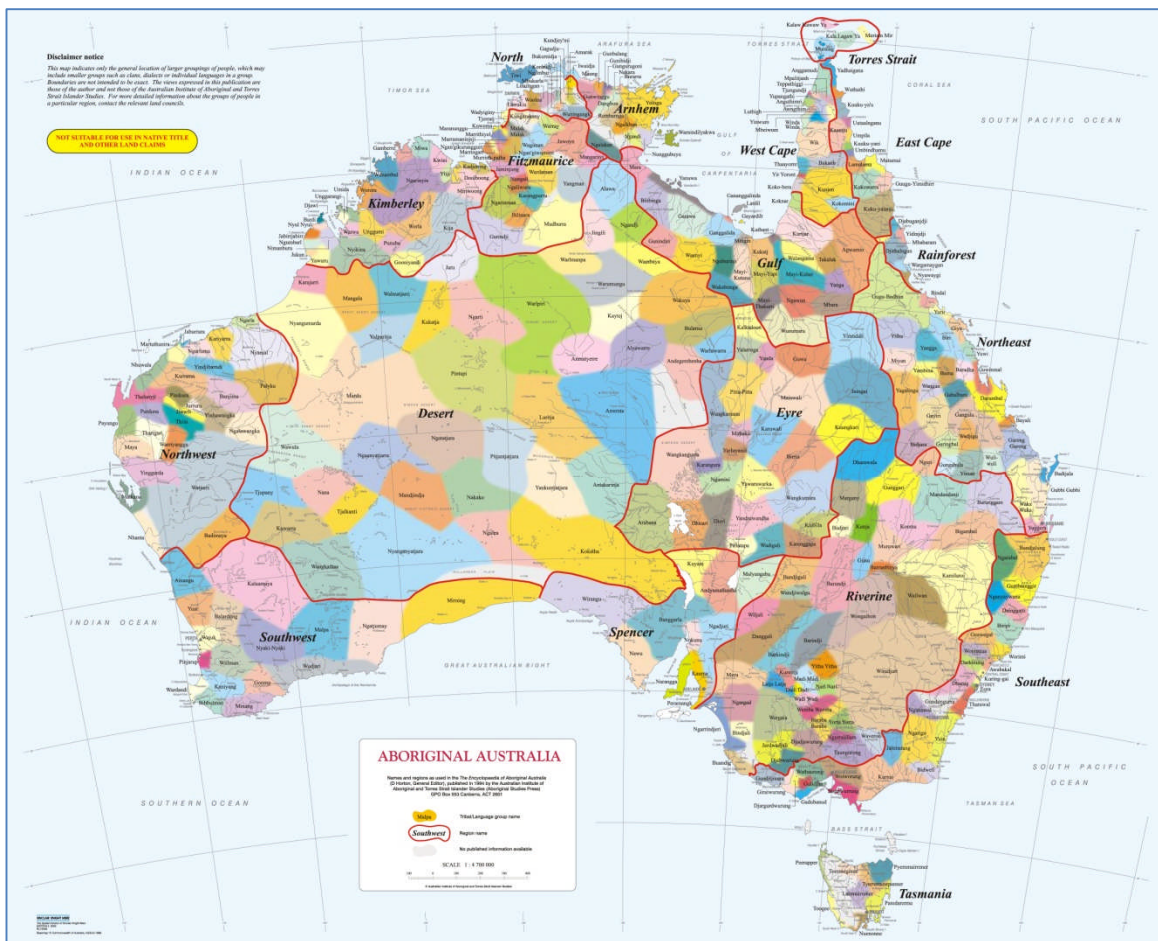


Figure 1. Aboriginal language groups in Australia.

(Horton, 1996)

Figure 1 is reproduced with permission of AIATSIS / Aboriginal Studies Press subject to the following explanatory statement to accompany Figure 1: This map is just one representation of many other map sources that are available for Aboriginal Australia. Using published resources available between 1988–1994, this map attempts to represent all the language, social or nation groups of the Indigenous people of Australia. It indicates only the general location of larger groupings of people which may include smaller groups such as clans, dialects or individual languages in a group. Boundaries are not intended to be exact. This map is NOT SUITABLE FOR USE IN NATIVE TITLE AND OTHER LAND CLAIMS. David R Horton, creator, © Aboriginal Studies Press, AIATSIS and Auslig/Sinclair, Knight, Merz, 1996. No reproduction allowed without permission.

Many of the language groups shown in Figure 1 are now no longer in active use, or are actively used by very small populations. As a result, decline and loss of Aboriginal languages is a key issue, with various efforts aimed at preserving, documenting and renewing Aboriginal languages.

### **1.2.1.3 Reconciliation: a major contemporary theme for Australia**

One of the major modern day social processes to help address the issues of disparity and disadvantage faced by many Aboriginal communities and individuals in Australia is the process of Reconciliation. The process of Reconciliation was formally adopted by the Commonwealth of Australia, via the *Council for Aboriginal Reconciliation Act 1991*, which established the Council as a statutory authority in 1991 (Council for Aboriginal Reconciliation 2000). The Council defined eight issues essential to the process of Reconciliation, namely:

- *a greater understanding of the importance of land and sea in Aboriginal and Torres Strait Islander societies.*
- *better relationships between Aboriginal and Torres Strait Islander peoples and the wider community.*
- *recognition that Aboriginal and Torres Strait Islander cultures and heritage are a valued part of the Australian heritage.*
- *a sense for all Australian's of a shared ownership of our history.*
- *a greater awareness of the causes of disadvantage that prevent Aboriginal and Torres Strait Islander peoples from achieving fair and proper standards in health, housing, employment and education.*
- *a greater community response to addressing the underlying causes of the unacceptably high levels of custody for Aboriginal and Torres Strait Islander peoples.*
- *greater opportunity for Aboriginal and Torres Strait Islander peoples to control their destinies.*
- *agreement on whether the process of reconciliation would be advanced by a document or documents of reconciliation.* (Council for Aboriginal Reconciliation 2000, chap. 2).

A major step in the Reconciliation process was the formal Australian Government apology to Aboriginal people of Australia, by the then Prime Minister Kevin Rudd, in 2008. Known generally as the “Apology to the Stolen Generation”, this apology is a milestone in the reconciliation process. Since that time, many Aboriginal and non-Aboriginal people, communities, and organisations have been working towards finding practical steps to help address Aboriginal disadvantage in Australia, and to encourage greater opportunities, self-determination, employment, leadership and cultural renewal. One such example of this is the GenerationOne initiative, which sets out its goal: “*to bring all Australians together to end the disparity between Indigenous and non-Indigenous Australians in one generation- our generation*” (GenerationOne, 2013, par. 1).

From this context, this research is part of my (and my supervisors) contribution towards encouraging understanding, appreciation and respect for Aboriginal culture in Australia in general, and Aboriginal sky knowledge in particular.

## **1.2.2 Contemporary astronomy**

### **1.2.2.1 The International Year of Astronomy 2009**

The year 2009 marked 400 years since Galileo turned his telescope skyward for astronomical observation, and the anniversary was celebrated globally as The International Year of Astronomy 2009 (IYA 2009). The proposal for the declaration of the IYA 2009 was endorsed by UNESCO, and later proclaimed by the United Nations. Many countries developed initiatives to showcase and celebrate astronomy. By the end of IYA 2009, it is estimated that some 815 million people experienced or participated in IYA 2009 events (International Astronomical Union, 2010). IYA 2009 achieved a very substantial global participation in astronomy events, with most nations participating in IYA 2009 (International Astronomical Union, 2010). IYA 2009 highlighted the very diverse cultural interests and perspectives relating to astronomy from countries around the world, including many historical and contemporary examples. IYA 2009 provided a timely opportunity to reflect on the profound influence astronomy has had on broader society. The goals of the IYA 2009 formed a significant motivation for this PhD thesis. The goals and objectives, which are detailed in Appendix 12, include an emphasis on the communication of scientific results in astronomy, access to fundamental science through the excitement of astronomy and sky observing experiences, supporting and improving informal and formal science education, facilitating new networks, and preserving and protecting the natural heritage of dark skies.

### **1.2.2.2 IAU Symposium 260**

The relation between science, astronomy and culture was a central theme in IYA 2009. One example of this at the commencement of IYA 2009 was the international symposium “The Role of Astronomy in Society and Culture”, International Astronomical Union symposium 260, which was hosted at UNESCO, Paris, France, in January 2009. This major symposium attracted delegates from around the world, with numerous papers presented regarding cultural, Aboriginal and ancient astronomical knowledge and belief, including a presentation by Prof Ray Norris regarding Australian Aboriginal astronomical knowledge. Subsequent to the IAU Symposium 260, other international meetings have focused on the relation and connection between culture, society and science. Examples include the South African science festival, “Scifest Africa 2011”, and “Science Across Cultures” the 6<sup>th</sup> Science Centre World Congress, Cape Town 2011.

### **1.2.2.3 IYA 2009: The Australian context**

The IYA 2009 resulted in a substantial number of astronomy related events conducted in Australia. The World at Night exhibition, featuring a global perspective of astronomical landscape photography, was presented at Sydney and Perth. A special IYA 2009 commemorative edition of Australian currency was issued. Special events featuring astronomical images projected onto buildings took place and various exhibitions were presented with astronomical themes, including the *Ilgarijiri* exhibition of aboriginal art. During IYA 2009, the *Ilgarijiri* exhibition was presented at Geraldton, Perth and Canberra. In addition to events which focussed on the science of astronomy, several IYA 2009 events presented Aboriginal perspectives of the night sky and astronomical phenomena. These are discussed more fully in section 2.3.

#### **1.2.2.4 Contemporary astronomy initiatives in Western Australia**

At a time when major investment is occurring in radio astronomy projects in Australia, there is great interest in research which extends our understanding of the universe. New astronomy facilities are being developed. Radio astronomy projects in Western Australia are currently being developed in relatively remote locations, and will extend over significant areas. These developments will affect local and regional communities, including Aboriginal communities.

Several contemporary astronomy initiatives, ranging in scale from the moderate (\$50M) to very large (\$200M+) have been implemented in Western Australia, in conjunction with substantial effort and planning to attract major astronomy development initiatives, primarily the Square Kilometre Array (SKA) radio telescope project. Examples of the diversity of astronomy related developments include the Australian SKA Pathfinder (ASKAP) radio telescope project, the Murchison Widefield Array (MWA), Perth Observatory, the Gravity Discovery Centre, Gingin Observatory, and the one metre optical Zadko telescope (a robotic telescope involved in the monitoring of Gamma Ray Burst and asteroid studies). The location of the main astronomy facilities in Western Australia are shown in Figure 2.

The SKA is described as “an international radio telescope for the 21<sup>st</sup> century” (ATNF 2013, par.1). The SKA project provides opportunities for the advancement of radio astronomy on a scale never seen before (Dewdney et al. 2009). The multinational collaboration is leading the development of the project in Southern Africa and Australia. In Australia, the project is centred on the Murchison region, in Western Australia. Aboriginal support for the SKA project is evident in the historic Indigenous Land Use Agreement (ILUA), formally agreed to in 2009 (ANZSKA 2009, National Native Title Tribunal 2009).

The Australian SKA Pathfinder (ASKAP) is currently being developed as a world class radio telescope, at the Murchison Radio-astronomy Observatory (MRO), in the Murchison Region of Western Australia. A key function of ASKAP is that of a technology demonstrator, to support and guide the development of the SKA project. ASKAP comprises an array of 36 antennas, 12 metres in diameter.

The Murchison Widefield Array is a new generation low frequency radio telescope, which is currently in development at the MRO. The \$50 million project is one of only three SKA precursors (Tingay et al. 2012). The “aperture array” radio telescope has no moving parts, instead it relies on computing power to point at astronomical objects and process the data it collects from the sky. The telescope has 4,096 antennas, split up into 128 groups of 32, called “tiles”, that are spread, up to 3km apart, in the Murchison.

These radio astronomy assets have been located in Western Australia to take advantage of the very low levels of artificial radio interference afforded by the site. Radio quietness, and maintaining very low levels of radio interference is an important aspect of the radio astronomy initiatives in Western Australia. To this end, a “Radio Quiet Zone” has been established via legislative means, to protect and maintain the radio quiet attributes of the site (Australian Communications and Media Authority 2010, CSIRO 2012).



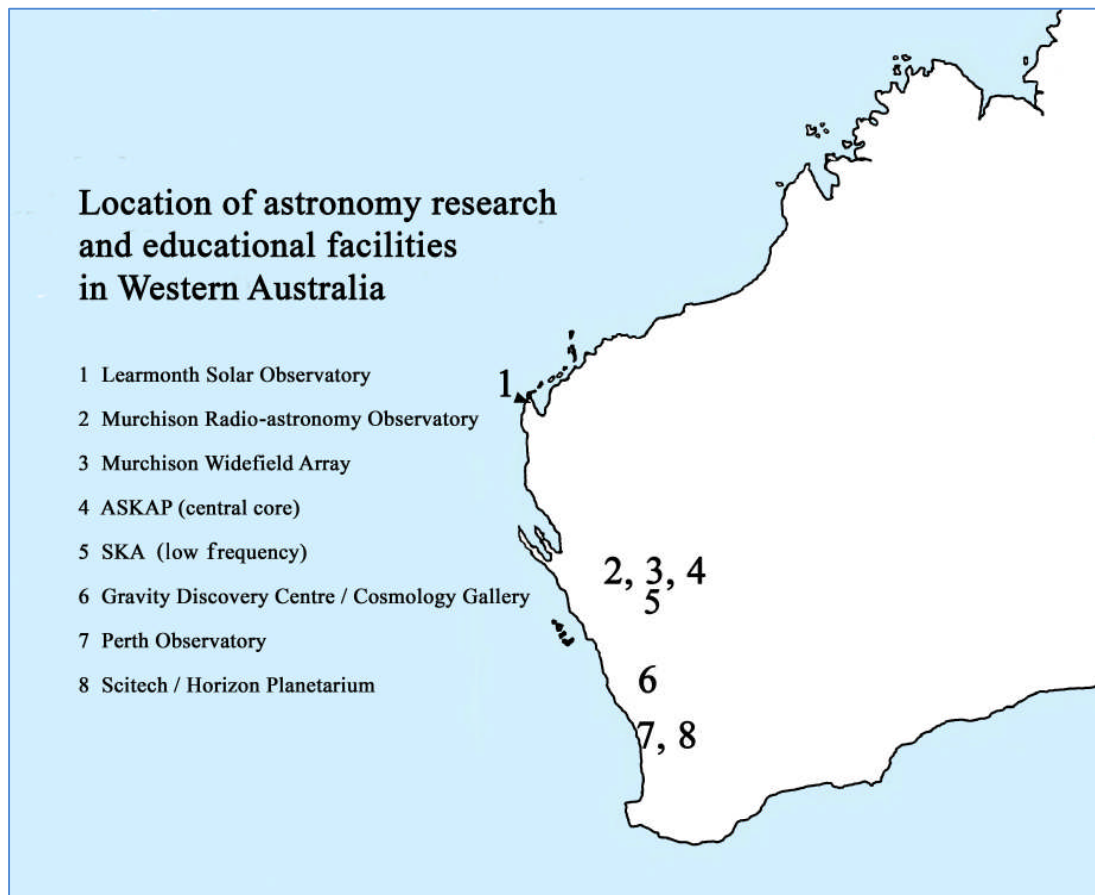


Figure 2. Location of astronomy research and educational facilities in Western Australia.

(Prepared by J. Goldsmith).

### 1.2.2.5 Significance

The contemporary radio astronomy developments taking place in Western Australia are highly significant. Not only are these initiatives part of a massive global scientific effort, the investment of more than \$2 billion into the initiative makes it one of the largest science investments made. The scientific significance of the SKA and related radio astronomy initiatives is also highly significant in that fundamental cosmological research will be able to be undertaken, including research investigating the Epoch of Re-ionisation, during the early phase of the development of the Universe.

Being centred on the Murchison region of Western Australia means that local communities including Aboriginal communities will be affected. This has given rise to a strong incentive to inform and collaborate with local communities. The opportunity presented by the cultural heritage of Aboriginal communities from the Murchison region has been recognised by organisations such as the International Centre for Radio Astronomy Research, and this has led to successful collaborations with such communities, which we will examine in section 2.3.2.1 and section 4.3. The convergence of the public upswell in interest in astronomy, brought about by IYA 2009, and the major radio astronomy developments taking place in Western Australia, have combined to create a fertile ground for collaboration with Aboriginal communities and research into Aboriginal astronomical knowledge in Western Australia.

## 1.2.3 Aboriginal astronomical and sky knowledge

### 1.2.3.1 Australian research

Whilst research into Aboriginal astronomical knowledge began early in the colonial settlement of Australia, the field of Aboriginal astronomical research is still comparatively small. An indication of this is provided by the first national gathering of Aboriginal astronomy researchers, which took place in November 2009, at AIATSIS, Canberra. Being a fledgling research area, there is considerable opportunity to develop and improve our understanding of research and communication practices in this field. This PhD thesis is one attempt to make a meaningful contribution in this regard.

Researchers to date have adopted several approaches to Aboriginal astronomy. First contact between European culture and Aboriginal people in Australia, and early colonisation, led to various attempts to understand Aboriginal culture. Examples of this are evident in the early efforts at understanding Aboriginal language. In fact, some of the earliest language studies include vocabularies that consist of word list translations, which include the names of astronomical bodies, such as Sun, Moon and stars. For example, between the years 1818 and 1821, Captain Phillip King explored the inter-tropical and western coast of Australia. On Christmas Eve, 1821, he prepared a Noongar (South West Western Australia) vocabulary list, in which he recorded and translated the Noongar word “Djaāt” as “Sun” (King 1827, 2:144). This is an example of one of the earliest attempts, which perhaps inadvertently led to the learning of Aboriginal astronomical knowledge in Australia.

Hugh Cairns, in conjunction with Bill Harney, has correctly noted the diversity of Aboriginal culture, and the likelihood that this diversity extends to knowledge about the night sky (Cairns & Harney 2003, 215):

*... so it became clear that every language group is likely to have their own stories even though some of the songlines traverse through huge areas of the continent with recognizably similar ancestral beings.*

Whilst overestimating the number of language groups in Australia, the authors (Cairns & Harney 2003,191) go on to express the wish that the heritage of the night sky from other language groups will also be shared:

*...it is hoped that the almost 750 languages in Australia and their people will join the Wardaman and offer their own night sky to others in this continent's full heritage.*

This context provides a motivation for the various research efforts in Australia to document and appreciate Aboriginal astronomical and sky knowledge.

Another research approach is to attempt to identify, or reconstruct, Aboriginal knowledge relating to the stars, prior to the first European contact in Australia. Some researchers argue that this approach is fraught with difficulties, brought on due to a variety of factors including language barriers, researcher interpretation and the influence and modification of cultural knowledge over time. For example, Bednarik (2011)

discusses the complexities and challenges of interpreting Aboriginal rock art. Whilst the issue of interpretation remains a complex one, some astronomical / cultural research lends itself to analytical and scientific methods. For example, supposed astronomical alignments of the Wurdi Youang Aboriginal stone arrangement have been analysed by Norris et al. (2013) for possible solar alignments. They concluded that “Our detailed survey of Wurdi Youang supports the Morieson hypothesis that a series of outlier stones marks the position of the setting sun at the solstices and equinoxes”, and that the “likelihood of this occurring by chance is extremely low” (Norris et al. 2013, 64).

Researchers in this field (e.g. Clarke 1998, par. 1) have noted the general lack of knowledge and research dedicated to Australian Aboriginal beliefs and knowledge regarding the night sky and cultural astronomy:

*In general, there has been little recording of Australian Aboriginal beliefs in astronomy. This is in spite of the predominance of astronomical themes in Aboriginal art... ..The investigation of beliefs concerning the Heavens, considered by many Aboriginal groups to exist as a distinct Skyworld, is important to the study of the cultural perceptions of all space.*

From the above context, it is clear that there is an opportunity for greater understanding and appreciation of Australian cultural astronomy, with a particular focus on contemporary knowledge, beliefs and practices. This context forms a key motivation behind this PhD study.

### **1.2.3.2 Sharing Aboriginal sky knowledge during IYA 2009**

During IYA 2009, numerous events were held in Australia which presented aspects of Aboriginal sky knowledge to the general public. Whilst a comprehensive listing of Aboriginal astronomy events in Australia was not provided in the IYA 2009 final report (International Astronomical Union, 2010), various exhibitions, lectures, performances, events and public talks took place, in addition to numerous media interviews with prominent researchers, such as Professor Ray Norris. Some of the highlights of Aboriginal astronomy during IYA 2009 are briefly described below. Aboriginal astronomy was introduced at Northern Rivers, New South Wales, via the “Starry, starry night tour”, in January and April 2009. In March 2009, the National Gallery of Victoria presented “The Shared Sky” which showcased various cultural views (including Australian Aboriginal) of the night sky. In May 2009, the Royal Society of Western Australia was presented with a talk on “Astronomy and Landscape- A Cultural Journey”. In June 2009, public talks occurred within the National Gallery of Victoria Shared Sky exhibition, with talks on “Stars Of Tagai”, and “Night Sky Songlines”. Prominent lectures followed in July, with “Australian Indigenous Astronomy” (The Harley Wood Lecture). A stage performance “The First Astronomers?” had seven performances at festivals across Australia. Various talks followed, including “Ancient Skies: How Different Cultures View, and Have Viewed The Sky” and “The Astronomy of Aboriginal Australians”. A unique collaboration and astronomically inspired Aboriginal art exhibition, “*Ilgarijiri- Things Belonging to the Sky*” was presented at Geraldton, Western Australia and Curtin University, Western Australia. The culmination of events during IYA 2009 relating to Aboriginal sky knowledge took place at the Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS), November 2009, in Canberra, with the hosting of the first

national gathering of indigenous astronomy. The symposium also featured the “*Ilgarijiri- Things Belonging to the Sky*” Aboriginal art exhibition (Tingay, 2011). The *Ilgarijiri* collaboration is introduced below.

### **1.2.3.3 “Ilgarijiri: Things Belonging to the Sky”**

The *Ilgarijiri* exhibition represents Western Australia's largest Aboriginal art exhibition primarily based on astronomical themes. More than thirty Aboriginal artists from the Murchison region of Western Australia, centred on Geraldton, are represented via *Ilgarijiri* (Appendix 8). Many of the artworks show the diversity of styles used to represent astronomical subjects. The story of the Seven Sisters (Pleiades) is a strong theme, in addition to the “Emu in the sky” star pattern. The exhibition also includes several paintings of specific astronomical objects viewed by telescope by Aboriginal artists, including Saturn, the Jewel Box star cluster, and a variety of constellations. Artworks include both traditional and modern styles. The exhibition has evolved over time, as artworks have sold and new versions of the exhibition developed. As noted by Tingay (2011) “*Ilgarijiri*” means “things belonging to the sky” in the local Wajarri Yamatji language. Importantly, the very name of *Ilgarijiri* indicates the importance of a sense of belonging and relationships, rather than a sense of individual ownership of astronomical knowledge. As of February 2013, “*Ilgarijiri- Things Belonging to the Sky*” has held eight exhibitions, including five international exhibitions (detailed in Table 6). The *Ilgarijiri* collaboration is the subject of detailed investigation in the current research (Chapter 4), as it provides insights into contemporary collaboration between radio astronomers and Aboriginal Elders, artists and communities associated with the major radio astronomy developments taking place in Australia.

## **1.2.4 Other issues**

Having discussed the context of Aboriginal culture in Australia, contemporary astronomy in Australia and research into Aboriginal astronomy and sky knowledge, there are two underlying issues which also need to be discussed. The first relates to the meaning of an “Aboriginal site”, the concept of which can be extended in the field of Aboriginal astronomy research. Secondly, the issue of light pollution and its degrading effect on the night sky is discussed, with special attention paid to its significance regarding Aboriginal sky knowledge in Australia.

### **1.2.4.1 Examining the concept of “Aboriginal site”**

Aboriginal cultural research uses the concept of an “Aboriginal site” to refer to geographical places that contain physical evidence of Aboriginal culture (i.e. archaeological sites) or places that have non-tangible associations (typically based on ethnography). In Western Australia, the term “Aboriginal Site” is defined in the Aboriginal Heritage Act (1972, sect. 4):

*Aboriginal site- means a place to which this Act applies by the operation of section 5.*

Section 5 of the Act (Aboriginal Heritage Act 1972, sect. 5) goes on to say:

*This Act applies to -*

- (a) any place of importance and significance where persons of Aboriginal descent have, or appear to have, left any object, natural or artificial, used for, or made or adapted for use for, any purpose connected with the traditional cultural life of the Aboriginal people, past or present;*
- (b) any sacred, ritual or ceremonial site, which is of importance and special significance to persons of Aboriginal descent;*
- (c) any place which, in the opinion of the Committee, is or was associated with the Aboriginal people and which is of historical, anthropological, archaeological or ethnographical interest and should be preserved because of its importance and significance to the cultural heritage of the State;*
- (d) any place where objects to which this Act applies are traditionally stored, or to which, under the provisions of this Act, such objects have been taken or removed.*

The Act (section 15) creates obligations for reporting:

*Any person who has knowledge of the existence of anything in the nature of Aboriginal burial grounds, symbols or objects of sacred, ritual or ceremonial significance, cave or rock paintings or engravings, stone structures or arranged stones, carved trees, or of any other place or thing to which this Act applies or to which this Act might reasonably be suspected to apply shall report its existence to the Registrar, or to a police officer, unless he has reasonable cause to believe the existence of the thing or place in question to be already known to the Registrar.*

The definition of an Aboriginal Site according to the Aboriginal Heritage Act (1972) clearly puts an emphasis on “places”. This has generally been interpreted to mean a geographical place, however, “non-tangible” sites are also recognised.

In the following chapters, I present extensive examples of Aboriginal knowledge relating to the night sky, and also knowledge linked to the landscape. It is evident that such knowledge can be based upon personal experience, personal recollections, and also from knowledge which is shared and communicated amongst individuals and communities, for example, “dreamtime stories”. It is also clear that such knowledge can be expressed in many different ways, such as through artwork, storytelling and song to name just a few, and that such knowledge is dynamic and changing. In some cases, knowledge about the stars is quite specific, and can be defined by careful documentation.

The cosmos can be seen to be a place which has multiple sources of cultural knowledge associated with specific objects or specific and definable areas. The concept of Aboriginal sites on the ground can therefore be extended to include the sky. In just the same way as geographical and physical places (Aboriginal sites) can be defined on the ground, the same can be done for the sky. However, the phrasing of the Aboriginal Heritage Act currently does not explicitly recognise this. I propose that, conceptually at least, the

definition of an Aboriginal Site can be extended, to include cultural knowledge relating to the night sky which relates to definable areas.

#### **1.2.4.2 “Light pollution”: Implications for Aboriginal sky knowledge**

Maintaining good visibility of the cosmos free from artificial interference, is of critical importance for not only radio astronomy, but also in relation to Aboriginal knowledge of the night sky. The Square Kilometre Array radio telescope initiatives in Western Australia have gone to very considerable lengths to select suitable observing locations which have minimal artificial radio noise interference, and to protect these qualities into the long term. In the same way, dark skies, free from artificial light pollution, are very important to allow people to experience a “natural” night sky, from which much of the Australian Aboriginal knowledge of the night sky has developed from.

One fundamental issue is the importance of maintaining access to the night sky. Degradation of the night sky, or “light pollution”, is caused mainly by excessive urban lighting and makes viewing the night sky difficult for communities in urban centres. There are other factors that affect people's access to the night sky in general, such as primarily indoor urbanised lifestyles at night, however, light pollution is the primary issue that detracts from experiencing a truly dark night sky. The splendour of the night sky becomes degraded due to the glow of cities. For Aboriginal astronomy, this issue becomes very important, because several important aspects of the night sky (such as the dark dust lanes in the southern Milky Way, and the Magellanic Clouds), are best appreciated in dark sky conditions. Therefore, urban light pollution, which degrades the experience of the night sky for the urban population, can seriously affect and diminish people's ability to experience the night sky. This issue has drawn international attention, in which access to starlight has been recognised as a common heritage and this has led to a “declaration in defence of the night sky and the right to starlight” (Marin & Jafari 2007, 3). The declaration, in its first principle, emphasised the importance of an unpolluted sky to the development of all people:

*An unpolluted night sky that allows the enjoyment and contemplation of the firmament should be considered an inalienable right of humankind equivalent to all other environmental, social, and cultural rights, due to its impact on the development of all peoples...*

We shall see in later chapters (e.g. chapter 4), that it is the dark dust lanes of the Milky Way (for example, that form the “Emu in the sky”), which have particular significance to many Aboriginal communities in Australia. Access to dark night skies is of critical importance for viewing such features. Degradation of the night sky, caused by excessive urban and city lighting, has resulted in a serious loss of quality of the night sky. This has potentially profound implications for our society, as generations will no-longer have regular access to truly dark night skies. The cultural heritage of the night sky is therefore becoming increasingly difficult to experience. Two photographic examples are provided in Appendix 3 to demonstrate the impact of urban light pollution on the visibility of the night sky, and in particular, Aboriginal sky patterns such as the “Emu” in the Milky Way.

The International Dark-sky Organisation is one such network that aims to raise awareness on a global basis about these issues. The IDA has led numerous practical initiatives, including support for the development of dark sky preserves, similar in concept to national parks, which are aimed at helping to protect and maintain access to dark sky resources and to protect them from the encroachment of light pollution.

The entirety of this research is about valuing the night sky as a source of inspiration and cultural knowledge, for both Aboriginal and non-Aboriginal people. Access to dark sky conditions has been essential for the research, particularly for documenting Aboriginal sky knowledge (Chapter 4). The research has involved multiple field visits over an extended period of time, and numerous astrophotography projects, which have helped to document the night sky and its cultural significance.

## **1.3 The current research**

### **1.3.1 A contemporary approach**

The overall objectives for the current research are focussed on documenting and assessing Aboriginal astronomical knowledge in contemporary Western Australia, including Aboriginal and non-Aboriginal perspectives of the subject. Thus, the research is focussed on contemporary or near contemporary traditional or cultural knowledge and does not attempt to “reconstruct” cultural knowledge from the ancient past, such as pre-contact times. It is therefore fully acknowledged that the research is expected to document knowledge that has been shaped by many factors, including the profound effects of Australia's colonisation, and contemporary education. In addition, the geographical focus of this research is directed to the South West of Western Australia, the East Kimberley region (Wolfe Creek Crater), and areas coinciding with the current radio astronomy developments of Western Australia (the core being in the Murchison region).

### **1.3.2 The research scope, hypotheses & objectives**

Based on the context I have outlined above, I have defined six research hypotheses which form the basis of this research, and four primary research objectives. These are described below. The hypotheses to be tested as part of this project are:

Hypothesis 1. That some Australian Aboriginal astronomical and sky knowledge is open and available for appreciation and learning by the general public.

Hypothesis 2. Collaborative, cross-cultural projects can act as an important catalyst to encourage the appreciation and respect of Aboriginal and scientific astronomical knowledge.

Hypothesis 3. That cultural astronomy and Aboriginal sky knowledge can be used as a tool to support Aboriginal and non-Aboriginal contemporary learning and education.

Hypothesis 4. That certain places and/or landscapes have particular astronomical importance within Aboriginal culture.

Hypothesis 5. That there exists in contemporary Aboriginal society, significant astronomical and sky knowledge, which is largely un-recognised.

Hypothesis 6. That cross cultural exchanges, based on Aboriginal sky knowledge, can encourage and facilitate Reconciliation.

With the above hypotheses in mind, the four primary research objectives of this study are to:

Objective 1. Investigate the variety of ways in which people engage with Australian Aboriginal astronomical knowledge in our contemporary society.

Objective 2. Gain an understanding of the issues and sensitivities regarding such cultural knowledge and the ways in which these issues can be addressed.

Objective 3. Collaborate with Aboriginal people to document and communicate in a culturally appropriate manner contemporary astronomical knowledge, including cultures from the south west of Western Australia, Mid West (Geraldton / Murchison) region, and the Kimberley (Wolfe Creek Crater) area.

Objective 4. To examine and apply the use of survey methodologies to assess knowledge, attitudes & beliefs relating to astronomy, and awareness in relation to Aboriginal Astronomy initiatives, with a focus on Western Australian populations.

### **1.3.3 Geographical scope and associated Aboriginal language groups**

As indicated in research objective 3, the geographic scope (and associated Aboriginal language groups) of the current research includes:

- South West of Western Australia (primarily Noongar Aboriginal people).
- Mid West - Murchison region, centred on Geraldton, Mullewa, and Boolardy Station (Yamaji Wajarri people).
- East Kimberley, associated with Wolfe Creek Crater, centred on Halls Creek (with a focus on Jaru Aboriginal people, however there are various other language groups in nearby proximity as well).

A more detailed discussion of the Aboriginal communities, Elders, artists and participants in the research, is provided in Chapter 4.

### **1.3.4 Overview of research methodology**

The research methodology to address the hypotheses is presented below. The research methodology is based on a combination of quantitative data collection, in addition to more qualitative approaches which



include detailed interviews. A critical component of the study is the collection of interviews, survey responses and field investigations. The quantitative component of the project is based on three surveys:

- the international survey “The Sky in Our Lives”.
- a survey of Aboriginal Astronomy Symposium participants.
- a survey relating to The International Year of Astronomy 2009 in Western Australia.

This study is the largest application of “The Sky in Our Lives” survey in Australia to date. The main project methodology steps, and their relation to the research hypotheses, are listed below (Table 1), followed by a description of the project methodology.

Table 1. Project methodology, hypotheses and research objectives.

<b>Project Methodology (overview)</b>	<b>Relation to hypotheses</b>	<b>Relation to research objectives</b>
A. Literature review	All	1, 2
B. Identify how people engage with Aboriginal astronomy	2, 3, 4, 6,	1
C. Review astronomical knowledge in Aboriginal art	1, 2, 3	1
D. Quantitative surveys:		
1: “International Year of Astronomy 2009”;	1, 2	4
2: “The Sky in Our Lives”;	1, 2	4
3: Participants of the Indigenous Astronomy Symposium	1, 2	4
E. In-depth interviews	1, 2, 3, 4, 6	1, 2, 3
F. Site visit to Wolfe Creek Crater	1, 5	3

**A. Literature review.** Review relevant literature including journals (e.g. *Archaeoastronomy The Journal of Astronomy in Culture*, *Rock Art Research*) and other sources, such as online archives from the Australian Institute of Aboriginal and Torres Strait Islander Studies, Curtin University Centre for Aboriginal Studies, Department of Aboriginal Affairs (WA), Indigenous Science Network, ABC Message Stick, and other sources. Material from the literature reviews are provided in sections 1.2, 2.2, 2.3, 3.2, 3.3, 4.2, 4.3, 4.4 & 5.3. Literature reviews form an important basis for all of the research hypotheses.

**B. Identify how people engage with Aboriginal astronomical knowledge.** The ways in which people engage with contemporary Aboriginal astronomical knowledge are assessed by identifying recent examples of exhibits, public presentations, art exhibitions, meetings and any other relevant examples. This information is derived via a literature survey, internet searches and information gathered from survey participants (primarily from the survey of Indigenous astronomy symposium participants, described below). Material is presented in Chapter 2 (section 2.3), which addresses aspects of several hypotheses including 2, 3, 4, & 6.

**C. Astronomical knowledge in Aboriginal art.** Art is one way in which Aboriginal astronomical knowledge is shared and communicated by Aboriginal people. Contemporary examples of Aboriginal art (containing astronomical themes) are reviewed, to determine what kinds of astronomical knowledge are presented in contemporary Aboriginal art. Online catalogues of Aboriginal art centres are assessed, with a focus on artwork originating from Western Australia. This method offers the benefit of being able to search a wide and extensive geographic area rapidly, via online access to art centre catalogues. The method is limited to those art centres which maintain active websites. Results are presented in section 2.3.1, and address hypotheses 1, 2 and 3.

**D. Surveys.** The PhD project is based on the collection of both quantitative and qualitative data. Three surveys are applied in this research:

1. The International Year of Astronomy 2009.
2. “The Sky in Our Lives” international survey.
3. The 2009 Aboriginal Astronomy Symposium.

**International Year of Astronomy (IYA) 2009.** IYA 2009 featured several events relating to Aboriginal astronomy, in Australia during 2009. The survey for the IYA 2009 assesses the effect of IYA 2009 in Western Australia and the role of IYA 2009 in awareness of Aboriginal Astronomy in particular. The survey samples primarily a Western Australian population, with no particular emphasis on people who have an astronomical background. The survey is suitable for use in Western Australian primary and secondary schools and also for wider application. An online version of the survey provides an alternative and convenient method for data collection. Results are presented in section 3.3.6 and address hypotheses 1 and 2.

**The Sky in Our Lives.** Documentation of contemporary astronomical knowledge, awareness and understanding is currently being conducted by an international survey led by Jarita Holbrook (University of Arizona), via “The Sky in Our Lives” survey. Data have already been collected via researchers in the USA, Kenya, Belarus and Mexico. This study uses “The Sky in Our Lives” survey, for the first time in Western Australia. Data for 2008 (worldwide) comprises about 150 surveys and has been analysed by Holbrook. The 2009 data (worldwide) comprises about 500 surveys and is yet to be analysed. Preliminary results of the survey were presented at the International Astronomical Union (IAU) Symposium 260, in January 2009. The Sky in Our Lives survey is presented in section 3.4 and relates primarily to hypotheses 1 and 2.

**2009 Aboriginal Astronomy Symposium.** Participants of the “Things Belonging to the Sky” Aboriginal Astronomy Symposium, which was held at AIATSIS in November 2009, represent a “special interest” population sample, of people who share a particular interest in Aboriginal astronomy. This sample subgroup is important because it targets the Aboriginal “expert”. The survey documents opinions regarding Aboriginal astronomy and gathers additional contemporary examples of sharing and communicating Aboriginal astronomy. The Indigenous Astronomy Symposium results are presented in section 3.5.5 and relate to hypotheses 1 and 2.

The data collection methods used have been chosen to target different populations. For example, the Post IYA 2009 survey is intended to gauge a non-specialist population, and has been directed towards secondary school students. The “Sky in Our Lives” survey is a more detailed survey, and is suitable for people with a more detailed knowledge, or greater experience, of the night sky. The survey of participants of the first national Indigenous Astronomy Symposium aims at gathering information from people assumed to have a significant background or interest in Aboriginal astronomical knowledge.

**E. In-depth interviews.** A highlight of this investigation is the use of in-depth interviews with key people who are actively involved in communicating Aboriginal astronomical knowledge. The face-to-face interviews are video recorded, with the permission of the interviewees. In-depth interviews were conducted with Elders and artists associated with the “*Ilgarijiri- Things Belonging to the Sky*” art exhibition, based on the on-site interaction between scientists and Aboriginal people, relating to the SKA project area. Interviewees include Yamaji Art Coordinator Charmaine Green, Yamaji artists Barbara Merritt, Margaret Whitehurst, Olive Boddington, Aboriginal community leader Kevin Merritt, and astronomer Dr Megan Argo (ICRAR). Mullewa artists included Wendy Jackamarra, Christine Collard, Debra Maher, Susan Merry and Barbara Comeagain. The video interviews with Yamaji artists (Geraldton) and Mullewa artists were conducted via a site visit. This approach strongly complements the survey based data collection approaches. Results are presented in section 4.3.

Interviews relating to Aboriginal people associated with Wolfe Creek Crater include the late Jack Jugarie and his eldest son, Keith Jugarie, Halls Creek Aboriginal Educator Doreen Green, and the late Elder Stan Brumby.

The interviews provide an important basis for several sections of the research. Results are presented mainly in sections 4.2, 4.3 and 4.4, and address several hypotheses including 1, 2, 3, 4, 6. Interview transcripts are also supplied in Appendix 13.

**F. Site Visit to Wolfe Creek Crater.** Two site visits to Halls Creek, Wolfe Creek Crater and the nearby community of Billiluna were conducted in August 2010 and August 2011, coinciding with the dry season, due to the need for suitable road conditions and access to the site. Prior site visits to the crater took place in 1998, 1999, 2000 and 2003. All site visits were conducted with the aim of consulting artists, Aboriginal Elders and others associated with the crater, to further investigate and verify where possible, my previous research conducted at Wolfe Creek Crater. Permissions were sought and obtained for the use of this information in the current investigation. This study accomplishes the urgent task of transcribing and analysing the video records of my previous visits to Wolfe Creek Crater. Extensive digital photographic documentation of the Wolfe Creek Crater has been accomplished based on the site visits. Results are presented in section 4.2 and developed further in section 5.5, and primarily address hypotheses 1 and 5.

The research methodology described above details the specific approaches towards data collection, geographical areas of prime interest, and the links between data collection methods and the research hypotheses.

### **1.3.5 Research ethics for this study**

The main ethical issues relating to this project include:

- Acknowledgement and respect towards custodianship of cultural knowledge.
- Appropriately managing any sensitive or restricted cultural information (e.g. information restricted to males/females, restrictions relating to public display of information).
- Copyright and intellectual property.

The practice of “Ask First” as recommended by the Australian Government in relation to Aboriginal issues, has been adopted for this project. The research ethics adopted are those as outlined by AIATSIS (2012a). Additional guidance regarding information management has been sought from applicable groups such as local Aboriginal custodians, the Western Australian Department of Aboriginal Affairs and/or the Centre for Aboriginal Studies, Curtin University. The study has received a formal ethics approval (approval RD 10-15), by the Curtin University Research Ethics Committee.

### **1.3.6 An introduction to the chapters**

Chapter 1 establishes the context and background for this research. The context of contemporary astronomy initiatives are discussed, including the role and significance of the International Year of Astronomy 2009, and astronomy initiatives in Western Australia, including the Square Kilometre Array radio telescope project. The research hypotheses and research objectives are presented, with a discussion of the three main geographical areas in Western Australian upon which this research focuses on. The context of the Aboriginal communities in these three areas are introduced. The *Ilgarijiri* collaboration is introduced, along with other examples of the contemporary communication and sharing of Aboriginal astronomy.

Chapter 2 examines research objectives 1 and 2. Issues and sensitivities that specifically relate to the communication and sharing of Aboriginal sky knowledge are discussed, with a core set of issues identified and comments provided on how these issues are addressed in the current research. The ways in which people engage with Aboriginal sky knowledge in contemporary settings is examined, with a wide ranging look at more than 20 examples across Australia. These examples have been selected due to their relevance to the current research, and their usefulness in highlighting issues and sensitivities previously discussed.

Chapter 3 applies the use of surveys as a methodology for data gathering. The development, application and results of the three surveys are discussed, together with an appraisal of the use of such methodologies for the investigation of Aboriginal sky knowledge. The chapter concludes with discussion about the applicability and limitations of such approaches, and suggestions are made regarding future use of such surveys, in similar research.

Chapter 4 provides a detailed examination of contemporary Aboriginal sky knowledge for the three main study areas: (1) East Kimberley and Kandimalal, Wolfe Creek Crater; (2) the Murchison Region; and (3) the South West of Western Australia. The results of several field visits are presented, with extensive use of interview transcripts to present the original research findings.

Chapter 5 expands upon the new knowledge presented in Chapter 4, by applying such knowledge for the communication and sharing of Aboriginal sky knowledge. This work examines several highly relevant case studies, including international perspectives from South Africa, featuring amongst others, the creator of *Cosmic Africa*, by Dr Thebe Medupe. Original research findings are presented in the form of interview transcripts, with extensive discussion. The chapter includes an articulation of factors that promote successful collaborations, the principles of which have considerable applicability for future Aboriginal sky knowledge initiatives. The development of the 360° imaging resources are discussed, which provide the basis for new and original resources to be developed, in the context of the collaboration principles, including the De Laeter Scholarship, Cosmology Gallery exhibit, the *Ilgarijiri* exhibition tour video, and the application of 360° imaging for the development of a new virtual tour which features the three research study areas.

Chapter 6 brings together a synthesis of the overall research, with a discussion of the primary research conclusions. Future research opportunities are identified, including online data mining, surveys, and application of collaboration success factors. Educational opportunities are discussed, together with options for the development of new visual resources to support future efforts directed towards communication and sharing of Aboriginal sky knowledge.

### **1.3.7 The significance of the PhD study**

This project provides an important opportunity to investigate Aboriginal astronomical knowledge, in the context of major radio astronomy developments taking place in Western Australia.

This study is of particular significance to the relatively new research field of Aboriginal astronomical knowledge in Australia, because it focuses on the contemporary ways in which such knowledge is being communicated and shared (research objective 1 of this study). This is significant because this approach permits direct examination of astronomical knowledge and beliefs in contemporary Aboriginal people. Assumptions regarding the presence or absence of contemporary astronomical knowledge can be examined and tested. This approach is not dependent upon interpretive attempts at reconstructing ancient astronomical knowledge. Generally, such studies do not come to firm conclusions, because there is considerable scope for different interpretations of data. The contemporary focus of this study therefore addresses a significant gap in research, and has the potential to record previously un-recorded cultural astronomical knowledge. Research objective 2 of the study focuses on developing an understanding of the sensitivities and issues of such cultural knowledge. The insights gained from this study are anticipated to provide an important contribution and improvement in understanding, regarding the communication and sharing of such cultural knowledge. This has considerable potential to influence future initiatives regarding

communication of Aboriginal astronomical knowledge, particularly via exhibits and related public education/awareness initiatives. The approach of using collaborative cross-cultural projects has the potential to be applied not only to astronomy but also to other areas of cultural knowledge as well. The approach offers a model for future cultural engagement.

The study includes a collaboration with Aboriginal people to document and communicate in a culturally appropriate manner contemporary astronomical knowledge (research objective 3). The study makes a significant contribution in this area, in part via the site visits to both the Murchison Region and Wolfe Creek Crater area. The incorporation of previously un-published records of Aboriginal knowledge relating to Wolfe Creek Crater, based on site visits conducted between 1998 and 2003 by the author, and first hand interviews with a variety of Aboriginal people associated with Wolfe Creek Crater, will be a particularly significant result for the study.

The study makes a significant contribution to improving our understanding of astronomical knowledge from Australian populations (research objective 4). The study has gathered data for the first time in Western Australia, using the international survey "The Sky in Our Lives". A comparison is made with South African data, which substantially extends the usefulness and value of this study. The study also achieves for the first time, a baseline of astronomical knowledge, understandings and attitudes, via "The Sky in Our Lives" survey. These data form a baseline from which future assessments can be made regarding the effect of astronomy developments (such as ASKAP) in Western Australia. As new international surveys take place with 'The Sky in Our Lives' survey, this will enable future comparisons with such internationally derived data.

The development of new methodologies and resources are original outputs of this research, including two video productions and one virtual tour, based on 360° photographic imaging (supplied on DVD disk, Appendix 17).

## Chapter 2

### Engaging with Aboriginal sky knowledge

*“It was my Grandmother’s religion (the story of the Seven Sisters)  
and as an Aboriginal person in Australia, it is my belief too.  
The story gives me an understanding of what my journey  
and purpose is in life”.*

Wendy Boyle, quoted in Seven Sisters Art Exhibition,  
BHP Billiton (n.d., circa 2008, par. 11).

Research from Chapter 2 has been presented in the following conference posters:

Goldsmith, J. 2010, “Sharing and communicating Indigenous astronomical and sky knowledge”. Poster presented at the Astronomical Society of Australia annual science meeting, Hobart, July 2010.

Goldsmith, J., Tingay, S., & Hamacher, D. 2011, “Building bridges between cultures, communicating and sharing Australian Indigenous sky knowledge”. Poster presented at the ninth “Oxford” International Symposium on Archaeoastronomy, Lima, Peru, January 2011.

#### 2.1 Introduction

There are many ways in which people engage with Aboriginal knowledge relating to the night sky. These include cross cultural interactions, between Aboriginal and non-Aboriginal people, between generations (children and elders), and between experts and non-experts, to name just a few. Other forms of engagement include informal learning experiences (e.g. cultural tours), and formal education. These interactions and methods of engagement provide a rich opportunity to learn about the sharing and communication of Aboriginal sky knowledge. In this section, I present the results of investigations relating to the research objectives 1 and 2 of this study, namely:

*Objective 1. Investigate the variety of ways in which people engage with Australian Aboriginal astronomical knowledge in our contemporary society;*

*Objective 2. Gain an understanding of the issues and sensitivities regarding such cultural knowledge and the ways in which these issues can be addressed.*

One of the most direct ways in which Aboriginal sky knowledge can be appreciated, is by directly experiencing the night sky, with Aboriginal people and in particular, with Elders. This approach was taken as part of the *Ilgarijiri-Things Belonging to the Sky* collaborative project, which is introduced in section 2.3.2.1. Figure 3 shows an example of Aboriginal and non-Aboriginal people coming together to share their knowledge of the night sky with each other.



Figure 3. Collaborative discussions under the stars at Boolardy Station.

(Photo: Dr Megan Argo)

Key issues associated with the communication and sharing of Aboriginal sky knowledge are examined, such as matters of research ethics, interpretation, management of intellectual property and practical, logistical issues. The subsequent section examines the diverse ways in which people engage with Aboriginal astronomical knowledge in our contemporary society, starting with a novel data mining exercise of online data in relation to astronomically themed Aboriginal art. The diversity of the ways in which Aboriginal astronomical knowledge is being shared and communicated is demonstrated by the different approaches used, including documentary exhibitions, artworks, film productions, and cultural experiences. These examples are used to highlight aspects of the key issues discussed in section 2.2.

## 2.2 Issues and sensitivities

### 2.2.1 Introduction

In this section, I identify, discuss and summarise key issues in relation to the communication and sharing of Aboriginal sky knowledge by considering these issues from a range of perspectives, including Aboriginal Elders, artists and researchers. Section 2.2 addresses research objective 2 of this study, which sets out to:

*Gain an understanding of the issues and sensitivities regarding such cultural knowledge and the ways in which these issues can be addressed.*



Developing an appreciation of the potential issues and sensitivities associated with Aboriginal sky knowledge is important because such insights can substantially inform and guide collaboration initiatives, leading to successful approaches for the communication of Aboriginal sky knowledge. The issues, themes and sensitivities vary in their applicability in any given situation. However, all of the issues and sensitivities can, to a greater or lesser extent, inform our current and future practices. Some issues relate specifically to Aboriginal sky knowledge, and other issues are more broadly applicable. All of the issues and sensitivities identified and discussed below have been derived from the current research. The issues are discussed with examples, where applicable, and a discussion of how each issue has been considered and applied in this research.

Issues from the perspective of Aboriginal Elders include the maintaining and passing on of knowledge and cultural practices, to younger generations. Some have personal experience and knowledge relating to the night sky, which is felt to be important and in need of being shared or passed on. Issues include the custodianship of stories, who has the right to communicate such stories, the value of and importance of passing on or sharing such knowledge, and how sensitive or restricted cultural information is dealt with.

From the perspective of an Aboriginal artist (e.g. *Ilgarijiri* artist), related issues can include the rediscovery or reconstruction of cultural knowledge, how scientific and other forms of knowledge are incorporated into contemporary art, how to share astronomical knowledge through art (and the more fundamental issue of the right to tell stories), and how to share Aboriginal knowledge with non-Aboriginal people.

Aboriginal or non-Aboriginal researchers also face certain issues. Of primary importance is the adoption of appropriate research goals and objectives for the outset of research. Related issues include: are the goals aiming to reconstruct ancient (or pre-contact) knowledge? If so, how, and for what purpose? Research methodology issues can include how to appropriately engage with Aboriginal people and communities to conduct research, research ethics, how to avoid appropriation of cultural knowledge, how to avoid speaking on behalf of Aboriginal people, and what types of engagement / consultation is appropriate with Aboriginal people associated with such research. In terms of interpretation of research, a variety of issues include the interpretation of Aboriginal sky knowledge, such as “scientific” or “rational” perspectives, or for that matter, from subjective perspectives. There are several practical issues, such as overcoming communication barriers, distance, and logistics. Other issues include the respect and management of intellectual property and copyright relating to research. Dissemination of knowledge is also an important issue, such as the communication of research findings, particularly with the research participants and their communities. Closely related to this is the management of information used in public displays, including cultural restrictions which may apply to people who are recently deceased.

### **2.2.2 Key issues and their application to the current research**

In the follow sections, key issues that have been derived from the research are examined by presenting various examples, together with a discussion on how these issues have been approached in this work. The key issues are:

- the night sky as a means of bringing people together.
- maintaining and passing on valued knowledge.
- research ethics / permissions.
- sharing knowledge beyond Aboriginal communities.
- language or English.
- interpretation.
- facilitating Aboriginal people to speak for themselves.
- the dynamic nature of stories and knowledge.
- dealing with sensitive or restricted cultural information.
- issues relating to recently deceased people.
- management of intellectual property.
- practical issues / travel / logistics.

### **2.2.3 The night sky as a means of bringing people together**

The night sky provides for a rich source of inspiration for personal experience, cultural heritage and scientific knowledge. Unlike knowledge associated with the terrestrial environment, which can be highly localised and location specific, the night sky is readily accessible to all cultures throughout the world. The common experience of the Sun, Moon, planets and stars, as well as a host of astronomical phenomena such as eclipses, comets and meteor showers, gives rise to a globally shared experience of the astronomical. Whilst this experience will vary depending on our geographic location on the Earth, the night sky establishes a common experience for all human cultures. This globally shared experience of astronomical objects creates common experiences between diverse and widespread cultures. The geological, biological, climatic, landscape and cultural diversity of terrestrial environments contrasts substantially to the largely enduring and consistent patterns and cycles of astronomical phenomena (on a time scale of many human life-spans). This gives rise to a remarkable consistency of experience over long durations of time, around which shared cultural knowledge of the night sky can develop and be passed on to subsequent generations.

This realisation provides an important insight into how the night sky can bring people together. The night is a source of fascination to many cultures and people alike. Curiosity unites people. The simple act of experiencing the night sky together, around a camp fire, swapping stories and talking about the night sky was used during the *Ilgarijiri* collaboration, which we will examine in detail in Chapter 4.

### **2.2.4 Maintaining and passing on valued knowledge**

My initial visits to Wolfe Creek Crater, which commenced in 1998, formed the basis for future site visits and directly led me to interviewing a senior Jaru elder, Jack Jugarie, who expressed his connection to the Wolfe Creek Crater landscape. I recognised his age (mid 70's), and also the fact that he openly wished to share his knowledge about the night sky, and the crater. He also noted that I was the first person to ask him about his knowledge of the night sky, in detail. As a result of this background, the field work I conducted

with Jack Jugarie in 1999 was conducted as an urgent priority. After the onsite interviews I completed with Jack Jugarie at the crater, he unexpectedly and suddenly passed away, less than one month after this field work was conducted. This circumstance demonstrates the urgency of field work, and the limited opportunity to conduct such work.

The issues of the preservation and passing on of “traditional knowledge” has been investigated by Glen Wightman, who was awarded a 2008 Churchill fellowship. His report “Passing it on, Traditional Aboriginal biological knowledge preservation and promotion” (Wightman, 2009) documented diverse contemporary issues and opportunities for such knowledge. Whilst his research focuses on biological knowledge, it is likely that many of the issues he identifies also relate to astronomical knowledge. During the work for this thesis, I have encountered numerous examples of Aboriginal people indicating the importance of passing on Aboriginal cultural knowledge (particularly to the next generation). One such example (Drok 2009/2010, 13) is illustrated by Charmaine Green:

*It's really important for our older people to pass on these stories like the Emu in the sky. The sky is linked to the land and how we look at the environment. It foretells seasonal changes and the availability of food sources... .. It's directly relevant to the way we live our lives.*

Some Aboriginal people have actively encouraged efforts to share and communicate aspects of Aboriginal culture with the broader community. Professor Sally Morgan (School of Indigenous Studies/The University of Western Australia) says:

*I would like to encourage Indigenous peoples to tell their stories, whether it's through writing or painting, or dance, music or theatre. We can all learn from each other and it helps to build the bigger picture. (Lake 2004, par. 16).*

In a speech at the Indigenous Economic Development Conference, 2003, Robert Lee actively encouraged the sharing of country and living (indigenous) culture to non-Indigenous Australians:

*Take the responsibility and share parts of your country and our living cultures in a good way with fellow Australians and the rest of the world. (National Capital Authority n.d, Artwork 12).*

### **2.2.5 Research ethics / permissions**

This study has received a formal ethics approval (approval RD 10-15), by the Curtin University Research Ethics Committee. The practice of “Ask First” as recommended by the Australian Government in relation to Aboriginal issues, has been adopted for this project. The research ethics adopted are those as outlined by AIATSIS (2012a), and the Australian Heritage Commission (2002). Advice has also been sought when needed from the Western Australian Department of Aboriginal Affairs and the Centre for Aboriginal Studies, Curtin University. A number of other permissions were obtained for the research. Approval was

obtained from the Western Australian Department of Education, for the use of surveys in applicable schools. Consent forms for school participation were prepared for endorsement by school principals (as required by the Department of Education), in addition to parent consent forms. A “Working with Children” Card was also obtained in accordance with the requirements of the Government of Western Australian. Consent forms were used for interviewees, for the use of data collected via video interviews in the study.

### **2.2.6 Sharing knowledge beyond Aboriginal communities**

The mere fact that there are diverse examples of the communication and sharing of Aboriginal sky knowledge does not mean that such knowledge is in fact open and available for such public dissemination. Whilst it can be assumed that such knowledge can be shared in a public manner, this assumption is examined as it is possible that some past practices may have been (unintentionally or otherwise) culturally insensitive. The interviews that have been conducted for this research have all been done on the basis of voluntary participation and with respect paid to the wishes of the interviewees, regarding the sharing of their stories and knowledge. I have adopted a flexible approach regarding consultation with the Aboriginal people who participated in this study. This has included multiple repeat meetings over extended periods of time. In virtually all cases, I found that the Aboriginal Elders and artists interviewed in this research keenly wished to document and share their knowledge, for people beyond their immediate communities. One such example is provided by East Kimberley artist Bonnie Deegan, who expressed her wishes in the following way:

*It's a pleasure... ...Ah, it's alright, it's a pleasure doing something for somebody, passing on knowledge, so that the rest of the world can understand how we see the skies. (Appendix 13.2.2).*

### **2.2.7 Interviews in language or English.**

The sheer diversity of Aboriginal culture and languages in Australia poses a substantial task for research that aims to develop a comprehensive documentation of cultural knowledge. In publishing the night sky heritage of the Wardaman, Cairns & Harney (2003, 191), expressed the wish that all of Australia's Aboriginal language groups “*will offer their heritage of the night sky to others in this continent's full heritage*”. My research is a contribution towards this ambitious goal.

If adequate interpreter resources are available, in general, it is preferable to conduct all interviews in the preferred language of the interviewee. In many contemporary situations, this will be English, or the particular Aboriginal language of the interviewee. For this study, interviews have been conducted in English. In some cases, interviewees also used their own language at times.

### **2.2.8 Interpretation**

When done effectively, interpretation can assist in concisely expressing complex subjects, or expressing key insights or learnings, in terms that are readily understandable by a given audience. Issues surrounding matters of interpretation can be complex. In general, interpretation can include aspects of distilling meaning, significance, or presenting information or stories in a summarised form, or via a more accessible form of language. This process invariably transforms the original information source, so it is important to

be aware of the limitations and validity of such interpretative efforts. The challenges and difficulties faced by interpretation of Aboriginal sky knowledge are varied. Firstly, the quality and quantity of the original information plays a critical importance here. Secondly, interpretation is dependent upon the knowledge, experience, attitudes and familiarity of the person doing the interpretation.

From a research perspective, researchers need to: (1) be able to correctly identify content (i.e. not miss significant content); (2) avoid over interpretation; (3) be aware of biases, inherent or otherwise (e.g. biases due to limited areas of expertise); and (4) recognise the limitations posed by inherently limited evidence or documentary records (particularly for historical records).

When Aboriginal sky knowledge is shared with non-aboriginal people, some form of interpretation is often needed, to facilitate understanding. This is due to several factors. Context and background is needed about the people, culture and landscape. Issues about comprehension need to be dealt with, including the use of suitable translations if English is not used. Even when English is used, accents can make comprehension difficult for some.

Care also needs to be taken regarding inappropriate literal interpretations. This issue can occur particularly when quantities, numbers or time are being interpreted or assessed. For example, a specific number may be used, when the intended meaning is simply “a lot” or “many”. Often, it is the specific context that can help determine what the best interpretation is, for such situations. Another example of care that needs to be taken regarding literal interpretations, relates to the use and meaning of specific terms. For example, it was found that some of the Aboriginal participants in this research, from the East Kimberley, used the astronomical terms “meteor” and “comet” as equivalent terms, when in fact they refer to entirely different astronomical phenomena. Careful investigation enabled a correct interpretation to be applied in the current research.

Another issue is the potential for over-reliance on historical research, which often was based on limited content. For example, Stanbridge (1858, vol 2. 139) provides a brief description of the “Emu”, as follows:

*Tchingal (Emu), (the dark space between the fore-legs of Centaurus and Crux), who pursues Bunya until he takes refuge in a tree, and who is afterwards killed by Berm-berm-gle.*

The description of the Emu pattern is very brief and it is unlikely that it comprehensively describes the whole Emu sky pattern. The brevity of the description gives rise to an issue of interpretation. Stanbridge's description of Tchingal (Emu) correlates to the “Coalsack Nebula”, however, the Coalsack Nebula is typically identified as the head of the Emu, with the neck and body extending down towards Scorpius. It is possible that Stanbridge's description did not fully describe the Emu. This example highlights the issue of early accounts of Aboriginal sky knowledge, the brevity of such descriptions and records, and the possibility of incomplete or partial descriptions. As a result, interpretations of such records should be done

with care, recognising the potential limitations such records have. Additional matters of interpretation in relation to the use of Stanbridge's research are discussed in section 2.3.6.3.

The absence of evidence can at times be taken to support a particular view or interpretation. In general, this approach is at risk of mis-interpretation, because it relies on an absence of evidence, rather than positive evidence.

Where there is a reasonable basis for speculation and such is clearly declared, this can be useful as an aid or pointer for future research or investigation. However, speculation which is based entirely on subjective views is generally not desirable, as such an approach does not lend itself to evidence based investigation.

### **2.2.9 Facilitating Aboriginal people to speak for themselves**

Closely related to matters of interpretation is the issue of facilitating Aboriginal people to speak for themselves. By doing so, we hear directly, rather than via a modified interpretation. For this study, I have chosen video recording for interviews, as one of the best ways of recording discussions. A major benefit of this approach is that such recordings effectively enable Aboriginal people to speak for themselves, in their own way, without being re-interpreted, or retold. Consent forms for the use of video interviews for this study have been used. In virtually all cases, interviewees consented for their interviews to be attributed. This has dramatically improved the directness and the first-hand accounts recorded in this research.

### **2.2.10 The dynamic nature of stories and knowledge**

The current research is based on the view that Australian Aboriginal cultures consist of dynamic and changing bodies of knowledge, attitudes and beliefs. Cultures adapt, incorporate new knowledge and are influenced by a host of external and internal factors. The impact and effects of colonisation over the last 200+ years have caused profound changes to Aboriginal culture throughout Australia. Whilst traditional, shared knowledge forms the basis of contemporary Aboriginal knowledge of the night sky, such knowledge has subsequently been shaped and influenced by many factors. This process continues today, so Aboriginal knowledge of the night sky is inherently a changing and dynamic field of study. It is fully expected that communities and individuals with such knowledge will continue to adapt, incorporate new knowledge and change over time. As a result, the emphasis of this research is clearly on the contemporary context, rather than attempting to reconstruct knowledge and beliefs that existed prior to European colonisation. Another aspect of this issue revolves around the origin of Aboriginal sky knowledge. Two prime examples documented via this research shed light on this issue. Firstly the interview with East Kimberley Elder Stan Brumby, revealed that it is his subconscious (literally dream states) that is where some of his knowledge, insights and inspirations are derived from, for various aspects of his sky knowledge (associated with Kandimalal, Wolfe Creek Crater). Secondly, the extensive interviews with artist Toogarr Morrison (discussed in detail in Chapter 4), reveal how it is via his personal journey of exploration and interpretation

of his Aboriginal culture, inspired by cues from the natural world, that has led to his coherent interpretation and expression of Aboriginal sky knowledge. These topics are more fully examined in Chapter 4.

### **2.2.11 Dealing with sensitive or restricted cultural information**

At the commencement of this research it was anticipated that some sensitive information may be encountered. I have been guided mainly by the views expressed by interviewees regarding any sensitivities or restricted cultural knowledge. In one case I was advised of confidential knowledge, and I have respected those wishes in this research, by not including such information. I have asked interviewees about the acceptability of communicating and presenting information gathered. In addition to this, I have used permission forms, to formally obtain permission for the use of such content.

There are examples of disputes and conflict in which the “ownership” of a story has been contested, or whether a particular person has a right to communicate / share such a story. The example of the dispute arising from the Northern Territory Supreme Court Seven Sisters artwork is a case in point (section 2.3.2.10).

### **2.2.12 Issues relating to deceased people**

In many Aboriginal communities, there are protocols relating to people who have passed away. For a duration after the death of a person, a period known as “sorry time” will occur, particularly in communities in northern Australia. There are often certain practices adopted, such as avoidance of referring to a deceased person directly by name, or even similar sounding names. Specific practices differ across Australia. I have been very mindful regarding this issue during this research and I have sought local advice regarding appropriate practices.

### **2.2.13 Management of intellectual property**

There has been considerable effort in recent years, regarding the advancement of intellectual property in relation to traditional knowledge. For example, the World Intellectual Property Organization (WIPO), has conducted roundtable forums on this subject, and have generated a number of substantial publications on this issue, including “Traditional knowledge & Indigenous peoples” (WIPO 2009), “What is traditional knowledge? Why should it be protected? Who should protect it? For Whom? Understanding the value chain” (WIPO 1999a) and “Intellectual property and traditional knowledge” WIPO (n.d.). These documents demonstrate that traditional knowledge and intellectual property are issues of importance and relevance to many cultural groups throughout the world.

For any copyright material, permissions have been sought for use of such material, and acknowledgements included. In the case of the development of two video programs (as detailed in section 5.5.1 and 5.5.2), permissions were sought and appropriate acknowledgements included in both productions.

### **2.2.14 Practical issues / travel / logistics**

The practical travel and logistics for this research are quite significant. Field work and site visits have required very substantial travel (4000km road travel using a 4WD vehicle), in remote country, over extended periods of time. Practical issues have included risk assessment, field work planning and preparation, safe field work and travel practices, contingency planning, and other practices including regular checkin procedures.

## **2.3 Engaging with Aboriginal sky knowledge: an overview**

The way in which people engage with Aboriginal sky knowledge is actually positioned within the broader context of how people engage with astronomy and astronomical knowledge in general. There are several aspects of astronomy that have broad appeal to the general public. Astronomy is both one of the oldest sciences and also one of the sciences that has ushered in enormous recent advances in knowledge, particularly within the last century. These advances have revolutionised our understanding of the cosmos and have profoundly changed the way in which we understand our place in the universe. Astronomy as a subject brings together the excitement of scientific discovery and a modern day sense of exploration, and also one of personal discovery of the universe. Astronomy offers both a rich intellectual history and the opportunity to experience memorable astronomical events, such as eclipses of the Moon and Sun, comets and meteor showers and a wide range of other events and phenomena. Ground and space based observatories and spacecraft reveal compelling images of the universe that excites the public's imagination. High quality and highly portable telescopes are readily available for the general public and the availability of digital cameras now means that many can photograph the universe for themselves. These various aspects that underlie the popularity of astronomy are noted in the IAU International Year of Astronomy 2009 review. In fact, the vision of IYA 2009 was encapsulated as:

*...to help people rediscover their place in the Universe through the sky, and thereby engage a personal sense of wonder and discovery (IAU 2010, 26).*

and the motto:

*...the Universe, Yours to discover (IAU 2010, 17).*

This sense of exploration and discovery was also expressed via the IAU Symposium 260, the Role of Astronomy in Society and Culture, held in Paris at the start of the IYA 2009. This symposium explored the ways in which astronomical knowledge is used by the diverse cultures of the world, including that of the many Aboriginal cultures of Australia.

The previous section established a foundation for understanding key issues and sensitivities associated with Aboriginal sky knowledge. In this section, various contemporary examples of the communication and sharing of Aboriginal sky knowledge are examined. These examples provide insights into the issues and sensitivities associated with research or communication of such knowledge. I review examples of shared



Aboriginal sky knowledge, which has contributed towards a greater appreciation of Aboriginal cultures and Australian landscapes. The examples used in the following sections illustrate the diverse ways in which people engage with Aboriginal astronomical knowledge, which specifically addresses research objective 1:

*Investigate the variety of ways in which people engage with Australian Aboriginal astronomical knowledge in our contemporary society.*

The examples presented and discussed in this section have been selected due to their relevance to the current research, their prominence in Western Australia or Australia and also the value that they provide in highlighting particular issues commonly encountered in this field of research, such as matters of maintaining and passing on valued knowledge, collaborative approaches and management of intellectual property. The following is not intended to be a comprehensive listing of all Aboriginal sky knowledge initiatives within Australia, as such a scope is too large for the current research. The examples are broadly categorised in Table 2.

Table 2. Overview: Engaging with Aboriginal sky knowledge.

Category	Number of examples (presented in Chapter 2)
Art exhibitions, artworks and performance events	9
Films and documentaries	3
Cultural experiences	4
Monuments / public art	2
Planetarium programs	4
Strategic documents and awards	2
Educational and scholarship programs	2
Currency	1
Symbolic applications	1
<b>TOTAL</b>	<b>28</b>

During the course of this research I have experienced and participated in many Aboriginal astronomy events, and I have also actively shared my own knowledge relating to my research, via more than 40 talks, presentations, posters and conference papers, at the local, state, national and international level. Examples of the various talks and presentations I have given from 2009 to 2012 are detailed in Appendix 16.

### 2.3.1 A review of online Aboriginal art centres

Aboriginal art centres are recognised as providing an important focus for many Aboriginal communities in Australia and Aboriginal art provides important ways of expressing knowledge, stories and connection to country. The role of Aboriginal art as an expression of personal and cultural knowledge, relating to the night sky is also widely recognised. One such example is the Association of Northern, Kimberley and Arnhem Aboriginal Artists (ANKAAA), whose mission is to “keep art, country and culture strong”.

(ANKAAA, Desart and Ananguku Arts 2011, 2). In a 2011 submission, ANKAAA highlights the role and importance of art in Aboriginal culture:

*Art is old. It was passed on from our ancestors to our grandfathers to our fathers to us... Art is talking about the land, the sea, about our culture, about our connection, about our kinship relationships – songs, dance, names, places, country, sacred sites. All these things are important to us.* (ANKAAA, Desart and Ananguku Arts 2011, 5).

This quote illustrates the connection between storytelling, art and the sharing and communication of knowledge. In the absence of written languages prior to first contact, Aboriginal communities have used art as a way of conveying knowledge, through associated stories. This approach has continued and developed to the present day. As a result, Aboriginal art can be a source of a wide range of knowledge, including cultural knowledge, practical knowledge about food sources and knowledge of specific landscapes.

During the course of this research, it became apparent that Aboriginal art centres provide a potentially useful and novel way of investigating Aboriginal sky knowledge. With the extensive use of websites, and online catalogues, Aboriginal art centres provide a way of accessing knowledge about the night sky, expressed via art, and generated by local communities. One advantage of a review of online websites and catalogues is that a very extensive geographical area can be assessed, at very low cost. I have applied this approach of reviewing online information, by sampling Western Australian online Aboriginal art centres. The methodology I have used is:

1. Identify a sample of Western Australian Aboriginal art centres with online galleries or catalogues (sourced from [www.aboriginalart.org](http://www.aboriginalart.org)).
2. Review online catalogues and galleries to identify artworks relating to astronomical themes. Websites were searched (where search functions were available) using the following terms: Sun, Moon, Milky Way, Seven Sisters, star, comet, meteor, shooting star, crater.
3. Count the total number of artworks (i.e. paintings), the number of artworks with astronomical themes, and identify artists and titles of works, where available.
4. Results are presented in Table 3.

An initial review was conducted in 2010, and an updated review completed in April 2012.

Table 3. Western Australian Astronomically themed Aboriginal artworks.

<b>Art Centre</b>	<b>Locality (Western Australia or Northern Territory)</b>	<b>Website</b>	<b>Number of artworks</b>	<b>Astron- omically themed artworks</b>
Aboriginal Art by Artlandish	Kununurra	<a href="http://www.aboriginalartshop.com">www.aboriginalartshop.com</a>	943	22
Aboriginal Indigenous Fine Art Gallery	Fremantle	<a href="http://www.aboriginart.com.au/">www.aboriginart.com.au/</a>	77	2

<b>Art Centre</b>	<b>Locality (Western Australia or Northern Territory)</b>	<b>Website</b>	<b>Number of artworks</b>	<b>Astron- omically themed artworks</b>
Art Gallery of WA	Perth	www.artgallery.wa.gov.au/	67	2
Gecko Gallery	Broome	www.geckogallery.com.au	30	1
Grasstree Gallery	Albany	www.grasstreegallery.com.au	294	1
Japingka Gallery	Fremantle	www.japingka.com.au	3188	36
Laverton Outback Gallery	Laverton	www.laverton-outback-gallery.com.au	215	40
Mangkaja Arts Resource Agency Aboriginal Corporation	Fitzroy Crossing	www.mangkaja.com	89	0
Mowanjum Art and Culture Centre Artists Spirit of the Wandjina	Derby	www.mowanjumarts.com	44	2
Roebourne Art Group	Roebourne	www.roebourneart.com.au/	6	0
Short Street gallery	Broome	www.shortstgallery.com.au	129	3
Turnbridge Gallery	Margaret River	www.turnbridgegallery.com.au	224	1
Urban Dingo Gallery	Fremantle	www.urbandingogallery.com.au	92	2
Warakurna Artists	(Via Alice Springs)	www.warakurnaartists.com.au	31	0
Waringarri Arts	Kununurra	www.waringarriarts.com.au	132	0
Warlayirti Artists	Balgo Hills	www.balgoart.org.au	119	1
Warmun Art Centre	Warmun (Turkey Creek)	www.warmunart.com	63	5
Yarlilil Arts	Halls Creek	www.yarliylil.com.au	176	1
<b>TOTALS</b>			<b>5913</b>	<b>119</b>

Appendix 2 includes an expanded listing of Table 3, with a detailed listing of artists and the titles of astronomically themed artwork.

The two galleries that returned the highest numbers of astronomically themed Aboriginal Artwork are: (1) Laverton Outback Gallery (Laverton) and (2) Japingka Gallery (Fremantle). The role of Japingka Gallery is examined in more detail in section 2.3.2.4, and insightful interviews with the gallery directors are presented in Section 4.4.5.

Reviewing online galleries and catalogues is a method which enables data to be “mined” via online searches, without the need for expensive travel. The results provide a snapshot of the various online

Aboriginal art galleries as of April 2012. The method has limitations, as not all art centres have websites (in particular, small, remote art centres). In addition, results are dependent upon the accuracy and currency of the online galleries. Search results can be influenced by the keyword used for searches (whether this is done via online or manual searches). Typical keywords used include: “star”, “sun”, “moon”, “shooting star”, “meteor”, “comet”, “seven sisters”, “milky way”, “night”, “evening star”, “morning star” and “crater”. Other keywords may be needed (e.g. the keyword “cave” may also be applicable for searches relating to meteorite craters). The number of astronomically themed Aboriginal artwork is likely to be underestimated, as the astronomical themes of some artworks are difficult to recognise, whilst the total number of artworks is expected to be slightly overestimated, due to the possibility of some artworks appearing more than once in online galleries (due to re-exhibited works). The online review is limited mainly to Western Australian based art centres, and does not include internationally based art centres. The following art centres (Table 4) were not included in the review because websites, online galleries or online catalogues were not available.

Table 4 Art centres not reviewed.

<b>Art centre, location</b>	<b>Notes / website</b>
Jirrawun Aboriginal Art Corporation, Wyndham	<a href="http://www.jirrawunarts.com">www.jirrawunarts.com</a>
Kalumburu Artists, Kalumburu	<a href="http://www.waringarriarts.com.au">www.waringarriarts.com.au</a>
Kayili Artists, Patjarr	(no website)
Martumili Artists, Newman	(no website)
Martumili Artists, Wiluna	(no website)
Papulankutja Artists, Blackstone	<a href="http://www.papulankutja.com.au">www.papulankutja.com.au</a> (website not active)
Randell Lane Fine Art, Mt Lawley	<a href="http://www.randellart.com">www.randellart.com</a> (website not accessible)
Spinifex Arts Project (Ilkurlka Community)	<a href="http://www.spinifex.org">www.spinifex.org</a> (no online gallery)
Tjarlirli Artists, Tjukurla Community	(no website)
Yaruman Art & Culture Centre, Ringers Soak	<a href="http://www.yarumanart.com.au">www.yarumanart.com.au</a>
Yirrebii Arts and Crafts Aboriginal Corporation, Kununurra	(no website)
Yuriny Cultural Centre, Derby	<a href="http://www.yuriny.com">www.yuriny.com</a>
Warburton Art Centre, Warburton	<a href="http://www.warburtonarts.com">www.warburtonarts.com</a>
Western Desert Mob, Western Desert	<a href="http://www.westerndesertmob.com.au">www.westerndesertmob.com.au</a>

Despite the noted limitations, the method provides a useful way to rapidly review existing artworks from a very extensive geographic area, at very low cost. Eighteen art centres within Western Australia and almost 6000 artworks were reviewed with 110 artworks identified with astronomical themes. Approximately two percent of reviewed artwork contained astronomically themed works, so this review does suggest that astronomical themed artworks in Western Australian Aboriginal art is quite uncommon.

After examining the data presented in Appendix 2, a classification has been achieved of the main themes or keywords, of astronomically themed artworks. To do this, I have derived logical keywords to categorise the main astronomical aspects of each artwork (limited to one main key-word per artwork). The results are provided in Table 5.

Table 5. Keywords used for online data-mining

	<b>Keyword classification</b>	<b>(equivalent terms)</b>	<b>Frequency</b>
A	Falling star	Meteor	1
B	Moon	Moon and star	7
C	Star		3
D	Seven Sisters	Pleiades	90
E	Crater	Wolfe Creek Crater	7
F	Morning star	Morning starlight	2
G	Evening star	Evening starlight	1
H	Milky Way		1
I	Emu (in the sky)		2
J	Southern Cross		1
K	Other	(e.g. “night”)	4
		<b>TOTAL</b>	<b>119</b>

This analysis shows the high number of artworks (76%) that relate to the Seven Sisters (Pleiades). In contrast, less than 2% of astronomical themed Aboriginal artworks featured the “Emu” in the sky. Given that the Emu in the sky is large and prominent (from dark sky locations), and that it is generally familiar by both Aboriginal and non-Aboriginal people in Australia (as supported by survey evidence in Chapter 3), this finding is surprising. The relatively low frequency of the Emu in the sky featured in Aboriginal art may indicate an avoidance of representing the Emu, in artwork.

Having established an overall context for astronomical themed Aboriginal art in Western Australia, in the following section, I review specific exhibitions and Aboriginal art projects which share Aboriginal sky knowledge.

## **2.3.2 Aboriginal artworks and art exhibitions**

### **2.3.2.1 “Ilgarijiri- Things Belonging to the Sky”**

This exhibition of Aboriginal art has developed out of a collaboration between Yamaji Arts (Geraldton, Western Australia), and the International Centre for Radio Astronomy Research (ICRAR). The exhibition has developed in the context of Australia’s bid for the Square Kilometre Array (SKA) radio telescope project (ICRAR, 2010). The artworks from the exhibition developed out of a site visit and collaboration at Boolardy Station, the site of the Murchison Radio-astronomy Observatory and the Australian SKA Pathfinder project. The site visit involved an exchange and sharing of knowledge, between the research

scientists involved in the SKA project, and the Aboriginal artists (Tingay 2011, Drok 2009/2010, Brophy 2009).

The first phase of the exhibition presented more than 80 works (Figure 4) by Aboriginal artists from the Murchison region of Western Australia (centred on Geraldton). Many of the artworks show the diversity of styles used to represent astronomical subjects. The story of the Seven Sisters (Pleiades) is a strong theme, in addition to the “Emu in the sky” star pattern. Artworks include both traditional and modern styles.



Figure 4. “*Ilgarijiri- Things Belonging to the Sky*” Exhibition, Curtin University, 2009.

(Photo: John Goldsmith)

The “*Ilgarijiri Things Belonging to the Sky*” exhibition has been adapted and developed over time into several exhibitions since its first public exhibition in June 2009. Eight exhibitions have occurred to date (Table 6), including exhibitions in Australia, South Africa, United States, Netherlands, Belgium, and Germany.

Table 6. *Ilgarijiri* Exhibitions

Location	Exhibition dates
Geraldton, Western Australia	12 June - 19 July 2009
Perth, Curtin University, Western Australia	16 September - October 2009
AIATSIS, Canberra, Australian Capital Territory	(commenced) 27 November 2009
Cape Town, South Africa	15 March - 19 March 2010
Washington DC, United States	(commenced) 27 October 2011
The Hague, Netherlands	27 February to 3 March 2012
European Parliament, Brussels, Belgium	5 March to 9 March 2012
Australian Embassy, Berlin, Germany	13 March to 17 March 2012

The exhibition’s showing in Canberra in 2009 coincided with the opening of the first national Indigenous Astronomy Symposium, hosted at the Australian Institute for Aboriginal and Torres Strait Islander Studies (AIATSIS) Canberra (AIATSIS 2011).

### **2.3.2.2 “Skylab Out of Orbit” exhibition**

The “Skylab Out of Orbit” exhibition was developed collaboratively by artist David Carson, video artist Brian McClave and sound artist George Millward. The exhibition is based on the crash of Skylab into Western Australia in 1979, and the contrasting example of Wolfe Creek Crater (Kimberley, Western Australia), which was caused by a natural meteorite impact event some 300,000+ years ago. In the exhibition catalogue (Carson, McClave & Millward 2003, par.1), people's emotive responses experienced towards the night sky are noted:

*It seems that things that fall to earth inspire an array of interesting responses in us: fear, curiosity, anger, awe and that age-old feeling that we may not be totally alone in the universe.*

During the development of the exhibition, Carson conducted a 10 day site visit to Wolfe Creek Crater. He gathered information about the crater in a variety of ways, including photography, video, audio recordings and drawings. The Kimberley Language Resource Centre (Halls Creek) provided assistance for access to Aboriginal accounts of the crater. The exhibition included an account of the meteorite crater from the Aboriginal Jaru people based on the research of Goldsmith (2000). The Aboriginal account relating to the crater was presented as a circular artwork exhibit, featuring the story text.

### **2.3.2.3 “Shared Sky” exhibition**

The “Shared Sky” exhibition was developed by the National Gallery of Victoria, and exhibited between 13 March – 2 August 2009. The exhibition was based on an exploration of cultural experiences of the night sky, throughout Australia. It includes a diverse range of cultural backgrounds including Aboriginal and non-Aboriginal artists. The exhibits included prints, drawings, sculpture, paintings and photography, which were selected from the collections of the National Gallery of Victoria (Gilchrist & Holland, 2009). An example of an Aboriginal exhibit is the work entitled “Mankokkarrng” (The Southern Cross) 1948, which was presented to the National Gallery of Victoria by the Commonwealth Government in 1956.

### **2.3.2.4 Japingka Gallery exhibitions (2010 and 2011)**

In 2010, the Aboriginal Fine Art Gallery, Japingka (Fremantle, Western Australia), presented “Star Dreaming Yanjirpirri Jukurrpa”. The exhibition featured 43 artworks, with approximately half representing astronomical stories or themes. Northern Territory Aboriginal artist Alma Nungarrayi Granites featured prominently, with the “Seven Sisters” being a key story represented through the artwork (Japingka Gallery, 2010).

In 2011, Japingka Gallery presented the “The Night Sky” exhibition, a solo exhibition by Alma Nungarrayi Granites. The exhibition presented the story of the Seven Sisters (Pleiades). An indication of the level of public interest in astronomical themed Aboriginal art is evident by the fact that the exhibition was one of the most commercially successful exhibitions hosted by Japingka Gallery, with all artworks sold.

Interviews of the Japingka Gallery directors are provided in Section 4.4.5, which examines the origin and development of the gallery, and its role in presenting the above two astronomically themed Aboriginal art exhibitions.

#### **2.3.2.5 “An Ever Expanding Universe”**

“An Ever Expanding Universe” exhibit was hosted by the Perth Institute of Contemporary Arts (PICA), 12 June – 3 August 2008. The exhibition brought together a variety of artworks inspired by astronomical, including Aboriginal, perspectives. According to the exhibition catalogue (PICA 2008, par. 1, 2, 11), the exhibition:

*...traces a series of trajectories in the vast and constantly evolving realm of Australian painting today. Navigating a constellation of distinct traditions and cultural histories, this exhibition journeys into a particular sphere of contemporary art practice.*

*...presents a range of works that either reference astronomy or cosmology, or are charged with a feeling of unbounded open-endedness. Each of these singular works is brought together by a sense of infinite possibility, multiplicity and wonder.*

*Dizzying fields of innumerable stars spread across Gulumbu Yunupingu’s work. A senior Yolngu woman, Gulumbu Yunupingu’s Garak, The Universe (2008) explores the cosmos, ‘all around, every tribe, every colour’ – and the link between the people on earth and the stars in the sky.*

*Fields of subtly varying yellow and white stellar-forms and dots dazzle the viewer. Their vast numbers generate a feeling of wonder, at the mystery of the infinite. Looking closely, these stars appear to cluster in certain locations, suggesting the formation and movement of manifold galaxies. Painted in local pigments and ochres and spiralling in unbroken masses across the surfaces of the barks and the hollow logs, these mesmeric works tell Yolngu stories and welcome contemplation.*

#### **2.3.2.6 “Tracks of the Rainbow Serpent” 2004**

This exhibition focussed on Aboriginal art relating to Wolfe Creek Crater. The exhibition was primarily based on commissioned artworks. The project was developed by US anthropologist Peggy Reeves Sanday, University of Pennsylvania, who is the daughter of Frank Reeves, one of the first non-Aboriginal people to “discover” the crater in 1947 (Sanday, 2007).

#### **2.3.2.7 “The Seven Sisters”, exhibition and theatre production**

Wongai Elder Josie Boyle, from Kalgoorlie, has a life-long relation to the night sky. Extensive interviews are provided in Appendix 13, in which Josie Boyle details the development of the Seven Sisters (Pleiades) art exhibition (BHP Billiton, n.d. c2008), which was presented at Kings Park, Perth. The exhibition



developed from childhood stories told to Josie, in which her mother personified one of the Seven Sisters (the following quotes are derived from interview transcript, Appendix 13.3.2):

*She was the one who the Seven Sisters left behind. She was the one who danced every morning. Everybody knew her as talking about the Seven Sisters, it was her religion. She danced it...*

The cross-cultural themes of the Seven Sisters story were then explored in a collaborative project between Aboriginal and non-Aboriginal artists at Kidigo Gallery, Fremantle, with results exhibited in 2011.

*...the Seven Sisters story is nice isn't it. It's a beautiful story and even the Greek story, see, similar and... ...we really got together in that story...*

The profound significance of the Seven Sisters to Josie Boyle is revealed in her comments;

*Well, it is a religion, see. And it's the more you link to it, it's a religion for me today. It was a religion for my mum. She danced the sun up every morning. She used to get up at daybreak. Daybreak was an important time for them.*

The creative approach to interpreting the Seven Sisters story continued, with Josie collaborating with the Ochre Contemporary Dance Company, in a theatre production called *Diaphanous, Seeing Through and Beyond*. The production featured at the Western Australian State Theatre Centre between 22 -24 November 2012, and the production explored the Seven Sisters story from Aboriginal and Ancient Greek perspectives (The Australian, 2012).

### **2.3.2.8 Cosmology Gallery: commissioned artworks**

The Cosmology Gallery (Figure 5), located at the Gravity Discovery Centre (GDC, Western Australia), brings together different cultural and scientific views of the cosmos (Goldsmith, 2011b). An introduction to the Cosmology Gallery is provided by the Gravity Discovery Centre Foundation (2008, 1):

*...explores the human yearning to understand our place in a vast and awe inspiring universe. The gallery is the result of a collaboration between scientists, artists, photographers, and cultural groups, including Indigenous, Christian, Buddhist, Islamic and Hindu traditions. The result is a new visual interpretation of creation stories of the universe we live in.*

The Cosmology Gallery commissioned South West Aboriginal artist, Toogarr Morrison to develop an artwork which expresses his Aboriginal perspective of the night sky. His creation “Bibbullmen Religion” (Figure 6) now features as part of the Cosmology Gallery exhibits. The artwork comprises one large central painting, with eight adjacent paintings. Morrison combines “dot-painting” styles, together with representations of spiral galaxies. Key elements of the painting include the seven sisters (Pleiades) and the hunter (Orion), the “spirit woman” (of the Milky Way), the Emu sky pattern (comprising the dark area of the Milky Way between the Southern Cross and Scorpius), the Magellanic Clouds, and other star patterns.

One aspect of Morrison's artwork which is particularly notable is the contrasting use of styles, with both contemporary styles of Aboriginal painting combined with images of galaxies inspired by deep space astronomical imagery.



Figure 5. The Cosmology Gallery, Gravity Discovery Centre.  
(Photo: John Goldsmith)



Figure 6. "Bibullmen Religion". Artist: Toogarr Morrison.  
(Cosmology Gallery. Photo: John Goldsmith)

### 2.3.2.9 Horizon Planetarium: commissioned artwork

Horizon Planetarium is co-located with Scitech, Western Australia's public education and science centre, located in Perth. Subsequent to the Cosmology Gallery commission, Horizon Planetarium commissioned artist Toogarr Morrison to produce an astronomically inspired artwork for the foyer of the Horizon Planetarium (Figure 7). The large scale artwork features similar elements to that of the Cosmology Gallery artwork, including the Milky Way spirit woman, Seven Sisters, the hunter, the Emu, Magellanic Clouds, the Sun and the Moon and various other star patterns. A special feature of the work is that it shows the Milky Way in its entirety, represented as a continuous, unbroken circle.



Figure 7. Toogarr Morrison's commissioned artwork, Horizon Planetarium.  
(Photo: John Goldsmith)

Both the Cosmology Gallery and Horizon Planetarium artworks present Morrison's knowledge of the night sky, in a new, creative interpretation and representation of his Aboriginal cultural knowledge. Stories represented in both artworks, such as the Seven Sisters and the Emu, are based upon ancient Aboriginal stories of the night sky, which are recognised by many Aboriginal communities throughout Australia. The artworks represent a contemporary way of recording, renewing and sharing Aboriginal sky knowledge, for both Aboriginal and non-Aboriginal communities in Australia.

### 2.3.2.10 Northern Territory Supreme Court public artworks

The Northern Territory Supreme Court, Darwin, exhibits a variety of Aboriginal art. One piece, "Milky Way Dreaming" by Nora Napaljarri Nelson, was commissioned by the Supreme Court, and was subsequently re-interpreted in a large scale glass mosaic (measuring 7.5 by 7.5 metres), by Melbourne Mural Studio artists Joe Attard and David Jack (Bauman, 2006). The theme of the Seven Sisters artwork highlights a key issue in Aboriginal cultural knowledge, that of who has the right to communicate and pass

on such knowledge. Senior men of the Yuendumu community, including the father of the artist, disputed the right of the artist to paint the Seven Sisters story. This dispute was subsequently resolved, and the glass mosaic artwork put on display at the Supreme Court (Hutchings, 2002).

### 2.3.3 Films and documentaries

#### 2.3.3.1 “Tnorala, Baby Falling”

“Tnorala, Baby Falling” is an example of a recent documentary which has featured Aboriginal astronomical cultural knowledge. Approximately 175km west of Alice Springs is a large meteorite impact structure, known as “Gosse’s Bluff”. The Aboriginal name for Gosse’s Bluff is “*Tnorala*”. The impact scar is an ancient formation, which appears as a circular set of hills, rising out of the flat adjacent plain. This site is a significant dreaming site for Western Arrernte people.

In 2007, the documentary film production “Tnorala, Baby Falling” (Figure 8) was released. This documentary presents the cultural connection to the ancient impact structure. The Aboriginal story relating to this site, as described in the documentary, presents the belief in the spirit child returning to the Earth (hence “Baby Falling”). This documentary is particularly interesting because it relates current day Aboriginal cultural beliefs to an ancient meteorite impact structure in Australia. The documentary was produced by the Central Australian Aboriginal Media Association (CAAMA), which is based in Alice Springs and the film is distributed by Ronin Films (Thornton, 2007).

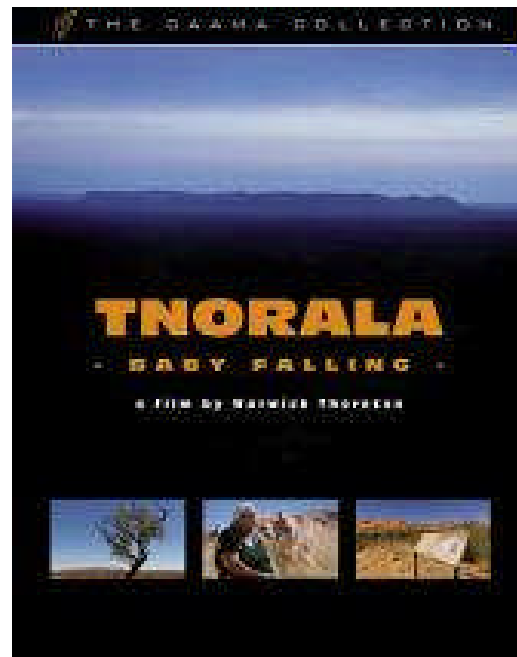


Figure 8. “Tnorala, Baby Falling”.  
(Image courtesy of CAAMA)

#### 2.3.3.2 “Singing the Milky Way”

“Singing the Milky Way” is a 62 minute documentary produced by Songlines, and featuring Aboriginal artist Paddy Japaljarri Sims, friends and family. The video production is featured on the Aboriginal-Art website ([www.aboriginal-art.com](http://www.aboriginal-art.com)) (Director, David Betz), however, it has not been possible to obtain a copy of this video to date.

#### 2.3.3.3 “Message Stick”

An Aboriginal astronomy story “Before Galileo” featured on the ABC TV “Message Stick” program in 2009. The program featured the *Ilgarijiri- Things Belonging to the Sky* aboriginal art exhibition, together with interviews with Elder Bill Yidumduma Harney (co-author of “Dark Sparklers”), Yamaji Art manager Charmaine Green, Professor Steven Tingay & Professor Ray Norris.

### **2.3.4 Cultural experiences**

There are numerous examples of cultural experiences in Australia, provided by Aboriginal people. Some of the cultural experiences are specifically focussed on Aboriginal perspectives of the night sky. Examples include cultural talks at Gingin Observatory, a public presentation at the University of Western Australia, and Aboriginal heritage tours at nature reserves and national parks. These are discussed below. Dr Noel Nannup operates Aboriginal cultural tours in Western Australia. The tours help to educate young Western Australians about the rich cultural heritage of Aboriginal people. The “Aboriginal astronomy” tour at Gingin Observatory explores several Aboriginal stories of the night sky, such as “the emu” sky pattern, and, in particular, the significance of the dark areas in the Milky Way. Dr Nannup has also presented public talks at universities including the University of Western Australia (UWA) and Edith Cowan University. One such event was “Creation Stories – The Dreamtime, Genesis and the Big Bang” hosted at UWA on 27 January 2011. The presentation included talks by an astronomer, a Rabbi, and Dr Nannup. His account of Aboriginal spirituality and sky knowledge was based on the sharing of knowledge which has been passed on by Elders and also the passing of knowledge gained via personal experience. Dr Nannup noted that Aboriginal spirituality was generally not well known or understood. He referred to the special role of the South West of Western Australia, and, in particular, the beginning point of the Seven Sisters dreaming. The important role of the Magellanic Clouds was noted; the Small Magellanic Cloud is associated with law and is sensitive and/or secret, and the Large Magellanic Cloud contains “everybody's” story, and is much more open. Other examples of Aboriginal cultural tours which relate to the night sky include the “Gudjal Yura, Two Up There Star Tour” presented at the Spectacles Wetlands (The Town of Kwinana, Western Australia), and the Mooditch Aboriginal Tours, Yanchep National Park, Perth.

### **2.3.5 Monuments / public art**

#### **2.3.5.1 Reconciliation Place, Canberra**

Reconciliation Place, Canberra, is a major national Australian monument dedicated to the reconciliation process. It is described (National Capital Authority n.d, 3) as:

*A place which recognises the importance of understanding the shared history of Indigenous and non-Indigenous Australians, and which reaffirms our commitment to Reconciliation as an important national priority.*

The significance of the location of Reconciliation Place is also highlighted:

*The location of Reconciliation Place in the Parliamentary Zone places the Reconciliation process physically and symbolically at the heart of Australia's democratic life and institutions. It signifies the importance the Australian people place on the ongoing process of Reconciliation and is a prominent symbol of the nation's commitment to healing the wounds of the past. (National Capital Authority n.d, 4).*

Reconciliation Place includes seventeen public artworks, of which two specifically feature Aboriginal astronomical knowledge. Artwork number 2 (Figure 9) is entitled “Smooth Sailing” and features astronomical knowledge from the Torres Strait (National Capital Authority n.d., Artwork 2):

*Represented on the first sail is the constellation of Tagai, a mythical hero who stands in a canoe; his left hand, the Southern Cross, holds a fish spear. The stars of Tagai usher in seasonal changes, and are a guide to voyaging and cultivating throughout the Torres Strait. The constellation on the sail is created from inlaid, hand-carved pearl shell.*

A universal and unifying idea is also explicitly recognised in this artwork:

*It reflects the idea that all Australians share their experiences under the same stars.*

Artwork 11 presents a story from the Ngarrindjeri People, (Lower Murray River), which expresses a story of the Sun, Moon and Stars:

*Ruby Florence Hammond PSM was well-known for singing the song about the sun, the moon and the stars, by her family and many other groups. It is a song about where we all come from. The artwork has been designed by ‘Munnari’ John Hammond, Ruby Hammond’s son. (National Capital Authority, n.d., Artwork 11).*



Figure 9. Indigenous astronomy featured at Reconciliation Place, Canberra.

*(Image supplied courtesy of the National Capital Authority.*

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### **2.3.5.2 Public art sculpture; the Emu constellation**

The Victorian coastal community of Bayside (located between Melbourne and Mornington Peninsula) is the site of a public art sculpture which features the Emu constellation, which is known by the local Aboriginal name of “Barraimal”:

*The sculpture by Glenn Romanis depicts Barraimal as a constellation and how it is seen using the constellations of the Southern Cross, (Crux), the Pointer, Scorpio, Sagittarius and using the Coalsack Nebula (the dark shadows under the milky way) to create its head, neck and back. Scorpio shapes the body and Sagittarius the nest and eggs.*

*In this work, Carolyn Briggs’ (Elder of the Boon Wurrung) is cross-referenced with scientific knowledge and the seasonal visibility of the constellation in the sky (only visible at the time when the male emu is sitting on a clutch of eggs – traditionally, the male was not hunted at this time). The constellation is seasonally visible, June, July or August.*

Bayside City Council, Victoria (2010, par. 1-2).

## **2.3.6 Planetarium programs, shows and planispheres**

### **2.3.6.1 Planetarium shows**

A collaboration between Horizon Planetarium (Western Australia) and Aboriginal Elder and artist Toogarr Morrison has presented a live planetarium show, featuring Toogarr Morrison’s astronomical inspired Aboriginal artwork. A special live show was presented on 1 July 2010. The approach adopted by Horizon Planetarium has been to adopt a live, storytelling style, which maintains an oral, storytelling approach. This has the benefit of ensuring the intellectual property is maintained by Toogarr Morrison, but it is also a more limited approach in terms of ability to reach audiences, due to the inherent limitations of a live show. This example highlights the conflicting issue of how Aboriginal people can share their knowledge and at the same time, retain control over that knowledge (discussed further in Chapter 5).

### **2.3.6.2 Scienceworks, Victoria**

A planetarium show has been developed by Scienceworks, presenting the “Stories in the Stars – the night sky of the Boorong people”. A 12 page “Teachers notes” document is supplied by Museum Victoria, with introductory information, a synopsis of the planetarium show, descriptions about Boorong constellations, a guide to making a planisphere, and other activities for students. (Museum Victoria 2008).

### **2.3.6.3 Virtual planetariums**

Stellarium is a free software, produced by [www.stellarium.org](http://www.stellarium.org). The main functions of the software are to provide planetarium images based on user specified input.

Stellarium includes representations of constellations, from a variety of ancient, and contemporary cultures, including:

Aztec	Lakota	Sami
Chinese	Maori	Tupi-Guarani
Egyptian	Navajo	Western
Inuit	Norse	
Korean	Polynesian	

Australian Aboriginal astronomy researcher John Morieson has developed, in conjunction with astrophotographer Alex Cherney, the first Stellarium based Australian Aboriginal star patterns (Figures 10 & 11). The star knowledge is derived from William Stanbridge, who described Aboriginal sky knowledge of the Boorong people, in an 1858 paper to the Philosophical Institute of Melbourne (Stanbridge, 1858). In the Stellarium documentation by Morieson, the Boorong people are described as priding themselves on knowing more of astronomy than any other tribe, based on Stanbridge's earlier work.



Figure 10. Stellarium view showing Boorong star patterns.  
(Image capture from Stellarium by John Goldsmith)

We have previously discussed issues of interpretation arising out of Stanbridge's 1858 paper in relation to *Tchingal*, the Emu (section 2.2.8). Morieson clearly indicates that his representation of the constellations used in Stellarium are based on his interpretation. However, what isn't noted in the Stellarium documentation is the representation of the "Emu" or "Tchingal" (to the Boorong people). "Tchingal", as represented in Stellarium, is shown as a (now extinct) ancient giant flightless bird. Whether the Aboriginal sky pattern known as the Emu is in fact based on cultural memory of a now



extinct bird species, is open to considerable debate. This representation illustrates how interpretation of sky knowledge can lead to a “new mythology” of the night sky.



Figure 11. Stellarium view showing “Tchingal”.  
(Image capture from Stellarium by John Goldsmith)

#### 2.3.6.4 “Aboriginal Sky Figures” planisphere

First published in 1996, the “Aboriginal Sky Figures” planisphere was produced by ABC Books for the Australian Broadcasting Corporation. The planisphere presented Aboriginal sky knowledge and constellation stories, based on Aboriginal Dreamtime stories. The production was a collaboration between Aboriginal Elder Gaparingu Naputa, and the Royal Astronomical Society (Gordon Patson). The design of the planisphere attempted to recognise the wide diversity of Aboriginal sky knowledge. It did this by recounting Dreamtime Stories, and related star patterns, from different regions, including Queensland, Tasmania, Victoria, Northern Territory, New South Wales with the notable omission of Western Australia (ABC Books 1996).

#### 2.3.7 Strategic documents & awards

Aboriginal cultural views of the night sky are being shared via key strategic documents in Australia, and also in major national science awards. For example, the Decadal Plan for Australian Astronomy features on its cover (Figure 12), a painting entitled “Warlu Time”, which features the milky way, seven sisters and emu constellation. This painting was commissioned by the Australian Telescope National Facility (ATNF) and was created by artist Charmaine Green, then a member of the Marra Arts collective, Geraldton (National Committee for Astronomy of the Australian Academy of Science, 2005). The theme continues with the mid-term review of the Australian astronomy decadal plan (National Committee for Astronomy of the Australian Academy of Science, 2011), the cover of which

presents the Pleiades (Seven Sisters), also called the seven Jija's (sisters), by the Murchison Aboriginal artist Christine Collard.



Figure 12. Aboriginal astronomy art; New Horizons decadal plan & mid-term review.  
(Images courtesy of Commonwealth of Australia)

The 2007 Eureka Science Prize for Science Photography saw the awarding of “Emu in the sky” by Barnaby Norris, of a composite photographic image illustrating the Aboriginal emu constellation and an ancient rock engraving of an emu (Figure 13). The submission achieved third place in the Eureka Science Prize for Science Photography competition, and gained widespread public attention. The image has subsequently been marketed via the “Emu Dreaming” website [www.emudreaming.com/poster.htm](http://www.emudreaming.com/poster.htm).

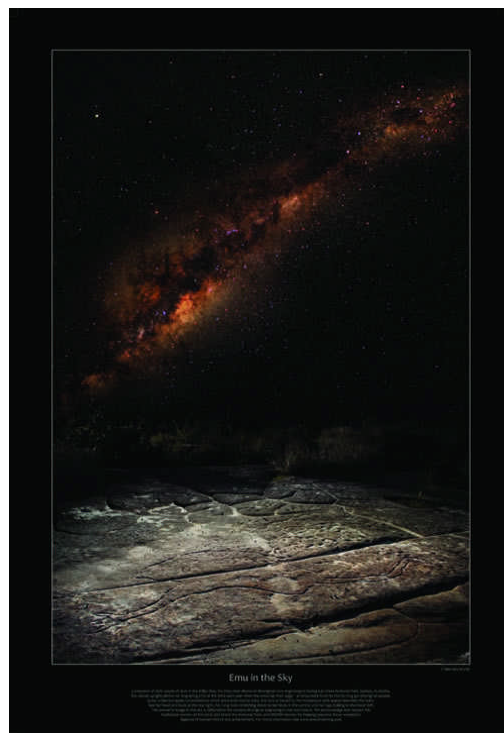


Figure 13. Eureka Science Prize finalist.  
(Image courtesy of Barnaby and Ray Norris)

### 2.3.8 Education and scholarship programs

The role of Aboriginal astronomical knowledge in Australian curriculum and education is discussed in detail in Chapter 5, however, two examples are discussed here to introduce and illustrate contemporary educational and scholarship programs. In 2012, the University of Western Australia developed two new units, “Our Universe”, and “Our Solar System”. Both units included Aboriginal, cultural and scientific narratives, to provide students with an understanding of the different ways people have attempted to interpret and understand the universe. A “welcome to country” was provided by Elder Kevin Cameron (Figure 14), and the Australian Aboriginal astronomy content included presentations by Elder Toogarr Morrison (Figure 15), at the Cosmology Gallery (Gravity Discovery Centre), Western Australia (as discussed in section 2.3.2.8). The Our Solar System unit attracted in excess of 120 students.



Figure 14. The “Welcome to Country” by Elder Kevin Cameron at the Cosmology Gallery.

(Photo: John Goldsmith)



Figure 15. Professor David Blair (left) and Elder Toogarr Morrison (right).

(Photo: John Goldsmith)

The late Emeritus Professor John De Laeter played a critical role in the development of the Gravity Discovery Centre Foundation (GDCF) and was chairperson since its inception through to 2010. In 2010, the GDCF established the De Laeter scholarship and the inaugural scholarship applications were sought by November 2010. The GDCF introduces the scholarship (GDC 2012, np) in the following way:

*The Gravity Discovery Centre (GDC) has established the (de Laeter) Scholarship to recognise the huge contribution to science education in Western Australia made by Professor John de Laeter and his wife Robin. The scholarship is designed to allow tertiary students to collaborate with scientists, educators, communicators and technicians through the auspices of the GDC. The successful applicant will design and construct an exhibit/display/multimedia production that will be permanently located at the Gravity Discovery Centre. The main purpose of the project should be to motivate and communicate science to the thousands of visitors annually to the centre.*

In addition to John De Laeter's leadership role with the Gravity Discovery Centre, De Laeter conducted substantial research in relation to meteorites. One of his publications is "Meteorites, A Journey Through Space and Time" (2002), co-authored with Dr Alex Bevan. This book includes an examination of ancient beliefs regarding meteorites as well as a brief review of the role of meteorites and Aboriginal culture in Australia. The research presented in this thesis formed the basis of a successful application to the inaugural De Laeter scholarship program, which resulted in the development of a new Aboriginal astronomy educational resource in the form of a video production publicly exhibited at the Cosmology Gallery. The scholarship project and the development of the video production is discussed in detail in Chapter 5.

### **2.3.9 Aboriginal astronomical practices featured on Australian currency**

Australian Aboriginal cultural practices relating to the night sky are featured on Australian currency. Marking the Australian bicentennial in 1988, a \$10 note was issued by the Reserve Bank of Australia, which featured aspects of Aboriginal culture, and Aboriginal cultural practices relating to astronomy in particular. The note featured the "Morning Star Pole" (Figure 16). The Morning Star pole is used in ceremonies that focus on the planet Venus, and the white feathers on the top of the pole represent the planet (Norris and Norris, 2009). Although not specifically featuring Australian Aboriginal astronomical knowledge or practices, the two dollar coin features an Aboriginal Elder and the Southern Cross.



Figure 16. "Morning Star Pole" on the \$10 note.

### 2.3.10 Symbolic applications

Both the Australian National Flag, and the Aboriginal Flag (Figure 17), use astronomical meaning and symbolism, to help create a sense of national identity. The Australian National Flag features both the Southern Cross, and the six pointed “Commonwealth Star”, also known as the “Star of Federation” which symbolically represents the states and territories of Australia. The Aboriginal Flag contains three symbolic elements (AIATSIS, 2012b):

Black: Represents the Aboriginal people of Australia.

Red: Represents the red earth, the red ochre and a spiritual relation to the land.

Yellow: Represents the Sun, the giver of life and protector.



Figure 17. Australian National Flag and the Aboriginal Flag.

(Photo: John Goldsmith)

### 2.3.11 Discussion

The examples I have provided of Aboriginal astronomical knowledge demonstrate that such knowledge is being shared and communicated via very diverse media. Examples of this diversity include Aboriginal art, exhibitions, films and documentaries, monuments, planetariums and planispheres, conferences, strategic documents, prizes, educational programs and symbolic applications. Aboriginal people are usually, but not always, the creative originators of such works.

One surprising theme to emerge from this review is the reconciliation dimension to Aboriginal astronomical cultural knowledge. This dimension is explicitly expressed as part of Australia's Reconciliation Place, in the heart of the nation's capital, Canberra, and builds upon themes that recognise the universal access to, and experience of, the night sky to all cultures and people. The themes of cooperation and sharing of knowledge between Aboriginal and non-Aboriginal people emerge in Chapter 4, with the *Ilgarijiri- Things Belonging to the Sky* collaboration. Some Aboriginal

communities are using Aboriginal astronomical knowledge as a means of cultural renewal or “reclaiming” knowledge. For example, *Ilgarijiri* artist Charmaine Green expressed this as “reclaiming the right to share cultural stories” (interview transcripts detailed in Chapter 4 and Appendix 13.1.5).

The review of online galleries from Western Australian Aboriginal art centres showed that astronomically themed Aboriginal artwork is uncommon. Approximately 2% of almost 6000 artworks showed clear astronomical themes. This approach of “mining” online databases has shown that useful information can be sourced via such an approach. The review identified art centres, specific artworks, and artists, throughout Western Australia, who paint astronomically themed paintings.

There are several examples of art exhibitions which feature cultural views of the night sky, examples being the Cosmology Gallery, Horizon Planetarium and the “Ever Expanding Universe” exhibition. Specially commissioned artworks based on astronomical themes exist.

Communicating astronomical cultural knowledge can be problematic, as demonstrated by a dispute relating to an artwork, at the Northern Territory Supreme Court. Such conflicts can occur in relation to “ownership” or “custodianship” of a story and who has the right to share such a story (in whatever medium it is expressed in). Despite these difficulties, problematic issues have been successfully addressed in various collaborative projects. The various examples of the successful sharing and communication of Aboriginal sky knowledge lend support to the view that some Aboriginal knowledge is indeed open and available to the public (hypothesis no. 1).

## **2.4 Conclusions**

The second research objective for this study is to “Gain an understanding of the issues and sensitivities regarding such cultural knowledge and the ways in which these issues can be addressed”. Section 2.2 examines a diverse range of issues and presents how these issues are addressed in the current research. In section 2.3, I identify 28 examples, in 9 categories, of how people engage with Aboriginal sky knowledge, in response to research objective 1. These examples further expand upon the discussion on issues and sensitivities relating to Aboriginal sky knowledge. Whilst some of the issues are applicable to Aboriginal knowledge in general, others relate specifically to Aboriginal sky knowledge, and all provide a useful foundation in relation to future Aboriginal sky knowledge collaborative initiatives.

## Chapter 3

# Assessing astronomical knowledge, attitudes & beliefs via surveys

*“...humans enjoyed a far more intimate relationship with the sky than we do now. We may know much more than they did about what is actually up there, but they were much more a part of it”.*

“Comet”, Carl Sagan and Ann Druyan (1985, 14).

### 3.1 Introduction

#### 3.1.1 Knowledge, attitudes and beliefs

The above quote by Sagan and Druyan expresses the difference between intellectual knowledge of the night sky and knowledge derived from the experience of the night sky. Put in other words, Sagan and Druyan express the view that today's knowledge is largely intellectual, whilst knowledge from the past was more experiential. Our contemporary access to information and news regarding astronomy and space exploration has increased enormously, via the internet. At the same time, our experience of the night sky is increasingly being affected by the glow of urban city lights, which reduces our ability to see and experience the night sky. These two processes tend to decrease direct experience with the night sky, and increase intellectual knowledge about astronomy in general. Contrast our contemporary situation with that experienced by cultures of the ancient past; they experienced very dark night skies with little or no light pollution and many cultures relied on oral traditions within communities and families to transmit knowledge of the night sky from one generation to the next.

In this Chapter, I investigate knowledge, attitudes and beliefs held in relation to astronomy, people's connection to the night sky and their awareness of particular astronomy initiatives. I examine survey based research methodologies and apply three surveys: (1) The Post International Year of Astronomy (IYA) 2009 evaluation; (2) “The Sky in Our Lives” survey; and (3) Aboriginal Astronomy Symposium survey. The first survey is directed at assessing awareness of astronomy and Aboriginal astronomy initiatives conducted during IYA 2009. “The Sky in Our Lives” survey is an international survey and is applied here for the first time in Western Australia, as a pilot study. The third survey targeted participants of the first national Aboriginal astronomy symposium held in Australia. I discuss the application and usefulness of survey methods and I highlight issues for future researchers

who may wish to adopt similar approaches in the future. The surveys establish baseline data in relation to both astronomy in general, and Aboriginal sky knowledge in particular.

### 3.1.2 Hypotheses and research objectives

The surveys applied in this research contribute to the research hypotheses and research objectives. Hypothesis 2 posits that collaborative, cross-cultural projects can act as an important catalyst to encourage the appreciation and respect of Aboriginal and scientific astronomical knowledge. This is investigated via survey data collection, firstly by identifying examples of such collaborative projects, and secondly, examining reported levels of awareness relating to Aboriginal astronomy initiatives. The surveys also contribute to an understanding of the issues and sensitivities regarding Aboriginal astronomical knowledge (research objective 2). This chapter primarily contributes to research objective 5, which is to examine and apply the use of survey methodologies to assess knowledge, attitudes & beliefs relating to astronomy, and awareness in relation to Aboriginal Astronomy initiatives. The main topics I am investigating via the use of the three surveys are detailed in Table 7 below.

Table 7. Main topics investigated by the surveys

Topic	Survey		
	Post IYA 2009	The Sky in Our Lives	Aboriginal Symposium
Knowledge, attitudes and belief in relation to different aspects of astronomy, Aboriginal astronomy and astrology.		✓	
Knowledge about Aboriginal astronomy.	✓		✓
Awareness of IYA 2009 Aboriginal astronomy events.	✓		
Comparisons with international survey results.		✓	
Strengths and weaknesses of surveys, for the investigation of cultural astronomy and Aboriginal sky knowledge.	✓	✓	✓

Comparative data from South Africa has been supplied for The Sky in Our Lives survey, courtesy of researcher Jarita Holbrook.

## 3.2 Survey methodologies

In this section I review applicable literature on the subject of survey based methodologies applied to astronomy and science. This is followed by a discussion on the advantages and disadvantages of survey methodologies and then I discuss issues common to all of the three surveys undertaken for this research, including: approvals and consent; survey populations; and approaches regarding quantitative



and qualitative data analysis. Specific topics relating to each survey are addressed in the subsequent sections.

### **3.2.1 Literature review**

There have been various studies that have investigated levels of awareness and knowledge relating to astronomy, in a variety of populations. Rijsdijk (2000) has described the use of astronomy as a vehicle for science education. He uses examples from the South African Astronomical Observatory, in which he describes the Science Education Initiative, “Friends with the Universe” and the “starbus” project. Elements of the initiative include the resource centre, resource development and workshop experience. McGuire (1998) examined the challenges and opportunities of communicating science to a non-scientific audience via the media, in his research entitled “astronomy for the masses”. Bauer (2008) investigated survey research in relation to public understanding of science (“PUS”). This research provided a 50 year overview (1957-2007) of surveys conducted in the UK, France, Italy, EU, Bulgaria, USA, Canada, New Zealand, Japan, India, China, Malaysia, Argentina and Brazil. However, the survey did not include Australia. Approaches for the evaluation of astronomy education and public outreach projects has been investigated by Bailey and Slater (2004, 2005). They present a “how to” guide with examples, together with a discussion on evaluation including project goals, evaluation techniques, and common evaluation pitfalls. Research methods and survey data collection, including quantitative and qualitative analysis, are discussed in detail by Leedy and Ellis-Ormrod (2013) and Williamson & Johanson (2013). They provide discussions on research planning, approaches to research methodologies and a range of data analysis techniques including qualitative and quantitative data analysis.

Two key examples of the evaluation of Australian science engagement include the Australian national reporting to the International Year of Astronomy 2009 Final Report (IAU 2010) and the Australian Audit of Science Engagement Activities 2012 (Metcalf, Alford and Shore, n.d. c2013). The National Audit of Australian Science engagement activities is described (page 1, par.1) as “the first national audit of its kind ever to be held in Australia”. The audit aimed to collect data about Australia’s science engagement activities. The audit used an online database tool to help determine gaps, collaborative opportunities and duplications. Information was gathered for the audit, in part by liaison with a variety of national organisations. The audit documented views about science engagement in Australia, by scientists and science communicators. The research itself was conducted via an online survey tool, focus-group discussions in seven locations across Australia and the use of an online visualisation tool. More than 250 people participated in the survey and 411 engagement activities were documented. The audit relied mainly on qualitative data analysis of focus group results and online survey results, including the categorization of extended responses, and the presentation of summary data. The current study has modelled its use of qualitative data analysis on that as used by the national audit.

### **3.2.2 Advantages and disadvantages of survey methodologies**

As a data collection method, surveys have certain advantages and disadvantages. Advantages include the systematic and structured approach to information gathering inherent in surveys, the establishment of baseline data results, the ability to resample future populations, and the ability to analyse data with quantitative and qualitative approaches. However, surveys as a methodology for data collection also have some disadvantages. The use of quantitative analysis of survey results is dependent upon adequate numbers of responses, particularly if statistical analysis are applied. Survey response rates are influenced by several factors including survey deployment methods such as online and hard-copy surveys. The structured, and relatively inflexible, fixed form of most surveys can in some circumstances be quite limited in its ability to investigate a given subject. In addition, adequately defining sample populations can be difficult. In the case of populations from small communities (which characterises many Aboriginal communities in the remoter parts of Australia), total populations are small. In such populations, sub populations such as Elders, can be substantially smaller in size than the community population, thereby further reducing the size of potential sample populations. Despite these issues, data collection methodologies that utilise a survey based approach have the potential to capture informative and insightful information.

### **3.2.3 Survey approvals and consent forms**

The surveys conducted for this research have received the relevant research and survey approvals, in addition to other specific approvals. Research approval was granted by the Curtin University Human Research Ethics Committee, protocol approval RD-15-10. Supplementary approvals were obtained for the use of two of the surveys (Post IYA 2009 and The Sky in Our Lives) in primary and secondary schools, by the Western Australian Department of Education. Consent forms for school participation were prepared for endorsement by School principals (as required by the Department of Education), in addition to parent consent forms. A “Working with Children” Card was obtained for the researcher and issued by the Government of Western Australia. Information sheets were developed to provide information to respondents about the surveys and their aims, privacy of data, publication of results, research ethics, and how to participate in the survey. No personally identifiable data was requested and respondents were asked to provide information anonymously.

### **3.2.4 Survey populations**

The Post IYA 2009 evaluation and The Sky in Our Lives survey were directed at Western Australians in general, and more specifically, at Secondary High School students (Years 8 – 10) within Western Australia. Both surveys were distributed to 70 schools in Western Australia, with an approximate student population of 56,000 students. Survey respondents were not limited to the student population and data are presented according to the main respondent categories: Western Australian students; other Western Australian's (mainly adults); other Australian and international respondents; and all respondents.

In relation to “The Sky In Our Lives” survey, the current research is the most extensive application known to date of this survey in Western Australia. A key theme in this thesis is the association between radio astronomy and cultural astronomy, between Australia and Southern Africa (in connection to both the Square Kilometre Array radio telescope project, and to cultural astronomy initiatives in both localities). Initial results of The Sky in Our Lives survey from South Africa is included, for comparative purposes, despite the numbers of responses to that survey being low.

The third survey was directed at participants from the first national symposium on Aboriginal astronomy, held in 2009. This population group was targeted so that the views and opinions of informed and expert participants (in relation to Aboriginal sky knowledge) could be sampled.

### **3.2.5 Quantitative and qualitative data analysis**

Various quantitative and qualitative methods can be applied to the results of the three surveys, for data analysis. In general, for quantitative analysis, response rates need to be sufficient (relative to the population sampled from) to enable the valid use of statistical techniques. Qualitative approaches include identifying key topics or themes from extended answers. Coding of responses can be applied to identify the relative frequencies of topics and issues present in responses. Qualitative methodologies are also used in Chapter 4, however, unlike the surveys methodology used in Chapter 3, they are based on video recordings of extended and detailed interviews with Aboriginal Elders, artists, and others who have a direct interest in Aboriginal sky knowledge. The Post IYA 2009 evaluation and The Sky in Our Lives survey have been treated as pilot studies, to test their application in the Australian context, and to make recommendations for future uses of the surveys. The response rates to the surveys in Chapter 3 have not been large enough to permit statistical analyses, however, the data are reported in quantitative terms wherever possible, and qualitative approaches used to analyse and discuss the data. Recommendations regarding future refinements to the surveys and opportunities for future research are discussed.

## **3.3 Post International Year of Astronomy 2009 evaluation**

### **3.3.1 The survey**

As discussed in section 1.2.2, the IYA 2009 resulted in many public astronomy events taking place in Australia, including those events specifically dealing with Aboriginal sky knowledge. In Western Australia, one of the highest profile events was the *Ilgarijiri- Things Belonging to the Sky* collaboration. The Post IYA 2009 survey, as described below, broadly encompasses IYA 2009 activities. The current research extends the work of Norris (2010) in that it quantifies awareness of IYA 2009 in Australia, participation in astronomy activities, and awareness of IYA 2009 Aboriginal astronomy events in particular.

### 3.3.2 Literature review

The IAU 2010 report documented and reported on the efforts of 148 countries in relation to IYA 2009, including the Australian national report. This report is of particular importance because it documents global initiatives undertaken during IYA 2009. In general, the national reports provide key statistics, including official languages, number of organising committee members, national population, number of people reached by IYA 2009, and budget. National reports commonly included an overview (including listing) of IYA 2009 activities, and a description of main activities undertaken, often with photographs, and additional details such as organisers of specific events and web sites. Whilst most countries provided written summary reports of IYA 2009 activities, events and various measurable outcomes, the Australian report relied mainly on what can be described as a “photo essay” of events in Australia. A description of the “*Ilgarijiri- Things Belonging to the Sky*” exhibition was provided in the national report, however, unlike most other national reports, no comprehensive overview of IYA 2009 events was provided, nor were other examples of Australian Aboriginal astronomy initiatives or events reported. This is somewhat unfortunate, because the report understates the range and diversity of IYA 2009 events in general, and those of Aboriginal astronomy in particular. Norris (2010) reported on a range of Aboriginal astronomy events during IYA 2009, via the *Communicating Astronomy with the Public* journal (Norris, 2010). He detailed the role of such events during IYA 2009, and characterised activities such as talks and presentations (60), a book publication (1000 copy print run), the *Ilgarijiri* virtual art gallery, and the Aboriginal astronomy symposium. The work of Norris (2010) provides a strong overview of IYA 2009 activities in Australia.

### 3.3.3 Survey design

The Post IYA 2009 survey (Appendix 4A) used here has been designed to assess awareness of, participation in and associated knowledge of IYA 2009 initiatives, especially for activities relating to Aboriginal astronomy, primarily in a Western Australian context. The structure of the survey was developed to closely mirror the goals of IYA 2009 (IAU, 2010). Table 8 shows the relation between IYA 2009 goals, and the Post IYA 2009 survey headings and questions.

Table 8. Relation between IYA 2009 Goals and the Post IYA 2009 survey headings/questions

IYA 2009 Goals	Post IYA 2009 Survey (headings/questions)
1. Increase scientific awareness.	Astronomy awareness (questions 1, 2, 3a, 3b)
2. Promote widespread access to new knowledge and observing experiences.	New knowledge and observing experiences (question 4). Future astronomy activities (question 13).
3. Empower astronomical communities in developing countries.	(not applicable at the national level in Australia).
4. Support and improve formal and informal science education.	Astronomy education (questions 5, 6). Radio astronomy awareness in Western

IYA 2009 Goals	Post IYA 2009 Survey (headings/questions)
	Australia (question 7a, b). Aboriginal astronomy (question 8a, b, c and d).
5. Provide a modern image of science and scientists.	The image of science and scientists (questions 9a, b, c and d).
6. Facilitate new networks and strengthen existing ones.	Networks (questions 10a,b).
7. Improve the gender-balanced representation of scientists at all levels and promote greater involvement by underrepresented minorities in scientific and engineering careers.	Gender representation of scientists / astronomers (question 11).
8. Facilitate the preservation and protection of the world's cultural and natural heritage of dark skies in places such as urban oases, national parks and astronomical sites.	Protecting the night sky (questions 12a, b, c, d and e).

Only one IYA 2009 goal (empower astronomical communities in developing countries) was not directly applicable in the Australian context, because the goal was directed at developing countries (national level), as opposed to developing communities, which would be applicable in Australia.

Structuring the Post IYA 2009 survey in accordance with the IYA 2009 goals means that the survey can be directly related back to those goals.

Part 2 of the survey seeks demographic information including gender, age, whether the respondent lives in Western Australia, and cultural affiliation such as Aboriginality, and cultural / linguistic diversity.

Generally, questions have sought a “yes/no” response, a selection from multiple choices, and in a few cases, open ended questions. This highly structured approach has been chosen to ensure that the survey is relatively easy to complete, can be applied to a wide range of respondents and also to ensure that comparisons between respondents can readily be made.

Some questions have been phrased to assess specific knowledge. For example, question 7a assesses whether respondents know about the Square Kilometre Array radio telescope project. A disadvantage of this approach is that some respondents may answer yes to such a question, because they feel they should know the answer, rather than actually knowing the answer. The underlying issue here is the desire for honest responses from respondents, and the recognition that some respondents may be influenced (in-advertently) by the phrasing of questions. Recommendations are made in section 3.3.7.2 regarding this issue.

The design of the survey was initially reviewed and refined. An online version of the survey was developed, using an online survey design service ([www.surveygizmo.com](http://www.surveygizmo.com)). The online survey was tested initially with test data, to ensure correct functionality of the online survey.

### **3.3.4 Survey methodology and sample selection**

The online survey interface was provided via the ICRAR website, at <http://www.icrar.org/surveys/iya2009>. The survey was also made available in hard copy format, and also via a down-loadable word document.

Survey participants were sought with a focus on secondary school students in Western Australian. Approximately 70 Western Australian primary and secondary schools were invited to participate in the survey, with an approximate student population of 56,000 students. A letter of invitation was first issued to the school principal, inviting their participation and also seeking their consent/endorsement for student participation. Hard copies of the surveys were supplied, in addition to a pre-paid and addressed satchel, for return of completed surveys. Notices regarding the survey were also posted on the Astronomy WA website ([www.astronomywa.net.au](http://www.astronomywa.net.au)), and advertised nationally via the Australian Physics network. Members of the Astronomy Society of Western Australia were invited to take part in the survey and other general public participation was sought, including during other astronomy outreach activities. As with all survey methodologies, inherent limitations exist with the methodology. For example, the online version of the survey assumes that participants have access to computers and the internet, and are comfortable using this technology. These effects can give rise to sample selection effects, which have the potential to introduce biases into the results. The geographical distribution of respondents comprised 33 responses from the Perth Metropolitan Area (or immediate adjacent areas), 50 responses from the South West of Western Australia (clustered mainly at Australind, Eaton, Harvey and Myalup), 1 response from the Kimberley region and 13 responses with unspecified or invalid localities. Based on this response distribution, most responses relate to the Perth Metropolitan Area, or the South West of WA.

### **3.3.5 Data input and verification**

Completed hardcopy survey responses were manually entered into the online survey, to generate an Excel spreadsheet of results. Data have been inspected for validity and minor corrections to the raw data have been applied (such as spelling corrections/grammar) where this is appropriate to do so and does not affect the subsequent analysis of data.

### **3.3.6 Results**

The Post IYA 2009 survey results are presented in Appendix 4B. A total of 97 survey responses were obtained, with 92% of respondents living in Western Australia, 57.7% male, 40.2% female (and 2.0% no response). Most respondents (63.9%) are aged between 11 and 15 years of age, the youngest being 8 and the oldest was 87 years old. A total of 6.2% of respondents identified themselves as being

Aboriginal or Torres Strait Islander origin (this compares to 2.5% of the Australian population identified as Aboriginal, via ABS 2010).

### 3.3.7 Analysis and discussion

#### 3.3.7.1 Survey outcomes

The following analysis and discussion of results is made in relation to the main applicable questions posed in section 3.3, regarding awareness of astronomy in general, awareness of radio astronomy, Aboriginal astronomy, and awareness of IYA 2009 initiatives. The data is examined to distinguish between Western Australian students (<18years), Western Australian adults (i.e. “WA non-students”), others (non-Western Australian respondents), and all respondents.

It is important to note that due to limited number of responses (n=97), the survey results should not be generalised to broad populations, as the sample size would need to be considerably larger to provide for an appropriately high confidence level and statistically valid sampling.

An indicator of awareness of astronomy in general is provided by the percentage of respondents who knew that 2009 was the International Year of Astronomy (Table 9).

Table 9. Awareness of IYA 2009.

	<b>Response</b>	<b>WA students (n=64)</b>	<b>WA non- students (n=26)</b>	<b>Others (n=7)</b>	<b>All respondents (n=97)</b>
1. Are you aware that 2009 was the International Year of Astronomy (IYA 2009)?	Yes	18 (28.1%)	14 (53.8%)	7 (100.0%)	39 (40.2%)

As a population group, students of primary and secondary schools, as a whole are likely to be less biased regarding astronomy, as compared to other population groups, such as members of astronomical societies, or participants/visitors to astronomy festivals. In the latter case, it can be assumed that participants already have a general interest in astronomy, and if surveys only sampled such populations, results would almost certainly be biased.

We can conclude that the majority of adult respondents were aware that 2009 was the International Year of Astronomy, whilst most students were not. Students and youths participating in the survey reported a relatively low level of awareness about IYA 2009. This suggests that the profile of IYA 2009 did not substantially reach the schools, students and youth who participated in the survey. If this is indicative of a broader trend, then an implication of this (for large scale astronomy public outreach

activities, such as IYA 2009), is that more attention may need to be placed on awareness raising for students, schools and youth in general.

Awareness of radio astronomy initiatives in Western Australia (Questions 7a and b) is shown in the Table 10.

Table 10. Radio astronomy awareness, according to respondent categories.

<b>Radio Astronomy Awareness in Western Australia</b>	<b>Response</b>	<b>WA students (n=64)</b>	<b>WA non-students (n=26)</b>	<b>Others (n=7)</b>	<b>All respondents (n=97)</b>
7a. Do you know what the Square Kilometre Array (SKA) project is?	Yes	10 (15.6%)	16 (61.5%)	5 (71.4%)	31 (32.0%)
	No	54 (84.4%)	9 (34.6%)	2 (28.6%)	65 (67.0%)
	NR	0 (0.0%)	1 (3.8%)	0 (0.0%)	1 (1.0%)
7b. Do you know what radio astronomy developments are proposed for Western Australia?	Yes	11 (17.2%)	12 (46.2%)	3 (42.9%)	26 (26.8%)
	No	53 (82.8%)	12 (46.2%)	4 (57.1%)	69 (71.1%)
	NR	0 (0.0%)	2 (7.7%)	0 (0.0%)	2 (2.1%)

More than two thirds of adults indicated they were aware of radio astronomy initiatives in Western Australia, whilst awareness in Western Australian students was low, at 15.6% (percentages are in relation to category totals rather than the response totals).

Some of the responses were partially contradictory. Question 7a asked the specific question regarding awareness of the Square Kilometre Array (SKA) radio telescope, with 32.0% indicating yes. The more general question, 7b, which asked about awareness of radio astronomy developments in Western Australia, attracted a “yes” response of only 26.8%. This result is partially contradictory as it would be expected that the more general question should attract a higher “yes” response. However, at the time when the survey was conducted, the decision regarding Australia's (and Western Australia in particular) role in the SKA had not yet been made, so it is most likely that respondents reporting awareness of the SKA project was due to international coverage about the project.

More than one quarter of respondents (27.8%) indicated that their first experience of astronomy occurred in 2009. We would expect that the younger the age of the respondent, the more likely that their first experience of astronomy took place (in 2009). We can evaluate this by looking at the reported “first experience of astronomy in 2009” vs. respondent categories. The survey data is consistent with our expectation (Table 11).



Table 11. Age vs. reported “first experience of astronomy in 2009”.

	<b>Response</b>	<b>West Australian students (n=64)</b>	<b>Other West Australians (n=26)</b>	<b>Others (n=7)</b>	<b>All respondents (n=97)</b>
3a. Did your first experience of astronomy occur in 2009?	Yes	23 (35.9%)	1 (3.8%)	3 (42.9%)	27 (27.8%)
	No	41 (64.1%)	24 (92.3%)	4 (57.1%)	69 (71.1%)
	NR	0 (0.0%)	1 (3.8%)	0 (0.0%)	1 (1.0%)

Question 4 assessed astronomy observing experiences and new astronomy knowledge. More than one third (39.2%) indicated they used a telescope during 2009. A total of 15.8% of respondents indicated they had photographed the stars.

Question 5 assessed participation in astronomy educational activities. It is notable that 0% indicated participation in university or postgraduate courses. This result is most likely explained by the demographics of respondents, the majority being too young to be involved in this level of education.

The survey results have provided unexpected insights regarding awareness levels in relation to, and the effect of IYA 2009 in the respondents. Only 40.2% of respondents indicated that they knew 2009 was the International Year of Astronomy. Significantly, awareness in under 18 year olds was substantially lower, at 28.1%. This unexpected finding suggests that specific awareness initiatives may be required for school aged children, regarding International Year initiatives and their events in Australia. 57.7% of respondents (to Q4a) indicated that they learnt something new about astronomy during IYA 2009. The level of awareness people have in relation to Aboriginal astronomy (during IYA 2009) was assessed by Question 8a, b, c and d. A total of 10.3% of respondents reported that they were aware of IYA 2009 events relating to Aboriginal astronomy. The results also indicate that two respondents knew of Aboriginal astronomy events, but did not know about IYA 2009. This could indicate that the profiling of Aboriginal astronomy events during IYA 2009, was not prominent enough to be noticed by these particular respondents. Of those respondents who indicated they had participated in an IYA 2009 Aboriginal astronomy event, 85% indicated that their understanding of Aboriginal astronomy had increased. Specific examples that were reported included the Aboriginal astronomy painting in the foyer of Horizon Planetarium, Perth, public talks on Aboriginal astronomy at Horizon Planetarium, and magazine articles.

Question 8d sought specific detail about the knowledge of respondents in relation to Aboriginal astronomy. There were nine responses regarding question 8d. Six responses refer specifically to the emu, one response to both the emu and the seven sisters, one referring to Orion (canoe) and another referring to an unspecified pattern. Some responses indicated that the respondent had a good

understanding of the special significance of the “emu” pattern, and that they recognised that the pattern is formed not by a pattern of a group of stars but by dark areas in the Milky Way:

*The “Emu” which I have viewed several times. Unlike “western” astronomical constellations which are based purely on shapes created by groupings of individual stars, the “Emu” is based on multiple stars, nebulae and everything in between, and describes the shape and colouring of an emu stretched across the entire sky.*

and:

*That there is an emu shape observable in the dark spaces outlined by stars.*

I use the term “sky pattern” to describe the Emu, as opposed to “star pattern”, or “constellation” because the Emu is formed mainly by an absence of visible stars, rather than a pattern defined by stars. Responses were typically concise (the longest response being one paragraph). The conciseness of the responses can probably be attributed to the level of knowledge of the respondents, their age, and also possibly due to the survey method, in which respondents either completed online surveys or hardcopy surveys (without discussion or prompting by the researcher). Eliciting more detail or expanded responses would most likely need to be via a different approach. Such an approach could involve the qualitative video interviews (as discussed in Chapter 4), or a more unstructured discussion between the researcher and participant.

The survey data show that six respondents (6.2% of the survey sample) indicated they are of Aboriginal or Torres Strait Islander origin. The percentage of Aboriginal people in the Australian population is 2.5% (ABS 2010). This indicates that the survey sample was over-represented by Aboriginal people, in comparison to the Australian population. Of the six respondents who indicated they were of Aboriginal or Torres Strait Islander origin, none of these respondents provided specific examples of Aboriginal astronomy (in response to Q 8d). Of these six, three were teenagers (13, 13 and 14 years of age), one aged 57 and two who did not indicate their age. In contrast, the nine respondents to question 8d, who detailed specific examples of Aboriginal astronomy, identified themselves as non-Aboriginal people. Only two were teenagers (aged 14), and the remainder were aged 30, 45(x2), 48, 50, 51 and 80. This provides evidence of non-Aboriginal people having some background knowledge about Aboriginal sky knowledge / Aboriginal astronomy. Interestingly, the fact that none of the Aboriginal people surveyed provided specific examples of Aboriginal astronomies serves as a reminder that it should not be assumed that all Aboriginal people have knowledge of particular topics, such as Aboriginal astronomy.

More than three quarters of respondents reported they did not attend any popular astronomy talks during 2009, which correlates reasonably well with the level of awareness reported about IYA 2009. The majority of respondents also indicated that they did not belong to an organised astronomy group during 2009, which is consistent with the awareness levels of IYA 2009.

More than half (56.7%) of respondents indicated they were familiar with the term “light pollution”, and more than three quarters (77.3%) saw the night sky away from bright city lights in 2009. Question 12c assessed participation in Earth Hour 2009 or 2010 and also provides an indicator of awareness regarding dark skies and measures to protect the night sky from light pollution. 27.8% indicated they did not know about Earth Hour, whilst more than one third (36.1%) indicated that they participated in Earth Hour. Most people (86.7%) indicated they did not know about any laws or guidelines for preserving dark skies.

Question 13 gauged future interest in astronomy activities and 44% of respondents provided specific comment. The four main themes include: (1) Star watching / using a telescope / astrophotography; (2) Observatories / visits / activities; (3) Learning / education / research / clubs & groups and (4) other comments.

Most respondents expressed interest in practical viewing of the night sky (with or without telescopes) or visiting observatories. One respondent specifically noted that they would like to learn how “Aboriginal people thought of the stars”. It is interesting to note that the response is phrased in the past tense, which indicates the respondent considers this knowledge to be a thing of the past. This response reveals, perhaps inadvertently, a bias from the respondent, which appears to preclude current day Aboriginal knowledge (cultural or otherwise) relating to the night sky. Whilst conducting this research, I have encountered such views on a number of occasions, in which there can be a tendency to view such knowledge as “old” or “from the past” and to not recognise the currency of such knowledge. As my research clearly indicates, particularly in Chapter 4, Aboriginal knowledge of the night sky is part of an ongoing, dynamic, living body of knowledge, which exists in our contemporary society today, and is not simply a “relict” from the past.

### **3.3.7.2 Recommended refinements to the survey**

Whilst the survey was designed specifically for assessing IYA 2009, there is potential to re-apply the survey in a modified form, for future initiatives of a similar nature (such as other international year initiatives). The phrasing of question 7a “Do you know what the Square Kilometre Array (SKA) project is?” (which is a leading question) and 7b “Do you know what radio astronomy developments are proposed for Western Australia” (an open question), can be improved to provide more insightful responses. It would be preferable to begin with an open question first, followed by a more specific question. Alternatively, the question could simply be “Please list current day examples of radio astronomy developments in Australia”. In this way, the knowledge of respondents can be verified, rather than yes/no responses which simply indicate the respondent's belief about their knowledge, which may or may not be correct. Such refinements to the survey will improve future survey results.

### **3.3.7.3 Opportunities for future research**

A larger scale application of the IYA 2009 survey was not possible in this current research due to the significant effort involved in gaining applicable approvals for the survey, and conducting the survey

itself. However, future astronomy initiatives should be subject to evaluation, and surveys provide one of the tools available to conduct such evaluations. The IYA 2009 survey provides scope for adaptation and larger scale applications, particularly for future major astronomy initiatives in Australia, whether they be coordinated at an international or national level.

### **3.3.8 Conclusions**

The IYA 2009 evaluation has contributed to research objective 4, which is to examine and apply the use of survey methodologies to assess knowledge, attitudes & beliefs relating to astronomy, and awareness in relation to Aboriginal Astronomy initiatives. Survey results produced unexpected findings.

The reported awareness about IYA 2009 by Western Australian students was unexpectedly low, at 28.1%. This contrasted to the awareness reported by other Western Australian respondents, which was 53.8%. The results suggest that awareness of IYA 2009 did not penetrate well to students (comprising mainly of secondary school students in Western Australia, and primary students within the Perth metropolitan area). This suggests that a more targeted approach for schools and students may be required in future astronomy public outreach activities, such as IYA 2009. Of those people who participated in Aboriginal astronomy events during IYA 2009, 85% reported that their awareness was raised regarding Aboriginal astronomy. However, not all participants in Aboriginal astronomy initiatives during IYA 2009, indicated that they were aware of IYA 2009 itself. This suggests that the IYA 2009 branding could have been more generally prominent. Another unexpected finding regarding Aboriginal astronomy was that seven respondents identified or referred to the Emu pattern, but only one referred to the Seven Sisters/Pleiades.

The survey results are most applicable in relation to the sample population. Due to the relatively low response rate ( $n=97$ ), the results cannot be generalised across broader populations. The results provide useful qualitative data and some quantitative data, and the survey is the first and only known attempt in Australia to quantitatively assess awareness of and participation in IYA 2009 activities, including Aboriginal astronomy activities. This baseline data is an important contribution to the Australian astronomy community.

## **3.4 “The Sky in Our Lives”**

### **3.4.1 Introduction**

“The Sky in Our Lives” is a cultural astronomy survey developed by the American researcher Jarita Holbrook, from the University of Arizona. Holbrook developed the survey to assess attitudes, awareness and beliefs relating to astronomy. The Sky in Our Lives survey developed in part from Kelly (2004), who evaluated the psychological attachment of respondents to the night sky, using a survey based on Likert scales. The survey has been applied in several countries to date, but has had almost no application in Australia. The use of the survey in the current research represents the first substantial application of the survey in Australia.

### **3.4.2 Background to the survey**

An introduction to the use of “The Sky in Our Lives” survey has been provided by Jarita Holbrook, at the International Astronomical Union (IAU) Symposium 260 “The Role of Astronomy in Society and Culture”, which was held at UNESCO, Paris, 19-23 January 2009. Whilst the results have not been published to date, Holbrook presented preliminary results of the first 91 survey responses. Survey responses were obtained mainly from USA (51) and Britain (27), unspecified European countries (9) and one survey respondent each from Brazil, Canada, Australia and a UK/USA dual citizen. Preliminary results were presented regarding respondent demographics, where respondents were raised, night-time activities of respondents, and knowledge in relation to star and constellation names, the sky and celestial names. Holbrook discussed some preliminary hypotheses, including the idea that a predominantly indoor lifestyle results in lower levels of awareness or connection to the night sky in respondents. The reported results indicate the following:

- Demographics of respondents (62% Male, 36% Female, 2% no response).
- Where respondents were raised (41% City, 19% Town, 19% Suburbs, 15% Country, 1% Island, 4% Desert, 1% Other).
- Where respondents spend most of their time at night (actual % values were not supplied, but approximate figures are provided as follows) 65% Indoors, 20% Mostly indoors, 13% Both, 2% Mainly outdoors. Most respondents indicated most of their night-time activities took place indoors.
- Respondents identified themselves in the following ways; 21% Astronomers, 13% Astronomy students, 8% Amateur astronomers, 16% Astrologers, 45% others.

Results regarding the recollection of star names and constellations indicated that the constellation Ursa Major (Big Dipper) scored the highest number of responses, followed by Orion, Taurus, Ursa Minor/Little Bear/Small Bear and Scorpius. The prevalence of northern hemisphere constellations is quite evident in the survey responses. Holbrook noted that whilst astronomers listed more celestial names, that this may have nothing to do with knowing how to identify night sky objects (by the naked eye, or without the use of coordinates), and further, that such listing of celestial names may be due to the training of astronomers in which celestial names are memorised. Holbrook concluded with future

plans for the survey including seeking more responses, further data analysis and refinement / redesign of the survey. Subsequent to the results reported at the IAU Symposium 260 in January 2009, Holbrook coordinated survey data collection in Africa, with data collected during October to November 2010, in Mafikeng, South Africa. Holbrook supplied these data for use in this research, to enable a comparative assessment of survey data to be made. I refer to this as the “South African” survey, which is used for comparative purposes with the “Australian Survey”, which involved original data collection specifically for this research. With a total of 23 survey respondents, the South African survey results are not a large sample. The respondents may not be a representative sample of the South African population, so the results should not be generalised to the broader South African population. Recognising these limits, and whilst quantitative results are included, the data lends itself mainly to qualitative, rather than quantitative comparisons with the Australian survey results.

### **3.4.3 Survey design**

“The Sky in Our Lives” survey has been adopted (with minimal modification) for use in this research. The survey is provided in Appendix 5A. The survey is structured in the following way:

- Part 1. Demographics of respondents.
- Part 2. The Sky in Your Life.
- Part 3. Attachment to the sky.
- Part 4. Astrology Survey.
- Part 5. The Astronomy Attitude Survey.

An online version of the survey was developed, using an online survey design service ([www.surveygizmo.com](http://www.surveygizmo.com)). The survey interface was provided via the ICRAR website, at [www.icrar.org/surveys/TheSkyInOurLives](http://www.icrar.org/surveys/TheSkyInOurLives).

Some slight differences exist between the Australian and South African survey, (e.g. Demographic information / Nationality question in part 1, and elaborations to question 15). It is envisaged that further international comparisons of data will be possible in the future, as new surveys are conducted and results published. The results provided in section 3.4.5 and appendix 5B show the Australian and South African survey results.

### **3.4.4 Survey methodology and sample selection**

Survey participants were sought, with a focus mainly on secondary school students in Western Australia. Approximately seventy Western Australian primary and secondary schools were invited to participate in the survey. The student population of the schools invited to participate in the survey is estimated to be approximately 56,000. A letter of invitation was first issued to the school principals, inviting their participation and also seeking their consent/endorsement for student participation. Hard copies of the surveys were supplied, in addition to a pre-paid and addressed satchel, for return of completed surveys. Notices regarding the survey were also posted on the Astronomy WA website

([www.astronomywa.net.au](http://www.astronomywa.net.au)), and advertised nationally via the Australian Physics network. Members of the Astronomy Society of Western Australia were invited to take part in the survey and other general public participation was sought, including participants at the 2011 Astrofest astronomy festival. Participation in the survey was entirely voluntary. It is assumed that this has caused inherent biases within the results, as it can be expected that respondents tend to be those who are motivated to participate, such as those with an existing interest in astronomy. In addition, the results will not include the views of people who chose not to participate (for whatever reason). Where populations and sub-populations (samples) can be clearly defined and quantified, it is possible to conduct certain statistical tests of the data, such as statistical significance. However, as a result of the difficulty in defining quantitatively the population from which the survey respondents are a sample of, it is considered that the survey results should not be generalised to broader populations.

### **3.4.5 Results**

The Sky in Our Lives survey results are presented in Appendix 5B. A total of 45 survey responses were obtained, with 84.4% of respondents reporting that they are Australian citizens, 68.9% male, 28.9% female (and 2.2% no response). The main age brackets of respondents are between 11-15, and 46-70 years of age, the youngest, aged 9 and the oldest, aged 74. No respondents identified themselves as being of Aboriginal or Torres Strait Islander origin, and three respondents did not answer this question.

### **3.4.6 Analysis and discussion**

#### **3.4.6.1 The survey**

The Australian survey responses (n=45) were approximately double that of the South African survey (n=23). The demographics of the respondents between the two surveys were broadly similar: males accounted for 68.8% and 73.9% of respondents in the Australian and South African surveys respectively; and females accounted for 28.9% and 21.7% of respondents respectively (note that %'s do not add to 100% due to "other" or no responses). Some differences are also apparent in terms of age, 40% of respondents were below 16 years of age in the Australian survey, whilst none were below 16 years of age in the South African survey. Religious affiliation also showed differences, e.g. 20% Christians in the Australian survey, and 69.6% Christians in the South African survey. This suggests that belief or faith based systems are more significant to the South African survey respondents as compared to the Australian survey respondents.

In the Australian survey, no survey respondents identified themselves as an Aboriginal or Torres Strait Islander.

Questions 1 to 11 in Part 2 of the survey assessed first hand respondent experience of the night sky and astronomical phenomena / events, in contrast to knowledge regarding the night sky. Some questions (e.g. 3, 6 and 7) also sought responses regarding personal preferences. The highest responses (in excess of 90%) related to respondents having viewed the moon during daylight, having

used a telescope, and viewing a rocket or space shuttle launch. High responses (75% or greater) were also reported regarding viewing astronomical events such as a solar or lunar eclipse and a meteor, in addition to visiting a planetarium. Lower scores (<70%) related to respondents having seen a comet, or visiting an observatory. The lowest percentage of responses (44%) related to personal preference regarding futuristic books, set in outer space.

Multiple responses were provided to question 12 regarding activities normally done between sunset and midnight. The largest number of responses included: watching TV (27); an astronomy related activity (14); other activity (13); eating/drinking (12) and reading (11). These results are indicative of most activities being conducted indoors at night time. In question 13, which specifically characterised where events took place (indoors or outdoors), almost 60% of respondents indicated indoors, or mostly indoors. Only 4.4% of respondents indicated outdoors. These results are consistent with the results from question 12.

Question 14 dealt with the frequency of viewing the night sky, and based on the results of question 12 and 13, it can be expected that there would be a majority of responses with relatively little exposure to the night sky (infrequent sky watching is defined here as several times a month or less frequently). The data supports this, with 53.3% of respondents falling within these categories. These results indicate that there is a substantial proportion of respondents who have relatively little contact with the night sky. It could be assumed that such respondents have correspondingly lower levels of awareness of knowledge about astronomy, or astronomical events, relative to those who have higher levels of experience with the night sky. We can test this by examining astronomical knowledge, (which can be measured in various ways, such as correctly recalling the name of planets and/or asteroids), relative to the degree of sky exposure. For this purpose, I categorise “frequent” sky exposure, as those respondents who view the night sky either every night, or several times a week, and “infrequent” sky exposure, as those who view the sky several times a month, once a month, every few months or once a year. If the degree of exposure to the night sky is related to astronomical knowledge, then we would expect those with the most sky exposure to have correspondingly higher astronomical knowledge. In this case, I use knowledge of the planets (number of correctly named planets) as an indicator of astronomical knowledge in general. It is expected that knowledge of asteroid names is likely to be far more limited. The results are shown in Table 12.

Table 12. Infrequent vs. frequent exposure to the night sky.

	Exposure to the night sky:	
	“Infrequent”	“Frequent”
Average number of planets correctly identified / named	7.4 (n=23)	7.7 (n=19)
Average number of asteroids correctly identified / named	1.0 (n=23)	1.3 (n=19)

Note: No response values (n=3) have been excluded from the above calculations.



The average results for frequent and infrequent exposure to the night sky (in relation to correctly naming planets), are both relatively high and are much lower for correctly naming asteroids. The results in both cases are consistent with the idea that “frequent” exposure to the night sky is associated with greater astronomical knowledge, (in this case, measured by the indicators of planet and asteroid names). However, the difference between “infrequent” and “frequent” exposure to the night sky is not substantial. This suggests that the degree of exposure to the night sky is not a major factor regarding the extent of astronomical knowledge. The two questions used in this research to test such knowledge are suitable for the purposes of this research, however, it is important to recognise that the two questions used are indicative only and that other questions can be used to test such knowledge.

Question 14a addressed the reasons why people look skyward. A very diverse range of responses were provided, but there were clear themes that emerged. The main group of responses focussed on “interest” or “curiosity”, followed by “special events” (i.e. of special astronomical events), then “astronomical objects”, “awe”, “beauty” and other factors. The categorisation of responses was based on grouping together the main themes of each response. Responses to Question 14b suggest that most people looked at the night sky, not due to a specific reason, but mainly due to a casual opportunity. Question 14c which sought deeper reasons for why people look at the sky, also gained a diverse range of responses. Some respondents felt that this question was somewhat redundant, with their interpretation that the question had already been covered in Question 14a. Despite this, a diverse range of responses were provided. The most popular categories were interest/curiosity, and seeing astronomical objects.

Descriptions of the night sky (question 15) elicited the highest responses to primarily emotive descriptions such as “beautiful”, “mysterious” and “romantic”. One particularly interesting comment specifically recognised this:

*I think it's interesting that even though I'm a scientist (biology, not astrophysics), I have ticked all the words that make me connect emotionally, not scientifically, with the night sky.*

Questions 16 to 22 tested verifiable knowledge about astronomy, and also sought information about where respondents learnt their knowledge. Almost two thirds (60%) correctly named all planets in our solar system, and 15% could only correctly name five or fewer planets. Interestingly, several respondents also correctly identified planets from other solar systems. However, knowledge about asteroids was far less, only one third of respondents could provide one or more correct asteroid names. It was also very clear that there is confusion regarding what an asteroid is, as some respondents incorrectly provided comet names. One third of respondents could not identify any stars or list them by name, and less than 9% of respondents could identify 20 star names correctly. The results were similarly consistent with knowledge about constellations; 22% could identify no constellations, whilst 15% could correctly identify 20. The most popular “favourite” constellations (Question 23) included Orion, Southern Cross and Scorpius. Whilst technically not a constellation,

some identified the star cluster Pleiades (Seven Sisters). Interestingly, the Pleiades (Seven Sisters) scored very low, possibly due to their small apparent size, or relative faintness. In contrast, Orion was very popular, probably due to its large size and very good visibility from both southern and northern hemispheres. There is also a larger proportion of southern hemisphere constellations noted, relative to the preliminary (unpublished) research by Holbrook, presented at the 2009 IAU260 Symposium. This is entirely consistent because Holbrook's study was primarily focussed on northern hemisphere populations. More than one third (38%) indicated they had used the stars to assist in navigation and the majority of people used the Southern Cross and the Two Pointers (Alpha and Beta Centauri) to assist them.

The reported favourite constellations of respondents has implications for the design of public astronomy initiatives. The results suggest that the greatest degree of familiarity and personal connection (in relation to constellations) is centred on Orion, the Southern Cross and Scorpius. Therefore, public astronomy initiatives that reinforce this familiarity and popularity are likely to have greater relevance to a general public audience.

Two thirds of respondents provided comments regarding question 25 (what they would like to know about astronomy and the night sky, and why). The thirty responses were grouped into five main themes, including physics/cosmology, curiosity, life in the universe, the night sky (practical observing), and other. Of the thirty responses, twelve related to practical knowledge of the night sky, and responses such as the following were typical:

*I'd like to be better at naming stars and constellations- have a better geography of the sky.*

*... I know them theoretically, but cannot usually tell their locations by looking up.*

*How to find my way around using the stars.*

In contrast, many of the other comments related mainly to intellectual knowledge about the universe, including cosmological questions and current astronomical research. These responses point toward an underlying trend in which respondents spend less time looking at the night sky (often in light polluted conditions), and at the same time, have greater access to astronomically related information, particularly via the internet.

Responses to question 26 indicate that a relatively high proportion of respondents (44%) indicated they participated in festivals or ceremonies on “celestial days”, with Easter being the event with the largest number of responses.

Questions 27 to 32 addressed the effect of spiritual and cultural beliefs, astrology and formal education on knowledge, stories, practices and attitudes towards the night sky. The reporting of religious/spiritual tradition via question 5 indicated that well over half of the respondents in the

Australian survey had no such tradition, were atheist, agnostic or undecided. Based on these results, it is expected that religious traditions would have relatively little effect on shaping their knowledge about the sky, stories they were told about the sky, practices with respect to the sky or their attitudes about the sky. This is precisely what is seen in the data, and the same trend is seen in relation to cultural beliefs and astrology. In strong contrast, formal education was reported to have a much greater effect on shaping the knowledge, practices and attitudes in relation to the night sky. However, there were still a portion of respondents who regarded that formal education did not have any role in shaping their knowledge or views, which is an unexpected result.

About one third of respondents indicated that they look at the sky to predict the weather. However, the responses to question 32a which sought comment, generally did not illicit much detail.

“Attachment” to the night sky was assessed via part 3 of the survey. Questions were phrased to assess interaction and experience with the night sky, and also emotional connection with the night sky. The statements which attracted the strongest responses in agreement were:

*I very much adore the objects in the night sky.*

*I'm very fond of the night sky.*

*Looking at the night sky pleases me.*

*I like to go outside to look at the sky at night often.*

Whilst respondents may like to look at the night sky, the results of Question 14 indicate a significant portion (53.3%) of respondents who infrequently (several times per month or less) look at the night sky. This result highlights the difference between attitudes and action; “liking” the night sky does not necessarily result in experiencing the night sky often.

Part 4, the Astrology survey, indicated that respondents largely recognise the difference between astrology and astronomy, and that astrology has not been scientifically proven. These results suggest that generally, the respondents understand that astrology is not a “science”. However, the results also suggest that awareness about astrology is high, with more than 90% of respondents able (or willing) to indicate their own star sign. The results also indicate the diversity of views which exist in the respondents, with 22% indicating they believe that the Sun, Moon and planets are gods and goddesses. Given that almost two thirds (62.9%) of the respondents indicated no particular religious tradition (or indicated atheist / agnostic), this result is quite unusual.

Part 5, the Astronomy Attitude Survey, identified a generally positive range of attitudes towards astronomy. Strong responses indicating respondents like astronomy were provided, and there was a strong disagreement to the statement “I am scared of astronomy”. There was also a large agreement to the statement “Astronomy is a complicated subject”, and a relatively high agreement to the

statement “What I learn about astronomy is not useful in my career”. Positive attitudes towards astronomy dominate the survey results.

In terms of knowledge, attitudes and belief in relation to astronomy, some marked differences between the Australian and South African survey results are apparent. Due to the sample size for both the Australian and South African surveys, the results and comparisons should not be generalised to broader communities, as for both surveys, there is potential for bias due to the small sample sizes. However, comparisons can be made in relation to the survey participants, and this is now examined. Results of the South African survey are provided in Appendix 5B, and comparisons of selected data area provided below. Some notable examples are shown in Table 13.

Table 13. Comparisons, questions 16, 18, 20, 21 & 25.

Survey question	Australian survey	South African survey
Q16. (Correctly naming eight planets)	60.8%	8.7%
Q16. (Correctly naming five or fewer planets)	15.6%	73.9%
Q18. (Correctly naming three or more Asteroids)	15.5%	0.0%
Q20. (Zero correct answers when asked to list up to 20 star names)	33.3%	69.6%
Q21. (Zero correct answers when asked to list up to 20 constellation names)	22.2%	82.6%
Q25. (Responses to the question: what do you wish you knew about astronomy?)	66.7%	78.3%

For question 25, one response specifically referred to African cultural astronomy:

*How Africans interpret the night sky and it will help me to have an idea about cultural Astronomy.*

Other responses indicated a considerable lack of understanding, for example:

*What makes the stars float in the air and how come they don't fall.*

Question 26a asked respondents to describe a festival or ceremony which the respondent knew about, relating to “celestial days like at the full moon, Easter, Ramadan, or on the longest or shortest day of the year”. One South African survey response indicated recollections of a practice no longer personally done:

*Well as a kid we use to dance at night when there was a full moon; I still remember, today I don't celebrate or dance.*

The percentage of respondents who referred to Easter were similar between the two surveys (24.4% in the Australian survey, and 26% in the South African survey). However, when we relate this to the demographics, this result is surprising. Only 20.0% of the Australian survey respondents indicated Christianity as their religion, in marked contrast to the 69.6% of the South African survey respondents. It is possible that the association of Easter with the lunar cycle was not fully appreciated by respondents (even though this was specified in the survey). The results also suggest that some Australian survey respondents participated in Easter, without being a Christian, so their interpretation of Easter may have also included the non-religious aspects of Easter.

Ceremonial and festival activities that are associated with astronomical phenomena were addressed in Questions 26, 26a and 26b. Significantly, the responses to these questions mainly related to religious ceremonies or festivals, and did not elicit any responses relating to Aboriginal astronomy, in both the Australian and African surveys.

The beliefs and attitudes of the survey respondents were assessed primarily by questions: Q27 (spiritual religious beliefs); Q28 (cultural beliefs); Q29 (astrology); Q31 (formal education); Part 3 (attachment to the sky); Part 4 (astrology) and Part 5 (attitudes), and are all based on Likert scale responses. These questions are paraphrased below:

Q27. How much do your spiritual / religious beliefs shape your (a) attitudes, (b) practices, (c) stories (d) knowledge in respect of the night sky.

Q28. How much do your cultural beliefs shape your (a) attitudes, (b) practices, (c) stories (d) knowledge in respect of the night sky.

Q29. How much does astrology shape your (a) attitudes, (b) practices, (c) stories (d) knowledge in respect of the night sky.

Q31. How much does your formal education shape your (a) attitudes, (b) practices, (c) stories (d) knowledge in respect of the night sky.

Part 3 Attachment to the sky.

Part 4 Astrology survey.

Part 5 Astronomy attitudes survey.

Where questions are phrased in a consistent way, (either all positively phrased, or all negatively phrased), results can be summed for comparative purposes. Summing the Likert scale responses provide a broad comparison between the two surveys, and the results (expressed as a percentage for ease of comparison) and comments are shown in Table 14.

Table 14. Comparisons, questions 27, 28, 29 and 31 (Summed results expressed as a percentage).

	<b>Not at all</b>	<b>Very little</b>	<b>Moderately</b>	<b>Very much</b>	<b>Greatly</b>	<b>NR</b>
Q27 Australian survey	62.2%	15.0%	14.4%	2.8%	3.3%	2.2%
South African survey	15.2%	17.4%	33.7%	16.3%	8.7%	8.7%
Q28 Australian survey	57.8%	16.7%	13.9%	4.4%	5.0%	2.2%
South African survey	12.0%	21.7%	35.9%	14.1%	7.6%	8.7%
Q29 Australian survey	58.9%	13.9%	23.2%	1.1%	2.2%	0.6%
South African survey	19.6%	33.7%	19.6%	12.0%	5.4%	9.8%
Q31 Australian survey	23.3%	19.4%	23.9%	16.7%	15.0%	1.6%
South African survey	0.0%	29.4%	40.2%	14.1%	6.5%	8.7%

The highest percentages occurred in relation to the Australian survey, indicating (Q27) that spiritual / religious beliefs don't shape (at all) (a) attitudes, (b) practices, (c) stories and (d) knowledge in respect of the night sky. This contrasted markedly with the South African survey response, in which half (50%) indicated that such beliefs do affect these attributes “moderately” and “very much”. A similar pattern is also evident in relation to cultural beliefs (Q28), and astrology (Q29). Q31, which dealt with the influence of education, showed a more even distribution of responses in the Australian survey, whilst approximately two thirds of the South African responses consisted of either “very little” or “moderately”.

Table 15. Part 3 Attachment to the sky. Comparison of summed values (expressed as a percentage).

	<b>Strongly Agree</b>	<b>Agree</b>	<b>Neutral</b>	<b>Disagree</b>	<b>Strongly Disagree</b>	<b>NR</b>
Australian survey	6.7%	12.4%	24.4%	28.4%	24.7%	3.3%
South African survey	20.4%	31.6%	22.6%	9.1%	7.4%	8.7%

Whilst neutral responses are similar for both surveys, the Australian survey showed a substantially higher proportion of “disagree” and “strongly disagree” responses and they converge for “agree” and “strongly agree”. This suggest that the degree of “emotional attachment” to the sky is lower in the Australian survey relative to the South African survey (Table 15).

Questions 33 (a-c) sought to elicit whether respondents knew of other people in their community, who knew about astronomical knowledge. Question 33a first sought some descriptive comment about their community, however, some respondents provided answers here that were more properly in response to Q33b. This reflects on the logic of the questionnaire survey. It is recommended that the survey be adjusted, to make questions 33, 33a and 33b more logical. Responses to 33a were informative, and suggestive that further investigations could identify new and useful information, if

pursued. However, this could only be done if recognised at the time of the survey, with additional specific contact details obtained, as respondents generally did not identify their community, and only provided very general descriptive information about their community. Adjustment of the survey to take this issue into consideration may be useful for future applications of the survey. Despite these issues, survey respondents from the South African survey gave interesting insights, as follows:

*...as having the connection with the past with the sky because dead people are said to turn into stars.*

and

*...My community believes in every knowledge that is generated within it. And they use all these different knowledges in respect from the elders as holders of most of the knowledge...*

Responses to Question 34b identified further information about cultural beliefs:

*Shooting stars are a sign of a death of a king.*

and

*There was a man, a king who owned the world, he had three wives- one had the sun at her nose, the other had the moon and the other the stars. One day the stars-woman and the moon-woman conspired against the sun-women. They convinced her to take the sun out so that they can see it. This while the husband was away. When she brought it out, it flew to the sky and there was light always, the husband was so furious, he confiscated his stars and moon and threw them up in fury.*

For both the Australian and South African “The Sky In Our lives” surveys, it is notable that respondents generally did not provide detailed explanatory responses to the open ended questions (such as Q26a, 26c, 32a, 33a, 33b, 33c & 34b). One factor which may influence this is the way in which data were recorded, by respondents (or survey assistants) writing the responses (as opposed to sound or video recordings of discussions). The surveys have successfully identified examples of cultural or Aboriginal astronomy knowledge known to the respondents, as demonstrated by the results from questions 26, 33 & 34. However, once such examples are identified, qualitative data collection methods, such as sound or video recording of discussions, are likely to enable greater documentation of such knowledge, in a less structured manner.

#### **3.4.6.2 Suggested refinements to the survey**

The general intent for the use of “The Sky in Our Lives Survey” for this research, has been to use the survey with as little modification as possible to that originally developed by Holbrook, so that as international results are published in the future, results will be largely comparable. However, as a result of using the survey in Australia in the current research, there are some refinements to “The Sky In Our lives” survey, that would improve its future applicability. For example, question 7 seeks information about the background of the respondent. The question is highly weighted toward

astronomy or astrology backgrounds and includes, somewhat oddly one option being “military”, (which may be more relevant for the survey's application in the USA). The fact that most respondents ticked the “other” box, indicates that the response options were not as applicable to the respondents. A review and modification to the response option for Question 7 could be more informative for future surveys. In question 9, some definition of the terms “a city”, “a town” could help better inform respondents, for example, are towns defined up to 50,000 people? As the response options are not precisely defined, the respondents are left to interpret the question. Question 26 seeks information about participation in ceremonies or festivals, which have some form of astronomical basis. However, the question is a leading one, in that it suggests possibilities, such as “full moon, Easter, Ramadan, or on the longest or shortest day of the year”. As a result, respondents are likely to be influenced by this prompting, which makes interpretation of the results more difficult. It would be preferable to rephrase the question to avoid prompting, so that responses reflect the un-prompted views of the respondents. The fact that Easter, Ramadan and certain other religious events have some basis in astronomical meaning, will not be apparent to all respondents. Question 33a which seeks a description of the respondents community, is quite vague, and this led to a wide range of descriptive terms being used, and also responses that were typically very brief. The order of question 33 and 33a would also be improved by reversing the order of these two questions.

#### **3.4.6.3 Other issues relating to applications of the survey**

Another issue in relation to the survey is the applicability of the survey for those respondents for whom English is not their primary language, which could apply in future applications of the survey. The need for a translator in such circumstances would be quite labour intensive, and could introduce unintended biases due to the potential difficulties associated with explaining terms which may not be familiar to the respondent.

An anecdotal observation I made whilst conducting surveys is that, as the survey is highly structured, this limits the way in which natural conversation can occur. As a result, discussions that would otherwise clarify and explain the responses provided are quite limited, as compared to qualitative survey approaches such as interviews, in which discussions can be used to explore responses, in a less structured way. The survey structure is relatively linear in its approach, and I noted that some respondents actually needed to think about a particular question several times, before providing their response.

#### **3.4.6.4 Opportunities for future research**

Initial applications of *The Sky in Our Lives* survey by Jarita Holbrook has resulted in preliminary data being gathered from respondents in several countries including USA, Britain, South Africa, Brazil, Canada and a variety of European countries. The current research represents the largest application of the survey in Australia to date. As new surveys are conducted, ideally with larger population samples, this will increasingly enable comparisons to be made between different populations. Future applications of the survey will need to be based upon well defined populations and sample sizes



which permit valid statistical analysis. Where sample sizes do not permit statistical analysis, qualitative data from the surveys can provide useful insights. The current research has applied the survey in its English language context, however, attention is required regarding the use of the survey with non-English speaking people, or people with English as a second language. This issue can be of particular importance in relation to some Aboriginal communities in Australia. Future research could examine the translation and application of the survey into other languages, or alternatively, the use of interpreters for data collection with non-English speaking respondents. The potential use of translators adds another layer of complexity to the survey methodology, which would need to be examined closely. As discussed in the previous sections, some of the phrasing of the survey questions may benefit from adaptation or refinement.

### **3.4.7 Conclusions**

The Sky in Our Lives survey results have contributed to research objective 5, which is to examine and apply the use of survey methodologies to assess knowledge, attitudes & beliefs relating to astronomy, and awareness in relation to Aboriginal Astronomy initiatives. Survey results have documented how the sky has been used by respondents, in their day to day lives. Verifiable information regarding the astronomy knowledge of respondents has been obtained, and this can provide a baseline for future surveys conducted in Australia. The role of spiritual/religious and cultural beliefs, astrology and the role of formal education has been assessed in relation to knowledge, practices and attitudes towards the night sky. Recommendations have been made regarding refinements of the survey, and future research opportunities are suggested. In general, the survey result should not be generalised to broader Australian populations, due to the small sample size.

## 3.5 Aboriginal Astronomy Symposium, November 2009

### 3.5.1 Background

In November 2009, the Australian Institute for Aboriginal and Torres Strait Islander Studies (AIATSIS), in conjunction with the International Centre for Radio Astronomy Research, hosted a one day symposium on the topic of Aboriginal Astronomy. This symposium provided a national forum to meet and share knowledge regarding Australian Aboriginal astronomy. Norris (2010, 7) comments on the importance of the conference:

*The significance of this conference should not be underestimated. While many writers have made valuable contributions over the years to our knowledge of Aboriginal astronomy, their work has largely gone unnoticed, or been dismissed as a fringe activity, by the professional research community. This is now changing, and a small number of systematic research studies in Aboriginal astronomy are now under way...*

Approximately one-third of the symposium speakers were Aboriginal and a range of topics were covered, as presented in Table 16.

Table 16. Aboriginal Astronomy Symposium presenters and topics.

Presenter	Topic
Yidumduma Bill Harney	The Wardaman sky.
Ray Norris	Aboriginal Australians – the World’s First Astronomers?
Charmaine Green	<i>Ilgarijiri – Things Belonging to the Sky</i> : Arts perspective.
Duane Hamacher	The falling star at Puka: using Aboriginal Dreaming stories to locate meteorite falls and impact craters.
Hugh Cairns	Introduction to “Dark Sparklers”.
John Whop	The philosophy of Tagai in the Torres Strait.
Dianne Johnson	Interpretations of the Pleiades in Australian Aboriginal and Torres Strait Astronomies.
Munya Andrews	Dreamtime Stars: An Exploration of Aboriginal Astronomy.
Joe Gumbula	Yolngu Astronomy.
John Goldsmith	Cosmos, Culture and Landscape, recent examples of art, science and culture working together, inspired by the celestial.
Ragbir Bhathal	Perspectives on Aboriginal Astronomy.

### 3.5.2 The purpose of the survey

The Aboriginal astronomy symposium provided an opportunity to examine expert views about the communication and sharing of Aboriginal astronomy knowledge and issues associated with such

research. A survey was developed to assist in the collection of quantitative and qualitative data. The main purpose of the survey was to better understand why people value Aboriginal astronomy knowledge and how this knowledge is being recorded, communicated and shared.

The participants of the symposium were chosen for the survey, because it was assumed that the symposium participants were interested in and knowledgeable regarding Aboriginal astronomy, and were therefore in a position to contribute useful information.

### **3.5.3 Survey design, methodology & sample selection**

A survey on Aboriginal astronomical knowledge was developed (Appendix 6A) in conjunction with ICRAR (Prof Steven Tingay) and CSIRO (Prof Ray Norris). The survey was developed around five key themes: (1) values and beliefs of the respondent; (2) characterising the respondent's interest in the subject; (3) learning about Aboriginal astronomies; (4) limitations to understanding and (5) views about future symposiums.

The survey sample comprised participants of the Indigenous Astronomy Symposium. The survey was distributed to participants who had e-mail addresses, and the distribution of the survey was managed by AIATSIS. The survey was sent by e-mail, to 42 recipients. The first e-mail notice regarding the survey was issued on 13 January 2010. A reminder notice was issued by AIATSIS on 29 January 2010. The survey closed on 15 February 2010. An acknowledgement was sent to all survey respondents.

### **3.5.4 Data collation and validation**

Survey responses were collated in an Excel spreadsheet, with the number of responses tallied for each question. New columns were included in the Excel spreadsheet to also include the number of non-responses. Personal contact details have been removed to maintain privacy, and grammar and spelling have been corrected, where applicable.

### **3.5.5 Results**

Of the 42 recipients emailed to participate in the survey, 13 completed surveys were received, equating to a response rate of 31%. The Aboriginal Astronomy Symposium survey results, including the survey responses to the extended answer/comments section (Questions 8 and 9), are presented in Appendix 6B.

### **3.5.6 Analysis and discussion**

#### **3.5.6.1 The survey**

The majority of respondents indicated that they value cultural stories about the night sky, and that Aboriginal sky and astronomy knowledge should be recorded for the benefit of future generations (question1). Respondents also indicated a majority view that most people have little understanding of

Aboriginal sky knowledge. It was expected that participants of the symposium valued Aboriginal cultural knowledge relating to the night sky. Several responses (to questions 8 and 9) state this and also indicate the effect that the symposium had on them:

*...I do strongly believe that traditional peoples around the world have knowledge traditions of immense value and importance, including star knowledge...*

*I already had an interest in Indigenous astronomy before the symposium – my interest and respect for it was increased by the symposium.*

*I hope that some of my comments have helped to convey my appreciation and excitement at having attended the symposium and feeling like I am a part of something special to broaden non-Indigenous Australians' understanding of, and respect for, Indigenous Australians' rich culture and history.*

Not all of the symposium participants of the symposium were expert researchers or Aboriginal people with a key interest in the subject. One respondent stated:

*It was wonderful for a lay person with no formal training in astronomy to have the opportunity to hear astronomers and researchers of various disciplines speak on their areas of specialisation and especially then to hear from the people themselves who are the custodians of not only wonderful interpretations of the night sky but also of their people's ancient cultures.*

So whilst much of the symposium was directed towards expert researchers, the content and issues discussed also appealed to non-experts, in an informative way.

Some respondents indicated what effect the symposium had on them:

*It was a real eye-opener for me when different speakers – presenters and members of the audience – explained the responsibilities of the custodians of the interpretations not to disclose certain aspects of the stories relating to certain constellations or events. I hadn't really thought about this aspect before.*

The majority of respondents made favourable comments regarding the symposium. Feedback was positive regarding the *Ilgarijiri-Things Belonging to the Sky* exhibition, which featured at the symposium:

*...as well as to see the wonderful paintings by the Yamaji artists.*

and:

*Thankyou for the wonderful “Things Belonging to the Sky” Symposium and art exhibition.*

There was one strongly negative comment made regarding the symposium. This respondent felt that the science of astronomy, and Aboriginal astronomical knowledge was portrayed as equivalent, to which the respondent took strong exception:

*...taking the position that western astronomy and aboriginal astronomy are equivalent scientifically, epistemologically and ontologically is profoundly wrong...*

The respondent does not clearly state whether this view was directed towards one or several presentations in particular, or whether it was directed at the whole symposium. The respondent goes on to explain:

*...that there is a large literature on how indigenous knowledge traditions and western science can be enabled to work together without one being subordinated to the other, and most importantly how their real and substantive differences can be acknowledged and valued.*

The main research issue flagged here by the respondent is the need to recognise the substantive differences between knowledge-based “western astronomy”, derived from scientific approaches, and Aboriginal astronomy, which exists in its cultural context, often based on empirical and personal experience. Recognising and appropriately addressing this issue can help to improve communication between scientists and non-scientists, at such forums.

The majority of respondents indicated having a general interest in the subject of Aboriginal astronomy (question 2). A much smaller proportion indicated having an academic interest in the subject. The response which indicated... “because it’s part of my Aboriginal heritage” had a low response, possibly due to respondents not wishing to indicate their aboriginality.

In relation to “Learning about Aboriginal Astronomies” (question 3), respondents agreed that art and storytelling is important in Aboriginal culture, and that there is some astronomical knowledge which is of a sensitive nature or restricted to certain people. Interestingly, the question regarding discrepancies between Aboriginal astronomical cultural knowledge and scientific astronomical knowledge showed greater variation; some agreed, some did not agree or disagree, and some provided no response.

Regarding factors which limit the understanding of respondents (question 4), a majority of respondents agreed that the factors of difficulty in finding information, not knowing who to approach, and their own knowledge about astronomy in general were all factors which limited understanding of Aboriginal astronomy. The majority of respondents indicated they would like to participate in future

research into Aboriginal astronomy, and would also like to attend future Aboriginal astronomy symposia (questions 5, 6 and 7).

An overview of responses for Q8 “Can you provide any other examples (of the communication and sharing of Aboriginal astronomies)?” and Q9 “Any other comments?” is provided in Tables 17 and 18. Respondents have been designated an arbitrary number. Responses have been categorised according to key topics and themes and respondents raised several highly relevant issues and topics.

Table 17. Overview of responses received from the four respondents who answered Q8. “Can you provide other examples” (of Aboriginal astronomies being communicated and shared)?

Topic / theme / issue	Survey respondent			
	1	2	3	4
1. The importance of Aboriginal sky knowledge recognised.		✓	✓	
2. Insights into cultural responsibilities and practices.			✓	
3. Research issues		✓		
4. Reconciliation			✓	
5. References		✓		
6. Opinions about the Symposium		✓		✓
7. Opinions about specific presenters		✓		
8. Comments about the <i>Ilgarijiri</i> exhibition			✓	✓
9. Learning as a result of the Symposium			✓	✓
10. Expression of thanks to the Symposium organisers			✓	✓
11. Meeting and hearing presenters valued.			✓	✓
12. Ideas about future communication / education			✓	
13. Topics / content for future Aboriginal Astronomy Symposia			✓	
14. Background information about the respondent	✓			

Table 18. Overview of responses received from eight respondents who answered Q9. “Any other comments?”

Topic / theme / issue	Survey Respondent							
	1	2	3	4	5	6	7	8
1. Links between radio astronomy and Aboriginal sky knowledge							✓	
2. Secret knowledge		✓						
3. Reconciliation theme							✓	
4. Educational opportunities (to be applied)			✓					
5. Educational activity (applied in schools)					✓			
6. Topic approached from art perspective			✓					
7. Aboriginal art (various examples)							✓	✓

Topic / theme / issue	Survey Respondent							
	1	2	3	4	5	6	7	8
8. Comments about <i>Ilgarijiri</i> exhibition.			✓					
9. Use of digital / video technologies for education					✓			
10. Models for astronomy/climatology ecotourism		✓						
11. Examples of events, presentations, festivals, tours, etc.						✓		✓
12. Posters								✓
13. Online sources of additional information				✓				
14. References	✓	✓				✓		✓

Whilst question 8 specifically sought recent examples of Aboriginal astronomies being communicated and shared, responses were diverse and included other responses (such as information about the respondents themselves, opinions regarding the symposium, etc). Such responses had been intended for question 9, which was a general, open ended “Any other comments?”, question. Likewise, some responses to question 9 more properly addressed question 8. For the purpose of the discussion below, relevant responses from both questions have been grouped together. The design of question 8 intentionally avoided being too prescriptive (such as listing various response categories), because this could prompt or lead respondents. However, the diversity of responses to questions 8 and 9 suggest that a more structured question may assist respondents.

The survey successfully elicited several examples of the communication and sharing of Aboriginal sky knowledge. Examples include a planetarium show (Boulder, Colorado USA), various talks and presentations (e.g. Aboriginal Skies, University of Colorado; The First Astronomers, Bill Harney and Ray Norris; Aboriginal Astronomy and Customary Law, Australian Museum; Aboriginal Night Skies Talk, Australian Museum; Customary Law Talk, Bond University), events at festivals (e.g. Katherine and Darwin Festivals), and posters (e.g. Wardaman Night Sky Posters, derived from “Dark Sparklers”). Links between radio astronomy and Aboriginal astronomy were also recognised within educational displays at Honeysuckle Creek, NSW, an important site for the Apollo Moon landing program:

*Another example of acknowledging Indigenous astronomy is at Honeysuckle Creek, which I am sure you are aware is the site of the tracking station which broadcast the first pictures of Armstrong stepping onto the moon (a few minutes before Parkes Telescope was able to pick up the signal). It is located in Namadgi National Park, south of Canberra and when I first visited it in March 2009 I was surprised and pleased to see among the plaques dedicated to the wonderful work done by the Honeysuckle guys an acknowledgement of how the Southern Cross is understood by different Indigenous peoples.*

The issue of “secret knowledge” associated with some Aboriginal astronomical knowledge was noted by one respondent:

*...Dr. Anne Kerle has published an eco-tourism text for ULURU-KATA TJUTA & WATARRKA as one on the National Parks Field Guide Series.... in which she incorporates significant information in a non-specific way of Aboriginal interpretations of various constellations. She also raises the secret nature of the Tjukurpa and therefore most of the deep astronomical information is not available.*

Furthermore, two responses drew attention to Reconciliation themes. One respondent recognised an opportunity to share Aboriginal stories of the night sky in the context of Reconciliation:

*I also plan to follow up with Reconciliation Australia (I am a reconciliation action plan coordinator for a government employer and have contacts with RA).... I just thought that maybe they could help with publicising some of the stories.*

Another respondent noted the role of Reconciliation Place (described in Section 2.3.5.1):

*There is a wonderful example of Torres Strait Islander astronomy artwork and explanation of the Islanders' practical links with the sky at Reconciliation Place in Canberra. It depicts Tagai and shows a number of references to the night sky and the sun and fishing. There are photos on the National Capital Authority's site for the range of Aboriginal and Torres Strait Islander pieces of art and architecture.*

Several educational initiatives were noted by survey respondents, including initiatives that could disseminate learnings from the symposium, or educational initiatives that had already been applied to communicate and share Aboriginal sky knowledge. Some examples include:

*Aboriginal astronomies from the symposium is now being shared and communicated within our whole school community (through cultural presentations forming part of SOSE learning area).*

and:

*The symposium was the first I've experienced (exploring the connections). I can see that school communities could assist in opening our understandings of aboriginal astronomy. Any chance for school students to participate? Especially Indigenous students who can then pass on this knowledge on to their peers? Via cultural presentations and leadership programs.*

The sharing of information and mix of participants at the symposia were valued by respondents, for example:

*It was a good mix of academics, researchers and Indigenous people all sharing their knowledge and ideas. The environment was positive, stimulating, collaborative and friendly.*



The survey has collected anecdotal and qualitative data, which provides insights into the views, opinions and knowledge of the symposium participants. This new knowledge provides a basis to inform and guide the development of future meetings. Some key aspects that can inform such future work include:

- A mix of science based and cultural based presentations are important.
- Where different views exist on a particular topic, discussion and debate are important.
- Whilst research symposia may generally be orientated towards researchers, non-specialists are also likely to participate.
- It is preferable to recognise the different knowledge systems present (e.g. scientific, cultural etc), and to not equate one with the other.
- There are numerous examples of how Aboriginal sky knowledge has been communicated and shared.
- The use of the *Ilgarijiri-Things Belonging to the Sky* exhibition was complimentary to the symposium. Art is one perspective.
- Reconciliation themes underlie Aboriginal sky knowledge.
- Event evaluations, such as the survey used for this research, can provide useful insights into the views, opinions and knowledge of the participants.
- Surveys should be reviewed and updated as appropriate for future use.

#### **3.5.6.2 Limitations of the survey methodology**

As with all survey methodologies, certain limitations exist within the survey. The distribution of the survey was made only to those symposium participants who supplied e-mail addresses to AIATSIS. No postal surveys were issued. Due to this, not all symposium participants were included in the survey. The distribution of the survey by e-mail was chosen mainly due to the practicality of reaching as many participants as possible in the most economical way. However, the use of an e-mail based survey response may also have biased the responses, as the characteristics of those surveyed may differ to those of all symposium participants. With a response rate of 31%, the survey results should be regarded as a general indication of the views of participants, but not comprehensive.

#### **3.5.6.3 Recommended refinements to the survey**

The survey has potential to be applied to future Aboriginal Symposium meetings or similar events. As noted in the discussion, responses were diverse to questions 8 and 9. Whilst the posing of leading questions should generally be avoided in surveys, some kind of improved structure, or clarification to Question 8 may be needed, so that respondents address the specific question. One solution is to include a note to the effect that Question 9 is for all open ended feedback / comments, but Question 8 is only for listing specific examples of the communication and sharing of Aboriginal astronomies.

#### **3.5.6.4 Opportunities for future research**

There are several opportunities for extending this research, such as:

- Using the same survey for future Aboriginal astronomy symposia.
- Investigating in more detail, the examples of the communication and sharing of Aboriginal astronomical knowledge such as the example of Reconciliation Place, Canberra.
- Investigating in more detail the perceived inconsistencies between scientific astronomical knowledge and some Aboriginal astronomical knowledge.

#### **3.5.7 Conclusions**

Baseline data have been collected from a sample of participants from the first national Aboriginal astronomy symposium, regarding the knowledge and opinions of the participants. The survey successfully identified examples of the sharing and communication of Aboriginal astronomy.

The survey results provide evidence in support of Hypothesis 2, (Collaborative, cross-cultural projects can act as an important catalyst to encourage the appreciation and respect of Aboriginal and scientific astronomical knowledge). One key issue raised by a respondent is: *“how indigenous knowledge traditions and western science can be enabled to work together without one being subordinated to the other, and most importantly how their real and substantive differences can be acknowledged and valued”*. Furthermore, two survey responses specifically recognised aspects of Reconciliation in connection with Aboriginal sky knowledge, which lends support to Hypothesis 6: That cross cultural exchanges, based on Aboriginal sky knowledge, can encourage and facilitate Reconciliation.

The survey has significantly contributed to research objective 1, by identifying several examples of how people engage with Australian Aboriginal astronomical knowledge, and in particular, the survey has drawn to light the role of Reconciliation Place, Canberra, and its use of Aboriginal astronomical knowledge. The extended responses to the survey have also informed research objective 2 by providing insight into the views, opinions and knowledge of the symposium participants regarding issues and sensitivities around cultural knowledge. This has enabled ways to be suggested to address such issues. Finally, the research has identified key aspects to guide future symposia meetings, based on the new knowledge derived from the survey results.

### **3.6 Concluding comments**

In this chapter, I set out to assess astronomical knowledge, attitudes and beliefs, via three surveys to investigate the levels of awareness people have in relation to astronomy in general, and Aboriginal astronomy in particular. The first survey investigated the International Year of Astronomy (2009) including awareness of Aboriginal astronomy events and is the only such attempt to do this in Australia. The Sky in Our Lives survey investigated the knowledge, attitudes and beliefs people have in relation to astronomy, Aboriginal astronomy & astrology. Comparisons with the South African data were presented. It is anticipated that as further international research occurs, additional

comparative studies can be done in the future. The third survey collected data from the 2009 Aboriginal astronomy symposium, the first such national meeting of its kind in Australia.

The use of surveys as a tool to investigate Aboriginal sky knowledge have certain strengths and weaknesses. The survey methodology used for all three surveys is based on a highly structured and essentially linear process of information gathering and eliciting of responses. This approach can be useful for assessing relatively categorical information (e.g. yes / no responses), or continuum based responses (e.g. strongly agree / agree / neutral / disagree / strongly disagree). I found that in general, survey responses which referred specifically to Aboriginal sky knowledge were relatively concise. The structured approach of the surveys tended to limit further exploration and responses from participants. Further, deeper exploration of such knowledge, would be best accomplished using qualitative data gathering approaches, such as interview based video recording of discussions between the researcher and the participant. Such an approach is far less structured, but when conducted by a skilled researcher, is able to explore, probe and adapt to the particular participant. Qualitative methods using video based interviews are the main feature of the data collection in the next chapter.

Participation in all surveys has been entirely on a voluntary basis. Practical factors regarding the survey methodology and survey distribution are likely to have caused some inherent bias within the survey results. As precise definition and quantification of respondent populations has not been possible for the current surveys, this has precluded statistical analysis to validly generalise the results to broader populations. Despite this, all three survey results provide informative and useful information regarding the knowledge, attitudes, beliefs and practices of the respondents in relation to the night sky. In general, the surveys have successfully collected data about Aboriginal sky knowledge.

The survey approaches have been useful, but are limited due to four main factors: (1) the inherent structure of surveys; (2) the labour intensiveness of data collection; (3) constraints imposed by necessary approval and permissions, when seeking information from particular sectors of the community, such as schools and students; and (4) limitations imposed by appropriateness of statistical analysis, which is dependent upon the ability to precisely define and quantify survey populations, and obtain sufficiently large response rates. The use of online surveys as a data collection method has demonstrated its effectiveness and practicality. Survey based approaches are suited to applications where fairly categorical responses are sought (e.g. yes / no responses), testing the knowledge of respondents, or seeking opinions about attitudes and beliefs (e.g. using a disagree / agree continuum). The relative inflexibility of survey based approaches means that such approaches are less suited for subjects that require adaptable, exploratory investigation. In terms of research methodologies for future cultural astronomy research, I caution against relying solely on survey based methodologies, and emphasise the importance of recognising the methodological limitations that such approaches can have, particularly when dealing with potentially complex knowledge, such as Aboriginal sky knowledge.

In the following chapter I apply qualitative data collection techniques based on video recorded interviews. Whilst survey based methodologies can be relatively labour intensive at the data recording stage, qualitative methods such as video based interviews can be labour intensive at the data processing stage (e.g. production of interview transcripts). However, such qualitative methods can ultimately provide valuable information, leading to significant new insights into Aboriginal sky knowledge.

## Chapter 4

# Documenting Aboriginal sky knowledge

*“The Spirit of the (Seven) Sisters is strong and still here today,  
in the People, in the Country and in the Sky”.*

Melissa Jacobs, quoted in *“Ilgarijiri- Things Belonging to the Sky”* (2009, row 31).

Research from Chapter 4 has been presented in the following conference posters and journal papers:

Goldsmith, J. 2010, “Sharing and communicating Indigenous astronomical and sky knowledge”. Poster presented at the Astronomical Society of Australia annual science meeting, Hobart, July 2010.

Goldsmith, J. 2011a, “Documenting natural and cultural places with 360° spherical images, panoramic and timelapse digital photography”. *Rock Art Research* vol. 28 no. 1, pp. 123-127.

Goldsmith, J., Tingay, S., & Hamacher, D. 2011, “Building bridges between cultures, communicating and sharing Australian Indigenous sky knowledge”. Poster presented at the ninth “Oxford” International Symposium on Archaeoastronomy, Lima, Peru, January 2011.

Goldsmith, J., & Brocx M. 2012, “A virtual tour exploring Wolfe Creek Meteorite Crater’s geoheritage, cultural and educational values”. Poster presented at the 34th International Geological Congress (IGC): Brisbane, Australia, 5 – 10 August 2012.

### 4.1 Introduction

The approaches taken to document Aboriginal astronomies and sky knowledge are varied, dynamic and continue to evolve. Some approaches attempt to reconstruct knowledge, primarily from earlier research, or by analysis of physical evidence such as archaeological sites. My research does not attempt to reconstruct past knowledge, rather, the research engages with contemporary Aboriginal people to investigate present day Aboriginal knowledge of the night sky. The emergence of new research tools are being utilised by researchers and applied to Aboriginal sky knowledge, in innovative ways.

Various researchers have investigated the ways in which Aboriginal people perceive, experience and relate to the environment, which in this context, also includes the night-time astronomical

environment. Qualitative research has also investigated differing research approaches. For example, Fler (1997, 113) made the observation and conclusion that:

*Given the cohesive nature of many Aboriginal communities, the sharing of knowledge construction across groups and in particular, the learning styles evident... .. it would seem that group interviewing is more likely to yield specific cultural knowledge relating to night and day. ... .. Further studies into this area are urgently needed.*

My research responds to Fler's call for research in this area, and my research uses both group-based and individual interview approaches. The interview-based approaches presented in this chapter represent qualitative data collection, which leads from the survey based approaches used in the previous chapter. The different data collection methodologies are significant, and complementary to each other. We shall see the differing results achieved by the use of such qualitative approaches. Interviews, by their very nature, utilise oral communication and enable exploration of topics and issues in far greater detail than typically achieved by survey based approaches. In this chapter, I present the results of investigations and documentation of Aboriginal astronomical knowledge. The results are largely based upon numerous interviews conducted with Aboriginal Elders, artists, community leaders, and other people who have a particular interest in Aboriginal culture in general, and Aboriginal sky knowledge in particular, such as Aboriginal art gallery directors. Chapters 4 and 5 draw upon the transcripts of the video interviews conducted with the participants of this research. The full transcripts appear in Appendix 13.

Whilst the video record of interviews was necessarily undertaken in an oral form, participants understood that the oral accounts would be prepared in written form in the research, and all participants gave their support for this to occur. Several participants actively expressed the desire to have their stories written down and shared. All participation in interviews was done on a voluntary basis, after having been briefed regarding the research (via information sheets and discussion) in accordance with the research ethics approval for this research, and consent forms used for the provision of consent to participate in the research. The documentation and sharing of knowledge, particularly from Elders in this study, was widely recognised by interview participants as being important. Indeed, the issue of the risk of loss of knowledge from the passing of Elders has been highlighted during this study, with at least four of the interviewed participants having now passed away.

In Chapter 1, the great diversity of Aboriginal language groups within Australia is noted. For the current research, it was decided to focus the scope of the research into three distinct geographical areas (Figure 18) and associated Aboriginal peoples or language groups, namely the:

1. East Kimberley Region (centred on Wolfe Creek Crater), relating primarily to the Jaru language group.

2. Murchison Region (centre of the MWA / ASKAP, SKA radio astronomy initiatives), relating primarily to the Yamatji-Wajarri people.
3. South West of Western Australia (the location of the head office of the International Centre for Radio Astronomy Research), relating primarily to the Noongar people.

In this way, the research areas relate to Wolfe Creek Crater, a site of considerable scientific interest, and to the major radio astronomy research initiatives in Western Australia. The three differing geographical areas and associated Aboriginal language groups have been chosen for detailed investigation, because they offer three contrasting contexts of Aboriginal knowledge of the night sky.



Figure 18. Location map of primary research locations.

(Adapted and revised from WALIA, 2010).

Figure 18 shows the main localities and sites on which this research focuses. Research into these areas provide important insights into the documentation, communication and sharing of Aboriginal astronomical knowledge, with significant opportunities for applying the insights gained into future initiatives.

This approach of recognising the three different geographical areas and their associated language groups is based on the first principle of the Guidelines for Ethical Research in Australian Indigenous Studies (AIATSIS 2012a, 2), which states:

*Recognition of the diversity and uniqueness of peoples, as well as of individuals, is essential.*

In section 4.2, I present the results of investigations into Kandimalal (Wolfe Creek Crater). The crater represents one of the very few terrestrial landscapes in which Aboriginal or Indigenous knowledge exists to this day, specifically relating to the impact crater. As such, it provides an important opportunity for cultural research.

Section 4.3 presents the results of interviews with Yamatji artists involved in the *“Ilgarijiri- Things Belonging to the Sky”* Aboriginal art exhibition. The *Ilgarijiri- Things Belonging to the Sky* exhibition is the pre-eminent example in Western Australia of scientific and Aboriginal collaboration, in the context of major scientific radio astronomy developments, in which Aboriginal knowledge of the night sky is shared and communicated with a local, national and international audience.

Section 4.4 investigates examples of contemporary Aboriginal sky knowledge of the South West of Western Australia, and the communication of such knowledge in a larger urban context. The chapter features a case study of the work of South West Western Australian Aboriginal Artist Toogarr Morrison.

The video recorded interviews, which form the principal data collection method for this chapter, have enabled a flexible, conversational, and investigative style for recording Aboriginal knowledge of the night sky. In general, it will be noted that the oral accounts show some repetition. The use of repetition is a technique used in oral storytelling and was commonly encountered during interviews with Aboriginal people in this research. Repetition serves to provide emphasis and to aid comprehension. I have generally adopted the approach of quoting interview participants to illustrate results. However, when verbatim quotes are difficult to understand, I have provided concise interpretations of the relevant discussions, simply for ease of comprehension. The original transcript record for all interviews is supplied in Appendix 13. The flexibility afforded by the conversational style during interviews has enabled probing questions to help clarify exactly what interview participants are referring to. A good example of this is the discussion which resulted in the recognition that the word “meteor” was also being used to refer to a comet. Another issue encountered is the variation in the spelling of names and words. These variations have been



preserved rather than standardised to reflect the best transcription that can be made from the interviews. As there are more than one “Jack” and “Jugarie” in the interviewees, I have adopted the use of first and second names to clearly and unambiguously indicate attribution.

## **4.2 Sky heritage of the East Kimberley**

### **4.2.1 Introduction: Kandimalal, Wolfe Creek Crater**

Wolfe Creek Crater, located on the edge of the Great Sandy Desert in the East Kimberley, Western Australia, is one of the few locations in the world where Aboriginal culture exists in relation to a meteorite crater. International examples of impact craters with known cultural knowledge include Lonar (India), Kaalijärvi (Estonia), and Tswaing (Pretoria, South Africa) (Bevan & De Laeter, 2002). Results are presented of investigations into the astronomical knowledge of Aboriginal people, relating to Wolfe Creek Crater. The research has been derived from my six site visits to the crater, conducted in 1998, 1999, 2000, 2003, 2010 and 2011, and reported extensively for the first time.

#### **4.2.1.1 Global distribution of impact craters**

The “Earth Impact database” provides a world-wide listing of known meteorite impact sites. Less than 200 meteorite sites are listed on the database (PASSC, 2011), with 26 impact sites listed in Australia (Figure 19). However, recent discoveries, such as the Hickman Crater (Glickson, Hickman & Vickers, 2008) in Western Australia, have not yet been listed.



Figure 19. Global distribution of meteorite impact structures.  
(Image derived from PASSC, 2011)

The global distribution of impact sites is not even. This can be due to several factors, including the suitability of landforms for preserving impact structures, and the varying intensity of search efforts for impact sites.

#### **4.2.1.2 Wolfe Creek Crater**

Wolfe Creek Crater (Figures 20 & 21) is one of the best preserved and most spectacular meteorite craters in the world. It is a highly significant site for scientific research. The site is one of the few locations in the world where local Aboriginal knowledge and culture relates directly to the meteorite crater. In addition to the scientific value of the crater, the site has also become an important tourist attraction.

The crater is situated at latitude 19° 10' 18.2" S and 127° 47' 43.56" E , in the East Kimberley region of Western Australia, approximately 130 km south of Halls Creek, on the edge of the Great Sandy Desert. The crater is accessed by the Tanami Desert Road, a gravel road which links Halls Creek to Alice Springs. The crater is protected by a National Park and is managed by the Western Australia Department of Parks and Wildlife (previously, the Department of Environment and Conservation).



Figure 20. Aerial view of Wolfe Creek Crater.  
(Photo: John Goldsmith)



Figure 21. Star-trails above Wolfe Creek Crater.

(Photo: John Goldsmith)

Planetary scientists speculate that the original meteorite which formed the crater was probably an iron meteorite weighing thousands of tonnes (Bevan & De Laeter, 2002). The tremendous speed of the meteor on impact caused a massive blast, comparable to a nuclear explosion, resulting in a near-circular crater almost 900 metres in diameter and 150 metres deep. The impact probably occurred more than 300,000 years ago. Since then, the process of erosion has slowly worn down the crater walls. Wind-blown sand and dust has partially filled the crater floor. However, the crater walls remain quite steep, and in places there are sheer cliffs, particularly on the inner side of the eastern crater wall. The crater walls presently stand up to about 40 metres above the surrounding flat plain, and the almost flat crater floor is 60 metres deep; about 20 metres below the surrounding plain. The outer portion of the crater floor is sandy, while the central portion consists of salt deposits. Soakwaters, also referred to as sink-holes, are located near the middle of the crater, and some water is present virtually all the year.

Although some small iron meteorite fragments have been discovered in the vicinity of the crater, very few particles of the original meteorite have survived. During the millennia which have passed since the impact, the meteorite has largely rusted away.

The following literature review provides an introduction to research on Wolfe Creek Crater. I provide an overview of my site visits to the crater, which have occurred over a 13 year period. Then I introduce the Aboriginal Elders, artists and community members who have been interviewed for this research and the results of the interviews are reported, based on the main astronomical themes.

### 4.2.2 Literature review

Meteorite craters on Earth are relatively rare geological structures and they provide important research opportunities for a variety of scientific and cultural investigations. A wide range of scientific studies have been carried out in relation to Wolfe Creek Crater. These studies include a range of geophysical (Hawke 2003), ecological (Cockell & Lee, 2002), space science studies, cultural / ethnographic studies (Tindale 2005, Hamacher 2009) and various film expeditions. A variety of site descriptions and mapping projects of the crater have been undertaken e.g., Commonwealth of Australia (1949, 1968, 1979) & Cassidy (1968). In addition, the crater has featured in several film productions, cultural studies and exhibitions (Carson, McClave & Millward 2003, Gilchrist 2009, Sanday 2005). The crater also features in fictional works, such as *The Will of the Tribe* (Upfield, 1962) and the horror movie *Wolf Creek* (McLean, 2005) (note the probably intentional incorrect title spelling).

The crater is often incorrectly described as “the second largest meteorite crater in the world” whereas Bevan (2009) describes more precisely that the crater is the second largest impact crater, from which meteorite fragments have been recovered. The crater has been studied by numerous scientists, but the cultural significance of the crater is only now beginning to be more fully appreciated.

The Western Australian Department of Aboriginal Affairs Aboriginal Sites Register indicates several known archaeological and ethnographic sites occur in the vicinity of Wolfe Creek Crater. Site 12192 is listed as “Wolfe Creek Crater” and is described as being a ceremonial and artefact scatter site. However this site file is not publicly available. Other sites in the vicinity of the crater include: site 13095 “Wolfe” (Artefacts / Scatter); site 13297 “Canning Stock Route” (Mythological); site 13617 “Carranya Station 1”; site 13618 “Carranya Station 2”; and sites further afield: site 13619 “Junction Waterhole 1”; site 13620 “Junction Waterhole 2”; site 13621 “Junction Waterhole 3”; site 13622 “Junction Waterhole 4”; and site 14329 “Shiddi Creek” (Engraving) (Department of Indigenous Affairs, Aboriginal Sites Register, 2009). The Western Australian Aboriginal Heritage Act 1972 sets out the basis for the protection of Aboriginal heritage sites and other matters. Section 5 of the Act defines an “Aboriginal site”, which, in broad terms, includes a place where natural or artificial objects have been left in relation to past or present traditional Aboriginal cultural life, sacred, ritual and ceremonial sites, and places associated with Aboriginal people that have historical, anthropological, archaeological or ethnographic interest. The Act goes on to establish the basis of the protection of such sites (Part IV), and the role of the Aboriginal Cultural Material Committee (Part V), and the Registrar of Aboriginal Sites. The protection of Aboriginal Sites includes the definition of offences (section 17), and a consent for “certain uses” (section 18). The archaeological and ethnographic sites in the vicinity of Wolfe Creek Crater are protected under the provisions of the Aboriginal Heritage Act 1972.

The first confirmed non-Aboriginal recognition of the crater occurred in 1947. Alex Bevan and Ken McNamara note in their book “Australia’s Meteorite Craters” (1993 & 2009) that F Reeves, NB

Suave and D Hart observed the crater from the air during an aerial survey of the Canning basin, in 1947. A field visit took place two months later. There is at least one claim of an earlier “discovery” of the crater by a non-Aboriginal person. R & E Gard (1995, 434) notes: “*Constable A.J. Jones of Halls Creek, the trooper... ..claims he was shown the crater by a black tracker as early as 1935, but he could not prove his claim*”.

Early publications about the crater include that of “The Wolf Creek Crater” report (Reeves & Chalmers, 1949). Speculation developed about the origin of the crater, and whether it was formed by volcanic or meteoritic processes (e.g., Leonard, 1949a,b).

The earliest Aboriginal ethnographic investigations relating to the crater appear to be that of the South Australian anthropologist, Norman Tindale. The journey to the crater was part of the University of California Los Angeles (UCLA) - Adelaide University's Anthropological expedition, 1952-1954. The actual visit to the crater occurred for a single day in 1953, during which Tindale collected drawings by Aboriginal people. He concluded that the crater “did not play a role in local rites or mythology” (Sanday 2007, 43).

The Western Australian film producer Guy Baskin produced “The Wonder of Western Australia” TV series, which features Wolfe Creek Crater in the first edition of the documentary series, in 1982. This series brought considerable attention to the East Kimberly in general, as it also introduced the “Bungle Bungles”, which became the Purnululu Conservation Reserve in 1987 (and subsequently, National Park).

Various publications about Wolfe Creek Crater subsequently appeared, including the Landscape Magazine article “Blast from the past” by Alex Bevan (1996) (WA Museum), and “Cosmic impacts in the Kimberley” by John Goldsmith (2000). The crater featured in the “Skylab Out of Orbit” collaborative exhibition by Carson, McClave Millward (2003), which contrasted the naturally occurring Wolfe Creek Crater with the Skylab satellite that crashed back to Earth in 1979. In 2009, Hamacher and Norris published a paper which related in part to Wolfe Creek Crater, in their investigation of “Australian Aboriginal Geomythology: Eyewitness Accounts of Cosmic Impacts?” (Hamacher and Norris, 2009).

In 1997, a unique cross-cultural long distance walking race took place, starting from Wolfe Creek Crater and finishing at Wyndham (approximately 400 kilometres cross country). The event was filmed as the “Human Race” documentary (Ogilvie, 1997) and featured three men from different cultural backgrounds: a German survival expert; an American ultra marathon runner and Aboriginal Elder Jack Jugarie. Elder Jack Jugarie claimed a connection to the Wolfe Creek country, and subsequently (in this research), provided special insight into astronomical knowledge and beliefs relating to the Crater. In August 1999, I interviewed and video recorded Jack Jugarie at Wolfe Creek Crater, and documented his knowledge relating to the crater and the night sky, approximately two

weeks before his unexpected passing. Detailed transcripts of the video interviews and notes of the discussions with Jack Jugarie appear for the first time, in Appendix 13.

In the late 1990's, anthropologist Peggy Reeves Sanday from the University of Pennsylvania visited the Wolfe Creek Crater and conducted investigations into Aboriginal knowledge relating to the crater and expression of the crater via Aboriginal art. Whilst Sanday's main research area is women's studies, she is also the daughter of Frank Reeves, the "co-discoverer" of Wolfe Creek Crater, and cites her father's role in the "discovery" as being a key factor in her interest into pursuing an anthropological career (Sanday, 2005). The results of her work in relation to the crater were presented in an exhibition "Tracks of the Rainbow Serpent", which exhibited in the USA, as well as a publication of the same name, describing her personal connection to the crater, and her interactions with contemporary Aboriginal people relating to the crater. The exhibition was featured in the book "Aboriginal Paintings of the Wolfe Creek Crater, Track of the Rainbow Serpent" (Sanday, 2007), published by the University of Pennsylvania, Museum of Archaeology and Anthropology. It is claimed that "*The Dreamtime story of the creation of the Wolfe Creek Meteorite Crater is told here for the first time*" (Sanday 2007, jacket). This claim is clearly not valid, as Aboriginal cultural stories relating to the crater and its origin have been previously documented and communicated, for example, by Bevan & McNamara (1993) and Goldsmith (2000). In addition, the managers of Wolfe Creek Crater National Park, the Western Australian Department of Parks and Wildlife, has onsite signage at the crater which notes Aboriginal accounts about the crater. I observed this signage during my first visit to the crater, in 1998 (see Figure 41, and the transcript provided in Appendix 9). The description of the crater by Sanday in the Prologue of her book as a "huge hole in the ground, one mile in diameter" is an imprecise description and significantly incorrect, as the variable diameter of the crater rim is approximately 870 metres (Bevan & McNamara 1993), and not "one mile" or 1,609 metres. These example of errors regarding basic facts and invalid claims detract from the book and also highlight the problem of unsupported, or unsubstantiated claims or interpretations; which can be a generic issue in this field of research.

A review was conducted for this research in relation to Native Title in the vicinity of Wolfe Creek Crater. Native Title (whether in the form of a claim or a Court determination) can have various implications for research initiatives, such as who should be consulted with regarding such research initiatives, and permissions regarding access and site visits. A review of the Register of Native Title Claims (National Native Title Tribunal, 2013) indicates that as of 30 June 2013, there are no Native Title claims in relation to Wolfe Creek Crater and the National Park, however, future Native Title claims may occur. The Tjurabalan Native Title area is the nearest Native Title land situated to the south of the crater. By way of background, Native Title developed out of the "Mabo decision" of the High Court of Australia in 1992, in which the High Court recognised that the Meriam people of the Torres Strait held native title over part of their traditional lands (National Native Title Tribunal, 2006, 2009). This decision provided the basis for Aboriginal and Torres Strait Islander people to seek recognition of Native Title. The commonwealth legislation Native Title Act 1993 established the

National Native Title Tribunal, who's primary role, as an independent federal government agency, was to assist in informing, negotiating and mediating in relation to Native Title. The determination of Native Title itself is made by courts (such as the Federal Court, High Court or similar). Native Title relates to a collection of rights and interests regarding land or waters and can be recognised in particular circumstances. These include the substantially uninterrupted practice of Aboriginal laws and customs, since the sovereignty of Australia (National Native Title Tribunal, 2006).

Based on the previous literature review, a brief synopsis is provided in Table 19, showing examples of research, documentation and other initiatives relating to Wolfe Creek Crater.

Table 19. Synopsis of Wolfe Creek Crater research, documentation and related initiatives.

<b>Year</b>	<b>Activity</b>
1947	First non-Aboriginal recognition of the crater during an aerial survey.
1949	“The Wolfe Creek Crater” report (Reeves & Chalmers, 1949).
1953	Dr Norman Tindale, Expedition notes; perhaps the earliest ethnographic records relating to the crater?
1982	West Australian film producer Guy Baskin “The Wonder of Western Australia” features Wolfe Creek Crater in the first edition of the documentary series.
1989	Stanton (1989) “Painting the Country”. Aboriginal art, including an Aboriginal art representation of Wolfe Creek Crater and vicinity.
1996	Alex Bevan, WA Museum, Landscape Magazine article “Blast from the past” (Bevan 1996).
1997	Documentary “The Human Race” features a 400km cross country walking race, from Wolfe Creek Crater, of a Jaru Aboriginal Elder- Jack Jugarie, and a German and an American.
2000	John Goldsmith, Landscape Magazine article “Cosmic Impacts in the Kimberley”.
2003	Carson, D., B. McClave & G. Millward, “Skylab, Out of Orbit” featuring an exhibition about Wolfe Creek Crater.
2007	Peggy Reeves Sanday, Exhibition of Aboriginal paintings featuring the crater.
2009	Hamacher, D.W. & Norris, R.P. Paper; Australian Aboriginal Geomythology: Eyewitness Accounts of Cosmic Impacts?

### **4.2.3 Field work; introduction**

The fieldwork carried out for this research has been undertaken with regard to the issues and sensitivities I have discussed in Chapter 2 (section 2.2). During my visits to Halls Creek and Wolfe Creek Crater, I met Aboriginal Elders and local Aboriginal people, who shared their stories and knowledge about the crater. I documented these discussions on video, recorded extensive notes, photographs, purchased examples of Aboriginal artwork depicting the crater, and obtained drawings and sketches relating to Aboriginal astronomical knowledge. Advice was sought from the Yarliyil

Art Centre regarding Aboriginal artists who painted Wolfe Creek Crater, in addition to the Kimberley Language Resource Centre, the then Department of Conservation and Land Management (now Department of Parks and Wildlife), and members of the Billiluna community.

#### **4.2.4 Interview methods**

The research has been based on conversational style interviews, to investigate, elaborate and document Aboriginal knowledge relating to Wolfe Creek Crater specifically, and astronomical knowledge more generally. Interviewees were selected based on Aboriginal people who professed to or were known to have close connection to the Wolfe Creek Crater country. One limitation to the current study is that interviews were conducted in English and generally not in the interviewee's native language. Wherever possible, interviews have been recorded on video and transcripts prepared (Appendix 13), based on those interviews. The transcripts attempt to record as faithfully as possible word for word records of the interviews. Notes were recorded in the few occasions in which video interviews were not conducted. The use of "Aboriginal English" and its conversational style will be apparent in the transcripts. Several words which may be unfamiliar are also commonly used. For example "gardia" (also spelt "kartiya") means a "white person" and is commonly used in the Kimberley region to describe a non-Aboriginal person. Also, the term "Blackfella" has been commonly used by Aboriginal interviewees. This name simply refers to an Aboriginal person and generally has no further connotation. The conversational style of interviews also leads to some inherent repetition, mainly to reinforce meaning. Extracts from transcripts have been commonly used, in an attempt to avoid un-necessary repetition. It is assumed that the reader is familiar with some aspects of Aboriginal culture, for example, references to "skin" groups refers to the complex group structure that exists within many Aboriginal communities and which provide the basis for social interaction, including communication between people, and marriage.

Transcript text is shown in *italics*, and indented. Any explanatory note within such text is shown in brackets and without italics. Underlined italics indicates that the interviewee used strong emphasis. The accompanying text provides the context for each transcript.

In the next section, I provide a chronological overview of the site visits, then an introduction to the key interviewees, followed by a detailed thematic presentation of sky knowledge specifically relating to Wolfe Creek Crater, and also more general astronomical knowledge.

#### **4.2.5 Field work chronology overview**

My visits and field work to the East Kimberley and Wolfe Creek Crater have occurred over a thirteen year period, commencing in 1998, and subsequent visits in August 1999, September 1999, September 2000, July 2003, August 2010 (collaborating with Gingin Observatory) and August 2011. A brief overview is provided below of the Wolfe Creek Crater field work and site visits.



**May 1998.** I carried out my first visit to Wolfe Creek Crater, in conjunction with astrophotographer James Athanasou, where we accomplished night landscape images of the crater, and astronomical photography during the Eta Aquariid meteor shower (originating from Halley's Comet). Our site visit to the crater lasted for almost one week. I met Elder Jack Jugarie for the first time in Halls Creek and began some initial documentation of his knowledge of the night sky.

**August 1999.** I travelled with Elder Jack Jugarie to Wolfe Creek Crater. I conducted video interviews at the crater and achieved extensive documentation of his astronomical knowledge relating to the crater. The journey coincided with the total solar eclipse of 11 August 1999 (not visible from the crater), and this event contributed towards a discussion about eclipses. My last meeting with Jack Jugarie in (Halls Creek) was on 16 August 1999, prior to returning to Perth. On 28 August, I learnt via a phone call from Joseph Blythe, a linguist at that time, based at the Kimberley Language Resource Centre, that Jack Jugarie had suddenly and unexpectedly passed away on 27 August.

**September 1999.** I returned to Halls Creek to attend the funeral of Elder Jack Jugarie in Halls Creek. I met Stan Brumby and visited Yarliyil Art Centre. My visit on the occasion of Jack Jugarie's funeral was very brief- only three days. It was during the three days that I stayed in Halls Creek that I had the opportunity to meet and talk to Aboriginal Elders and community members including Jack Lannigan, Stan Brumby, Frank Clancy and Lilly Banks, and learn more about the astronomical knowledge of the Jaru people at Halls Creek. Whilst the visit was brief, it provided considerable insight into astronomical knowledge and related stories.

**September 2000.** I conducted site photography and astrophotography at Wolfe Creek Crater. In Halls Creek, I met and interviewed Elders Stan Brumby, Jack Lannigan and Tanbar Banks.

**July 2003.** I journeyed to Wolfe Creek Crater, together with Pat Lowe (wife of deceased Aboriginal artist Jimmy Pike, see Chapter 4, section 4.4.5), and also visited the Billiluna community, where we met and video interviewed community Elders including Boxer Milner and Speiler Sturt. In Halls Creek, Elder Stan Brumby was video interviewed.

**August 2010.** The August 2010 field visit consolidated the previous site visits and included another visit to Billiluna community. My fieldwork collaborators included James Athanasou and Grant Thornett, both from Gingin Observatory (Figure 23). The field work was partly sponsored by the CSIRO Scientists in Schools program, to meet remote Aboriginal schools (including Yulga Jina, Murchison region, Halls Creek District High School and Kururrungku Catholic Education Centre, Billiluna). A site visit to the crater was undertaken (Figure 25). Astrophotography (Figures 21 & 22), timelapse and several 360° daytime images of the crater were undertaken. The school visits enabled a discussion about astronomy and the importance of the crater. The interest shown by school children was clearly evident in their interaction with a photo of Wolfe Creek Crater (Figure 24). In Billiluna, I met Mary Darkie, Chairperson of the community, and discussed my PhD research with her. Whilst

in Halls Creek, I interviewed several Aboriginal people with connection to the crater including Aboriginal artists, Elders and community members (Keith Jugarie, Bonnie Deegan, and Stan Brumby). Several video interviews were completed. Permission was obtained from Keith Jugarie (Halls Creek), eldest son of the Jugarie family, regarding the use of the prior records relating to his father, Jack Jugarie, for the current research. Permissions were also provided by Elder Stan Brumby, and Ivy Lannigan (in relation to Jack Lannigan).

**August 2011.** The August 2011 journey included a visit to Yarliyil Art Centre (Halls Creek), meetings and additional video interviews with Elder Stan Brumby and Keith Jugarie. On this occasion, the site visit to the crater took place with Jack Jugarie's eldest son, Keith Jugarie. At Billiluna, Keith Jugarie and I met Harold Boomer, who regarded himself as a "TO" ("Traditional Owner") of the crater. Harold encouraged us to visit the crater, expressed interest in our proposed night photography and also referred to the emu in the sky. As a result, Keith and I visited the crater over a four day period, which included a four hour walk around the rim of the crater, as well as visiting the central region of the crater floor and soak waters. I discussed with Keith Jugarie his knowledge about the crater and the night sky. In general, Keith appeared to be far less familiar with the night sky and stories or knowledge about the crater (relative to his father, Jack Jugarie). It was in fact his first visit to the crater. Astrophotography, timelapse and additional 360° daytime images of the crater were undertaken. Permissions for the proposed De Laeter Scholarship video exhibition (see section 5.5.1) were granted by Stan Brumby and Keith Jugarie.



Figure 22. Star trails above Wolfe Creek Crater.  
Photo from a timelapse sequence: John Goldsmith)



Figure 23. Our team at Kandimalal, Wolfe Creek Crater, 2010.  
(Photo: John Goldsmith)



Figure 24. Students relating to Wolfe Creek Crater, Billiluna.  
(Photo: John Goldsmith)



Figure 25. August 2010 site visit to Wolfe Creek Crater.

(Photo: John Goldsmith)

#### 4.2.6 An introduction to the interviewees

A brief introduction is provided for the East Kimberley Elders, artists and community members who are featured in this study (Figure 26). *Jack Jugarie* was a Jaru Elder, who lived in Halls Creek. In his early days, he was a police tracker. In the 1990's, he featured in the Ronin Films film production "The Human Race" (Ogilvie, 1997) which documented his participation in a 400km cross country "race" against a German survival expert and an American ultra marathon runner. The race started from Wolfe Creek Crater, concluded at Wyndham, and the three contestants crossed the finishing line together. Jack Jugarie passed away in 1999. The high degree of community respect expressed towards Elder Jack Jugarie is indicated by the establishment of a commemorative statue (Figure 27), by the Halls Creek community. *Keith Jugarie* is the eldest son of Jack Jugarie, and lives in Halls Creek. *Bonnie Deegan* is a resident of Halls Creek and played a key role in the preservation and recording of Aboriginal languages. She helped to establish the Kimberley Language Resource Centre, Halls Creek. Bonnie Deegan serves on the Yarliyl Art Centre (Halls Creek) Board of Directors. *Stan Brumby*, a widely known Jaru Elder, was one of the most prolific artists of the Kimberley, who featured Wolfe Creek Crater in his artwork. Stan Brumby served on the Yarliyl Art Centre (Halls Creek) Board of Directors. He passed away in late 2012. *Doreen Green* served as a teacher and educationalist, supporting education of Aboriginal students. She retired from the Halls Creek District High School in 2011. Doreen features in the video "Harmony in Halls Creek", a documentary which was a finalist in the best documentary category, 2010 WA Screen Awards. *Tanbar Banks* is a resident of Halls Creek. Elder *Jack Lannigan* (now deceased) was an

Aboriginal Elder, artist and resident of Halls Creek. Jaru elders **Boxer Milner** (born c. 1935), and **Speiler Sturt** (born c. 1935) were community elders from Kururrungku Community (Billiluna community), which is the nearest permanently occupied settlement to Wolfe Creek Crater. **Jack Gordon** is a resident of Billiluna (and contributed Figure 28), but was not involved in video interviews. Transcripts of the video based interviews are provided in Appendix 13.

The interview participants enthusiastically participated in the interview process, which were done entirely on a voluntary basis. The interviewees indicated pleasure in being involved in the interviews, and one such example is that of Bonnie Deegan:

*It's a pleasure... ...Ah, it's alright, it's a pleasure doing something for somebody, passing on knowledge, so that the rest of the world can understand how we see the skies.*

The approach of sharing knowledge with others, and particularly to a wide audience, was clearly indicated in the above quote. For Elder Stan Brumby, participating in the interviews gave him an opportunity to share his knowledge about the crater with others:

*You got to teach them, down there... You, kid, family kid. You got to learn them, and your family, you family. Big people like you, like me. Down home. Down Perth, or Sydney, or overseas. You family, here. You look at me in the movie, look at me in movie, down there. This is the bloke, Stan Brumby. He's the traditional owner for Wolfe Crater. ...That's my mother country.*

As an interviewer, the interview process was a positive experience. I was made welcome by Elder Stan Brumby, and he specifically expressed his support and permission for the recording and sharing of his stories:

*Well you say, you say in other people, this is Stan Brumby tell me about the story about morning star, in his country, and this is a welcome to him, to you, welcome to you. I give you permission, I give you that word (permission), you can carry on tell your friend, tell your family in the book, story, they can read, from me, and the video, ... they can look me in the video, what I'm talking about you and me. I give you that word, permission, what you call it, from me, you my friend.*

*...He's my friend, and I told all my story, welcome, to him. You can go ahead, write all the book.*

*...I give you permission to you, for story, my story, you my friend.*

Extracts of the interviews with both Stan Brumby and Jack Jugarie also feature in the video production (transcript supplied in Appendix 15), and the video is supplied in Appendix 17 .



Figure 26. East Kimberley interviewees.

(Photos: John Goldsmith)

Clockwise from top left: Jack Jugarie, Keith Jugarie, Stan Brumby, Doreen Green, Bonnie Deegan, Tanbar Banks.



Figure 27. The Memorial of Jack Jugarie, Halls Creek.

(Photo: John Goldsmith)

The importance of learning about Aboriginal culture and knowledge of country, is emphasised by Doreen Green, a respected Aboriginal educator, who participated in this research. Her interview (supplied in full in Appendix 13), focuses on the importance of children learning about their culture:

*...we owe it to our kids, you know. These kids are hungry for their culture and their language and their history. They are hungry to learn about how did our ancestors live, what did they eat, what sort of clothes did they wear, how did they travel. I know, because I've been a teacher now for 26 years and I've always brought in the Aboriginal perspective...*

#### **4.2.7 Thematic results of field work**

The following presents and discusses the astronomical knowledge, accounts and beliefs of the Aboriginal people who participated in this research. Our focus is on “traditional” or “cultural” astronomical knowledge. As a result, my focus is on investigating Aboriginal understandings of the *visible* cosmos, which primarily can be characterised as the Sun, Moon, planets, milky way and stars,

recognisable patterns in the sky, the Magellanic Clouds, transient phenomena such as meteors and comets and finally, the terrestrial landscape which focuses on Kandimalal, Wolfe Creek Crater. The themes are structured and sequenced in an approximate order of the apparent prominence or visibility (as opposed to significance). An overview of key themes and findings are summarised below, and fully presented and discussed in the subsequent sections.

### **Sun**

- recollections of a solar eclipse (most likely a deep partial eclipse).

### **Moon**

- Moon (and marriage laws).

### **Planets**

- Evening star, Morning star.
- Evening star, as the star that fell to Earth, forming Wolfe Creek Crater.
- Evening star, characterised as a mother and baby.
- Morning star as an indicator of time, for cattle drovers.

### **Milky way and stars**

- Milky Way.
- Milky Way law.
- Using stars as navigational tools.

### **Recognisable patterns in the sky**

- Constellations and star patterns: Seven Sisters; “Saucepan” (Orion's belt); Man hunting emu in the sky; Emu; Kalarrcar (desert lizard footprint) and Yilgarn (Spirit being).

### **Magellanic Clouds**

- Two men in the sky (Large and Small Magellanic Clouds).
- “Power man” (as a description of the Magellanic Clouds).
- Large and Small Magellanic Clouds (and association with complex stories relating to murder).

### **Transient phenomena** (eclipses, meteors, comets and atmospheric/optical effects such as halos)

- “Small comet”.
- “Large comet”.
- Shooting star / meteor “Marril”.
- “shaking ground” from large meteor, “Coolungmurru”.
- Large meteors as a sign of someone's death.



### **Wolfe Creek Crater** (terrestrial landscape)

- Origin accounts of Wolfe Creek Crater.
- Moon and evening star approaching, causing evening star to fall to Earth (forming Wolfe Creek Crater).
- Name of Wolfe Creek Crater: Kandimalal, Gandimalal, Murring.
- “Star” in the crater.
- Elder Stan Brumby's “star song”.
- Knowledge of soakwaters (sinkholes) in the centre of the crater.
- Beliefs in a snake / rainbow curled up in the centre of the crater.
- Wolfe Creek Crater and belief in an underground tunnel to Sturt Creek (at “Red Rock”).

#### **4.2.7.1 First encounters between Aboriginal and non-Aboriginal people**

Jack Jugarie provided the following account of the first encounter between Aboriginals and white people (presumably the first white explorers) during a discussion that was held at Wolfe Creek Crater, in 1999:

*One day..., this is the story I want to tell you. One day whitefella came in with the horses to find out how many Blackfellas you know, if they can know white people. They didn't come for fighting, they tried to quiet them down, people, you know.*

*We got plenty tucker, but they didn't know English. This side, people talk Jaru. That side (i.e. south west of crater), Walmajarri. This side (i.e. west of crater), Buniba and Guniyan. That away (i.e. north of crater), Lunga and Gidja. And... people, that away. This way (i.e. east of crater), Gorinji, Mulgan and Wilburra. And this way (i.e. west of crater), Wilburra, Walmajarri, Jaru. At one place here, we have... four languages, we all mix here, Gidja, Walmajarri, Jaru and Lunga in Halls Creek, we here, Blackfella. That's the way... We only speak one place Gidja and Jaru and Walmajarri... ...three languages, here, for this place, Goorinji (east of the crater), Lunga (north), Gooniyani (west) and that side Yilbarn and Walmajarri that away (south west) old people language right around us... Jaru and Gidja right here (at Wolfe Creek).*

*...In those days, when country been new, because not many Blackfella been walking around that time, that thing been happen, this part here (i.e. when the crater formed). Not many blackfella in here...all round, everywhere, they used to live in the hill, Blackfellas frightened of whitemen (laugh). They didn't know, you know, when they see white people come up, to talk to Blackfella to make 'im friend, you know. And the Blackfella and he go shit at looking at you. Who is this fella going to come, what this?, what him?, he talk to another Blackfella. Whiteman been come in early days, you know, prospectors (looking for gold), one old fella whitefella he came to a place called “poperty” he come with a bag and a swag. And look like that, heh...That's the devil coming! You reckon the devil is white too?..... very quick and*

*off, up to Turkey Creek and off to big high hills, big fright, till one day, young people, been grew up,.. one young fella we see 'im this one, I don't think he's the devil, maybe he's like a man like we. Maybe go and have a yarn with him. Blackfella didn't know English much. He talk this way (i.e. using gestures). Kardia, Whitefella... "You wantum this one?" (i.e. do you want something to eat?). Yeh, Mungari, Yeh yeh Mungari. So he give him a bit of damper, all the prospectors, in the early days, give 'em damper, ...Mungari, what this one, ...pressed meat (corned beef) that's "corru".... Well you want it, Yeh!.... well, from that time one Blackfella been teach about kardia, they learn 'im everyone, they know today all the kardia together, that from been starting.... make 'em understand Blackfella taken law from white people... They didn't know your colour. They reckon, there's the devil coming!...*

*That's the story from the old people been telling me, and I've been thinking about what have they been frightened about... ... They used to bring in gold and give it to... here to buy some more tucker. They got money and everything, but they didn't know what that was, they reckon it was, just paper.*

The story from the very early post-contact period, in which the role of money was yet to be recognised, is very insightful. The perception of money being simply paper highlights cross-cultural misunderstandings, which inevitably occurred between such different cultural groups. Of course, attitudes regarding money have changed greatly since that early experience.

#### **4.2.7.2 The Sun**

In an interview with Jack Jugarie in August 1999, he spoke about an unusual experience when the sun became dark. He recalled the sun was rising, and the sun was “*not really dark, just like a shade*” for a couple of hours. He described the sun as “*stopped for a while*”, and then the “*sun moving.... ... bright again..., and make you warm again*”. Estimating when this occurrence took place was difficult, however, Jack Jugarie described the event as occurring “*about two years after World War II, after the small star with a tail from the south*”. The features of this event, as described by Jack Jugarie, include a fading of the sun for a period of time (approximately 2 hours), a cooling of temperature and a return to brightness. These features are consistent with a substantial partial solar eclipse. Presumably the event was not a total solar eclipse, because if this had occurred, then it would be assumed that the totality phase of the eclipse (if witnessed) would have remained a highly memorable event. Jack Jugarie's recollection of the eclipse is very interesting in that he noted the drop in temperature which resulted from the solar eclipse. NASA's reference publication “*Fifty Year Canon of Solar Eclipses, 1986-2035*” (Espenak, 1987), details eight partial or total solar eclipses that pass near Halls Creek: 14 February 1915; 30 July 1916; 21 September 1922; 13 December 1936; 25 December 1954; 8 April 1959; 16 March 1969 and 16 February 1999. Based on Jack Jugarie's recollection of the timing of the event (after World War II), this suggests that the eclipse may be that of the 25th December 1954.

#### **4.2.7.3 The Moon**

Jack Jugarie recounted the following story featuring the moon, in 1999. He stated that the story is told to teach young people who they are permitted to marry, as by Aboriginal law, marriages must occur between the right skin groups. This story tells of the moon wanting to marry his “cousin sister”, who was the most inappropriate person for him to marry. An old woman of the mob tried to redirect his interest to another woman, someone more suitable, yet the moon insisted pursuing his cousin sister. The old woman tried with another woman, and the moon continued to refuse. Finally, after trying to interest him with all the other unmarried women, the old woman arrived at the moon’s cousin sister, and the moon accepted, yes, she is the one. The moon broke the law and married his cousin sister. This story may not be complete as there does not appear to be any negative implications which arose when the moon married his cousin sister, although it was clear that the moon did the wrong thing, by doing this.

#### **4.2.7.4 Planets**

The evening and morning “star” (i.e. Venus), was referred to in several interviews. Elder Stan Brumby described the evening star as the “Mother and Baby”. The evening star features prominently in an account of the origin of Wolfe Creek Crater, and will be discussed in section 4.2.7.9. The approach of personifying astronomical objects such as the stars and planets, establishes a personal connection with the astronomical world. This is sometimes indicated by Elders referring to astronomical objects with “skin” names, in the same way as such names establish distinct social relations between Aboriginal people.

#### **4.2.7.5 Stars, “constellations” and recognisable patterns in the night sky**

Several recognisable patterns in the night sky were described, including the “Man” in the Milky Way, the Emu, the Lizard footprint, the “spirit being” and the “camel”. These are described below.

A “man” in the night sky, comprising of a dark zone in the Milky Way was described by Jack Jugarie in 1999:

*... he's standing up, he's watching with that emu right now... ...that “Mowan”... ...That's the one now,... that's the man, he's watching that emu there, that emu on the front now, According to old people, you know, that's the old emu up front, You can see the man standing up, show up when that thing go down a bit more....*

The “man” is located where there is a prominent split in the Milky Way in the northern sky (as viewed from Wolfe Creek Crater), near the constellation Delphinus. The phrase “up behind” refers to the northern sky and northern Milky Way, as viewed from the East Kimberley (Wolfe Creek Crater) at latitude 19.2° South.

An Aboriginal resident of Billiluna, Jack Gordon, described and drew the man hunting the emu, in the Milky Way (Figure 28). His description and drawing was largely the same as Jack Jugarie's description.

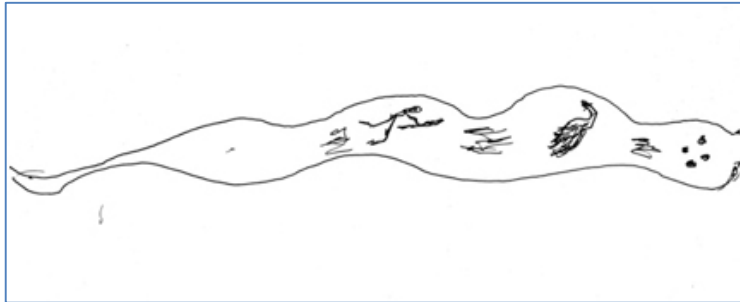


Figure 28. Man hunting the Emu in the Milky Way.

(Drawing by Jack Gordon, Billiluna)

As indicated by the “Mowan” story, an Emu is recognised amongst the stars. The Emu is located along the Milky Way between Scorpius and the Southern Cross (the Coalsack Nebula is the head of the Emu) with the neck and body of the Emu indicated by the major dark areas in the Milky Way. Jack Jugarie did not seem to know much about the Emu and I did not pursue this story to any depth. It was clear that he was aware that there were differing views as to where the legs of the Emu were in the sky. The Emu pattern is well known in many parts of Australia, and there are many variations of the emu story relating to the sky pattern. It is perhaps one of the largest recognized patterns in the sky.

Halls Creek artist Bonnie Deegan (Figure 29) shared her story of the Emu and the Milky Way, as expressed through her artwork (Figure 30). Bonnie referred to the Emu, which she regarded as a “dreamtime” story. She also referred to the camel in the night sky, located near the Southern Cross. She regarded the camel pattern as different to the Emu pattern and clearly recognised the camel as a relatively recent, (not “dreamtime”) sky pattern. Bonnie indicated that she has in the past painted the emu and the camel in the sky, however, only the Emu is represented in Figure 30. The “camel constellation” is also independently referred to and consistent with the image drawn by Tanbar Banks (see Figure 39, section 4.2.7.8) and this is the first corroborating evidence of such a star pattern.



Figure 29. Bonnie Deegan, Halls Creek, 2010.  
(Photo: John Goldsmith)



Figure 30. “Emu and Milky Way”. Artist: Bonnie Deegan.  
(Photo: John Goldsmith)

Jack Jugarie described a creature called “Yilgarn” or “Yulgarn” in the Milky Way, near the Emu sky pattern (Figure 31). Jack Jugarie noted that some people regard a dark patch in the Milky Way as the legs of the emu, whereas others regard it as a separate creature called “Yilgarn”. Interestingly, the Jaru dictionary (Wrigley et al. 1992, 113) includes the following notes about the word “Yilgarn”:

*Leech. Comment: This creature has a life cycle with a snail phase, a leech phase and a parasitic phase. In the leech phase it is green. Weird.*

Jack Jugarie described Yilgarn as a “leech” sucking the blood from the Emu, and he was very specific indicating the location of “Yilgarn”. It comprises a small dark patch in the Milky Way, near the constellation Scorpius. There was some confusion as to whether Yilgarn represented a man hunting the emu, however I don’t think this is the case, as the man was attributed to the far north eastern sky.

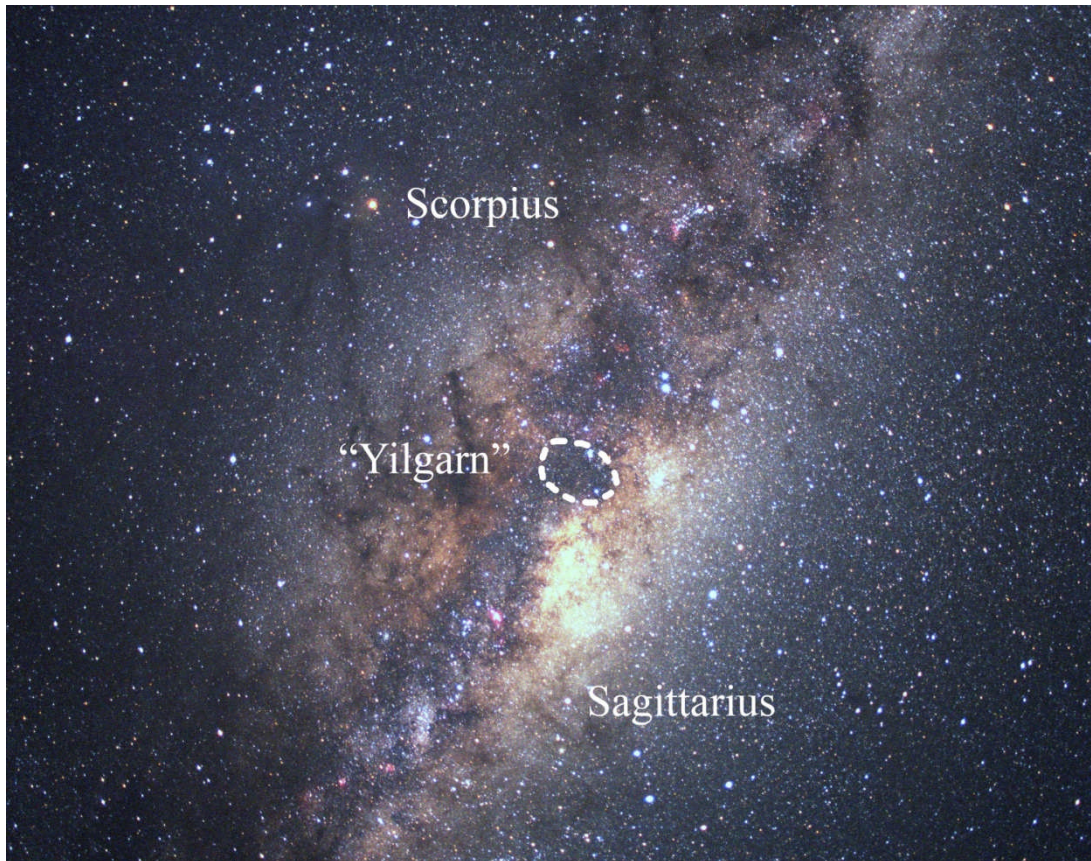


Figure 31. “Yilgarn” star pattern.  
 (Photo and overlay: John Goldsmith)

The word “Yilgarn” and its meaning seems to be quite unusual (as compared to other Jaru words). A greater understanding of the meaning of the word could be gained by understanding the astronomical context of the word and further investigation on the Yilgarn constellation is required.

Jack Jugarie referred to the stars which make up the belt and “sword” of the constellation Orion (otherwise commonly known as the saucapan in Australia), as “Kalarrcar”, the lizard footprint. The pattern of stars correlates very closely with that of the footprint of a particular lizard (it may be the lizard referred to in the Desert Lizard story described in Appendix 10). Jack drew both the imprint of the lizard footprint, and the star pattern, noting the similarity between the two (Figure 32).



Figure 32. Kalarrcar star pattern (left) and lizard footprint (right).  
 (Drawing: Jack Jugarie)

#### 4.2.7.6 Magellanic Clouds

The Magellanic Clouds are very distinctive features as viewed from the dark skies of the East Kimberley and appear as two detached portions of the Milky Way in the southern sky. The Magellanic Clouds were the source of beliefs and accounts of murder. The stories were primarily recounted by Jack Jugarie and Jack Lannigan. Whilst the subject is somewhat heavy, neither indicated that this content was secret or restricted in any way:

*That white one in the south... Down south this way,... like a bit of a smoke, round, another one down below...and this one.... (referring to the Large and Small Magellanic Cloud). That's a "torrel wada", sometimes you say "mukin wada".... But that like a Milky Way, inside that white one, that's the one, when anybody gets hurt, that thing drops down and drinks all the blood of that man, dead man, and makes him wake up and he come good, but, maybe one day, or maybe three days, then he dies. Little smokey thing (Small Magellanic Cloud)... this way, law, that's the one that drink all the blood out of the man, that's according to Blackfella law. ...Whiteman, that's the Milky Way,... always been like a smoke, one side, that's the fella that drink all the blood... When anyone gets killed, drinks all the blood, that's what the man did do.... Take him all the blood out. That thing different one over there, he come out light, but that fella's drink all the blood,...*

Both Jack Jugarie and Jack Lannigan describe similar accounts relating the Small Magellanic Cloud with practices of murder. In one such account, two men go out (supposedly) on a kangaroo hunt, with spears. During the hunt and away from the others, one man spears the other and kills him, by spearing him in the side of the stomach. It was not clearly explained why the murder is committed or whether this is an act of justice or retribution. The Small Magellanic Cloud comes down, like a misty, smoky cloud over the dead body, and takes blood out of the dead body. The murdered person then (apparently) comes back to life, and two (or so) days later, he dies again. The "waking up" of the dead person for two to three days indicates that this effect is temporary, and during that time, the body is in a somewhat trance-like state. After two to three days, the person returns to the dead state.

*The (Small Magellanic Cloud) is like smoke. It is bad. It will take the blood of the person who was murdered. This one can get you quicker. The (SMC) will come down (to the person who was killed). On the bottom.*

The indication of the SMC "will come down" and being "on the bottom" accurately describes the relative positions of the Large and Small Magellanic Clouds, when they are descending in the South West (during their apparent rotation around the South Celestial Pole). The apparent movement of the Small Magellanic Cloud at this time is "downward" (i.e. descending towards the horizon), and at that time, the Large Magellanic Cloud is positioned "above" the Small Magellanic Cloud. A drawing of the Milky Way, and the Large and Small Magellanic Clouds, by Jack Jugarie, is shown in Figure 33. A clear distinction was made with the Large Magellanic Cloud:

*The (Large Magellanic Cloud), he is like a man, he does not do anything to you (i.e. anything bad to you). The (LMC) says “look out for the little one (SMC), no, don't do that”, the (LMC) tries to help the murdered man.*

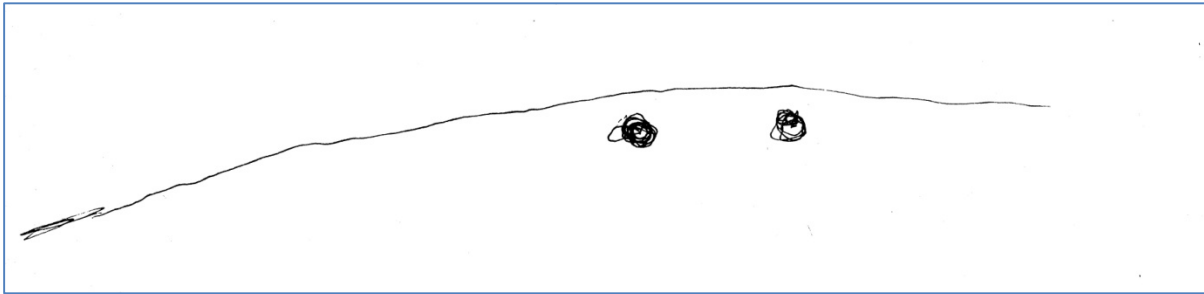


Figure 33. The Milky Way and the two Magellanic Clouds.

(Drawing: Jack Jugarie)

Jack Jugarie continued with further details regarding how hair from the murdered person is used to track the murderer:

*A little bit of hair is taken from the person who was murdered (hair taken from the very top of the head)... hair belt. Police get a man from a fingerprint, Blackfella cuts a little bit of hair from the dead person- this is used to identify the guilty person (the murderer). This always works, it never goes wrong, to find the person. The Blackfella way is faster than the Police way with fingerprints. The murderer tries to get away. A little bit of hair taken from the top of the head. The spirit makes this noise,...Mmm, Mmm, Mmm. After two days, the man becomes sick in the camp. He feels hot and goes down to the water to cool down. Don't say anything.*

Those people who know the identity of the murderer now sit back and watch, not letting on that the murderer's identity is now known. They watch as the person becomes ill. This comment indicates knowledge that is not revealed at this stage:

*Then he dies. His family buries him. No fight, no argument, all clear.*

The body is wrapped up and placed in a tree (on a platform?- bowshed), maybe about 2 metres high. It must be positioned so that they are facing west (i.e. where the sun sets). Three (or so) days after the death of the murdered person, it was claimed that people may approach the body to see its spirit:

*This method of finding a guilty person is still used today. The body is in the tree. A circle of rocks is placed around the tree, groups of rocks organised according to groups. On the third day, someone approaches from downwind. Two people approach, then one man moves closer very quietly. He can see a man sitting up next to the dead body. This is the spirit of*



*the murderer. Once he is sure he has recognised the spirit, he stands up and speaks up. The spirit disappears.*

Another account describes how the murderer is identified by where blood (from the deceased) falls, in relation to the rock circle:

*Rocks are placed around the tree, where the dead man is placed. The rocks are left around the tree when the body is taken away, and the rocks stay there for a long time. Each rock has a name. Does the blood land on the Jaru, Walmajarri, Gidja, Gorinji (rock)? The spirit tells the blood which rock to deposit on, to indicate who the murderer is (i.e. which group he is from). No-one can enter the circle until the matter is settled and the body is removed from the circle and is buried in the fire/anthill. Ash is spread on the ground within the circle so that if anyone enters the circle, their footprints will be revealed. You got to lock him up good (inside the anthill), put the fire in and close it up so that no smoke escapes. The rocks are inspected for blood, this identifies the person (mob/skin) who was the murderer. The murdered person is then taken down from the tree platform, cut up, put in an anthill with fire on top. When identified, the murderer becomes sick and dies within 3 or 4 days. He tries to cool himself off by swimming. There is a rock circle located near Old Halls Creek. There is a camp behind the hill, and rock circle(s?) behind further.*

It appears that for the first three days after the body is placed in the tree, with the stone circle around the tree, no-one (i.e. white person or blackfella) may go inside the circle of rocks, or touch the rocks. Ash is spread inside the circle, so that if anyone does enter the circle, their footprints will be revealed. When the body has been taken from the tree and put in the anthill (“buried in the fire”), and the murderer has been identified and has died, then it is considered that justice has been obtained. The matter is considered settled (resolved) and there is no fighting between groups. People are now not restricted in their access to the rock circle, but it is intended that the circle of rocks remain for a long time. As the business is now settled, anyone can see the circle of rocks.

A similar account involving the Magellanic Clouds was also described by Jack Lannigan in August 1999. He recounted a story about the “Two Men in the Sky” and their remarkable powers. The story has many elements in common with Jack Jugarie’s story about the Magellanic Clouds, and is almost certainly one and the same. Lannigan indicated that the “Two Men” were the Large and Small Magellanic Clouds, with the arcing Milky Way around them (Figure 34):

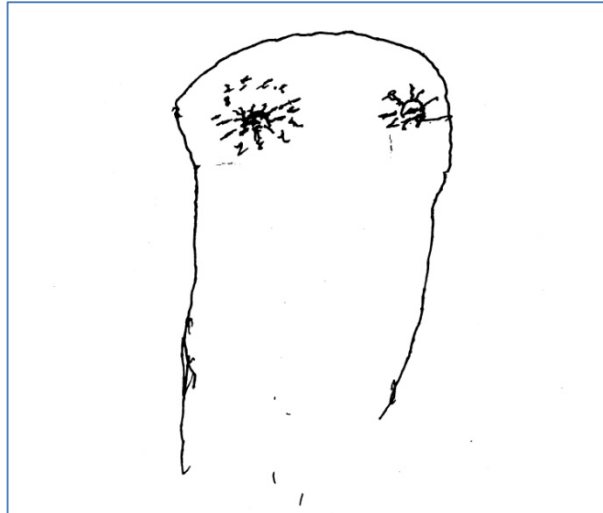


Figure 34. Milky Way and Magellanic Clouds.

(Drawing: Jack Lannigan)

*Two men in the sky, come down. Make him numb (they won't fight back). You have to kill him. He can't kill him. Missionary been teaching, you can't do it this way.*

Lannigan explained that it was due to a “wrong marriage” (against appropriate skin groups) that the person had to be killed:

*Because he steal your wife, wrong type of marriage. Mulli (in laws) would straighten him out. Two men come out of the Milky Way, two men, he take your spirit away. He keeps you in the Milky Way till you die. That's finish.*

Lannigan described the Magellanic Clouds as “the Two Men” and described their characteristics. The “Two Men” as shown in Figure 35 (drawn by Jack Lannigan) contains specific detail that is not immediately apparent. Figure 35 shows a detail of the smaller of the “Two Men”. When queried, Lannigan explained that his drawing showed a “man” (1), partially surrounded by “a light” (2), and that the radiating dashes were Ki Ki (star) (3).

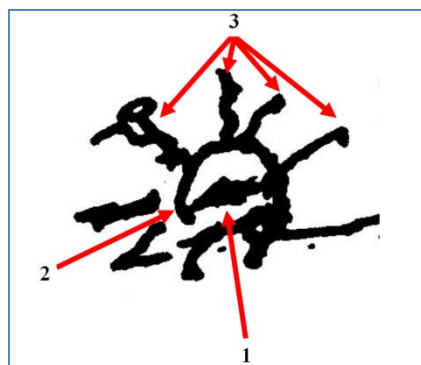


Figure 35. Detail of one of the “Two Men” (Small Magellanic Cloud).

Drawing by Jack Lannigan.

Lannigan then went on to describe the characteristics of the “Two Men” (Figure 36), with a focus on the Small Magellanic Cloud:

*Power all round, like a light, like a Superman, he can look all over the land. Both men can make...? Only need one to make you numb. Suck him blood and blow in sky. Two men sit. Power like electricity. Short one, short fat. Long one, long skinny. All finish now, all gone now.*

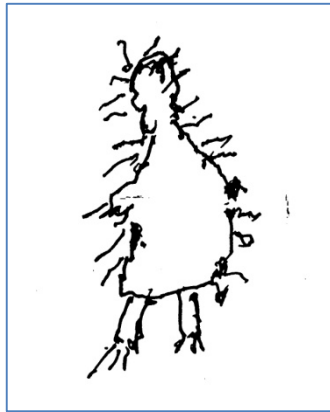


Figure 36. “The Power Man”.  
(Drawing: Jack Lannigan, 1999)

Jack Lannigan referred to “suck him blood and blow in sky”. There is a reference in “Bradshaw Art of the Kimberley” of a similar account (Walsh 2000, 431, 433):

*The thrust of the mythology centres on the devious, sneaky and deadly nature of Djangargun, who is attributed with teaching mortal men the art of assassin-style killings, purely for the challenge of it. He is also associated with the heavy sorcery cult beliefs of creating a “zombie” from a murdered victim so that he could return to his camp and “die properly” with mystery surrounding the cause of his death. There are sorcery killing techniques and many other dark elements associated with Djangargun, which are beyond the scope of the art origin discussions of this publication.*

*The murderer went over and shook the man. “Ah yes, he is dead already!” he said. “Ah, all right, I’ll pull it out of him”, he said as he removed the spear from the corpse and probed the wound. Then the murderer sucked some blood from the spear wound in the corpse and turned to spray some up towards the sun.*

Jack Lannigan described a similar account to that of Jack Jugarie's, in which he described a fatal wound (on a dead person), which is “healed quickly”, so that no-one knows who the murderer is. Lannigan then described “two fella's from the sky, make him get up, come to life”, and then, a few days later, the wounded person dies, this time for good, whilst the murderers have dispersed.

Lannigan explained it was acceptable for females to be present and to hear this story, but not to repeat or speak of it.

The role of the Small Magellanic Cloud in relation to concealed murder plots, suggest that the Magellanic Clouds have played an important role in Jaru Aboriginal culture. Whilst accounts of the murder plots are known (e.g. Walsh, 2000), the connection with the Small Magellanic Cloud was unknown to the author, and an unexpected finding. Whether the stories are primarily mythological, or have a real basis, is unknown. At no time did any of the Elders who shared this knowledge indicate that this was secret knowledge or restricted in any way.

During discussions with Tanbar Banks in August 2010 regarding her knowledge of the night sky, she referred to a practise in which people, when camping out, would avoid facing the southern direction at night time, because of the risk of the large whitish thing near the Southern Cross. It appeared that she was probably referring to the Large or Small Magellanic Cloud (or both), but I was unable to verify this as our meeting was held during daytime. However, whilst reviewing the Walmajarri-English Dictionary (Richards & Hudson 1990, 94), I noted that there is a reference to a spirit named “Kukurr” that:

*...can take different forms, e.g. dog, crow, woman, evil spirit, ghost, devil. Related to the southern areas, said to be nocturnal and feared.*

The spirit is also known as “kunamany”, “kunaturrun” and “mamu”. The characteristics of this spirit, particularly its association with the southern areas, nocturnal and being feared, closely match with the description of the Small Magellanic Cloud, and so I speculate that it is possible that the “Kukurr” and the Small Magellanic Cloud may be one and the same.

#### **4.2.7.7 Transient phenomena: meteors & comets**

With the numerous interviews and discussions I conducted for this research, I noted that names of some astronomical events were used seemingly interchangeably, such as “comet” and “meteor”. At times, particular care was needed to correctly distinguish between different astronomical phenomenon. Discussions conducted for this research with Jack Jugarie led to the following drawing (Figure 37), which represented a comet (top), meteor (middle), and star (lower). Interestingly, the image of the star, superficially looks like a comet, with a comet like tail, directed to the earth. Based on Jack Jugarie's description of this, I understood this to represent starlight, coming down to the earth.

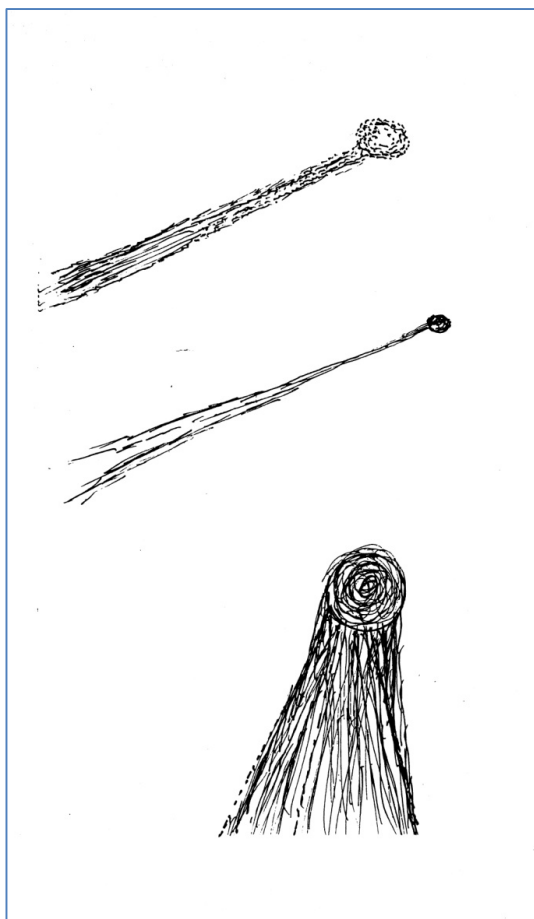


Figure 37. Jack Jugarie's "Comet, Meteor and Star".  
(Drawing by Jack Jugarie)

Whilst drawing the comet, meteor and a "star", Jack Jugarie made passing mention of black stones which are in some way associated with marril (shooting stars) and particularly with the heat which has formed them. I asked if they had any particular shape and Jack said no, just like a stone. This discussion (held in Halls Creek) was brief and I would have liked to have discussed this in more detail. Whether one of these "black stones" is available for inspection is unknown. It is possible that he is describing tektites, as they have quite distinct characteristics and are generally readily recognisable. Bevan & de Laeter (2002) describes tektites as a "naturally occurring, once airborne, *glass* ejected by explosive meteorite impact", and they note that tektites are *not* meteorites. An investigation into the Aboriginal knowledge and use of tektites could prove to be fascinating, as there may be insights into whether special properties are attributed to them, and whether they are associated in any way with meteors or meteorites.

The following two accounts by Jack Jugarie refer firstly to his own observation and recollections of a comet, and secondly, his recollection of an account from his ancestors, of an object which most likely was a large meteor.

Jack Jugarie, in an August 1999 interview, recollected a “small comet”, which he referred to when he described his experience of the sun dimming (or a partial solar eclipse) as previously discussed. He reports that when he was “a small boy”, he saw a small comet, when he was at Wave Hill Station in the Northern Territory, east of Wolfe Creek Crater. He went to Wave Hill Station because he had finished stock work and was on a holiday:

*What's that thing with a tail on it? Could be a comet? A star with a tail on...I've been watching every night... What's that star with a tail on it? Look at that star, it's got a tail. I've been watching every night. It's there in the evening...*

Jack Jugarie indicated that the comet was seen due South, approximately 20° above the horizon, which corresponds very closely to the South Celestial Pole, as viewed from the Kimberley region of Western Australia. He noted that the comet was seen during the dry season, maybe one, two or three years before World War II. This recollection provides an approximate date of the mid 1930's when the “small comet” was witnessed. This estimation is reasonably consistent with his recollection of when he saw the “comet” and his age. Presumably the comet was seen some time between the mid to late 1930's. In Yeoman's *Great Comets of History* (2007), only three “great” comets are listed, between the period of 1910 and 1965, namely Halley's Comet (1910), Comet Skjellerup-Maristany (1927) and Comet Ikeya-Seki (1965). Comet Skjellerup-Maristany, with a maximum magnitude of 1 and perihelion (closest approach to the Sun) in December 1927, is a possible candidate for Jack Jugarie's sighting. However, the ephemeris for Comet Skjellerup-Maristany (1927), generated by the NASA Horizons web interface (<http://ssd.jpl.nasa.gov/horizons>) shows that for one month before and after perihelion, the comet was located more than 25° from the South Celestial Pole (i.e. < -65° declination), and this appears to preclude this comet, based on Jugarie's description of the location of the comet near the South Celestial Pole. In addition, the timing of the comet in 1927 is earlier than Jack Jugarie's recollection of the comet appearing “one, two or three years before World War II”, however, this recollection of timing could be imprecise. Whilst it is possible that he recollected seeing a lesser known comet, no likely candidate of a known comet visible in the southern hemisphere during the 1930's has been identified at this stage.

The second account described by Jack Jugarie refers to a story about an object seen in the sky (by his ancestors, but not by himself), which is described as “the first one, the big one”. This story clearly is not a firsthand observation, and influence by “white preachers” is referred to. The description of the object is initially ambiguous, showing features of both a comet and a large meteor, but later, it appears that a comet is being described, as the object is seen on multiple nights. It is also possible that what is described is not actually a single event, but a merged account of several events. The story is included here, as an example of the difficulties that can be encountered when attempting to interpret oral accounts and personal recollections:

*The first one; the big one, we never saw. The first mob saw that (i.e. Jack's ancestors). A long tail, like a rainbow, a curved tail, not straight. The old people saw it after the Sun went down (i.e. in the evening). The tail was like a spark from sharpening an axe, stretching across at least one third of the sky.*

The description of a “*curved tail*” is suggestive of a comet, whilst the description of the tail “*like a spark*” is more descriptive of a large meteor. Jack Jugarie notes that he himself did not see this object, but that his ancestors (“*the first mob*”) did. Then the next part of the description refers to the influence of Missionaries, which was a completely unexpected aspect of this account. The story seems to have been expanded upon, embellished or distorted as a result of what was told to Jack Jugarie by the white preachers at Wave Hill Station. He found the comet frightening because he was told by white people that if the comet tail touched the Earth, “it would burn the country”:

*Missionary: You got to come along to listen to the word (to church), about the “comet” we never saw this one; maybe one day; no good. Want to be careful, come and listen to the word. You belong to this ground, he (God) made this world.*

The story about the “comet” which could come and burn the earth alarmed Jack considerably and he promptly returned to Old Halls Creek (when aged about 15), where he thought it was safer:

*Small comet, might get big. If it does, this country will be burnt to pieces.*

and:

*The big comet from the south, like a rainbow colour, real blue clean bright light. One night in the south, the next night higher, the next night it moved further, the next night toward the north. Need to be careful about it, the tail stretching across the sky, the comet moved slowly, not like a marril (shooting star). The tail, all in a line, like a spark which was blue; the big one mother or father of the small comet. This story came from blackfella, from old people. One day when you get old, you might see it again.*

Jack Jugarie's concern was maintained throughout his life, regarding the comet that could “burn the country”. Jack refers to the “burnt country” which he obviously considered very bad and undesirable. Could this be a distorted reference to Hell, which may have been gained from the preaching that took place? This account shows that Jack Jugarie was concerned about the potential for harm from some astronomical events. The account of the comet “burning the country” if it touched the Earth, evidently had a religious context, and clearly, Jaru Aboriginal knowledge in this particular account has been influenced by cross-cultural elements. The combination of the astronomical event with the influence of missionaries suggests that this account has considerable potential for mis-understanding or mis-interpretation to occur here. The documentation of the effect of missionaries and Christianity on Aboriginal knowledge relating to the night sky is an unexpected finding and the effect of

missionaries, and religion in general, is evident in some of the accounts by Jack Jugarie and Tanbar Banks.

#### 4.2.7.8 The whole sky

In addition to examining knowledge about particular features of the night sky, I also examined knowledge of the sky in its entirety. I recorded two representations of the whole sky by Stan Brumby and Tanbar Banks. The two examples show a “synthesis” of the whole, and are relevant because they indicate: (1) how the participants conceived of the sky in a holistic way, rather than just individual parts; and (2) how these “maps” assisted them to explain and share their understanding of how the sky works (in relation to the apparent motion of the sky).

A representation of the cosmos was drawn by Stan Brumby, during my visit to Halls Creek in September 1999. The drawing is interesting in that it shows the relationships between astronomical bodies based on their apparent motion and appearance. Stan Brumby indicated that the Sun, Moon and planets moved along the horizontal line (Figure 38), corresponding to the ecliptic. The arc of the Milky Way is shown on the left, whilst the diagonal line indicates the star, which is used to navigate back to camp. This figure provides a simple and effective mental model of the visible sky.

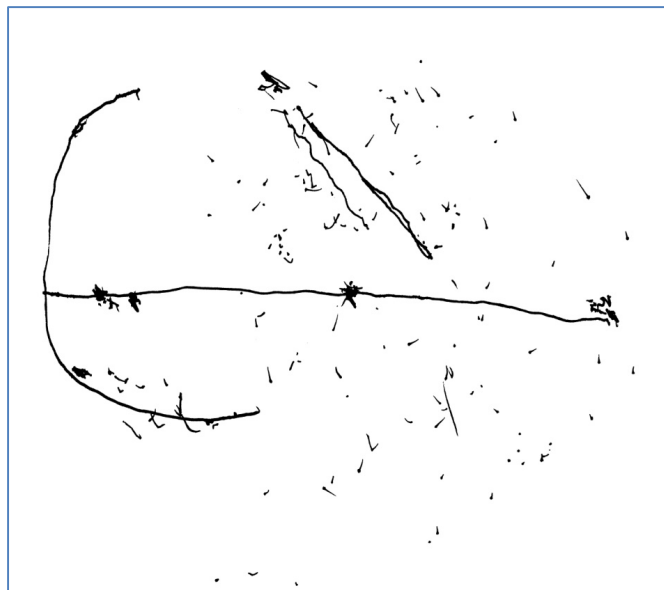


Figure 38. “Cosmos”.  
(Drawing by Stan Brumby)

Tanbar Banks, eldest sister of the Banks family, and sister to Lilly and Bonney Banks, drew a sketch of the cosmos, which provides a concise “map” of the sky (drawn 12th September 2000, Figure 39). The drawing shows the following: (1) Sun; (2) Moon; (3) Morning Star; (4) Evening Star; (5) Milky Way (Warraloo); (6) Emu (dark); (7) centre of Milky Way (bright); (8) Large and Small Magellanic Clouds (name not recorded); (9) six stars; (10) group of stars, near morning star; (11) shooting stars and (12) other stars (near the Magellanic Clouds). Whilst Tanbar Banks referred to (6) as the Emu,



she actually drew the pattern as a camel. This drawing is the first indication that I am aware of, of the “camel constellation”, as described in section 4.2.7.5. The group of stars identified as (10) may be representation of the belt of Orion. Note the similarity of this star group to Figure 32, which does represent Orion's belt.

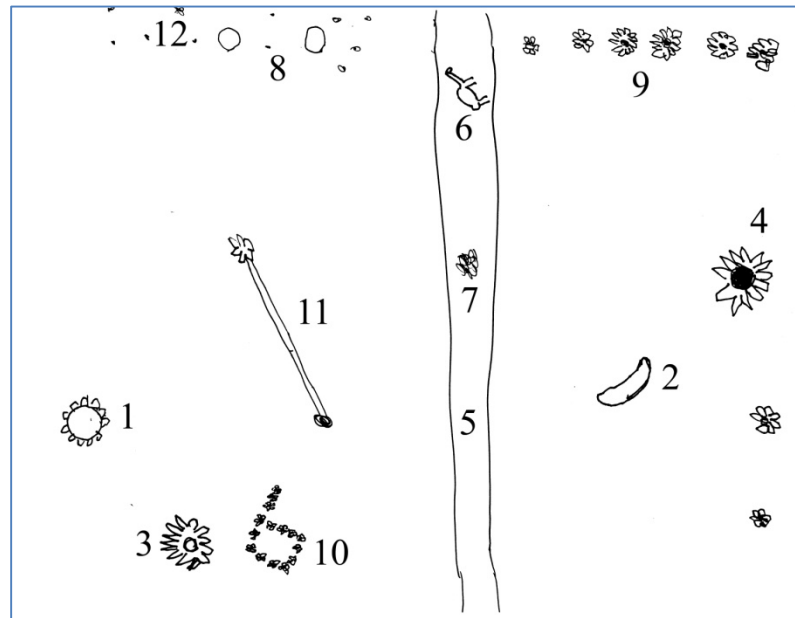


Figure 39. “Sky”.  
(Drawing by Tanbar Banks)

Tanbar noted that the Magellanic Clouds and the morning star had particular importance, because people “knew them”. She also noted the belief in large meteors as being a sign of the death of a person in the community.

The preceding accounts demonstrate that there exists a range of knowledge and beliefs about the night sky in general within individuals from the Jaru language group of the East Kimberley. Such knowledge ranges from personal experience and recollections of the night sky and astronomical events, to cultural beliefs that have been passed on from generation to generation. In the next section, we focus on astronomical knowledge and accounts that specifically related to Wolfe Creek Crater.

#### 4.2.7.9 Kandimalal, Wolfe Creek Crater

Wolfe Creek Crater is known as “Kandimalal” to the Jaru Aborigines. Aboriginal knowledge of Kandimalal is expressed in a wide range of ways, including storytelling, artwork, song, drawings and personal recollections. From a broad perspective, and particularly when first talking about the crater with Aboriginal people, such as Jack Jugarie, Jack Lannigan, Stan Brumby and others, the context of the crater is described. This is often done by highly efficient line drawings (or drawing in the sand), showing the crater in relation to other locations and landscapes. One such example is shown in Figure 40 and was drawn by Stan Brumby, depicting Darwin, Katherine, Kununurra, Halls Creek, Fitzroy

Crossing, Derby, Broome, Wolfe Creek, Sturt Creek, Lake Gregory (Lake Paraku), Wolfe Creek Crater, communities such as Billiluna, Balgo, and other features such as the Canning Stock Route and the Tanami Road.

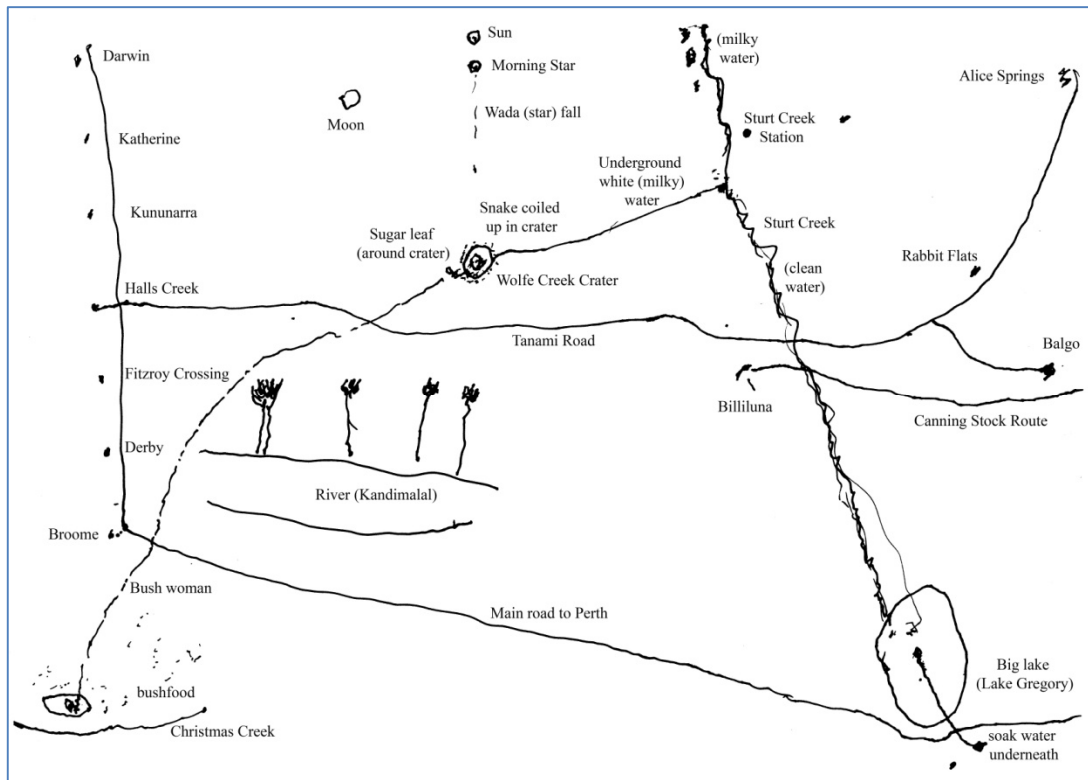


Figure 40. Wolfe Creek Crater, Sturt Creek, Billiluna and Balgo.

(Drawing by Stan Brumby)

These concise line drawings convey the essential relational information of the crater, main water courses (typically Wolfe Creek and Sturt Creek), and key communities, over large distances (>1000km). A notable feature of the drawing is the inclusion of the Sun, Moon and morning star in the same perspective as that of geographical, terrestrial locations.

The original research findings regarding astronomical knowledge associated with Wolfe Creek Crater are presented here. Firstly, a brief overview is provided to introduce the reader to some of the main themes that have emerged from the research, and detailed findings and discussion are provided in the remainder of this section. The crater features prominently in the art of several Aboriginal artists such as Stan Brumby and Barbara Sturt. Knowledge about the crater includes stories and accounts of the origin of the crater (despite the actual age of the crater far exceeding that of known human occupation in Australia). Other stories refer to the role of meteors and the crater, which reveal an unexpected practice of “listening to the shaking country”, after a large meteor has been seen. Large meteors are also interpreted to indicate the death of a person. There is also a range of stories which relate to the physical form of the crater, and in particular, the soakwaters in the central salt encrusted crater floor. The strikingly circular form of the crater is reinforced by the appearance of the roughly circular salty area in the centre, and there also exists a partial arc of vegetation, concentric with the centre. The

circular pattern of the crater, is shown in several Aboriginal artworks of the crater, and circular symbols are commonly used in many styles of Aboriginal art.

Current day National Park signage at Wolfe Creek Crater (Figure 41) introduces visitors to Aboriginal perspectives about the crater. A transcript of the signage is provided in Appendix 9. One well known story refers to the passage of two rainbow snakes which formed the nearby Wolfe Creek and Sturt Creek as they crossed the desert. In the Dreamtime, one snake emerged from the ground, forming the crater.



Figure 41. Signage at Wolfe Creek Crater.

(Photo: John Goldsmith)

Several Aboriginal artists represent the crater in artworks. Examples of Aboriginal art featuring Wolfe Creek Crater are shown in Figure 42, and more extensively shown in Appendix 11. A variety of drawings relating to the crater are provided in this chapter. These representations of the crater are important because they provide insights into Aboriginal views about the crater, including accounts and representations of the “star that fell to the earth” forming the crater, belief in an underground water link between the crater and Sturt Creek, and snake symbolism associated with the crater.



Figure 42. Indigenous paintings of Wolfe Creek Crater (Goldsmith Collection).

(Courtesy Yarliyl Art Centre. Paintings by Stan Brumby, Barbara Sturt and Frank Clancy.

Photos: John Goldsmith)

Whilst the name of the crater is generally recognised as “Kandimalal” (with a spelling variation of Gandimalal), my research also recorded Jack Jugarie (in 1999) and Keith Jugarie (in 2011) referring to the crater as “Murring”:

*Jack Jugarie: This place where we are here now, in this Wolfe Creek Crater, we call this place name Murring, that's the name of this Wolfe Creek Crater, Murring, that's it.*

I documented several accounts of the origin of the crater, with Stan Brumby, Jack Jugarie & Jack Lannigan. These accounts are broadly consistent with each other. It is clear that there are Aboriginal accounts of the origin of the crater, and that this is commonly expressed as the “star” or “evening star” that fell to Earth. What is not clear, however, is the extent to which this may be due to the adoption and incorporation by Aboriginal people, of relatively recent scientific knowledge of the origin of the crater. Whilst the earliest known recognition of the crater by non-Aboriginal people took place in 1947, there has been substantial time since then for new knowledge to be incorporated into

local communities. However, several of the stories and accounts presented in this research have been described as coming from the “old people” and in some cases, specifically claimed to be several generations old. If this is literally true, then that suggests that at least some knowledge about the crater predates 1947. Regardless of this issue, it is clear that the crater is recognised in contemporary Aboriginal communities, and in particular, by respected Elders, and that this knowledge is passed on to others in a variety of ways, including storytelling, artwork and song.

Stan Brumby's song of the crater and the “falling star” is a rhythmic, repetitive and brief song, made up of only three words: “warda” (star) “wandinga” (fall down) “morungai” (the ground). His song was recorded and features in the Cosmology Gallery video exhibit, which is described in section 5.5.1. A transcription of Stan Brumby's song follows:

*Warda wandinga*  
*Warda wandinga morungai*  
*Warda wandinga*  
*Warda wandinga morungai*  
*Warda wandinga*  
*Warda wandinga*  
*Warda wandinga morungai*  
*Warda wandinga*  
*Warda wandinga morungai*  
*Warda wandinga*  
*Warda wandinga*  
*Warda wandinga morungai*  
*Warda wandinga*  
*Warda wandinga morungai*  
*Warda wandinga*  
*Warda wandinga morungai*  
*Warda wandinga*  
*Warda wandinga*

How and where such a song develops from, was unknown, until Elder Stan Brumby explained that much of his knowledge of culture came to him, via dreams:

*Yeh I can hear him, I can dream him. When I sleep, I dream, they give me... culture. Song, everything. Song...Yeh, I can dream. Like you got to come and dream and talk to me, “Hello, Stan Brumby”, “Hullo”, like that, I'm talking to you “Hullo”, dreaming, I dreaming you, and them Murrungoo, I'm dreaming like that, you talking to me, dreaming, they talk to me, they give that...culture, I sing that in the next morning, I sing him. In the night, in the morning. I sing him, this one, this one, this one, finish, you see. Same as that morning star.*

*Murrungoo been giving me that song, with the language, right there, I've been camped right there, in the crater. Take a photo.... .... camp there, I've been dreaming at the same time. I've been looking at the place, from top, high, crater...*

The interview with Elder Stan Brumby provided an important insight into how he receives cultural knowledge, via dream states. His “star song” that describes the meteor that created Wolfe Creek Crater is a case in point, as there had been no prior indication of how this song developed, so his description of the role of subconscious states via sleep was a surprising outcome.

Jack Jugarie's account of the origin of the crater takes the form of a narrative, from an eye witness perspective:

*Well, this thing been fall, well, the Blackfellas reckon in the early days, the first mob, you know, they never saw any white people, or anyone, they only know their own colour, you know, like us. They reckon, star, second star from the big one, you know, been fall. Well we call him wada, that star. Wada it been fall in this ground and it makes big noise and shakes this country and... made a round, what's a name, rim right round, and he made a hole... there, and in the centre, down there, it's a hole there, no water stay in there. Doesn't matter how much rain can be here, the water don't stay here in the middle, it goes in the hole, and come out through down there, where we came, inside... Yeh, sink holes, right in the middle.*

I took Jack's comment that “no water stay in there” to mean that water does not fill the crater floor, but resides in the soak waters:

*Well, when this thing been fall, in those days, and it made a great big hole, and right in the centre it made another big hole. And I think that powerful that thing been fall inside, when it hit the ground, that half a piece would go inside, see, and made a big hole inside there and the water don't stay there; it go down the creek, from a little hole, you know, make 'im bigger and bigger, every rain come bigger and bigger inside,... hole. Water don't stay there,... that big rain...water don't stay, it go inside, go down to the river. Inside now...*

*From my old grandfather told me, yeh, Father Mike, yeh, from those one, and they got the word from their father (Grandfather Mike, and grandmother), from their father, and that father with them, he told by his father again, all the way like that, that word from the beginning, come little by little it come right up big, right up to us fella..., I don't know from how many years, how long Blackfella been living here? From that time, that story.*

Jack Jugarie described the origin of the crater, which involved stars (wada) and the moon (yalgarn):

*Wada. Each one moves because the other one wants to come in there, it gives him room to move, but what they reckon in the old days, that big star, (second to the moon), it was rising up in the afternoon, you know, the first one. They see 'im, you know. What's this fire coming up?, they reckon the Blackfella, early days, that's a fire, we'll watch him, like a bush fire. ...and keep watching him and it came out now, there is a big star, now see, that's the first one, come up a little bit up here now, and then they see another bright coming behind him, that's the moon, Ohh, that's we call glinda, yalgarn, you know, yalgarn, that moon we call yalgarn, yalgarn coming up behind him, that wada....*

*That wada been go up here a little bit here, and next time that moon, that yalgarn, coming very close to him, and blackfella reckon in early days, that moon been too hot for him, that's why him make him that thing lost and fall here, that that story from old people. That thing that come out and fall in the ground here. That moon was very hot...with that star, that's a star no more little one, like this round now (i.e. the crater) (that sort of star), he didn't want that moon to come closer, so he give him some room and he slip and fall here..*

*And big bright light came down, very quick, when him hit this ground,... when he hit this one, according to old people, you know, early days mob, wild people, they never seen gardia people, that's the mob...yeh. They reckon that noise went off, when it blew up, I tell you, that light that flash everywhere, you know, do you reckon Blackfella would wait here? They would go with their bloody lives and never come back again! he he (laugh).*

*...later on, maybe two years down, they been come to look, what been happen here, Ahhhh, and old Blackfella reckons, you know what? That wada ... that wada, that first one, that morning star, second one that's morning star, the first one, that's the one that's been fall, nothing there with him, might be more to come along, later on in the morning, ...that thing been fall here, he coming out, that morning star, but it wasn't that a one, but the first one, the evening star (second to the evening star) that's the one that fall, that wada, we call it, that... wada...*

Jack Jugarie's account of the origin of Wolfe Creek Crater is very interesting in that it takes the point of view of an eye witness account. This gives rise to an intriguing question. The meteorite impact is believed to have occurred some three hundred thousand years ago, which is clearly more ancient than the oldest known Aboriginal occupation of Australia. If we assume that due to the time discrepancy it is not possible for any eye-witness observation to have occurred of the impact, then the recounted story must have an alternative origin. Such alternatives could include a description of meteor activity or a meteorite fall, which has now been attributed to Wolfe Creek Crater. Another alternative is that Aboriginals deduced what must have happened at Wolfe Creek Crater, following observations of natural meteor activity. Jack Jugarie also described the reaction of Aboriginal people when they encountered the crater. The account takes the form of a narrative, as a first person witness after the

actual meteorite impact and should not be taken literally, as the crater considerably predates known human occupation in Australia. An alternative way of looking at this is that we are seeing here the creative and imaginative interpretation and storytelling, by Aboriginal storytellers, to this day:

*When they first came up, this one was flat country,...this one you know, like that country there, but he been higher, like ridges country, you know. Flat. Well, Blackfella don't stop around the high country, you know, they got to stop in the river side, where the water is, see. They reckon, they been camping down that place, that Murring, near Wolfe Creek Crater, called Murring, there's a big camp there, and when this thing been fall, this one (i.e. the crater), big wada (i.e. star) been coming, which way,... never saw, but him come down, and it made the light on top, that light, behind him, spark, but already hit the ground. Well, they were listening now, what thing been listening, when he hit the ground, that sound from what star been fall, we call Coolungmurru, he shakes the country, this one,... they said ohh, look at this ground maybe shake,... what been fall there? they can see big dust. Blackfella come from there, heh, you look round, red ground, red rock, no spinifex, look,... very frightened too, look from the top (i.e. of the crater), that side... great big hole. Everyone came in, all the Blackfella been come in, and have a look at this hole here, and they said, "What we call this country name this wada where been fall, that star?" Well, we'll call him, this hole, name is "Kandimalal", this one now, that's the wada, Kandimalal, name from Blackfella, this one, that shooting star.*

He continues on to describe a water source in the centre of the crater, and its broader link to Sturt Creek:

*...we got no water in this country. Water be laying there in the centre, there, where it's been keep raining, he made little by little hole, gone down. Water go inside, he don't stay inside,... Comes out down there (pointing towards Sturt Creek). Water don't live there, great big hole inside there, right down to the creek, like a pipe, down to the creek.*

I returned to the subject of meteors, first asking about the name of a "shooting star". Jack Jugarie replied:

*... that's the wada that we call,... that wada, "coredibudy wundigum windigum wundigum burrum wundiar...". That means; He start off with the light and fall in the ground,...Blackfella says like that ...that means, English way, "that thing been fall that light that star in this hole,.. Kandimalal, that the Blackfella name of this place...*

I then noted the use of the word "Coolungmurru", and Jack Jugarie explained:

*"Coolungmurru". That the name of that (star) when he hit the ground. When the star, when he move, that's the one I'll tell you, that star been move, and he made a big light, you know,*



*when he run, on the top, and the light go off, and they listen now,- keep quiet everyone, we listen for the Coolungmurru now, listen for a while, and when he hits the ground, he shakes this country,... and that's it, that's the Coolungmurru. That's a wada... a star been fall, we call him Coolungmurru, that a one, shooting star.*

This report was very surprising because this was the first indication of awareness of sound producing meteors (a most rare phenomenon) and intentionally listening for such a sound. Several Elders and artists recognised the appearance of large meteors as being a potential sign of the death of someone in the community, and therefore of considerable significance. I sought to clarify exactly when the sound is heard, because such sounds typically occur a few minutes after the actual meteor is seen (due to the speed of sound and the distance to be traversed). However, in some cases, there are also reports of sound occurring at the same time as the meteor. Keay (1992) puts forward a viable mechanism to explain this unusual observation, by electromagnetic emissions from the meteor itself, causing sound producing vibration in the vicinity of the observer at the same time of the meteor sighting. Clarification of when the sound is heard is a significant detail and I asked whether the sound is heard at the same time as the meteor is seen. If such audible effects occurred at the same time as the meteor, then one explanation could be that it is a perception effect where the observer (wrongly) associates a sound with the observed meteor, when in fact no such sound occurs. The reports gathered by this research clearly indicate deliberately listening for the sound in the minutes after a large meteor is seen. So explanations of “mis-perception” can almost certainly be ruled out. The deliberate practice of “listening for the coolungmurru” suggests that some Aboriginal people were indeed aware of unusual astronomical events, such as meteors that cause sonic effects. How such a cultural belief has developed, relating to such an uncommon astronomical phenomena, is unknown. It is also currently unknown what proportion of the Jaru population is familiar with the “coolungmurru”:

*No, shooting star first, when he finished with the light, but listen for the sound now, everyone quiet, they shake the country, that's it, its fallen to the ground, like that. It's the Coolungmurru we call it, shooting star.*

Initially, reports of sounds associated with meteors were treated with scepticism, until plausible theories were put forward to explain how sound could be perceived at the same time as a meteor was observed. The scientific understanding of sound associated with meteors has focussed on the generation of electrophonic sounds, from very low frequency (VLF) radio waves. Beech (1998) describes how VLF radio waves are generated via “*the trapping of geomagnetic field lines in the highly ionized, turbulent plasma in the tail of an ablating meteoroid*” (Beech 1998). Various studies have examined reported observation of meteor related sounds (e.g. Tancredi et. al. 2009, Beech 1998 and Keay 1992). In the study by Beech (1998), Leonid meteor shower observations were examined. The Leonid meteor shower, which is derived from comet 55P/ Temple Tuttle, has exhibited major periodical meteor showers, at “storm” levels, including the famous Leonid meteor storm of 1833. Beech regards the 1833 Leonid meteor storm as “*one of the strongest meteor storms on record. The*

*estimated peak hourly rate of visible meteors (meteors brighter than magnitude +6.5) was  $10^5 \text{ hr}^{-1}$* . The study examines the reports of observers, who heard “slight explosions”, “crackling” and “hissing” sounds. A remarkable example of observed audible effects from a fireball is that of the witnessed meteorite impact on 15 September 2007 near the southern shore of Lake Titicaca (Peru), investigated by Tancredi et. al. (2009). Known as the Carancus event, the impact created a crater 13.5 metres in diameter. Tancredi et.al. (2009, 1967) reports the impact as the “*first impact crater whose formation was directly observed by several witnesses*”. Witnesses reported hearing “explosive sounds” and the event was recorded via both infrasound and seismic station.

Jack Jugarie indicated he learnt about the Coolungmurru from his ancestors (“the old people”), and he reported hearing the sound himself on several occasions. I enquired whether he had told other (non-Aboriginal) people about this before and he indicated that no white person had ever asked him about it previously.

Jack Jugarie demonstrated the scale of the vibration by picking up a rock (from the land) and showing a slight rocking vibration motion:

*He don't shake very hard. Sort of, you can see him, sort of, you in the top here like this (land) and when the star fall, and it sort, that land, sort of like that (vibration), see. You don't move very fast, this mob, this land, this one small,.. like that.*

He concludes with some comments about the crater, and craters elsewhere in the world:

*Yeh, a little shake. I don't know about big one, great big one when he falls, I don't know about this one (Jack points to Wolfe Creek Crater)... formed that time, this thing been formed. I don't know how many years this one (i.e. Wolfe Creek Crater). This is the biggest star (i.e. crater) in the Kimberley. This thing been fall. Big one out of the mob, like. I don't know about other places, might be more bigger than this, in America they reckon?...*

Whilst Jack Jugarie demonstrated a varied knowledge of the night sky and Wolfe Creek Crater, subsequent discussions with his eldest son, Keith Jugarie, showed that Keith was less familiar with astronomical events and had no direct experience of Wolfe Creek Crater itself (his first visit to the crater occurred during my 2011 site visit to the crater). Interviews with Keith Jugarie (Appendix 13) indicate he held beliefs about the crater and that he recalled various stories about the crater told to him by his father.

The following stories provide insight into the stories, knowledge and attitudes of Aboriginal people regarding the centre of the crater. The stories are significant in the following ways: (1) The recollections of vegetation in the floor of the crater are consistent with known historical changes in the vegetation of the crater (derived from aerial photos), which gives added confidence about the

accuracy of the story; (2) the story contains a significant indication of origin and age, i.e. “*That's a story from the old people*” which indicates that this story about the crater is of considerable age, potentially pre-dating the 1947 “discovery of the crater”; (3) the stories (particularly the tunnel accounts) illustrate the commonly encountered situation that “astronomical knowledge” is often enmeshed with other knowledge, such as biological / environmental knowledge, and (4) such stories relating to the crater are also represented in contemporary Aboriginal artwork featuring the crater (see for example Figure 42, in which three of the artworks represent the “tunnel”).

Jack Jugarie shared the following story, whilst visiting the centre of the crater in 1999. The discussion took place in the centre of the crater, adjacent to one of the “sink holes” or soak waters, which attract a variety of animals, birds and insects. Jugarie's comments and actions demonstrated a care for animals and wildlife, via managing access to water sources, in this case, in the centre of the crater:

*This is the water, well sometime, when you get plenty mud, block that little bit of hole, when one great big hole inside there, he go right down the creek there, underneath this hill here, in the Wolfe Creek Crater, inside of it, he comes out there. But he might be a little blocked up with the mud inside and little bit of water staying here, where the birds can get him, or the kangaroo's, but most water down the river, but water living here, because this is a little bit a hollow place, where the water lives, this water to lay here, and that's why the water is right here now. That's it... That old fella before, he was mucking around with the hole, could one of these (sinkholes in the centre of the crater). That's the story according from old people. And he couldn't find the water, must have been real clean in that time, no trees about this, that's the old days, you know.*

This observation suggests that in the past, there was considerably less vegetation in the centre of the crater, and it was difficult to get water. Both recollections suggests a drier climate than that of the present. Relatively recent aerial photographs of the crater do show considerably less vegetation in the centre of the crater:

*He went down this hole, and couldn't find the water. He went further down a little bit he went down see right through, clear inside, and he told his mate... “Hey mate, I'll have to take a walk, inside this hole here, I have to go get that river there, that's where the water is going down”. Anyway, he went inside the hole and that bloke he wait, I don't know for how many hours, waiting for him in the river now and he hear him coming out of the hole and he couldn't believe that. That's a story from the old people, that's it, and now today its blocked up and that's why the water lay here, see... ...That's that story, that's the Dreamtime Story,...*

The soakwaters in the centre of the crater provide water for animal and insect life. Jack described how wasps are indicators of nearby water:

*Butterfly this mob. When you see 'em, butterflies, and that hornet he flying around here. He tells you where the water is. Flying around with his body, right around, he tells you where the water is. He green colour that hornet, he tell you, and follow him, you follow that one, he go straight into that soak water, you can see a big mob of butterfly now from this soak water, ohh, there's water there all right, that thing don't tell you no lie, that hornet, he belong to this spring country, that's true... ..Bird finally get a little bit of water there, it's alright for bird,... but some birds don't dig holes, go out to the big river there, fly over this crater... ..That's why I put that stick there, where the bird can have a drink there, might be too far to go over that crater and go down the river, so I had to put the stick across the water, there, little water, enough for bird to get a drink there.*

Jack Jugarie lent over the sinkhole, prodding the muddy water. He broke off twigs and formed a small platform near the water and I asked him what he was doing. It was for the birds, so that they could perch as they drank the water. This thoughtful action on the part of Jack Jugarie illustrated the role of carer for the land and its animals, which Jack adopted. He then continued with an account of the “sinkholes”, which is paraphrased as follows. One day, a Jaru person entered the crater and saw water in the sinkholes, in the centre of the crater. He entered a sinkhole, to discover a passage which went underground. After a considerable trek, he emerged into daylight, at the relatively nearby creek. Although vague, Jack probably intended to refer to Sturt Creek. It is said that because of the link from the crater sinkholes and the creek, the crater floor never floods. Jack Jugarie also recounted a story noting the risk of snakes in the sink-holes and the darkness of the underground passages.

The theme of an underground passage between the centre of the crater and Sturt Creek is represented in several paintings that feature the crater, including works by Barbara Sturt and a drawing by Jack Lannigan (Figure 43).

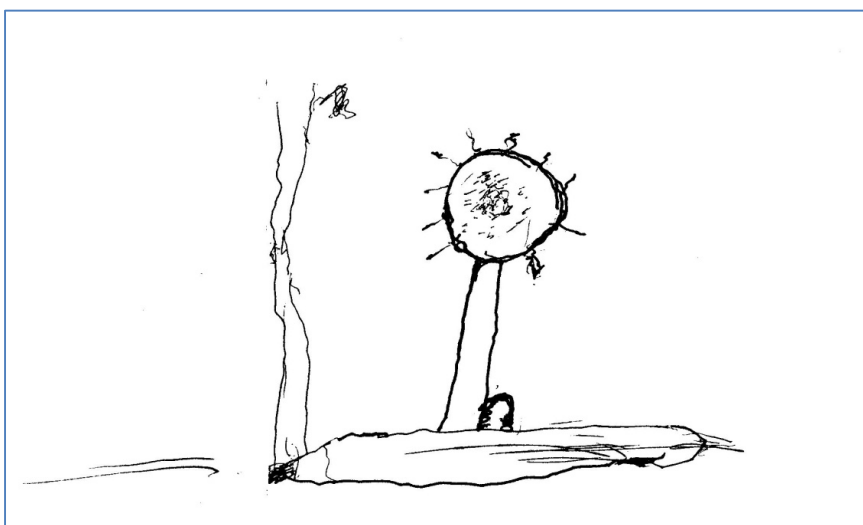


Figure 43. The Crater, Wolfe Creek, Sturt Creek and the “tunnel”.  
(Drawing by Jack Lannigan)

Stories based on this theme were also told by Jack Jugarie and Frank Clancy, a middle aged Aboriginal person who I met at the Yarliyil Art Centre in August 1999. Frank Clancy recounted a story about an underground tunnel and the Wolfe Creek Crater. Paraphrased, the story is that in the Dreamtime, there was a man from a place called Red Rock. He had a small dingo, which he kept in case he needed food. (At Red Rock) he went into a long underground tunnel, which goes all the way from (Sturt) creek to Wolfe Creek Crater. After walking a long way into the tunnel, he killed the dingo (for food). Blood was on the ground and a big snake, the rainbow snake then appeared in the tunnel. The tunnel collapsed on the man, trapping him. He is still there to this day; he never got out alive, with his dingo. The story differs from Jack Jugarie's story in several ways. In particular, the man travels along the tunnel from the creek to the crater, which is the opposite direction of the journey referred to in Jack Jugarie's story. My notes of this discussion follow:

*Underground tunnel (from Wolfe Creek Crater), to red rock. Man from red rock, he had a small dingo, like a puppy, (for food). Long time living along the underground tunnel (walking). Dingo, man killed dingo in the tunnel. Blood. Big snake, water snake, rainbow snake. The tunnel fell in on him and the man is still there in the tunnel. Dead in the tunnel. Finish. He never get out- the dingo is still there as well. This story can be told to anyone, man, woman and child. Dreamtime story.*

Stan Brumby has shared various accounts of the crater and its origin (Appendix 13) and he often uses a narrative story. In one discussion, he described the evening star as being “two stars” (Figure 44), in which the “mother one”, the “biggest one” came to the ground (at Wolfe Creek Crater) and the “baby one” (the “brightest star in the sky”) was left behind (which we see as the evening star today).

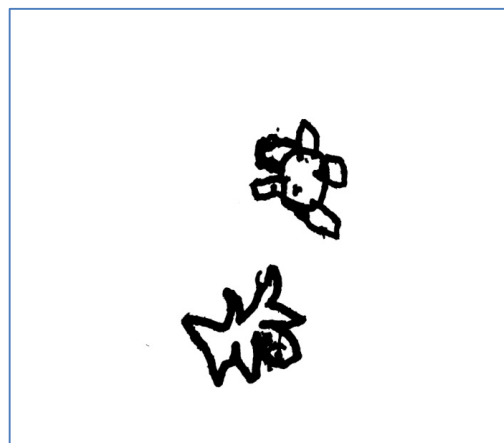


Figure 44. The Evening Star “mother and baby”.

(Drawing: Stan Brumby)

Stan Brumby recounted the following story about Wolfe Creek Crater in September 2000 (at Halls Creek):

*...Star- he was man, fall down. He can kill you, that man in the star, that evening star, when it come out in the morning. Kundimulal, soak water, milky water from the crater. Run out to Sturt Creek, milky water. Rainbow curled up in crater, holding the soak water. Murongorru- Bush women... ...Mooring- name of fly. Rainbow. Kill fly, bushwoman, snake/rainbow. Kundimalal- Grandfather/mother country...*

Stan Brumby referred to the Evening Star, coming out in the morning. This could indicate a correct understanding that the evening and morning star is actually the one and the same object. Brumby also used the word “Mooring” associated with the crater. Jack Jugarie used the word “Murring” to describe the crater, and these words may be the same.

Billiluna, the nearest permanent community to the crater, is located approximately 70 kilometres to the south west of the crater. The population of Billiluna is less than 400 people. Discussion with Elders Boxer Milner and Speiler Sturt revealed that similar accounts to those of the Jaru existed regarding the origin of the crater (by the star falling to earth), and also the belief in an underground tunnel between Red Rock on Sturt Creek, and Wolfe Creek Crater.

#### **4.2.8 Conclusions regarding Wolfe Creek Crater**

My original research into Aboriginal astronomical knowledge associated with Wolfe Creek Crater is based on several complementary research approaches, including literature reviews, field work, multiple on-site visits and a variety of documentation methods including video based interviews, field notes of discussions and onsite photography. Previously unrecognised knowledge relating to Wolfe Creek Crater has been documented, including from Elders Jack Jugarie and Jack Lannigan. Examples include the awareness of meteors which cause audible effects (including a name specifically given to this phenomenon), and a link between the Magellanic Clouds and accounts of murder. This knowledge was at immanent risk of being lost. Documentation of Jack Jugarie’s knowledge occurred only weeks before his unexpected passing (in 1999) and highlights the ongoing risk of loss of knowledge from Elders. This is especially the case with Jack's eldest son, Keith, who did not appear to be aware of much of his father's knowledge. In addition to the previously known Aboriginal name of Kandimalal for Wolfe Creek Crater, this research has also recorded “Murring” as another name of the crater or its immediate vicinity. During the field work, some evidence of secret knowledge relating to the crater was encountered (during interviews). However, this information was not substantial, and in keeping with the wishes of the particular Elder, this information is not presented within the current research. There was no apparent reason as to why such knowledge was of a restricted nature. As the scope of the current research is not dealing with secret or restricted knowledge, this aspect has not been investigated further.

First person accounts and evidence supports the view that some of this astronomical and sky knowledge is open and available for appreciation and learning by the general public, which confirms hypothesis 1 of this research. Examples of this include the active representation of Wolfe Creek

Crater in Aboriginal artwork, and associated stories, particularly by Elder Stan Brumby. Kandimalal, Wolfe Creek Crater, is a landscape feature which has cultural meaning to this day, and it is clearly viewed as part of a much larger network of landscape features. There is abundant and strong evidence of Aboriginal knowledge existing to this day relating to the crater which includes personal knowledge and memories, stories about the crater and its origin, artworks featuring the crater, and song. The findings to date have indicated that specific knowledge about Wolfe Creek Crater does exist in a variety of Elders, artists and community members, to this day.

The “Star from the sky” story (by Elders Jack Jugarie and Stan Brumby), is analogous to the scientific account of meteorite impact. This could suggest adoption of this scientific knowledge and its re-expression, but there is also evidence that this story existed prior to white contact, as indicated by Jack Jugarie, when he was questioned about the origin of the story. He indicated the story originated from at least three generations within his own family. While the story of the star from the sky is not necessarily to be taken literally, the story could indicate that the meteoric origin of the crater was deduced by Aboriginal people.

The interviews findings have lent support to Hypothesis 5 of this research, that some Aboriginal knowledge relating to the night sky is unrecognised. This research has also surprisingly identified and documented a previously unknown star pattern constellation, recognised by Aboriginal people of Halls Creek. There is evidence of contemporary influence on star knowledge, as demonstrated by “the camel in the sky”, as recounted by Halls Creek Elder Bonnie Deegan. The relatively recent origin of the camel star pattern is clearly recognised and the pattern is distinguished from other “dreamtime” stories associated with the night sky or star patterns.

This research has been able to investigate astronomical knowledge between Jack Jugarie (father) and Keith Jugarie (eldest son). These interviews indicate that Jack Jugarie had considerable familiarity with the night sky and its uses. However, his eldest son showed less familiarity, and in fact, had not previously visited Wolfe Creek Crater, until 2011. Based on the apparent differences between father and son, this study has found evidence of different levels of knowledge amongst these family members, and between the respective generations. This could be indicative of cultural knowledge not being retained and preserved by the current generation. However, this finding is only applicable between the two individuals, and generalisations regarding differences in intergenerational knowledge should be avoided.

This research has demonstrated that Wolfe Creek Crater is known to Aboriginal people to this day, that it plays an important part to at least some Elders, that the crater is featured in Aboriginal art, and that there is a range of knowledge, stories and beliefs associated with the night sky in general, and the crater in particular.

## 4.3 Night sky heritage of the Murchison Region

### 4.3.1 Overview

The Murchison Widefield Array (MWA) and the Australian SKA Pathfinder (ASKAP) radio astronomy developments are located in Yamatji country, in the Murchison region of Western Australia, approximately 350 kilometres north east of Geraldton, on Boolardy Station (Tingay et al, 2012). The name “Yamatji” is commonly used to refer to Aboriginal people in the Murchison and Gascoyne region, including the coastal communities of Cervantes, Dongara, Geraldton, Carnarvon, Kalbarri, and inland communities including Mullewa, Meekathara, Mt Magnet, Sandstone and Yalgoo. The 2001 Aboriginal population within Yamatji country is approximately 5600 people, or 10% of the region's total population (Department of Education, 2010).

There are several Aboriginal language groups within Yamatji country. The main Aboriginal language groups in the vicinity of the MWA and ASKAP radio telescope facilities include the Wajarri people (including Boolardy Station), the Badimaya (to the south), the Amangu, Hanta, Malkana and Yinggarda (coastal region), the Warriyangga, Thinn, Yinhawangka, and Ngalawangka (to the north), and the Wawula and Tjupany (to the east) (see Figure 1). Within the Wajarri area, several small remote Aboriginal communities exist. The nearest community situated to the MWA and ASKAP radio telescope facilities is the Pia Wajarri community.

In this chapter, I review applicable literature relating to Aboriginal communities in the vicinity of the project area. Then I provide an overview of the collaborations between scientists, astronomers and Aboriginal communities, relating to the radio telescope project area. I present an introduction to the *Ilgarijiri- Things Belonging to the Sky* collaboration and examine the astronomical content of the project. The *Ilgarijiri* exhibition developed out of a collaboration between Yamaji Arts (Geraldton, Western Australia), and the International Centre for Radio Astronomy Research (ICRAR). The exhibition has developed in the context of Australia's bid for the Square Kilometre Array (SKA) radio telescope project (ICRAR, 2010). Another expression of the importance of Aboriginal sky knowledge to the SKA project in Australia is shown by the naming of radio telescope facilities with Wajarri Aboriginal names. Two key examples include: (1) “Gulgarnu” the Wajarri name given to the Murchison Widefield Array and (2) CSIRO's approach of naming the radio astronomy antennas with Wajarri names, in collaboration with the Wajarri community. This approach has appropriately acknowledged the Wajarri culture in a respectful way. The naming of the antennas is a practical way of maintaining the Wajarri language in contemporary usage. This topic is discussed in further detail in section 4.3.6.

I make extensive use of first hand documentary accounts obtained via the video interviews conducted with Aboriginal Elders and artists who participated in the collaborations. The interviews conducted for this project have focussed on artists and Elders from two main localities, Geraldton, and Mullewa (both associated with the Yamaji Art cooperative in Geraldton).



### 4.3.2 Literature review

There is often considerable variation in the spelling of Aboriginal names or words. I have adopted the common form of spelling used for Wajarri, but other spellings are also applicable such as “Watjarri” as indicated by Horton (1996) in the Aboriginal Australia map of language groups, and also “Wadjarri”. Spelling variations also occur for “Yamatji” (which is adopted for this research), with “Yamaji” being the main example, such as the “Yamaji Art Centre”. In this case, I have avoided standardising the spelling, to recognise the spelling variations that remain in common usage.

Early documentation of Aboriginal knowledge relating to the night sky was compiled by Daisy Bates, the wide ranging 19th century researcher. An undated manuscript by Bates is referred to in “Coombsweb, the Asian and the Pacific Studies Server” of The Australian National University (n.d.). The manuscript details the “myths and legends of Murchison tribes” including “legends of spirits, stars and the Pleiades”. Aboriginal sky knowledge from the Murchison region was also documented by Day and Morrissey (1995, 4) in “A History of Mt Magnet”. They describe the emu sky pattern of “the Buddiamia”, which corresponds to the Badimaya (Horton 1996), and they note:

*The night sky was also made meaningful by attaching stories to the various star clusters. Perhaps the most significant here is that of the emu, made up of the dark patches across the Milky Way. In autumn, once the nights become colder and following the first rains, the emu in the night sky becomes quite visible. Below the emu is a cluster of eggs. This signifies that the time is right to look for emu eggs. The Bushmen of the Kalahari Desert are the only other people known to place significance on the dark patches of the night sky.*

This important reference correctly notes the importance of the emu sky pattern and also the link between atmospheric and seasonal conditions; the first rains and the coincidence of the availability of emu eggs for hunting. It provides a good example of Aboriginal knowledge relating to the stars, the environment and food gathering, which illustrates a holistic, rather than specialised approach to knowledge. However, the quote also incorrectly attributes “Bushmen of the Kalahari Desert” as the only other people to place significance on the dark areas of the Milky Way. This clearly is not correct, as other cultures, particularly South American ancient cultures, are known to include the dark areas of the milky way in cultural based star patterns (Pacheco, Flores & Salazar 2011). Such knowledge was known well before the 1995 publication of Day and Morrissey, see for example Urton's account (1981) of the South American Inca's recognition of the Llama, which was known to be formed by the dark areas in the Milky Way. Day and Morrissey's comment regarding the “Bushmen of the Kalahari Desert” is unreferenced, however, it is probably based on popular accounts of “the Bushmen” as described by van der Post in “The Lost World of the Kalahari” (1958), and “The Heart of the Hunter” (1961). The latter book focussed on African Aboriginal knowledge of the night sky.

Whilst many cultures recognise star patterns that are formed by groups of stars, the recognition of patterns formed by the dark areas in the Milky Way is a very different approach to pattern recognition. Sometimes, those who are familiar with pattern recognition of conventional constellations (i.e. groups of stars), can initially encounter difficulty in recognising patterns formed by dark areas in the Milky Way. This is noted in Urton's account (1981), in which he describes the chronicler Garcilaso de la Vega, who could not recognise the Llama star pattern "*but I could see nothing but the spots, which must have been for want of imagination on my part*" (Urton 1981, 110).

During the current research, I encountered a remarkably similar sky pattern account, based on the dark areas of the Milky Way, from completely different cultural backgrounds; that of Australia and South America. Alencar (2011), describes a South American example (from the Tupi Indians of Brazil), which parallels the Australian Aboriginal emu constellation extremely closely. Alencar describes the "Celestial Rhea" (large flightless bird of South America), in the same position and orientation as the commonly recognised Australian Aboriginal "Emu" sky pattern. In both cases, the coalsack nebula, adjacent to Crux (the Southern Cross), forms the head of both the Celestial Rhea and the Emu. There are many Aboriginal accounts of the Emu sky pattern across Australia. This particular example illustrates how very similar interpretations can be made in relation to the night sky, from societies that are largely geographically and culturally independent of each other.

As noted in section 2.3.7, the Australian Aboriginal emu sky pattern has been documented by Barnaby Norris (son of astrophysicist Ray Norris), via astronomical imaging of the Ku-rin-gai Chase National Park emu rock engraving, and emu sky pattern. The image was a finalist in the 2007 Eureka Science Prize for Science Photography.

Murchison pastoralist Karen Morrissey authored "The Night Emu's Fly, An Australian Christmas Story" (Morrissey, 1986). This book represents a rare example of a cross-cultural re-telling of the emu Aboriginal sky pattern. It merges the Aboriginal emu sky pattern story, together with the Christmas tradition and is presented in the form of a children's story. The Emu sky pattern, as described by Day and Morrissey (1995) and Morrissey (1986), formed the basis of the Australian Geographic article about the Emu sky pattern by Goldsmith (1999).

Aboriginal communities and proponents of radio astronomy initiatives in the Murchison region have worked together on various successful collaborative projects and agreements. One example is the Indigenous Land Use Agreement (ANZSKA, 2009), which was developed over a two year period of negotiation and consultation. The collaborations between Murchison Aboriginal communities in general, and the Yamatji and Wajarri people in particular, have linked scientists, astronomers, researchers and Aboriginal communities together, with the aim of learning about proposed radio astronomy developments and sharing knowledge in a two way process.

Preliminary accounts of the process have been described by Drok (2009/2010), in which radio astronomers and Aboriginal Elders and artists collaborated and shared knowledge of the night sky. Radio astronomer Prof. Steven Tingay (ICRAR) explained the radio telescope project to Elders and artists, during an onsite visit. The visit to the Murchison's Boolardy Station also included using telescopes and binoculars to enable the Elders and artists to directly view the night sky. As Drok describes, camp fire discussions enabled Aboriginal artists to share stories about the night sky. The artists, who included Charmaine Green, of Yamaji Art Centre, explained the importance of Aboriginal star knowledge:

*It's really important for our older people to pass on these stories like the Emu in the sky. The sky is linked to the land and how we look at the environment. It foretells seasonal changes and the availability of food sources. For example, when the Emu appears in its entirety over the horizon, at a particular time of the night, that's when you should hunt for Emu eggs. It's directly relevant to the way we live our lives (Drok, 2009/2010, 13).*

The link between Aboriginal knowledge of the night sky, and our contemporary scientific efforts at investigating the cosmos, are also documented by Brophy (2009, 9). The then State Minister for Science and Innovation, Troy Buswell, noted:

*...the skies which their ancestors had gazed at for centuries, which had guided them with its stars, would be the same skies that would reveal the mysteries of the universe, through the SKA...*

A more detailed description of the collaborative process is provided by Tingay (2011) for the *Ilgarijiri* project. The *Ilgarijiri- Things Belonging to the Sky* was named by Wajarri Elder and songman Ross Boddington. The exhibition has resulted in important cross cultural exchanges between scientists and Aboriginal people, with active sharing of knowledge about the night sky occurring between all parties. Tingay (2011, 203) introduces the *Ilgarijiri* collaborative project as:

*“Ilgarijiri - Things Belonging to the Sky”, is a collaborative project between Australian Indigenous artists and astrophysicists, initiated during the 2009 International Year of Astronomy. Artists and scientists came together to explore their different understandings of the night sky and the Universe. The project connects the ancient and the modern and aims to promote reconciliation between Indigenous and non-indigenous peoples in Australia through the night sky, a view of the Universe shared by all peoples on Earth.*

*Ilgarijiri* also featured prominently in the Australian feature reporting on the International Year of Astronomy projects (2009), as reported in the IAU final report (2010). *Ilgarijiri* is not the first example of art being used to investigate Aboriginal perspectives of the night sky. Majewski, Boles

& Patterson (1999) provides a useful background regarding the use of art for teaching astronomy, using Aboriginal and scientific perspectives of the Australian night sky.

### **4.3.3 Cross cultural exchanges between Elders, artist and scientists**

The CSIRO appointed an Aboriginal Liaison Officer (Robin Boddington), in Geraldton (seconded from Curtin University), to facilitate communication with Aboriginal communities, in relation to consultation and negotiation relating to the SKA radio astronomy initiative. This approach provided a formalised mechanism for consultation, which was an essential part of the radio astronomy initiatives. Such an approach was particularly important during Australia's international bid to host the SKA project. Gaining Aboriginal community support via the formalised land use agreement provided confidence in the long-term land use arrangements, and this strengthened Australia's SKA bid, which was ultimately awarded on a shared basis between Australia and Southern Africa.

In addition to the formalised consultation approaches, various community outreach events have taken place with several communities in the Murchison region (e.g. Meekatharra & Cue), including remote Aboriginal schools and communities, such as Pia and Yulga Jina (the nearest community situated to Boolardy Station). CSIRO staff such as education officer Rob Hollows, ICRAR's radio astronomer Dr Megan Argo and myself have participated in several community and school based educational and astronomy awareness events. Site visits also took place with radio astronomers, including Prof. Steven Tingay, to Boolardy Station (Figure 45).

As the concept developed for a cross-cultural exchange in scientific and Aboriginal views relating to the night sky, the *Ilgarijiri* art exhibition took shape. Yamaji Art, the Geraldton based Aboriginal arts centre, began a collaboration with ICRAR under the management of Katherine Moroz and Charmaine Green (the then Centre Managers of Yamaji Art). A key stage in the *Ilgarijiri* project was the onsite visit to Boolardy Station with scientists, Aboriginal Elders and artists. This site visit specifically had the goal of sharing knowledge between the group and between Aboriginal and non-Aboriginal people. The site visit and the discussions and experiences of the night sky provided a strong basis for the subsequent artwork development for the *Ilgarijiri* exhibition. The *Ilgarijiri* artworks developed out of, and were directly influenced by, the collaboration, knowledge sharing and site visit between Aboriginal Elders, artists and radio astronomers. After the site visit, artists and Elders continued to explore and learn about the night sky. Artworks developed along several broad themes:

1. Traditional Aboriginal stories about the night sky, expressed in artwork.
2. Representations of the night sky, as experienced via the site visit.
3. Paintings which record the journey and site visit to Boolardy Station.
4. Other.

The resulting artworks have featured in the dynamically evolving *Ilgarijiri* Aboriginal art exhibition. Engagement and exchange between Aboriginal and non-Aboriginal people continued in a variety of

ways, such as attendance at the Indigenous Astronomy symposium at AIATSIS in Canberra (November 2009), and subsequent art exhibition, including the first international showing of *Ilgarijiri* in Cape Town, South Africa (2010), USA (2011), and then Europe (2012). In the following section, we look in detail at the *Ilgarijiri* exhibition.



Figure 45. Prof. Tingay and Wajarri Elder Teddo Ryan at Boolardy Station.  
(Photo: Dr Megan Argo)

#### **4.3.4 “Ilgarijiri- Things Belonging to the Sky”**

The *Ilgarijiri- Things belonging to the sky* collaboration was introduced in Chapter 1. The *Ilgarijiri* exhibition represents Western Australia's largest Aboriginal art exhibition primarily based on astronomical themes. The story of the Seven Sisters (Pleiades) is a strong theme, in addition to the “Emu in the sky” pattern. Artworks include both traditional and modern styles. The exhibition has evolved over time, as artworks have sold and new versions of the exhibition developed. As noted by Tingay (2011) “*Ilgarijiri*” means “things belonging to the sky” in the local Wajarri Yamatji language. Importantly, the very name of *Ilgarijiri* indicates the importance of a sense of belonging and relationships, rather than a sense of individual ownership of astronomical knowledge. As of February 2013, “*Ilgarijiri- Things Belonging to the Sky*” has held eight exhibitions, including five international exhibitions (detailed in Table 6, see Chapter 2).

The following section provides examples of the *Ilgarijiri* exhibition, including the Seven Sisters, the Emu, and specific astronomical objects viewed by telescope by Aboriginal artists, including Saturn, the Jewel Box star cluster, and a variety of constellations.

### 4.3.5 Interviews with artists and Elders

#### 4.3.5.1 Overview

A series of video interviews have been recorded, featuring Wajarri and Yamatji Elders and artists, who have had firsthand experience and participation in *Ilgarijiri*, in addition to other people associated with the Murchison radio astronomy developments, including the CSIRO Aboriginal Liaison Officer, Robin Boddington, and ICRAR radio astronomer Dr Megan Argo.

Interviews with Yamatji Artists include:

(Geraldton)

- Charmaine Green.
- Olive Boddington (deceased).
- Margaret Whitehurst.
- Barbara Merritt.
- Kevin Merritt.

(Mullewa)

- Barbara Comeagain.
- Wendy Jackamarra.
- Christine Collard.
- Debra Maher.
- Melissa Jacobs.
- Susan Merry.

Additional Interviewees:

- Dr Megan Argo, ICRAR.
- Robin Boddington, CSIRO.

The following sections are derived from transcripts, from the video interviews. The discussion explores the ways in which Aboriginal people associated with the radio astronomy developments taking place in the Murchison, and how they have shared and communicated their knowledge of the night sky with scientists, astronomers and the general public. The transcripts (Appendix 13) are the source of the quotations used in this section. The oral recording achieved via the video interviews has documented a conversational style of English. I have attempted to transcribe word for word, so the idiosyncrasies of each speaker will be apparent in terms of their style. Also notable is the common use of repetition in discussion.

#### 4.3.5.2 *Ilgarijiri*: collaboration, development and exhibition

One important issue during the *Ilgarijiri* exhibition was the way in which sensitive cultural knowledge was dealt with, and also the general question about the right of people to share stories, via art.

Margaret Whitehurst: *See, a lot of the stories that we tell... Even if it's not sky stories, there's a lot of stories, that we, mainly stories that I tell that we can touch, we are allowed to touch, because, I haven't got any elders now, I've only got my uncle who can tell me what to do and what I can't do. So mainly my stories are all about the food, the land and the water... because there's a lot of things out there that you can't touch. So I try not to do anything in my painting that would offend an elder. Things like that, so but all the sky stories, it didn't offend anyone, so I think that there is nothing really that can offend the old people from up in the sky.*

In general, interviewees noted that culturally sensitive knowledge may relate to several different issues, such as who has the right to communicate a given story, and avoiding giving offence to an Elder. The insights provided by Margaret Whitehurst about the management of sensitive cultural knowledge reveal her approaches taken with these issues, which include knowing what stories she can share, and also the challenge posed by relying for guidance on her Elders, of which only one Uncle now remains. This also highlights complexities encountered by Aboriginal people regarding knowledge and transition between generations, as Elders pass on. Her reference to the “the old people from up in the sky” is a direct reference to her belief that deceased ancestors reside in the sky.

The topic of sensitive cultural information can be a problematical one, as the specifics of the issues are often not discussed. In relation to *Ilgarijiri*, Charmaine Green noted the extensive amount of time required for the group to consider these issues, and to decide upon their approach.

Charmaine Green: *Well, anything with the sky is sort of culturally problematic and it took the committee at least eight months to even say yeh, we will go there. It took them a long time sitting in with the board, throwing it back and forth, shall we do this? Are we doing the right thing? Are we going to get in trouble? What sort of stories? But then the positive side of it out-weighed that because there is not enough a lot of opportunities to tell stories to the wider public and not enough opportunities to tell stories to our kids or our community, so that side of it, sort of... People knew their boundaries. They knew that there is stories connected to the sky that they can't tell, and they won't tell.*

Charmaine Green's account here clearly refers to some stories relating to the sky as being secret and an avoidance of presenting such stories in the *Ilgarijiri* project. The other very notable point made here is the significant time taken to consider these issues at the Yamaji Art Centre management board. Their eventual decision to go forward with the project was clearly based on careful consideration and a view that: (1) opportunities for sharing and communicating their knowledge was limited; (2) the benefits outweighed any negative aspects, and (3) the participants knew what was, and was not, acceptable. This interview provides a very interesting insight into the initial decisions about *Ilgarijiri*, but in general, the specifics of the issues were not revealed.

CSIRO Aboriginal Liaison Officer Robin Boddington also noted gender restrictions relating to sky knowledge:

*Robin Boddington: ...but from a woman's point of view, we can't talk about the stars and all that, I could give you the Aboriginal names. But I can't, because it's all related to men's law. Seven Sisters dreaming story and the Milky Way and the Emu, we could tell you that one, but I don't know how much the men could tell you. I can't speak for that...*

Robin Boddington's interview clearly established that some Aboriginal sky knowledge is associated with Aboriginal Law and that in general she cannot discuss that subject. As the scope of the current research is based on Aboriginal sky knowledge that is open and available to the general public, restricted knowledge is outside the scope of the current research. However, there is potential for future research to be done, with a primary focus on Aboriginal Law and as we can see from Robin Boddington's interview, such a subject will almost certainly involve aspects of sky knowledge.

The way in which Aboriginal artists and Elders initially responded to the exhibition is quite broad, from the enthusiastic and very positive (e.g., Kevin Merritt and Charmaine Green) to initial thoughts of scepticism and doubt (e.g. Margaret Whitehurst), which subsequently developed into a very positive and affirming attitude:

*Kevin Merritt: ...when I first heard about it, I thought it was a really great thing for the artists in this region to be able to put on canvas stories that they've learnt and heard the old people, you know, while we are growing, to be able to display to the world as it is, you know, the stories of the stars, I thought that was really great.*

Charmaine Green, as the then manager of Yamaji Art, provided much of the organisational support for the development of the exhibition:

*Charmaine Green: It's been a really fantastic project and it's part of us wanting to reclaim the right to tell stories from my perspective anyway, and this project's allowed this as well.*

Robin Boddington (CSIRO Aboriginal Liaison Officer) spoke more broadly about the consultation and liaison processes associated with the MRO radio astronomy developments:

*Robin Boddington: The Elders and the people from the area was really behind this process. We are also working on the Indigenous educational side of it. The Pia Wajarri kids, know all the galaxies, because Rob Hollows, our educational (officer) has been out there and they know all the galaxies, so we are doing an education package which soon should be put together... So we got to trial it with the Pia kids first.*



Margaret Whitehurst, a Yamatji artist, first reacted with scepticism and doubt regarding the *Ilgarijiri* exhibition concept, however, her views were transformed when she experienced the views of the night sky, the use of a telescope, and the interaction with radio astronomy scientists:

*Margaret Whitehurst: ..well, when I first started I thought, oh, well nah... it was going to be boring. I thought it was going to be boring. Nah...I haven't got much stories of the sky. When they first approached us and said that we are going to do these stories about the sky, look I don't know much about stories in the sky. All I knew was about this Emu in the sky and Charmaine and Kathryn said: "You go out and you look at the sky and you will see". So we did, and we went out and I just could believe all the things that we saw in the sky, you know. I didn't even know even half of the things that was in the sky, because we didn't look for them things. All we did was look for the seven sisters, and the pot in the sky, what they used to tell us, the seven sisters, the emu in the sky, that was it. I didn't know any more, till I saw the ones in the sky. Now I think I could do more stories of it, you know tell more stories about it. Just looking ... through the telescope, into the sky, yeh. It's really given me a lot of things that I can go back, and well, I went back and told my kids and my Grandkids all about it, but they didn't believe me. They didn't believe there were that many things in the sky. Yeh...*

The comment by Margaret Whitehurst reveals her experience with the *Ilgarijiri* project significantly expanded her understanding of the night sky, in particular, via the direct observation of deep space objects as viewed with telescopes. The experience was clearly a very positive one, and one that was contrary to her first expectations. This highlights the dramatic transformation that can occur, as a result of practical sky viewing, whether done with or without telescopes. The other important aspect for Margaret Whitehurst's comments is the opportunity that developed from the *Ilgarijiri* experience, which enabled her to share new stories with her family (and grandchildren).

Discussions with artist Barbara Merritt also revealed the effect of childhood stories about the night sky (in this case, the moon):

*Barbara Merritt: I had an Auntie, and she knew a lot about the stars and like, she read the stars every day but not only that, she knew where every stars was, and what was in the sky, the scorpion and that, she told us all that, so we weren't afraid to talk about the stars and I noticed a lot of friends, and they'd say "I don't know anything". Belonging to the stars, but we have stories there and I think back in the old days, they occupied the kids, by telling them that this story now...Don't you do this, because he'll be watching you, there like, someone on the moon, so the moon was something scary to look at, because we thought we would always see something, because of how they told us there was something on the moon.*

In this case, the story about the moon contains an ethical message clearly aimed at influencing the behaviour of children. The story indicates that the moon was “something scary to look at” and also highlights another interesting issue, that of prior attitudes towards the night sky. This is particularly relevant for practical astronomy education initiatives in such communities. An activity, such as viewing the moon (with or without a telescope) may seem harmless enough, but for those people brought up in a community with negative attitudes towards such viewing may well take a different view. It is helpful for educational practitioners to be aware of the potential of this issue in the community in which they operate in.

Collaborations between scientists, artists and Elders occurred during the Boolardy Station site visit, during which participants shared their knowledge amongst the group. Several of the artists commented about the experience of the Boolardy Station visit, and the experience of interacting with radio astronomy scientists:

*Kevin Merritt: I thought that was very positive, because we were able to relate our stories, in the... They were able to show close-up views of the constellations that we looked at over our life, we could see that even though we thought it was just a star, it was another constellation, you know. It just blows your mind away...*

*To be able to have their (the astronomers) expertise tell us about all these things, and I think some of the older people learnt a great deal more than what they knew before, about the stars and the constellations, about where we fit in, our own little world, where we fit in this great cosmos we live in.*

The journey, and the viewing of ground based radio antennas, was recorded in *Ilgarijiri* paintings, of which two examples are provided below (Figure 46). The second example shows the ground based radio antennas, and is probably the first ever Aboriginal painting of such radio astronomy antennas ever produced.



Figure 46. Examples from *Ilgarijiri* showing the MRO site.  
(Images: courtesy Yamaji Art, Artists: left, Susan Merry,  
right, Wendy Jackamarra and Edward Ryan)

Stories and knowledge about the night sky were shared, around a campfire at Boolardy Station between the scientists, Elders and artists (Figure 47). The discussion was recorded by the ABC “Message Stick” film crew and subsequently featured on ABC TV. Artists Wendy Jackamarra and Barbara Merritt commented about the open air meeting and the night sky tour by Professor Steven Tingay:

Wendy Jackamarra: *...by the camp fire, and sit and Steve (Tingay) showed us with his laser, pointed all the different things in the sky to us, things that we didn't know were there.*

Barbara Merritt: *...so, we had that opportunity for like, specialists, scientists to give us more information on it. It was really good...*

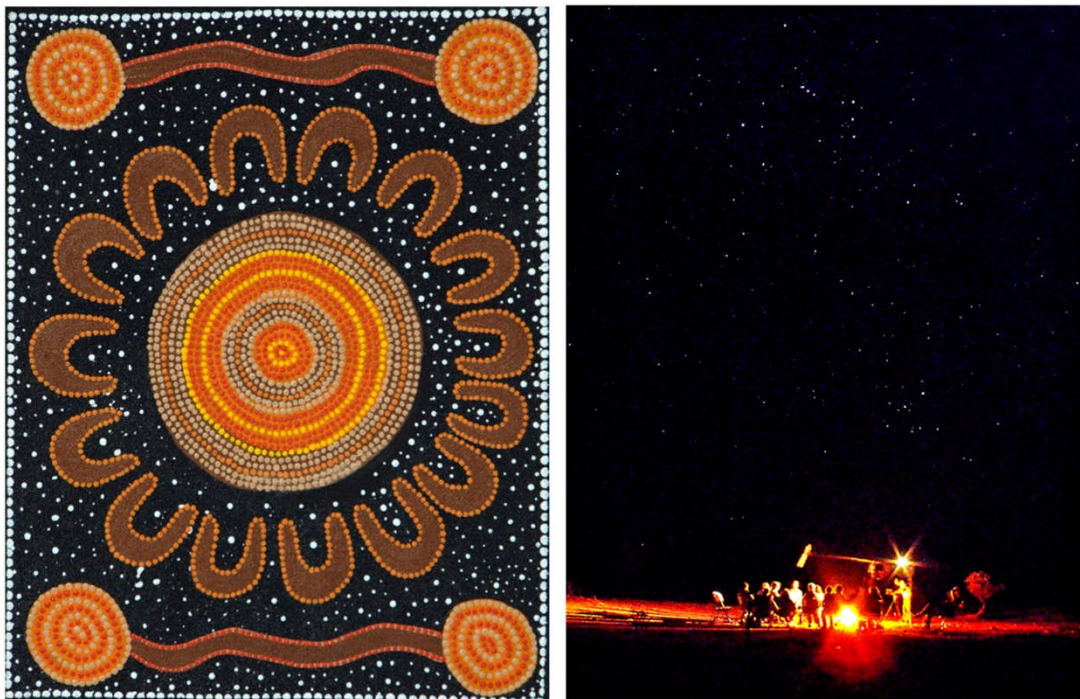


Figure 47. Two views of the Boolardy Station meeting.  
(left) Painting courtesy Yamaji Art. Artist: Wendy Jackamarra, (right) photo by Dr Megan Argo.

The excitement of a practical viewing night, in a group setting, and the sharing of knowledge out on country, was clearly expressed:

Margaret Whitehurst: *...and that night when we went home back to the station, sat around a big campfire and we told stories, and we even pointed out the sky, they saw the emu in the sky that night we pointed out up in the sky and the non-Indigenous people couldn't ....They got so excited when they saw the emu in the sky. Yeh, they really... they couldn't believe it... We'll show you the emu in the sky when it gets dark and we showed it to them...they just couldn't believe it because we saw it plain as thing out there at Boolardy. And all the stars, it was so... and Mr Tingay showed us a lot of other things that he saw, that we can see up in the sky and what we never seen before, that's where I saw a lot in the sky that night. I can't*

*remember all the names but, because they were, some of them weren't Australian, so, but really enjoyed Boolardy. A good trip. It was wonderful out there, yeh.*

The above accounts clearly establish that the interaction with radio astronomers was viewed positively by the Aboriginal Elders and artists. The sharing of expert knowledge was valued, as well as the setting around a camp fire, to share cultural stories. However, the anticipation of interacting with astronomers and scientists did cause some anxiousness on the part of some Aboriginal participants:

*Charmaine Green: But um, everyone was quite anxious on how we were going to interact and how we were going to connect with the astronomers but the good thing was people like talking about the sky and just like looking at the stars. So the connection there was when the sun came down, people had lots to talk about.*

Charmaine Green's comment about the timing of the meeting is quite significant. The difference between talking about astronomy in the daytime, as compared to the same discussion at night, in a setting around a campfire at night is indicated by Charmaine's note that people had lots to talk about, after the sun had gone down. This detail is significant, because it points to the value of timing such collaborations and discussions. It is likely that people in general felt more at ease at night, and that this facilitated discussions, in addition to having direct access to the night sky, in which objects could be pointed out, during discussions. This immediacy of the night time experience contributed to the successful interaction and discussions between the radio astronomers, Elders and artists.

Many of the artists and Elders commented about the way in which the exhibition and collaboration affected themselves, primarily as a learning process. Charmaine Green reported examples of self motivated informal learning:

*Charmaine Green: ... Doing checks on the internet, thinking what's this about, reading more stories. People were finding videos about astronomy. We had about 12 people sitting in my lounge room one night, just looking at this video on the universe, the sky and the planets, so it just opened a whole wide world of different discussions, and looking at the night sky.*

The actual process of creating Aboriginal artwork with astronomical themes also had a distinct effect on some artists:

*Barbara Merritt: I think that they really felt like that they were in that painting because of the stories and like they were really glad that these stories have come out and so that everyone can learn about these stories about, you know, from our own culture, and the people, and that, because we still have really cultural people, they're close, and we meet up*

*with them, and talk with them, and they are really glad and happy about it and like to tell you more stories about it.*

Kevin Merritt commented on the long term effects of the exhibition:

*Kevin Merritt: It certainly was a positive experience and I think that's still flowing on today. That excitement we had in the beginning, is still there today. We'd like to see more of it.*

*Personally I thought that it was really great for all of us to be included in this project. I think we are very proud to be a part of that and we'd like to continue to be a part of it too.*

#### **4.3.5.3 Experiencing the night sky: observations**

Whilst interviewing the Mullewa artists, Christine Collard noted her value of sky watching, together with a campfire:

*Christine Collard: We see it all the time, only when it's not cloudy. Mainly summer time. Summer time is the best time. We all sit around the campfire. Like Sue said, have a yarn. You tell your kids the stories, all what's up there in the sky. They get very interested in it too. Yes, so we love that, love sitting outside, we're outside people.*

The *Ilgarijiri* exhibition features two major Aboriginal star patterns, the seven sisters (Figure 48), and the Emu. Kevin Merritt described the constellations:

*Kevin Merritt: The seven sisters with the hunter is a well known story with Aboriginal people in this area, and also the story of the milky way constellation where we can look at the sky at certain times of the year and know when the emus are laying their eggs, also the story of the Southern Cross, story from the Wajarri people from where that story is connected to, to that particular star system...*

Kevin then went on to note that whilst the stars of the Southern Cross are very prominent, they do not feature strongly in terms of Aboriginal stories associated with the night sky:

*Kevin Merritt: It's one of the prominent features of the sky, but not one of the prominent story. Not too many people know about that story, it's a story that people are just beginning to learn about that story, so that's one good thing that's come out of it, since that project started.*

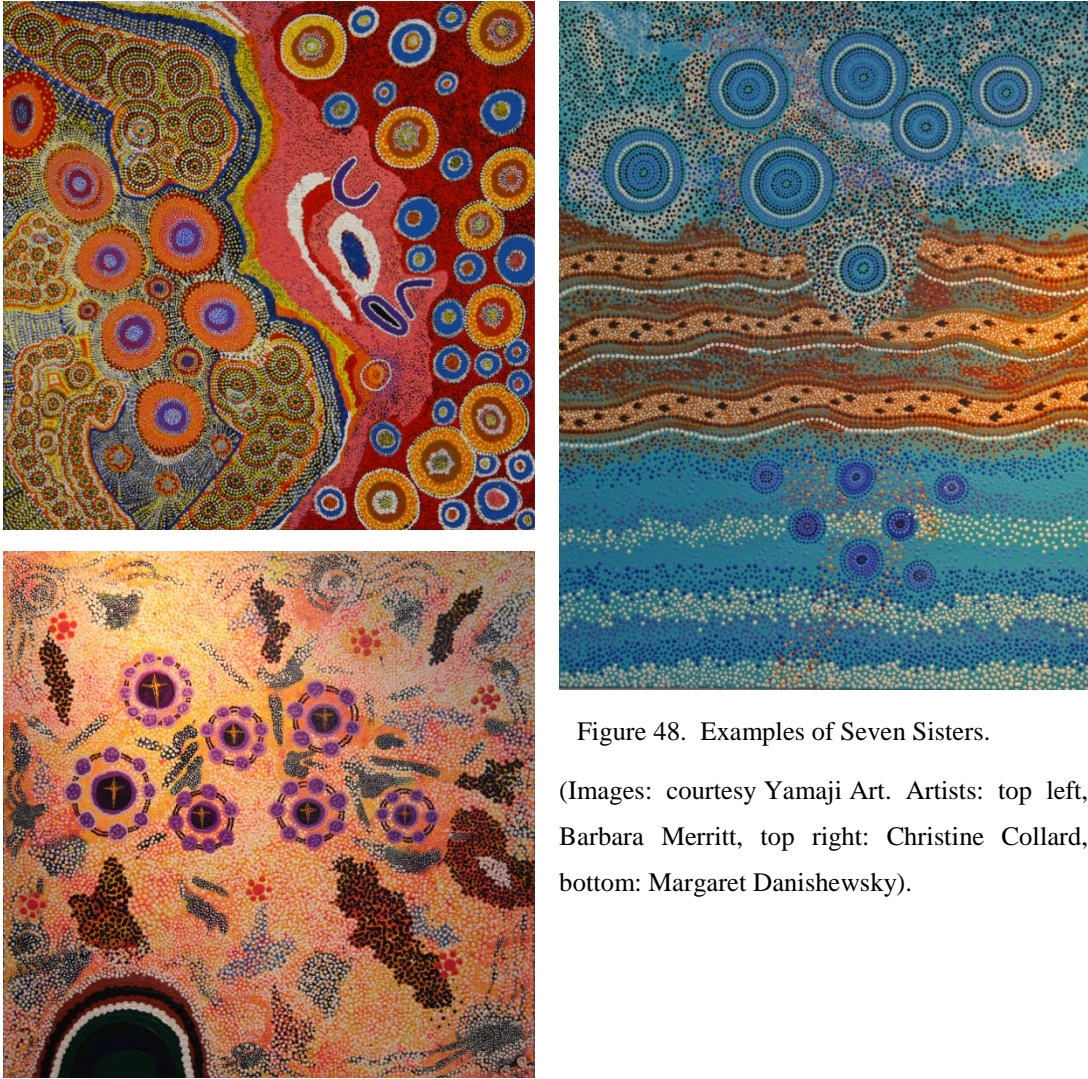


Figure 48. Examples of Seven Sisters.

(Images: courtesy Yamaji Art. Artists: top left, Barbara Merritt, top right: Christine Collard, bottom: Margaret Danishewsky).

Olive Boddington, senior elder and artist, described the seven sisters, emphasising the role of the group of sisters “calling back” the sister:

Olive Boddington: *There was the seven sisters, and there was ah, I can't think of the name, but there was one that, um, sort of away from the others most times, and she was really wanted by an old fellow, and she was, but the other sisters they kept calling her back and helping her to stay among them and that's what I think and in the painting she's a little bit away from the six (stars of the seven sisters).*

“The emu” is a widely recognised Aboriginal sky pattern, which comprises the dark areas in the Milky Way, between the constellation Crux (Southern Cross) and the general vicinity of Scorpius (Figure 49). The coalsack nebula is recognised as the head of the emu.



Figure 49. Examples of “The Emu” in the sky.

(Images: courtesy Yamaji Art, Artists: top left: Charmaine Green, top right: Margaret Whitehurst, Lower left: Sonya Edney, lower right: Susan Merry).

Olive Boddington: *When you first see the emu, you don't see the whole of him, just you see the neck and the head part and as the months go by it shapes more into the emu, and then .. ...it's sort of lying and when it does that that's when the emu's laying eggs and everyone seems to hunt for them...(the emu eggs) ... special time.*

Susan Merry: *Every year, we look forward to emu eggs. So, we take the kids out emu egg hunting. So when we look into the sky we see that shape in the sky. We know that that is when they are laying ...starts forming...*

Other artists spoke about other star patterns and in particular, views of star clusters seen through telescopes. Star clusters such as the Jewel Box star cluster received a great deal of attention and this object was featured in several paintings:

Barbara Merritt: *That's just amazing thing, sparkling pretty colours, so that's the first painting I drew, was the jewellery box, and that got sold very quickly.*

*...it made a big impression alright because, just the name alone, the jewellery box, jewellery box, a star called, you know, the jewellery box. As women, like, these are the things that we talk about, and do. Well, I do beading and things in my spare time and jewellery is in our lives, every day and then to see the jewellery box, ahh...*

The Jewel Box star cluster attracted an unexpected amount of attention from the *Ilgarijiri* artists. At first, it was unclear why the star cluster attracted so much attention, but the interview with Barbara Merritt helped to explain this. The cluster was commonly called the Jewellery Box cluster by Aboriginal artists. The view of the cluster through the telescope during the Boolardy site visit, revealed a bright group of stars, with distinct and multiple colours. Artists reported surprise at the colour of the stars in the cluster, and, as indicated by Barbara Merritt, the name of the cluster and its association with jewels made it a popular object amongst the Aboriginal artists. These factors contributed to the very positive responses made regarding the cluster, by the artists.

The interviews also identified differences in conceptual frameworks, inadvertently identified when interviewees commented about the phrasing of questions. For example, in an interview with Kevin Merritt, and a question relating to *deep space*, he noted that that concept is not one that he generally holds:

Kevin Merritt: *...And you say deep space. We don't have that con.... (concept) we don't see deep space. As Aboriginal people, we just see what is around us, what's above us and deep space is beyond anyone's comprehension we just can't understand, you know, how all these things have been created, you know.*

*...Just what we see with our naked eye as far as the..., like the nearest stars that we see, the moon, the sun, some of the closest stars, that we see shining so bright in the sky, and we are a part of that but beyond that we don't have any connection to that.*

When given the opportunity to view deep space objects with a telescope, reactions by Aboriginal artists and Elders were distinct:

Barbara Merritt: *That was really, really a big eye opener to, you know, see the stars that close and through the telescope and the colours, and the, yes... I'd think I'd look at them every day if I had the telescope,...*



Elder Olive Boddington was not able to view Saturn through the telescope, however, she listened to the descriptions of Saturn from those people who were able to view through the telescope. She then went on to paint an image of Saturn (Figure 50), based on the descriptions provided by others.



Figure 50. “Saturn”. Artist: Olive Boddington.  
(Image: courtesy Yamaji Art).

Another example of a telescopic view of Saturn is shown in Figure 51, by Debra Maher (Mullewa).



Figure 51. “Saturn”. Artist: Debra Maher.  
(Image: courtesy Yamaji Art)

*Ilgarijiri* artists also expressed an ability to represent conceptual ideas through Aboriginal art. For example, discussions about radio waves in space, with radio astronomers during the Boolardy site visit, were translated into some highly visual representations, such as those produced by Gemma Merritt (Figure 52).

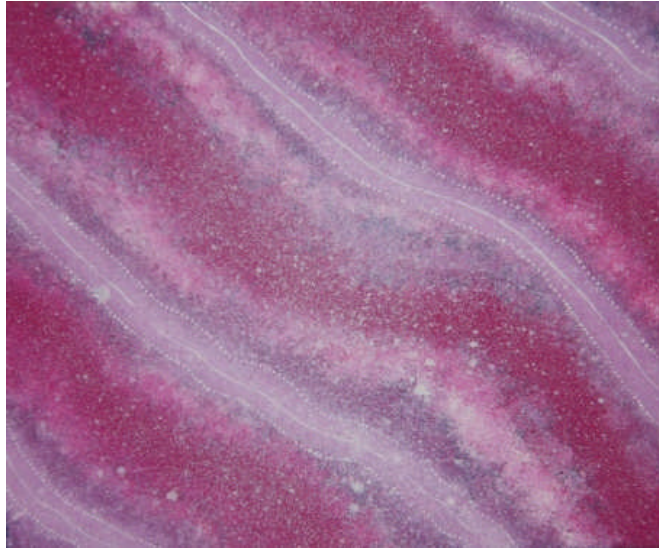


Figure 52. “Sound Waves”. Artist: Gemma Merritt.  
(Image: courtesy Yamaji Art)

The above example of “sound waves” (in space) is a direct result of the discussion held between the Elders and artists, and the radio astronomers, including Prof. Steven Tingay. The concept of radio waves and their importance to astronomy were discussed, in the context of the radio astronomy initiatives for the Murchison region. The analogy of travelling sound waves was used as part of the discussion about radio waves, which was then represented by artist Gemma Merritt. This artwork is a good example showing how conceptual ideas can be incorporated into contemporary Aboriginal astronomical art. Another example of conceptual artwork is “Star explosion” by Gemma Merritt (Figure 53).



Figure 53. “Star explosion”. Artist: Gemma Merritt.  
(Image: courtesy Yamaji Art)

Kevin Merritt made far reaching and profound comments about why people search amongst the sky and succeeded in relating the sky to people throughout the world.

Kevin Merritt: *I find it quite interesting, the stars are interesting to all races of people of the world,... We will always be searching amongst the stars for whatever reason we like to search the stars. When we come out at night, it just fascinates myself anyway you know, the brilliance and the enormity of our own little solar system, compared to what's out there, further out.*

The *Ilgarijiri* exhibition at AIATSIS, Canberra, provided numerous effects and a strong sense of self validation, and confidence in the abilities of the artists.

Kevin Merritt: *In Canberra we had a great reception there and the one at Curtin University, that was a real success and I think it's shown the Aboriginal people throughout Australia, that anything like this (i.e. Ilgarijiri) they can put some together, something that's very important to them in their beliefs, their dreaming and their stories, you know, and I think it's one of the greatest things that Aboriginal people here, when we did the paintings, that we were proud to show on canvas what our stories were, yeh.*

*I thought it was a learning experience that we could look outside our own little, what they call the "sand pit" (i.e. solar system) and that outside and there is so much we can be a part of, you know, as far as the exhibition is concerned we are a part of the astronomy... ..people, I thought that was a great experience, not only for me but also for all the other artists. We are still telling people to come and join us a be a part of it. I think that's great, I think that's really great.*

Barbara Merritt also noted the effect of hearing other Aboriginal people speaking confidently about their culture, in this case, referring to Wardaman Elder Bill Yidumduma:

Barbara Merritt: *... really in Canberra, it opened my eyes. When I saw that elderly man talk about his there in the Northern Territory and like, he wasn't shy about it. He told all the stories, and he spoke up really well about the stories, and here we kind of, a lot of the elderly people didn't say much but I thought, well that's just wonderful, you know, to know these stories, that's the first time I've heard his stories like from the Northern Territory. So I thought well, that was really good that we had our artwork and the stories about our ancestors, really...*

The comments by Kevin and Barbara Merritt reveal several important aspects of the role of the AIATSIS *Ilgarijiri* exhibition. Firstly, we see the pride in Aboriginal people being able to create such an exhibition. Secondly, the importance of sharing stories, as expressed through artworks was greatly valued. The learning opportunities provided by *Ilgarijiri* were noted, and the sense of being a part of the initiative is strong. This is of course re-enforced by the very name of *Ilgarijiri- Things belong to the sky*. An important outcome of the *Ilgarijiri* project is the framing and context of the subject, which is directed towards a sense of belonging, and personal relationship with the sky. This theme has considerable potential to be explored in future collaborative projects in this field.

Allison Yearwood, manager of Yamaji Art, invited the Mullewa artists to provide a video message for a “welcome” for the *Ilgarijiri* Washington DC tour. Mullewa artist Christine Collard also took the opportunity to provide a welcome to exhibition visitors, for the Washington DC tour:

Christine Collard: *For the America exhibition, in America, I'm very pleased to know that we are going international again and, America, you know, you hear a lot about America. Didn't think your heart would ever make it there, is another thing. I'm just so happy and thankful to Auntie Charmaine. She's our big inspiration. She just inspired us all and the support she has given us all. Alison who's actually taking the artwork over there. Unfortunately none of us are going to go on the plane, because we have a fear of flying, but we are just so happy and overwhelmed that it's (the exhibition) going over there.*

After some discussion between the Mullewa artists, Christine Collard expressed the following message, which was directed towards the Indigenous people of the United States of America:

Christine Collard: *We'd just like to say, hello from all the Yamaji (means Aboriginal), Naru (means Women) which are us, the women of Mullewa. We'd like to welcome and acknowledge all the past and present elders that are in Alison's country (USA). We hope you all enjoy the exhibition that we are now going to produce to you. Thankyou.*

#### **4.3.5.4 Ilgarijiri: Significance, legacy and aspirations**

How should we view Aboriginal knowledge and stories about the night sky? Should such knowledge be valued and be regarded as important? Is it useful to contemporary people today, for both Aboriginal and non-Aboriginal people? Or should such knowledge be regarded as a relic, superseded and of no further practical relevance? It is with this background that I enquired about the importance of “old” knowledge, to learn about how this issue is viewed by Aboriginal *Ilgarijiri* artists. Kevin Merritt provided a profound response to my question about the value of such knowledge:

Kevin Merritt: *I think it's got a lot to offer, in the way that, you know, the older people had to exist, somehow and to be able to... to exist, just exist. To show the younger people that,*

*you know, everything was never like this before and that there were...other...the world has been changing and their world will be changing soon too. It doesn't always remain the same, so really a learning curve for them because growing up I'd never thought I'd see the things that I see now in the world today, and you know, if my Grandparents ever came back, they'd never believe what's in the world today and I think this project will show the young people that what the past was because the past is very important to everybody, for our ancestors and for those who are going to come after us. I think it is very important. No matter whether you are Aboriginal or non-Aboriginal.*

Here, Kevin Merritt addresses the key issue of the importance and value of cultural knowledge. First he recognises that such knowledge has helped previous generations to exist. As current generations are based on the success of prior generations, this comment naturally gives rise to an appreciation of such knowledge. Secondly he notes the reality and implications of a changing world. And finally, he notes that these issues are important for all people, irrespective of their background. Merritt's view frames the importance of cultural knowledge in a way that both acknowledges the value of such knowledge to prior generations, and at the same time, showing the relevance to current generations. Kevin Merritt's views have wide ramifications, and this was not expected during the interview process. This comment demonstrates that investigations into Aboriginal sky knowledge can lead to far reaching implications which are directly relevant for today's (and future) generations.

The *Ilgarijiri* collaboration also generated a range of positive experiences, including intergenerational sharing of knowledge.

*Charmaine Green: ...there's the encouragement of artists, getting artists to come out of their shell and tell stories, it could be stories connected to the sky or could be stories that are actually in the sky or leaping from the sky onto the ground so that the activities we do because of something that happens in the sky. The artists just become really more confident, in saying yeh..., well I do have a story to tell, and I want to tell it via painting...so there is those benefits so really... ...You know, building our culture and getting the stories out there, and also that intergenerational type flow, there as well with maybe Barbara and Margaret including their grandchildren in looking at the sky, talking about the sky and then painting and the grandchildren and the children painting with them, so that's been really fantastic.*

Many artists and Elders expressed views about how their aspirations for the future regarding the sharing of Aboriginal sky knowledge:

*Kevin Merritt: What I'd like to see is an incorporation of our painting with photographs of the night sky in an exhibition, side by side so that when people look at it there shouldn't be any differences. Only the form that we put it in... you put it in. As a photography thing, they*

*are really brilliant and then bring it down to the earth, to the Aboriginal people's perspective as to how we look at the sky, in paintings.*

Charmaine Green: *I think we have only just scraped the surface, like, you see that iceberg and all the rest of it underwater. I think we have only just scraped the surface of it, we've been able to get five exhibitions from the project branching off into different things but we still want people to paint and maybe leap from the sky to the ground, or to the land, and talk more about the stories, practices and the beliefs that come with linking the two together and people are starting to see now and starting to think about that a lot more and starting to say, yeh, we've got a right to tell our story, and yes this is important, people do want to see our cultural perspective on stuff. So there is still a lot to go and I think we could move the project further into the future and that's what we are hoping to do from Yamaji Art, anyway... yeh.*

Margaret Whitehurst: *...That's a great thing you're doing, because it's going to get out to everybody, you know, everybody is going to see this,... and, what is that show, I forget now (Message Stick ABC TV program)....And everybody come and telling us... it's going to get out to everybody, and I hope it goes further, I just hope we can do more, story in the skies, and I just hope it will get back to the young kids, you know, all the young kids growing up now, that there are stories in the sky that they can learn from... A lot of the stories, I didn't even see before in my life. I'm trying to teach my grand kids that, because it's a good thing for ...I reckon its good thing for the non-Indigenous too because a lot of them didn't know a lot of things about the sky too but now they do after seeing what they saw, what we've been doing so I just hope we keep doing it, I just hope we keep doing the stories about the sky.*

These comments demonstrate a strong desire for future initiatives in this field, and for future collaborations. Linking and presenting Aboriginal stories with astronomical photography is highlighted. We also see a strong sense in the right of Aboriginal people to tell their stories has emerged, and is being asserted. This will undoubtedly provide a motivation and driving force for future initiatives. The value for both Aboriginal and non-Aboriginal people is also recognised, so future initiatives almost certainly will be inclusive in their approach. Margaret Whitehurst's comments indicate the values of stories, the experience of the Boolardy site visit, reactions to the diversity of space and the sharing of knowledge with her family members.

Margaret Whitehurst: *I think I've got a lot of stories for my family now because when I got home from Boolardy I told them all about it and they don't believe it that those things are up there, you know. They don't believe those things are in the sky and yeh, it was a great time, I really enjoyed it, I can tell my grand kids. See, I took my little granddaughter out and it was on "Message Stick" too. Took her showing pointing to the sky, and telling her where it was. She saw it and she couldn't believe it that there is an emu in the sky, she saw the whole*

*pattern of it and we done it just out of town here, yeh, it was very good. It's something that I can tell my grandkids and children about it now. I hope that they can take over what I've been doing, I hope they can do that...*

In summary, the importance of the *Ilgarijiri* art exhibition is highlighted in the IYA 2009 final report (IAU 2010, 464):

*Art exhibit bridges cultures in Australia. Throughout IYA 2009 Australia has witnessed an extraordinary celebration of astronomy as inspiration for art and cultural exchange. The latest success story is a project named Ilgarijiri, which means "things belonging to the sky" in the Wajarri Yamatji language of the Murchison region in Western Australia. Astronomy has a strong presence in the area, which is home to the Murchison Radio-astronomy Observatory and a potential location for the future Square Kilometre Array. Astronomy also plays a significant role in the stories and traditions of the indigenous people of Australia. To connect these two perspectives, in March 2009 a group of indigenous artists from the Yamaji Arts collaboration based in Geraldton spent several days and nights with radio astronomers from Curtin University. They travelled through the region, sharing scientific and traditional stories about the Universe, rediscovering nature and observing the sky.*

#### **4.3.6 Acknowledging Wajarri culture by the naming of radio antennas**

A prominent example of the recognition of Aboriginal sky knowledge, associated with ASKAP and the Murchison radio astronomy developments, is the official naming of radio telescope antennas based on Wajarri names. The Wajarri name of the Murchison Widefield Array "Gulgarnu" (pers. com. Prof Steven Tingay, 2013), and the Wajarri naming of the CSIRO ASKAP antennas have been received by local Aboriginal people in a very positive manner. This is a practical example of the respect and acknowledgement of Aboriginal culture afforded by radio astronomy proponents including the CSIRO and ICRAR (ANZSKA 2011).

*Robin Boddington: ...they did the acknowledgement. CSIRO acknowledges us in every way, but to hear the president of the Shire, acknowledge the Wajarri people, that's a start, so it grows you know. You got to do these things to help the relationship.*

*...So he was an elder from Boolardy area, so Ike is one of the last elders left, so there was a road named in his honour.*

*The first six (antennas) were named, Wajarri names, and now discovering more names, now. So they'll name them as well. There's Wilara the Moon in Wajarri language, Bundara is the Stars. Biyarli is the Pink and Grey cockatoo and that's also one of our oldest Yamatji names as well, so two parts to that one, (elder and a bird) and Jirdilunga, Milky Way, so that's the Milky Way name and there's one called Balayi, Balayi Lookout, looking west, so they called*

*it lookout Balayi. Diggiedumble was a hill top near table-top hill, so that's name of Diggiedumble, table tops where the rock fell down, so that's the name of one of the first antenna's was put there, so.*

The naming ceremony for the first six ASKAP antennas at the Murchison Radio-astronomy Observatory (CSIRO, 2011) was held on 2 June 2011, and subsequently, all 36 antennas were formally given Wajarri names. The CSIRO supplied the following (Table 20) unpublished listing of antenna names (with phonetic pronunciations in brackets).

Table 20. ASKAP Antenna Names.

<b>Antenna Number</b>	<b>Wajarri name (phonetic pronunciation)</b>	<b>Notes</b>
1	Biyarli (bi-yar-li)*	Galah (bird)
2	Birliya (bir-li-ya)	Flat leaf Mineritchie tree
3	Bundara (bun-da-ra)*	Stars
4	Bimba (bim-ba)	Edible gum
5	Gagurla (gu-gur-la)	Bush pear
6	Wilara (wi-la-ra)*	Moon
7	Irra bardi (irr-a - barn-di)	Good mouth and lips
8	Jirdilungu (jir-di-lu-ngu)*	The Milky Way
9	Balayi (ba-la-yi)*	Lookout
10	Bardi (Bar-di)	Wajarri name of Bertie Mitchell (Wajarri Elder and Lore Man): also means witchetty grub
11	Manggawarla (mang-ga-war-la)	Hat. (This represents both races of people on the Murchison: it is the stockman's hat that both the Wajarri traditional owners and the Station owners wear).
12	Yalibirri (ya-li-bi-di)	Emu
13	Jabi (ja-bi)	Small lizard
14	Gagu (ga-gu)	Crow
15	Birri-birri (bi-di - bi-di)	Butterfly
16	Jindi-Jindi (jin-di - jin-di)	Willy Wagtail (bird)
17	Marlu (mar-lu)	Kangaroo
18	Ilgarijirri (il-ga-ri-ji-ri)	Things belonging to the sky
19	Biji-biji (bi-ji - bi-ji)	Caterpillar
20	Wana (wa-na)	Female digging stick
21	Minda (min-da)	Shade or shadow
22	Nyingari (nyi-nga-ri)	Small messenger bird
23	Nyambi (nyam-bi)	Traditional Wajarri dance with knee shaking



Antenna Number	Wajarri name (phonetic pronunciation)	Notes
24	Janimaarnu (ja-ni-marr-nu)	Chinaman (in recognition of CET54's construction of the ASKAP antennas)
25	Magamarra (ma-gu-ma-rra)	Ned Ryan, Wajarri Elder and Lore Man
26	Yamatji nyarlu (ya-ma-ji - nyar-lu)	Yamatji females
27	Yamaljingga (Ya-mal-jing-gu)	Ross Boddington (Wajarri Elder and Songman)
28	Ngurlubarndi (ngoo-loo-barn-di)*	The Wajarri name of Fred Simpson, father of Wajarri Elder Ike Simpson (Antenna location: Old top shed road)
29	Diggiedumble (dig-gee-dum-bull)*	Table top hill
30	Nyarluwarri (nyar-lu-war-i)	The Seven Sister (Pleiades)
31	Mungal (mu-ngal)	Morning
32	Woodarudda (oodda-yarnna)	A hill on Yallalong Country
33	Budara (bu-da-ra)	A hill on Wooleen Station (English names, Mt Welcome)
34	Jinna Wirri (ji-na - wirr-i)	Joe Dann (Wajarri Elder). He was given this name by his Grandfather because he had a black spot on the sole of his foot.
35	Ngubanu (ngu-ba-nu)	Dingo
36	Birli (bir-li)	Lightning

\* indicates the first six antennas to be named.

#### 4.3.7 Conclusions: Night Sky Heritage of the Murchison Region

The *Ilgarijiri- Things Belonging to the Sky* project has provided a cross-cultural experience in which scientific knowledge and Aboriginal cultural knowledge has been shared, interaction between people encouraged, and creative works of art developed and exhibited, on an international scale. The collaboration has proven to be highly successful. This research has documented via video interviews, the experiences of the participants. Aboriginal Elders and artists have indicated the ways in which the project has been valued by them. Insights into the processes used for the project have been gleaned via the video interviews. The most common Aboriginal sky knowledge stories expressed through the art project included the emu sky pattern, and the Seven Sisters. The Emu sky pattern has particular relevance to the science of radio astronomy. A major characteristic of radio astronomy is its ability to see through interstellar dust, which at optical wavelengths, blocks light. However, in radio frequencies, radio waves are able to pass through these dust clouds, so that more distant, deep space objects can successfully be studied. The Emu in the sky, and its significance to Aboriginal cultures in general in Australia, also has considerable significance for radio astronomers, in that the radio astronomy observations literally see through these dust clouds. Whilst the reasons may differ, in both cases for Australian Aboriginal people and for radio astronomers, the dark dust lanes of the Milky Way are significant.

Participants reported that the project encouraged significant informal learning amongst participants, and that the project provided a way of “taking back” or reclaiming the right of Aboriginal people to tell and share their stories. It is clear that participants experienced the project in a very positive way, in part because it encouraged the recognition and celebration of Aboriginal knowledge, under their own management and direction, and provided a way to share such knowledge in an engaging way (via the artworks) with the broader public. Mullewa based artists reported that it was the *Ilgarijiri* project that they felt was most helpful for establishing their international art reputation, and this was seen to be a very valuable thing. Several participants expressed the strong desire to encourage the passing on and communication of stories to the general public, and their own younger generations.

In relation to the SKA initiative, Aboriginal collaboration with the project has been essential and the Indigenous Land Use Agreement contributed towards the success of Australia's bid for the SKA project. The Wajarri naming of the radio telescope antennas are also a prominent example of the respect shown towards the Wajarri Aboriginal community.

## **4.4 Night sky heritage from South West Western Australia**

### **4.4.1 Introduction**

In the South West of Western Australia, several places provide insights into Aboriginal astronomical cultural knowledge relating to the night sky. Examples include Joondalup Lake, with cultural stories relating to the Milky Way, Wave Rock (located some 300 kilometres east of Perth), and the Perth city suburb of “Mirrabooka” which is named after an Aboriginal name for the Southern Cross. Recent representations of Aboriginal sky knowledge have been developed by Artist and Elder Toogarr Morrison. This section investigates two main artworks which present Morrison's view and knowledge of the night sky via commissioned works by the Cosmology Gallery and Horizon Planetarium, Western Australia. Also discussed is the work of Elder Dr Noel Nannup, who has shared his knowledge of the night sky via several public discussions and presentations.

### **4.4.2 Literature review**

There are various accounts of the “Spirit Woman in the sky” or Milky Way. For example, one account of the name of Lake Joondalup refers to the lake being “the place of white glistening” (City of Wanneroo, 1998), with stories relating this freshwater lake to the “Spirit Woman in the sky”. Also referred to in the Claisebrook Bibbulmun Dreamtime story are places such as Wave Rock (located to the east of Hyden), near the eastern extremity of Noongar country, and “Bates Cave” located to the north of Wave Rock. Bates Cave is also known as Mulka's Cave. The Wave Rock landform features prominently in Aboriginal stories still recounted today, relating to the night sky.

Elder Noel Nannup produced an oral recording (CD), as a collaboration with the Swan Catchment Council, the regional natural resource management organisation. The audio recording presents a

Noongar “story of country” which provides insights into the relationship between Aboriginal people and the land, and also the night sky (Nannup, 2004 & 2006). Nannup's story, “The Carers of Everything” begins:

*This story begins here, in the south west of Western Australia, it begins at a time when the Earth was flat and featureless, there was nothing on it at all, there was almost total darkness. The sky was a thick dark mass that sat on the ground, there was no wind, and it was freezing cold, this time is known to local Aboriginal people as nyetting, the time when it was “freezing cold”.*

The story is a long one. The story contains a wide range of information about Aboriginal culture, but essentially, it explores the question of which beings in the world (including plants, animals and people) have the right and responsibility to care for the earth. The story refers to “spirits” which appear to be an essence of a being, prior to their manifestation in a physical form. The story highlights the importance placed on meteors, and a spiritual belief which relates meteors to an essence of a being prior to conception. A central character in the story is “The Spirit Woman” who is linked to the Milky Way. The spirit woman acquires the “spirit children” in her hair (Milky Way):

*... the spirit children rained down from her hair turning into stone as they hit the ground.*

*...She made this beautiful orange glowing fire, and she called it Munda and then she started to gather the children around her fire, once she had gathered the right amount she said to witch, now I am going to send them back to earth. They have won the right to be the carers of everything. I know that we have all been outside on the dark night and seen a shooting star streak across the sky, I have heard some people say make a wish, when we see this we always say by-ee coolunger nyina, which means little spirit children returning to earth. When they reach earth they are nothing more than a little stone, some are a bit bigger than others, and some don't make it at all. The spirit children return to earth all the time, with a known pattern of large showers about every thirty three years, that is when we believe that our spiritual energy is at its strongest. When the spirit children reached earth they all transformed into spirit adults, and there were seven clans of people all the same age, as instructed they all followed the great trails out to kutta keitch which is the name of the rock where the spirit woman was lifted up into the sky...*

This story provides an indication that meteors, and meteorites, are an important aspect of Aboriginal culture in the South West of Western Australia. The story concludes:

*They dreamed their language, the language is in the land the people are taught the language which is always returned to the land through ceremony when they die. They also dreamed*

*that there would be six seasons, and that during each season there would be six basic diets. The people were now ready to perform sole purpose of being, to care for everything.*

The Carers of Everything story was subsequently published by Nannup (2006). It is claimed that the story had never been documented before (Nannup, 2004). However, this has been disputed by Elder Toogarr Morrison, who claims to have previously documented aspects of the story.

Contemporary astronomical knowledge by Aboriginal people has also been expressed through artworks. Two examples include the commissioned artworks of Toogarr Morrison. The first project took place in 2008 at the Cosmology Gallery (Gravity Discovery Centre Foundation, 2008), and the second took place in 2009 at Horizon Planetarium, Scitech, Western Australia. The Cosmology Gallery project was an ambitious collaborative project that sought artistic interpretations of the night sky, the universe, and its origin, from the perspective of major cultural groups in Western Australia (including Aboriginal, Christian, Buddhist, Islamic, Hindu and scientific perspectives). Both sites commissioned public artworks, expressing Toogarr's cultural knowledge of the night sky. What developed, in both instances, was a re-construction, personal reinterpretation, and revival of cultural knowledge about the stars, star patterns and astronomical phenomena, expressed through the paintings.

#### **4.4.3 Bibbullmun Dreaming story**

Near the banks of the Swan River, and situated within 2 kilometres of the Central Business District of Perth, is the inner city urban renewal project of Claisebrook. Within Claisebrook are several urban art projects and one such project combines ancient Aboriginal sky knowledge of the South West of Western Australia with a contemporary solar alignment monument (Figure 54). The structure is constructed to indicate the major sunrise directions, including the equinox and summer and winter solstice. From the same vantage point, a mosaic representation (Figure 55) of a Bibbullmun dreamtime story is presented. The story itself is provided in a plaque (Figure 56) on the southern wall, and a mosaic representation of the story is inlaid into the pavement.



Figure 54. The Claisebrook monument.  
(Photo: John Goldsmith)



Figure 55. Mosaic Bibbullmun Dreamtime story.  
(Photo: John Goldsmith)

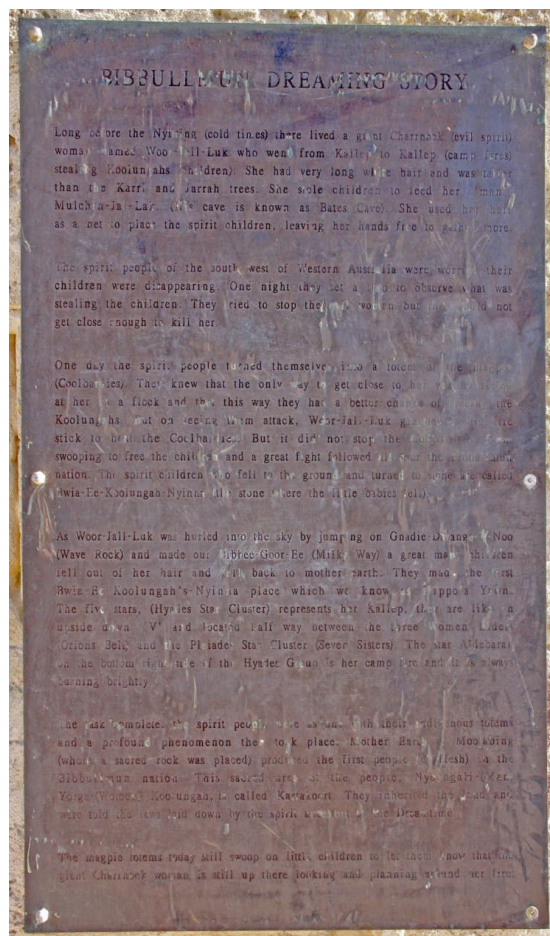


Figure 56. The Bibbullmun Dreamtime story plaque.  
(Photo: John Goldsmith)

The colour and the markings of the plaque make the text not easy to read, and so for readability, the content of the plaque is quoted below:

*Long before the Nyitting, (cold times) there lived a giant Charnock (evil spirit) woman named Woor-Jall-Luk who went from Kallep to Kallep (camp fires) stealing Koolungahs (children). She had very long white hair and was taller than the Karri and Jarrah trees. She stole children to feed her man, Mulchin-Jal-Lak. (His cave is known as Bates Cave). She used her hair as a net to place the spirit children, leaving her hands free to gather more.*

*The spirit people of the south west of Western Australia were worried their children were disappearing. One night they set a trap to observe what was stealing the children. They tried to stop the evil woman, but they could not get close enough to kill her.*

*One day the spirit people turned themselves into a totem of the magpie (Coolbardies). They knew that the only way to get close to her was by flying at her in a flock and that this way they had a better chance of freeing the Koolungahs. But on seeing them attack, Woor-Jall-Luk grabbed a big fire stick to beat the Coolbardies. But it did not stop the Coolbardies from swooping to free the children and a great fight followed all over the Bibbulmun nation. The spirit children who fell to the ground and turned to stone are called Bwia-Ee-Koolungah-Nyinna (the stone where the little babies fell).*

*As Woor-Jall-Luk was hurled into the sky by jumping on Gnadie-Darange-E-Noo (Wave Rock) and made our Bibbee-Goor-Ee (Milky Way), a great many children fell out of her hair and fell back to mother earth. They made the first Bwia-Ee-Koolungah's -Nyinna place which we know as Hippo's Yawn. The five stars, (Hyades Star Cluster) represents her Kallep, they are like an upside down 'V' and located half way between the three Women Elders (Orion's Belt) and the Pleiades Star Cluster (Seven Sisters). The star Aldebaran on the bottom right side of the Hyades Group is her camp fire and it is always burning brightly.*

*The task complete, the spirit people were as one with their indigenous totems and a profound phenomenon then took place. Mother Earth at Moojabing (where a sacred rock was placed) produced the first people (of flesh) in the Bibbulmun nation. This sacred area of the people, Nyoongah - (Man) Yorga - (Women) Koolungah, is called Kartakoort. They inherited the land and were told the laws laid down by the spirit ancestors of the Dreamtime.*

*The magpie totems today still swoop on little children to let them know that the giant Charnock woman is still up there looking and planning around her fire.*

#### **4.4.4 Cultural astronomy tour by Dr Noel Nannup**

In November 2009, I conducted some experimental filming of Dr Noel Nannup at Gingin Observatory, during his public introduction to Aboriginal astronomy. The filming was conducted with a Sony High Definition video camera, using infra-red night vision. This enabled me to film in almost complete darkness, without the need of intrusive lighting. This approach also enabled the night-vision of participants to be preserved. An example scene from the night vision video is shown in Figure 57. The green hue is due to the use of the night-vision video camera mode. Infra-red based night vision filming is a useful way of recording interviews in low light. This approach has considerable potential to be used when video interview recordings are desired, in near-complete darkness or extreme low-light situations, without the need of intrusive lighting. A drawback of infrared vision filming is that it generally does not record star light particularly well. An alternative option is to use image intensifier based video cameras, to enable the recording of both starlight and interviews at the same time. These methods have the potential to be used more extensively in recording cultural astronomical knowledge in Australia.



Figure 57. Night vision view of Gingin Observatory.  
(Image: John Goldsmith)

Dr Nannup has gone on to present several Aboriginal astronomy talks to the general public, in a variety of settings including universities (UWA extension course lectures, and at Edith Cowan University), Astrofest outdoor star tours (2011) and Gingin Observatory.

#### **4.4.5 "Star Dreaming" exhibition at Japingka Gallery**

In section 2.3.1, I examined the role of Western Australian Aboriginal art centres and galleries, and conducted a data mining investigation, to identify Aboriginal art with astronomical themes. Japingka Gallery, located in Fremantle, returned the second highest number of Aboriginal astronomical art. In section 2.3.2.4, the role of Japingka Gallery in featuring two Aboriginal art exhibitions with

astronomical themes was introduced. In this section, I present the results of interviews with Japingka Gallery, to examine their role in showcasing Aboriginal astronomical knowledge, from a commercial art gallery perspective. Japingka Gallery is operated by Directors Ian Plunkett and David Wroth. The beginnings of Japingka is explained by David Wroth (full interview transcripts in Appendix 13):

*So consequently with partners we set up a company called Desert Designs and that focussed on working with Aboriginal artists and creating textiles and a whole lot of everyday products that had Aboriginal designs on and as part of that we would market limited edition prints and paintings, and one thing led to another, and now we manage a gallery that is entirely focussed on Aboriginal Art.*

*This gallery really started probably with a focus on Jimmy Pike's artwork and Kimberley artists. We already had a very close association with Pat and Jimmy through licensing Jimmy Pike's designs into Desert Design, as well as running exhibitions and fine art prints and etchings and silk screen prints...*

The origin of Japingka is closely associated with the Kimberley region, via Aboriginal artist Jimmy Pike, and his connection to Wolfe Creek Crater. Jimmy Pike was born in the Great Sandy Desert (around 1940), and emerged as an Aboriginal artist in the early 1980's. His artworks are represented in the Art Gallery of Western Australia collection. O'Ferrall (c. 1995) provides a catalogue of Jimmy Pike's artwork and his work is also featured in "Jilji, Life in the Great Sandy Desert" (1990), co-authored with his wife, Pat Lowe. The latter work combines Jimmy Pike's artwork and photographs as a visual narrative exploring life in the desert. Another notable publication is "Yinti desert child", by Pat Lowe, with illustrations by Jimmy Pike, (1992). This book features the story of "A falling star" which essentially was a story to warn people to not walk around in the desert at night. David Wroth notes:

*...yes, there's always been a very close tie with Jimmy's group, particularly the Walmajarri people of the Kimberley and so in the last decade of his life Jimmy lived in Broome, and Pat and he were an eye onto the cultural and lifestyle realities of Aboriginal people in that part of the world.*

Having visited Wolfe Creek Crater himself, David Wroth describes his experience:

*...fantastic, and ...Wolfe Creek Crater, is, for somebody who comes outside the world of astronomy, to visit that site is very sensational. I remember I went there in the (19)70's, and was blown away just by the monumental scale of it and an appreciation of the kind of forces that are at work and some of those issues, but it is a great site and Jimmy Pike painted some works early on which were based on the subject of Wolfe Creek Crater and therefore it was*



*of intrinsic interest and he used to talk about the star story that related to this part of the world, yes.*

In relation to Japingka Gallery, Aboriginal artworks with astronomical themes began to emerge, as David Wroth comments:

*I think we first saw the star stories, from areas Walpirii artist from around Yuendumu, and maybe going back a decade or so, but it's been recently that stories from Yuendumu have been strongly represented particularly by Alma Nungarrayi Granites. It captured our imagination because, yes, most of the paintings we represent are terrestrial maps, and what Aboriginal people bring in particular to that is a kind of closely observed map of country, that gives them the sort of information that's important to them. Whether it is a kind of creational story or whether it's got to do with everyday issues of hunting and food gathering and so on.*

Notable is the fairly recent emergence of this form of art, as David Wroth refers to his first awareness of the Yuendumu artwork being from the 1990's. He then goes on to comment on the representation of terrestrial space, and the sense of scale, in Aboriginal art:

*So these maps can represent either small areas of space (so they could be a few square metres), or they could represent vast tracts of land. So the scale issue was always a fascinating issue, when Aboriginal people were painting these terrestrial maps.*

In February 2010, Japingka ran its first exhibition dedicated to astronomically themed Aboriginal art "Yanjiripirri Jukurrpa - Star Dreaming" and this was followed in July 2011 by Alma Nungarrayi Granites- "The Night Sky". Ian Plunkett introduces Northern Territory Aboriginal artist Alma Granites:

*Alma is a daughter of two very famous artists from Yuendumu which is to the west of Alice Springs. Her parents, Paddy and Bessie Simms were founding artist of the Warlukurlangu Arts Centre there, which is an Indigenous owned and run arts centre, and the second Indigenous art centre to be formed after Papunya Tula. So it has a very pivotal role in Indigenous art, and has been one of the first to be out there promoting art to a wider audience.*

*(Alma) hasn't had any formal training whatsoever, but she's had the traditional training where her parent and Aunties have brought her up, told her the stories. She's fully initiated and this is one of her dreaming stories what we have here. So she's been taught the traditional way to paint, and as the custodian of this dreaming story, she's entitled to interpret it as she sees fit, and so she's taken this particular dreaming story to another level.*

The exhibitions which feature her star themed artworks, “Yanjirpirri Jukurrpa - Star Dreaming”, and “The Night Sky” feature very prominently the story of the seven sisters. Ian Plunkett provides a brief introduction to the story:

*It's basically the story of... in one version anyway, of unrequited passionate love, where this Japiljari man, depending upon where you hear the story, it's either one of the stars of Orion, or it's Venus has fallen in love, with one of these seven sisters, but it's a forbidden love because he is of the wrong skin group, so it's definitely forbidden. But he pursues her anyway. So her sisters take her, and they flee to get away from this man, and he chases them right across from the east coast of Australia right over here to Perth in Western Australia, where it ends right on the banks of the Swan River and the Indian Ocean, where they can go no further, and the Japiljari man is coming right up to them, where the powerful local spirit takes pity on the sisters and turns them into stars in the heavens, but the Japiljari Man is a powerful medicine man himself and coming to the Indian ocean, he realises what has happened. He turns himself into a star and pursues them across the heavens, and... he is forever pursuing them, but never catching them and it really just documents what you can see in the sky as they move across the heavens every night, its replayed, the same story.*

Ian Plunkett goes on to comment about the special characteristics of Aboriginal art featuring the night sky:

*It's a very unusual perspective. Most Indigenous artists paint from an aerial perspective looking down on the land. Whereas, Alma's one of the few, probably one of three or four, who paint looking up into the heavens. So, for a start that's quite unusual, but in some ways you wonder why it is unusual, because if you have ever been out to the desert, the one thing at night, that really strikes you is the clear skies and the stunning views of the Milky Way and all the different star clusters. So that is one of the first things that really hits you. But the other unusual aspect of it is it's one of only two dreaming stories that I know of that is national, goes right across Australia... ..but, along with the rainbow serpent, it's the only one I know that is national dreaming story, that's recognised right across Australia by all the different groups. So that's really unique. But it's also a very very ancient story, which is telling.*

The two key elements noted here are: (1) the relatively few artists who represent the night sky in artworks; and (2) the very extensive range across Australia, in which the Seven Sisters story is recognised. The cultural significance of the Seven Sisters story is then expanded upon:

*For a culture that had no written language, one of the main ways of passing on knowledge was through art, and oral tradition, and sometimes dance as well, this particular seven sisters dreaming story has a very long tradition and if it's done full ceremony it goes on for several days. There are different dances that tell the whole story and re-enactments. But*

*what Alma has done here is to put it onto canvas, and to distil the essence of the story, using her innate sense of colour, to tell the story in her own way.*

Japingka Gallery sees a developing future for Alma Granites:

*...we've been lobbying the Warlukurlangu Arts Centre for several years now, to get a solo show, because we think she's is a major artist, with some of her own story to tell, and in a very distinctive way, and that's been borne out in the sales of this exhibition. It's a sell-out exhibition and this is in a very flat art market, in fact retail market generally. So for her to have a sell out show in this environment I think not only speaks to her talent but to the universality of the subject matter, and I think people right across Australia are fascinated with astronomy and the stars and I think it goes to something within our souls, our very being, where we have always looked up at the heavens, and wondered what are they, and where are they going and what does it all mean if you like, and Indigenous people are no different. They've documented these and they've made sense of them, by bringing stories into them, trying to explain the existence of them.*

The commercial success of the exhibitions held to date are an indicator of the popularity of astronomically themed Aboriginal art. Ian Plunkett concludes:

*...and yet, this particular subject matter of... this exhibition is called the night sky, even though it just focuses on one or two constellations. It appeals so widely, we've had sales to a Museum in Switzerland, major arts collectors around the world, have clamoured to be buying these paintings. It's because, but I can't speak, but certainly for me, it's about the wonder and the mystery of the universe, the complexity and the fact that it is inherently beautiful to look at and what Alma's done here is brought this down to earth, if you like, for all of us to see and enjoy, even those people who don't have dark skies, and they just look up and see it, here it is on, brought down to earth, for everyone to, you can own a piece of the heavens really, you can buy one of these paintings, hang it on your wall, and enjoy it, marvel and wonder at the complexity and exactly what's behind it. I think that's what it is, it speaks, it's hit a cord with a very wide range of people, people who probably have very different tastes in art, and come from very different cultures. It still speaks to them, and I think that's the thing about astronomy, is that everyone can enjoy it, everyone just has to look up and see it, and since time immemorial, we've wondered.*

#### **4.4.6 Case study, Toogarr Morrison**

The development of the Cosmology Gallery, Gravity Discovery Centre, was based on a collaboration between Christian, Buddhist, Islamic, Hindu, Aboriginal and scientific groups in Western Australia. The commissioning of artworks was based on a process which sought the development of artistic interpretations about the universe and its origin, from a variety of cultural perspectives. The

Cosmology Gallery development project, its aims, processes, and results, is described by Goldsmith (2011b). Elder and artist Toogarr Morrison (Figure 58) was commissioned to develop an artwork expressing his Aboriginal knowledge about the night sky.



Figure 58. Toogarr Morrison at Horizon Planetarium.  
Photo: John Goldsmith

The centre piece of Morrison's Cosmology Gallery artwork (Figure 59) is a rich representation of the night sky. It is a representation of a wide part of the visible night sky that also modern astronomical imagery, such as spiral galaxies, and various other deep space objects (e.g. the Horsehead Nebula). Features of the painting include Woor-jall-luk (the spirit woman with the Milky Way for hair), Nyettinup Waitch and Boorinup (the emu and the ancestral grandfather spirit), Mendin Moe Koolungs (Seven Sisters and the spirit children), Booyerl-Neeb-Gindies (Spiritual elders, associated with the Southern Cross, False Cross), Koort-Wynarn Marding-Ku (the Large and Small Magellanic Clouds) and various star patterns including the kangaroo, snake, and the hunter (Orion).



Figure 59. Cosmology Gallery artwork by Toogarr Morrison.

Photo: John Goldsmith

After the Cosmology Gallery commission, Morrison was commissioned by Scitech (Horizon Planetarium), to develop a similar painting about the night sky (Figure 60). This commission expands upon the Cosmology Gallery artwork, by presenting the entire view of the Milky Way as an extreme wide angle view of the night sky. It is perhaps the first Aboriginal painting of the night sky in Western Australia which has attempted to represent the entire visible cosmos.



Figure 60. Horizon Planetarium artwork by Toogarr Morrison.

Photo: John Goldsmith

In an interview conducted at Horizon Planetarium, Morrison describes the basis of the painting, and the meaning and knowledge he has imbued the painting with. He describes the creative, imaginative and interpretive processes, through which the painting was developed. The process included research into historical records, interpretation and visits “on country”, out of which he has created a visual synthesis of his knowledge and storytelling about the night sky. Much of the story is based on respect for our planet, which he refers to as “our mother”:

*...the painting just looks at what you see in the night sky through different phases, and that of how our mother is turning and all that.*

Morrison recounted the way in which he developed his understanding of the “cosmology story”:

*I was the first person, when Percent for Art came out, that's Public Art, I was the first Aboriginal to get a public art commission. I did it down in Narrogin, down there, Narrogin, I written my first, in the project book, I wrote my first trial, I suppose you could say, of this cosmology story that were are talking about. But back in those days, I didn't know the names, because I was still researching, and when you are researching and you don't go to the library and get a white persons book, that's already tells you, and then you talk from a white persons perspective, so I was going out in the bush, and just hopefully doing the right thing, by picking up words with my imagination, of, saying to myself, this is what my old people are telling me. Because they're there. Because in our culture, in our religion, we*

*don't go to heaven or hell. We just stay here on our ground. We just come up and have a yarn with people when they want us too.*

The creative process used by Toogarr Morrison contrasts with that used by other Aboriginal artists, such as the group based work of the Yamaji Art Centre artist detailed in section 4.3, and those of Elder Stan Brumby (Halls Creek, East Kimberley), who utilised subconscious, dream states as a source of cultural knowledge relating to Wolfe Creek Crater (as detailed in section 4.2.7.9). Toogarr Morrison's approach clearly demonstrates a very active process of trying to understand and make sense of a variety of sources of information. This developed into a synthesis of Morrison's knowledge, via the Cosmology Gallery painting. I asked Toogarr to describe the key parts of the painting, and he replied enigmatically:

*Well maybe the key parts aren't painted because if I tell that story, like ah...*

and he then proceeded to describe the story of the "little spirit babies", of which there are many similarities with Nannup's account (Nannup 2004, 2006):

*... we got a word that's called Beway Coolongar, that's means that's a rock where little spirit babies sits, and a Yorgah, a female, before she becomes a mother, a Nanjun, she will get pregnant by the spirit, before conception with the man takes place, so she's already pregnant from that rock...*

Morrison then went on to describe his view of a link between morality and "spirit children", which we have previously seen are regarded as meteors:

*...but now in the south west here, its morally unstable. So that means it's got to go from there and come back down here to earth again. So that means that those little children who have jumped up there, have to come back and the rocks have to form again on the land. See, it may have formed before and that's why the cloud of rocks around the earthly planets, and the Oort cloud is way out there, so maybe it's a process which duplicates itself, over and over and over, so because they're out there waiting to come.*

*So what's our time here for? So that puts a (Philosophical ?) statement then of who you are as a person here. And as a person, the Aboriginal people from the South West always believed and I think elsewhere, that they weren't allowed to touch their mother (Earth), that means they weren't allowed to dig up no precious stones, like gold, diamonds, or anything else, because they knew that they were not born from the mother, but given to her from out other side of Gorbinda, that may have brought them here, the Great Grandmother and other people, or stars, or relations through the stars, or whatever, would have thrown them all*

*here, so they to stay here, because they had a different contribution to how the earth, the mother, will react to different situations.*

*So everything has a place and this is what you as a human being had to really stick to within your mother country.*

Toogarr concluded with comments about his view of the central responsibility of people, being to look after the earth:

*But ah, there is still another story that doesn't answer all the questions. And I know that people are trying to, white people, you know, they are trying to find out about how the big bang occurred, you know, but who's going to worry about that, when you know that you have to look after your part of the earth, to make a chance for them other Beway Coolongars, when they come back, to run around and roam around. So your role here isn't to ... but to look after it, for them fellas to come and that's why that walk is still going on, to get 'em back. But now we are using spaceships and that to go up there, so they might come back quicker, who knows...*

Toogarr Morrison's artwork at Horizon Planetarium has subsequently been developed into a special full-dome screening, at the Planetarium. In a collaboration between Morrison and Carley Tillet, the Horizon Planetarium manager, Morrison's artwork has been digitized, and incorporated into a planetarium projection. A special screening was held on 1 July 2010. Morrison has maintained an oral storytelling approach to share this story, and has addressed the live audience, while digitized portions of his painting are projected onto the Planetarium. This approach has been popular, with good attendances at the few events held to date. However, it has been quite limited in terms of the numbers of people who have been able to attend such showings.

#### **4.4.7 Conclusions: Night sky heritage of the South West of Western Australia**

Contemporary examples of Aboriginal sky knowledge, as interpreted and presented by Morrison, shows clear first hand evidence that such works are an attempt to interpret Aboriginal sky knowledge. Firsthand accounts of the research and learning behind Morrison's artworks indicate that the works are an attempt to collate, interpret and present a wide range of Aboriginal stories, and values, through the artwork. Morrison's Horizon Planetarium artwork is particularly notable in that it represents the entire visible cosmos, and may in fact be the first such representation of the whole night sky, by an Aboriginal artist.

Morrison's Aboriginal astronomical themes, expressed through his artwork and storytelling, is a very prominent example of Aboriginal people wanting to share their knowledge and perspectives with non-Aboriginal people. Parts of the night sky (i.e. the Large and Small Magellanic Clouds), are related to Aboriginal "Law". Whilst this is openly referred to and identified in the artworks, the exact nature of



the Aboriginal Law is not presently clear, and is quite possibly considered to be of a restricted nature, at least to some Aboriginal people.

## **4.5 Conclusions**

Chapter 4 has presented the results of investigations into Aboriginal sky knowledge at the three geographic areas for this research: the East Kimberley (Wolfe Creek Crater); Murchison region; and the South West of Western Australia. This chapter presents a wide range of evidence, based on qualitative data collection (mainly via video interviews), transcripts of discussions, observations from site visits, site photography, the collection of drawings by Aboriginal Elders and artists, the presentation of case studies, and various other sources. These data and evidence are presented mainly in relation to hypothesis 4 and 5, and research objective 3. Key conclusions include that certain places and landscapes do have particular astronomical importance within Aboriginal culture (Hypothesis 4), including places such as Wolfe Creek Crater, Wave Rock, Mulka's Cave in addition to contemporary sites such as the Claisebrook Bibbulmun Dreaming Story. The original documented evidence, particularly regarding the heritage of the East Kimberley night sky (Wolfe Creek Crater), shows that significant astronomical knowledge, which has largely been unrecognised, does exist within contemporary Aboriginal society (Hypothesis 5), illustrated by the Jaru name of the “coollungmuru” and the practice of active listening for the effect of large meteors, that “shake the country”. Collaborations have successfully been accomplished with Aboriginal people to document contemporary astronomical knowledge in a culturally appropriate manner (research objective 3), for all investigated areas. This forms the basis of communication initiatives presented in the next Chapter. In conclusion, the documented evidence supports hypothesis 4, and 5 and research objective 3.

## Chapter 5

### Communicating Aboriginal sky knowledge

*“I would like to encourage Indigenous peoples to tell their stories, whether it's through writing or painting, or dance, music or theatre. We can all learn from each other and it helps to build the bigger picture”.*

Professor Sally Morgan,  
Aboriginal Writer and Artist, quoted by Lake (2004, np).

*“Take the responsibility and share parts of your country and our living cultures in a good way with fellow Australians and the rest of the world”.*

Lee 2003, quoted in Reconciliation Place  
(National Capital Authority, n.d, np)

Research from Chapter 5 has been presented in the following conference posters:

Goldsmith, J., Tingay, S., & Hamacher, D. 2011, “Building bridges between cultures, communicating and sharing Australian Indigenous sky knowledge” Poster presented at the ninth “Oxford” International Symposium on Archaeoastronomy, Lima, Peru, January 2011.

Goldsmith, J., & Brocx M. 2012, “A virtual tour exploring Wolfe Creek Meteorite Crater’s geoheritage, cultural and educational values”. Poster presented at the 34th International Geological Congress (IGC): Brisbane, Australia, 5 – 10 August 2012.

## 5.1 Introduction

There are a range of projects which have presented Aboriginal knowledge of the night sky to mass audiences. These projects include Australian based projects, but also projects in other countries, such as the United States of America and South Africa, to mention just two. These projects have used different methods and approaches. In this chapter, I describe and discuss a set of key attributes for successful and effective communication of Aboriginal sky knowledge. These elements can help to guide and inform future initiatives aimed at sharing and communicating Aboriginal sky knowledge with mass audiences. I present this as key attributes, because practical factors can have a very significant bearing on a given project, such as the degree of collaboration and consultation, time, resources, logistics (particularly for remote locations) and associated resourcing in terms of budgets and funding. I present four case studies which explore differing ways in which Aboriginal knowledge is being communicated, two case studies from Australia, and two international case studies. The two Australian case studies feature the Canning Stock Route project and the Gascoyne Astrocineamatography project by Dr Peter Morse, who is a consultant, researcher and content development for digital immersive imaging. The two international case studies feature the Cosmic Africa film production (South African astrophysicist and cultural astronomer Dr Thebe Medupe), and advanced digital imaging by XRez Studio (USA), and its 2008 fulldome production entitled “Crossing Worlds”. The two international case studies have been selected as they illustrate quite different approaches to the communication of sky knowledge. “Cosmic Africa” is strongly based on an inspirational story of Dr Medupe, and his re-discovery of African cultural astronomy. It is in a style of documentary and semi dramatized storytelling. “Crossing Worlds” differs entirely, and relies on a visual story telling approach with no reliance on a script or the spoken work. Instead, it uses an evocative soundtrack to elicit an emotional connection with audiences. The case studies all use, to a greater or lesser extent, digital imaging to support the communication of Aboriginal sky knowledge. I then discuss in detail, the application of digital imaging in the current research, particularly in relation to the Murchison Widefield Array and Kandimalal, Wolfe Creek Crater.

Based on the factors identified for successful collaborations, the insights gained from the Australian and international case studies, and the generation of new digital imaging resources, I then discuss the creation of three new resources, which support the communication of Aboriginal sky knowledge. The projects include a gallery video featuring scientific and Aboriginal perspectives of Wolfe Creek Crater (developed with the support of the De Laeter Science Engagement Scholarship, Gravity Discovery Centre Foundation), the *Ilgarijiri* exhibition video, and an Aboriginal astronomy virtual tour. I describe how the virtual tour has already been used as an educational tool, via video link and remote learning, and I discuss further opportunities and applications in this area. During the course of this research, I have communicated my own research to a wide range of audiences including international, national, state and local audiences, with approximately 40 presentations given in the three year period between 2009 and 2012. Appendix 16 provides a listing of these talks. Chapter 5 concludes with a review of the role of Aboriginal perspectives in Australian education, including a

review of the Australian National Curriculum, in relation to Aboriginal astronomical and sky knowledge.

## **5.2 Success factors: collaborations & communication**

The diverse examples of Aboriginal sky knowledge, as detailed in Chapter 2, have used a wide range of approaches towards the communication and sharing of such knowledge. The outcomes of such approaches have also varied. Some initiatives have been very successful in reaching mass audiences, whilst others have been directed at more specialised audiences, and in some cases, some approaches encountered issues that proved to be problematical. In this section, I distil and present key factors which promote effective collaborations and communication of Aboriginal sky knowledge. These factors can be used to guide and inform future collaborative initiatives. In the subsequent section, I then explore several case studies, in which the approaches used, success factors, and outcomes are examined and discussed.

**Leadership and motivation.** Projects that focus on communicating Aboriginal knowledge in general, (or sky knowledge in particular), should have a strong Aboriginal leadership basis and motivation, and ideally will be driven based on community needs or wishes.

**Consultation and collaboration.** This is an essential feature of all successful projects. This includes providing appropriate opportunities to consult, discuss and collaborate, from the concept stage of a project, through to completion. Participation during the early phase of a project is essential because this is fundamental to genuine collaboration. Projects also need to be mindful of cultural protocols which may apply, (e.g. potentially different consultative approaches for males and females). Effective methods for the approval of content and the return of project results back to communities are important aspects of consultation and collaboration.

**Interdisciplinary skills amongst the project team.** Project teams brought together based on the skill required, including interdisciplinary skills, will have an advantage over those that have a more limited skill set. For example, for interdisciplinary research on cultural astronomy, skills in both cultural and astronomical knowledge are clearly needed. Science based skills, combined with artistic skills, can facilitate innovative, informative and creative exhibitions.

**Project scale.** Projects that involve relatively large numbers of people, tend to produce bigger impact results. For example the *Ilgarijiri* collaboration involved more than 30 Aboriginal Elders, artists, astronomers and scientists, produced a substantial resource of Aboriginal artworks, and this formed the basis of eight Australian and international exhibition tours between 2009 and 2012.

**Utilisation and harnessing of emerging technologies.** Aboriginal knowledge is being applied to an increasing range of communication technologies, including advanced digital imaging, 360° imaging, planetarium productions, virtual tours, and internet based resources.

**Orientation towards education and research.** Projects that combine both research and educational elements in their work can benefit from engaging different funding sources, and also different audiences, thereby maximising impact.

**Multi format productions.** Projects maximise their impact by producing resources in a variety of formats, e.g. exhibitions, accompanying book, film series, website, and research papers. Projects that are able to utilise several production formats are more likely to reach wide audiences.

**Alignment to “big issues”.** Successful projects tend to align with big picture issues which are high profile. Examples include the *Ilgarijiri* collaboration with the Square Kilometre Array radio telescope, the reconciliation monuments of Reconciliation Place, Canberra and the alignment of the “Crossing Worlds” project with the COP15 Global Climate Summit, which is discussed later.

**Logistics and resourcing.** Essential to all successful projects is the sourcing of an adequate funding resource, and appropriate logistics, which can include extensive remote field work over an extended period of time.

## **5.3 Case studies (contemporary examples)**

The following case studies examine Australian and international examples of the communication of Aboriginal (Indigenous) knowledge. The different examples highlight aspects of the success factors described above, and they provide insight into how such initiatives have been developed. This provides a basis for the development of new resources, which are discussed later in the chapter.

### **5.3.1 “Stories from the Canning Stock Route”**

#### **5.3.1.1 Overview**

The Canning Stock Route traverses the interior of Western Australia, a route of almost 2000km, from Wiluna, to Halls Creek. It was named after Alfred Canning who, in 1906, led a party to establish a series of wells along the route. This enabled cattle to be driven across the centre of Western Australia, to the Kimberley region, thereby assisting the Kimberley cattle industry, and the emerging Kimberley populations. The stock route traversed many Aboriginal language groups (Figure 61), and contact occurred between Aboriginal and non-Aboriginal people. However, the stock route itself eventually fell into disrepair, and its use diminished. The story of the Canning Stock Route was essentially poorly known within the Australian context. The stock route ends at Halls Creek, and goes via Billiluna, which is the closest community situated to Wolfe Creek Crater. Despite the stock route traversing within approximately 20 kilometres of the crater, it appears that the crater was not recognised by non-Aboriginal people until 1947.

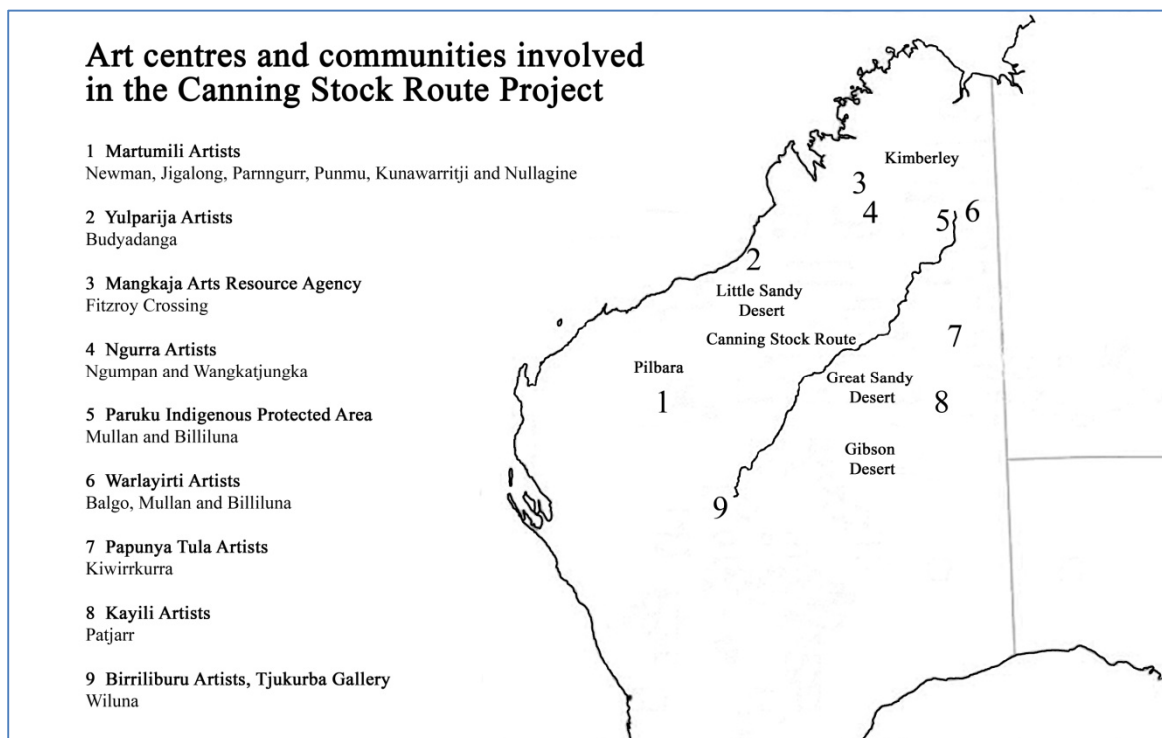


Figure 61. Canning Stock Route location figure.

(Adapted from Form, 2012)

The intriguing story of the stock route and the essentially untold story of Aboriginal views of the stock route, led to the development of a four year long collaborative project to research, investigate, collaborate and develop a major exhibition, mainly from an Aboriginal perspective. The following case study is based on the project's primary documentation, as presented in "Ngurra Kuju Walyja, One Country One People, Stories from the Canning Stock Route" (La Fontaine and Cart, 2011), and online information sourced from [www.form.net.au](http://www.form.net.au). The specific online resource for the project is [www.form.net.au/aboriginal-development/canning-stock-route-project](http://www.form.net.au/aboriginal-development/canning-stock-route-project).

As we shall see, the project alludes to the importance of sky knowledge to Aboriginal people associated with the stock route. However, it is the process used and outcomes achieved by the project that are the primary interests for this case study, because these offer significant insights into successful Aboriginal / non-Aboriginal collaborative projects and can inform future collaborations.

This project was led by Form, described as "a not for profit organisation which advocates for and develops creativity in Western Australia". Its origin dates back to 1968, when as "Craftwest" it was established as the peak body for craft and design. Subsequent developments led to its renaming to become Form in 2004. Form's four program areas are:

1. Regional Development.

2. Aboriginal Creative Development.
3. Creative Capital.
4. Industry Development.

The *Stories from the Canning Stock Route* project has used several processes during its development. Form has adopted an approach of extensive consultation and collaboration during the development of The Canning Stock Route exhibition. This has included multiple repeat journeys on site, consultations over an extended period of time, approval workshops to ensure content is used appropriately and with consent, and also repatriation of knowledge back to communities.

The *Stories of the Canning Stock Route* project commenced in 2006 and developed over a four year period, with many site visits carried out to communities and individuals along the Stock Route. The “Bush Work” involved a program of site visits and consultation (which were planned over a 9 month period) and then conducted over an 8 1/2 month period. In July and August 2007, a six week desert journey from Wiluna to Billiluna involved 60 artists from 7 art centres and 4 major artist's camps. Form reports that 51 different workshops involving communities, artists and the project team were carried out, including seven one-week curating sessions, over a 14 month period. This work resulted in the selection of 142 artworks for the project and exhibition.

The Canning Stock Route exhibition has developed several outputs and products. The exhibition itself developed over time, and some of its key events and outputs include:

- “Through Our Eyes, the Canning Stock Route” Exhibition at the Port Hedland Courthouse Gallery (September 2008).
- Telling Our Stories Through Painting exhibition. Tjukurba Gallery. (November 2008).
- Exhibition. Perth Town Hall (2008?).
- Beijing Olympic Expo Showcase. A selection of 19 works from the Canning Stock Route Collection. (2008). Approx 95,000 visitors.
- Book publication “Ngurra Kuju Walyja, One Country One People, Stories from the Canning Stock Route” (2011).
- National Museum of Australia (July 2010 - January 2011). 122,000 visitors.
- Western Australian exhibition (CHOGM) October 2011). 32,900 visitors.
- Australian Museum, Sydney (17 December 2011-29 April 2012).

A major feature of the project is the use of multimedia. Examples include sound recordings, artworks, photographs, video productions, book productions and historical records, including over 250 oral histories (including transcripts), motion picture (hundreds of hours) and more than 10,000 photographs.

One challenge encountered by Form regarding multimedia data, was how to make such data readily available to the public via the exhibition. Form solved this problem by developing a large digital

touch screen table, made from 10 touch screen monitors mounted in a horizontal position. The digitized survey map of the Canning Stock Route (1906-7) was then used as the basis of the touch screen image and multimedia sources were made available, relating to the survey map, including photographs of Aboriginal paintings, video clips, sound recordings, historical photographs, and satellite images. In this way, digital and multimedia resources were made accessible and organised in a locally meaningful way for access by exhibition visitors.

The presentation of multimedia via touch screens, based on maps of a geographical area has considerable applicability for communicating and sharing cultural knowledge of the night sky. Instead of using the survey map of the Canning Stock Route, a digital sky map could be used, and cultural views of the night sky included, such as videos, photographs of paintings, sound recordings and other resources.

### **5.3.1.2 Astronomical content of “Stories of the Canning Stock Route”**

Early in the “Stories of the Canning Stock Route” a profound overview is provided contrasting non-Aboriginal and Aboriginal law, with direct reference to the night sky (La Fontaine and Cart 2011, 34-35):

*There's two laws see: kartiya law and blackfella law. Kartiya law is all written down on paper. Blackfella law is written in the stars, on the ground, on the Countryside, in the hills, everywhere.*

This tantalising statement implies that for Aboriginal people (associated with the Canning Stock Route), the night sky is an important aspect of their culture. However, there is relatively little subsequent content that explores the sky aspect of this knowledge. The proximity of Wolfe Creek Crater is not noted in the text, nor is it shown in associated maps.

Also notable is the preoccupation with daytime experiences. One indicator of this is the ratio of photographs showing daytime scenes to night-time scenes, which is 257 to 5 (1.9%). One astronomical image is featured, “Starscape over the Canning Stock Route” (pp 35, 36). Other astronomical or night time scenes include: Pangkapina “The story about the seven sisters” (pp 96); and “we were sleeping at Well 36 and I painted the Seven Sisters in the sky, like stars” (pp 104 - 105).

The importance of the night sky to Aboriginal culture (in relation to the Canning Stock Route) is clearly indicated, however the project did not explore this subject in any significant detail. Based on discussions with Form (Monique La Fontaine, pers com, September 2012), it was explained that content relating to the night sky in general (e.g. the Seven Sisters story) and Wolfe Creek Crater, was not presented in detail simply because these subjects were not the central focus of the Canning Stock Route project, which was to tell the Aboriginal history of the Canning Stock Route. Beginning initially as a small project, the Canning Stock Route project grew over five years, and maintaining a coherent focus for the project during this time was a priority.



### 5.3.1.3 Attributes of success

Various indicators and attributes of success are demonstrated by The Canning Stock Route Project. These include:

- The number of Aboriginal communities, families and individuals participating in the project.
- The successful attraction of adequate funding over an extended period of time for the project.
- The development of significant project partnerships.
- The quantity and range of content developed as part of the project, including
  - artworks.
  - photographs.
  - videos and films.
  - historical records.
  - publications.
- Consultation, engagement and collaboration over an extended period of time.
- The development of content approval processes.
- Repatriation of knowledge back to communities.
- High profile achieved from the exhibition.
- Successful uptake of the exhibition into the national collection.

The *Stories of the Canning Stock Route* project demonstrates a successful collaboration between Aboriginal and non-Aboriginal people. The approaches used can serve as a model for future collaborative projects. Future research and collaboration could focus on expanding upon the content of astronomical knowledge in Aboriginal culture associated with the Canning Stock Route and its significance, and in particular, the importance of Kandimalal, Wolfe Creek Crater.

### 5.3.2 Gascoyne “Astrocinematography” by Dr Peter Morse

Gwoonwardu Mia, the Gascoyne Aboriginal Heritage and Cultural Centre (Carnarvon, Western Australia) commissioned Dr Peter Morse to produce an Aboriginal Astronomy full-dome exhibition production. The production was officially opened in June 2012 (Morse 2012a, b, Allbrook 2012). The concept and general intent behind the project was to create a rich audience experience, featuring an Aboriginal story of the night sky, expressed via dome projection technology to create an authentic dome experience. The production is based on an oral history recording by Stella Tittums, a Gascoyne Aboriginal Elder, and was recorded by anthropologist Mary-Ann Jebb. It presents the story of the Emu constellation, and features full-dome (180°) timelapse imaging of the night sky, photographed in the Gascoyne region during the first half of 2012.

The project team for the collaboration included Dr Peter Morse (imaging), Research Associate Professor Paul Bourke (mirror dome system design), Anthropologists Mary-Ann Jebb and Malcolm Allbrook, Stella Tittums (Gascoyne Aboriginal Elder), and Scott Watson Design (exhibition design).

The equipment used for the production was developed by Dr Peter Morse and his fulldome timelapse collaborator, Chris Henderson. The equipment was previously used in the fulldome documentation of Mawson's Hut, Antarctica. This prior approach of using the digital imaging technology to document remote but cultural important places is the same approach used in my own research, particularly of the Wolfe Creek Crater documentation.

Fulldome imaging was recorded via a Canon 5D Mark II camera with a sigma 8mm fisheye camera lens. The production has used fulldome imaging recorded specifically for the project, and features various daylight timelapse images of prominent Gascoyne landscapes. Timelapse imaging has also been supplemented with visualizations created by the Nightshade Astronomy Simulator.

The production has been developed in fulldome format designed for projection onto a 360° by 180° dome. The dome system used by the Gascoyne Aboriginal Heritage and Cultural Centre is a “walk-in walk-out” 4 metre diameter dome, using a mirror projection system designed by Professor Paul Bourke. The production itself runs for approximately 15 minutes and features the story by the Gascoyne Aboriginal Elder (by a sound-track voice over), combined with fulldome astronomical timelapse, and various tracking shots. The soundtrack includes ambient sound recordings sourced during the Gascoyne field trip in 2012 (Morse, 2012a, b).

The project team encountered some issues during the project development. The audio recording of the Aboriginal “Emu” star story, was relatively brief (approximately 3 minutes). The brevity of the recording was addressed by Dr Peter Morse, by including fulldome timelapse sequences combined with ambient soundtracks, recorded on location during the site photography. The resulting production is approximately 15 minutes duration, which was deemed suitable for its application and viewing at the Carnarvon cultural centre.

Image processing and rendering for the production of the fulldome exhibit is very computer intensive. The computer processing requirements are substantial and image processing and rendering has been carried out on top-end Mac desk-top computers. This is due in part to the large volume of data from the original timelapse content, and secondly, by the numerous computational and rendering processes required, including High Dynamic Range (HDR) image processing, deflickering, noise reduction and hot pixel removal.

Key features of the astro-cinematography production include:

- The fact that the project was initiated by the Gascoyne Aboriginal Heritage and Cultural Centre, and is therefore responsive to the expressed wishes of the community.
- The recording of fulldome timelapse image resources from key local areas, ensuring that the production highlights locally relevant content.
- The sharing of Aboriginal sky knowledge, via the oral recording of the “Emu” sky pattern.

The astro-cinematography project has become a key and valued part of the Gwoonwardu Mia Gascoyne Aboriginal Heritage and Cultural Centre. The centre manager reports (pers com, 2013) that the display is part of the permanent interpretive exhibition of the centre and that the astro-cinematography display is viewed regularly by visitors to the centre. Visitor feedback, via visitor comment books, provide positive comments about the display. The centre venue is also the venue for National Aborigines and Islanders Day Observance Committee (NAIDOC) week celebrations. NAIDOC is a national initiative that “*seeks to increase the awareness in the wider community of the status and treatment of Indigenous Australians*” and “*...is a celebration of Aboriginal and Torres Strait Islander cultures and an opportunity to recognise the contributions of Indigenous Australians in various fields*” (NAIDOC 2013). During NAIDOC week celebrations, visitors and guests experience the astro-cinematography display at the Gwoonwardu Mia Gascoyne Aboriginal Heritage and Cultural Centre.

### **5.3.3 An African perspective: Dr Thebe Medupe and “Cosmic Africa”**

Southern Africa has a long history of research into cultural astronomical knowledge. Early examples include the Wilhelm Bleek and Lucy Lloyd archive. This remarkable archive dating from the 1870's, is now part of the UNESCO “Memory of the World”, and is described in *Claim to Country* (Skotnes 2007, jacket):

*In the 1870s, facing cultural extinction and the death of their language, several San men and women told their stories to two pioneering colonial scholars in Cape Town, Wilhelm Bleek and Lucy Lloyd. The narratives of these San—or Bushmen—were of the land, the rain, the history of the first people, and the origin of the moon and stars. These narratives were faithfully recorded and translated by Bleek and Lloyd, creating an archive of more than 13,000 pages including drawings, notebooks, maps, and photographs. Now residing in three main institutions—the University of Cape Town, the South African Museum, and the National Library of South Africa.*

In March 2010, after participating in the “Communicating Astronomy with the Public” CAP2010 conference in Cape Town, I had the opportunity to visit the Wilhelm Bleek Lucy Lloyd digital archive, at the University of Cape Town, South Africa. Three curating institutions (National Library, Iziko South African Museum and the University of Cape Town) collaborated to create the digital version of the archive which is readily accessible via the internet. The digital archive includes a 280,000-word searchable index, cross-referenced and including notes and summaries for each of the stories listed. The digital archive is available online at <http://lloydbleekcollection.cs.uct.ac.za/>, and the archive comprises:

- 28 notebooks by Wilhelm Bleek.
- 110 (|xam) notebooks by Lucy Lloyd.
- 17 (!kun) notebooks by Lucy Lloyd.
- 4 (Kora) notebooks by Lucy Lloyd.
- 2 notebooks by Jemima Bleek.

- 32 notebooks by Dorothea Bleek.

Laurens van der Post published several popular accounts about the Kalahari Bushmen (san) people, and aspects of their African Indigenous sky knowledge, for example, “The Lost World of the Kalahari” (1958), “The Heart of the Hunter” (1961), and “Testament to the Bushmen” (1984) (with Jane Taylor). Patricia Vinnicombe's 1976 publication “People of the Eland” (rock paintings of the Drakensburg Bushmen as a reflection of their life and thought), also described some astronomical beliefs relating to the moon. More recent examples of South African publications featuring Indigenous sky knowledge include Skotnes (1999), Skotnes and Fleishman (2002), McNamee (2001), Krog (2004) and Alcock (2010). The South African Weather Service has produced “Rainbows in the Mist” (Alcock, 2010), a large volume exploring Indigenous weather knowledge, beliefs and folklore in South Africa (which includes substantial chapters on the stars, moon, the sun, solar and lunar eclipses, the seasons, rainbows, haloes and other optical phenomena).

The above brief review of South African Indigenous sky knowledge demonstrates a wide range of research and enquiry into the subject of Indigenous sky knowledge. It suggests that the field of Indigenous astronomical knowledge research in Africa is more developed than in Australia. Two major factors may have contributed to this, firstly, the fact that the African population has a large proportion of Indigenous people. The South African 2011 census, as reported by Statistics South Africa (2012) indicate 88.1% (more than 45 million people) of the South African population are described as “Black African” and “Coloured”. In contrast, Australian census statistics report that 2.5% (517,000 people) of Australia's population is Aboriginal (ABS, 2010). Secondly, the cultural diversity of Africa is much greater in comparison to Aboriginal cultures of Australia.

This leads us to the film documentary “Cosmic Africa”, featuring the South African astrophysicist, Dr Thebe Medupe, and his exploration into African cultural astronomy (Figure 62). The documentary presents the story of Dr Medupe's research with contemporary African communities, including the Namibian Bushmen (san) community, Mali and Egypt. The award winning documentary was produced by Cosmos Studios (Druyan et al. 2009). A description of the research into African Indigenous sky knowledge used for the development of *Cosmic Africa* is provided by Rogers (2007). Key themes of *Cosmic Africa* include the search by Dr Medupe to incorporate his African cultural heritage into his scientific and astrophysics research career. Another key theme is that the shared heritage of the night sky is a common heritage between people and cultures.



Figure 62. Dr Thebe Medupe.  
(Photo: John Goldsmith)

In 2010, I interviewed Dr Thebe Medupe in Cape Town, at the South African Astronomical Observatory. I began by asking Dr Medupe about the usefulness or value of Indigenous sky knowledge:

*I think this is a worthy project, because this kind of information is related to stories of the land, sky, related to folk lore, star lore. It's very important. It tells you something of the history of the people as well.*

and the origin of “Cosmic Africa”:

*The idea came from, there was a film maker and a field researcher, all based on a field researcher, two people who wanted to make a documentary about astronomy in Africa, people in the villages in Africa and what their beliefs are. People approached me because I am an astronomer, and I was interested in those kinds of things, and eventually, we managed to get good funding from Cosmos Studios in the US and the idea of the film just became big to visit several African countries.*

Dr Medupe shared some of his experiences during the making of Cosmic Africa, and his encounters with Namibian (san) Bushmen:

*...Namibia to study the bushmen people, we spent one week there... ...We got them to tell us about their knowledge and the stories of the night sky. We also went there... ...Solar eclipse in 2001 and it was very interesting. Asking them about eclipses a few days before the eclipse*

*took place. According to their way of thinking, an eclipse cannot be predicted. It's an unnatural event. They were very very shocked. They associate an eclipse with the lion which is like enemy number one, they live in the (veldt?) where the lion is the big enemy, lions everywhere, lion wrapping its tail around the sun and so, the eclipse is an evil thing, according to them. They were very worried, that I somehow could control these things. So, ...we had to go back to them and explain to them, according to our science, modern way of understanding things, we had to explain, the sun is a big round ball and the moon...*

*It was interesting because I think some elders internalised this knowledge. We asked him what he thinks causes an eclipse. He told us back the information we told him. I don't know if that is good or bad, we didn't go out to teach them science.*

*I felt that we interfered with their knowledge system, I don't know, it's an interesting question to deal with. So from there we went to Mali and there we studied the Dogon people. Very isolated community. We spent three weeks with them. Everything is graphical...*

This observation by Dr Medupe demonstrates the potential of unintended impacts and changes to Indigenous knowledge, which may occur as a result of the interaction and communication between researchers and Indigenous people. Knowledge is a highly dynamic attribute, which can change due to learning, new experiences or the impact of communication. It shows that attempts to record or document knowledge from the past can be a very difficult, or impossible, undertaking. At best, perhaps what can be achieved is knowledge in the here and now, and *interpretations* of knowledge which may have existed in the past, for any given individual or community group. Australian astrophysicist Prof. Ray Norris pointed out this difficulty (Leung, 2008), in relation to interpreting such knowledge, from the perspective and experience of a contemporary researcher. Any research project that attempts to research knowledge from the past, as opposed to contemporary knowledge, may need to develop well thought-out approaches or policies to acknowledge this issue, and to put in place effective mechanisms to avoid unintended impacts.

Dr Medupe described an experience during the Cosmic Africa production, in Mali, with the Dogon people, who have been reputed to know about the Sirius B companion star:

*...there is a lot of symbolism to do with astronomy and also we were curious, they apparently knew about Sirius and the companion (star, Sirius B) going around it. How can they know that when they didn't have telescopes? The film directors were very excited, I would have to explain when they didn't have a telescope. I was very reluctant, but fortunately for me, nobody seemed to know about this. I felt very relieved (!)*

*...when we were in Mali with the Dogons. The old man there, told us... He gave a very powerful statement: The Earth and the Sky are like men and women, you can't talk about*

*one without the other. So according to them the whole knowledge is completely integrated. For them, a Zebra is as much a part of nature as Betelgeuse, which is beautiful I think, ...So this idea of combining tourism and linking it with the sky. It's a very nice way of making people aware after all we are part of this universe, quite nice.*

Here we see the theme of holistic knowledge systems emerging. There are various parallels with Aboriginal cultures in Australia, which have been described by a variety of researchers in various fields including Australian Aboriginal biological knowledge. For example, Wightman (2009) researched Aboriginal biological knowledge, as part of a Churchill Trust fellowship. In addition, Brown, Harris & Russell (2010) characterises five different forms of knowledge, namely:

<b>Individual knowledge</b>	Lived experience, identity
<b>Local knowledge</b>	Shared experience of people and place
<b>Specialised knowledge</b>	Mono, multi & transdisciplinary, the professions
<b>Strategic knowledge</b>	Administration, government, organisations
<b>Holistic knowledge</b>	Essence, core of a system

Aboriginal knowledge systems most strongly relate to Brown's "Holistic knowledge culture" but can also contain aspects of individual and local knowledge cultures.

Dr Medupe described how they are seeking to incorporate Indigenous knowledge education:

*...In South Africa we've been using this information to try to make Science and astronomy attractive to young south Africans. Absolutely I support this kind of study. It has mostly been done by an isolated group of people.... It has not really formally reached the schools... ..to be written in the form of high school books which can be used in addition to the other learning material, about science in schools. To that effect I've been approached by Cambridge Press, the one based in Cape Town and I've written at least one or two books one book about African night sky which is a small book for children maybe 7 or 8 year olds.*

*I'm writing the history of astronomy in South Africa, but slightly different, because there we are looking at the written records in West Africa, people have been writing for about a thousand years. There are a lot of ancient books, using Arabic script, local languages. Its slowly getting there.*

*It's not as good as we hoped it to be. Ideally we would hope this information to be included in the curriculum, specially at lower levels at school, and the higher levels. To just add a dimension with science and the message is. If our ancestors were so in touch with the natural surroundings with astronomy and even tried to understand what was happening. It's*

*a kind of science, not science in the modern sense. It was their kind of the understanding. Making science part of our culture today, that's the message we are trying to...*

Here we also see parallels with the experience of *Ilgarijiri*, and the Australian need for educational resources in schools (particularly secondary schools). In this case, Aboriginal knowledge can provide an Australian context for science education.

Dr Medupe described some of the effects *Cosmic Africa* had on his subsequent work:

*Almost immediately after the release of Cosmic Africa, I was invited to write a series of articles every month for a travel magazine on African knowledge of astronomy so that was quite fun. And also for the whole country of South Africa we have Science Week. And during the science week. In many places we have many exhibitions and posters.*

*There was an initiative by a company in Johannesburg, to try and improve this kind of knowledge as part of the Tourism experience. One way you do this you train game rangers. African indigenous stories about the stars the different constellations, and the African equivalent, and in that way, people will come to visit our game parks, to see the animals at times when you can't see the animals. Then the game rangers can tell them about the night sky and it's very beautiful because it brings together the African concept of the surroundings.*

*And also there has been a lot of TV and radio interested in this kind of information. But I think really, we should try and make this part of the school curriculum. When I was studying as a young person during the high schools, the junior years at school, I used to learn about Inca astronomy, the Chinese, European astronomy. But there was nothing on African astronomy. So we need to rewrite our introductory books on astronomy and science, to include African (and Aboriginal) astronomy. It will just integrate everything together. It's nice I think.*

Dr Medupe's themes are expanded upon by the words of Sivuyile Manxoyi, who in 2010, was the South African Astronomical Observatory Education Outreach Officer (Figure 63).





Figure 63. Sivuyile Manxoyi.  
(Photo: John Goldsmith)

I interviewed Sivuyile Manxoyi in 2010, and he drew important themes together of the unifying power of astronomy. He described his views in the context of South African Apartheid:

*All the languages are related and the culture. They share their common origin. Their modes of behaviour. Now if you look at the Mooni People. Even their clans, some of the clans are astronomical. They relate to the stars. Even the traditions. The people have a long tradition... .. old relationship with the stars. Most of the ceremonies are regulated by the stars. One example which is crucial in our community. The one of manhood...*

*People have lost touch with their tradition and culture and now, when we introduce science. They think astronomy has come for outside, but now when you relate to their culture and they realise, they have always had this relationship, and the gain confidence,... .. can serve as a bridge to understand modern astronomy. They identify easily with astronomy.*

*Because of our history, what has happened here is that.. ....history of Apartheid. Apartheid was about separating people, funny divisions. Xhosa, just before 1994 when democracy came in before there was a lot of tribal fights. They are one. As a way of unifying and dissolving artificial bridges between the tribes. They are from one root. They are all one,...*

*...apart from stimulating the interest in astronomy, it helps to unify our people, I think it's very important.*

I asked about the unifying role of Indigenous sky knowledge, and our discussion concluded with:

*I would definitely encourage that. In fact I've learnt also about other cultures now. Sometimes we share the same stories, some stories are common, Number 1, it helps to instil a sense of pride and number 2, because astronomy is close to everyone. The skies are accessible to everyone because it doesn't matter where you are... ..*

Our discussion concluded by Sivuyile noting:

*We should make links between the Indigenous people in the different parts of the world, and start sharing our stories, we are willing to work with them.*

The interviews with Dr Thebe Medupe, and Sivuyile Manxoyi provide informed insight into contemporary South African Indigenous sky knowledge. We see insights into how such knowledge is being valued in a highly practical way in the South African setting, and the effect that this has on Dr Medupe himself (in his astrophysics career). The theme of holistic knowledge is clear, and there are parallels with the Australian Aboriginal sky knowledge as well. We see the potential impacts on Aboriginal knowledge, when scientific knowledge is shared, and the unintended effects that this can have. We also see a strong theme of the unifying power of the sky amongst culturally diverse people, and the role such knowledge can play, to encourage reconciliation between different cultures within national societies. These issues are profoundly important for post-apartheid South Africa, and contemporary reconciliation initiatives within Australia. Key themes that have emerged from cultural astronomy include the fact that the night sky is open to all to experience, the fact that no-one or no community can own the night sky (or claim exclusive possession), that the night sky provides for a shared cultural heritage, a heritage that is global in scale, and that the night sky can be used as a source of unification amongst communities.

Links between Southern Africa and Australia will continue to develop over time, particularly with the Square Kilometre Array radio telescope project being shared between the two regions. This will undoubtedly encourage further exchange about cultural astronomy initiatives. The Cape Town exhibition of *Ilgarijiri- Things Belonging to the Sky*, and the May 2011 Aboriginal astronomy presentation at the Scifest Science Festival (Grahamstown, South Africa), are two such examples of Australian Aboriginal cultural knowledge being shared and communicated in a South African context. Likewise, the work of Thebe Medupe, via the *Cosmic Africa* documentary, provides a key resource for sharing African cultural astronomy perspectives. This production also can be used as a model for future documentary productions, with potential application in Australia.

## 5.3.4 Advanced digital imaging by XRez Studio

### 5.3.4.1 Overview

Advanced digital imaging is being applied to a wide range of applications, including cultural heritage documentation, national park interpretation, geological research and a variety of other applications. In addition to its value as a research tool for site documentation, advanced digital imaging provides innovative and engaging ways to facilitate communication about cultural knowledge (in general), and specifically the communication of Aboriginal astronomical knowledge, which is often intertwined with knowledge of specific terrestrial landscapes. In the following two sections, I examine the use of such techniques by the XRez studio, which is one such organisation that is applying a diverse range of advanced digital imaging (XRez Studio, 2010a,b). The techniques discussed have in part inspired the current research, to apply such digital imaging into the field of Australian Aboriginal sky knowledge as part of the current research. After introducing the role of XRez studio, I then present the application of these techniques in the current research, which has led to significant site documentation using 360° imaging techniques, which is then further applied to develop new resources and an innovative Aboriginal Astronomy virtual tour.

The XRez studio utilises a variety of advanced digital imaging techniques, which include:

- Extreme high resolution imagery (e.g. Gigapixel imagery, i.e.,  $10^9$  pixels).
- Digital terrain modelling.
- High dynamic range imaging.
- Spherical animation.
- Timelapse photography.
- Multispectral imaging.
- Polynomial Texture Mapping.
- Photogrammetry.

Projects using advanced digital imaging for cultural documentation purposes by XRez studio, include the *Shamans Panel Rock Art Documentation project* and the *Crossing Worlds* Fulldome film production. These are briefly described below.

### 5.3.4.2 “Shamans Panel” rock art documentation

The “Shamans Panel” rock art, is situated in the vicinity of the Grand Canyon, North America. It is a large panel of ancient rock art, created by Native Americans. The online project profile by XRez (2010a) estimates the age of the rock art as between 3,000 and 15,000 years old. The XRez studio has, in 2010, completed high resolution (gigapixel) photography and photogrammetry. They report that 182 vertical overlapping images were recorded, the surface mapped, and the 3D positions of the camera positions for each of the 182 photos derived. This has enabled the creation of a 3D digital model of the panel, in which the gigapixel image is overlaid onto the 3D digital model.

### 5.3.4.3 “Crossing Worlds”

XRez (2010b, par. 1) describes the fulldome production “Crossing Worlds” as:

*A visual tone poem designed for the emerging full dome planetarium format, “Crossing Worlds” utilizes spherical photography from the American desert west to immerse the viewer in a transcendent spectrum of austere landscapes. xRez Studio’s first dome format film, “Crossing Worlds” won a coveted “Domie” for Best Design in a Dome at DomeFest 09 in Albuquerque, NM. The beautiful soundtrack was provided by Marconi Union in the UK, and Paul Buehler at the Glendale College Dome provided key assistance in production. ... it was shown at The Elumenati GeoDome theatre with 350.org at the COP15 Global Climate Summit in Copenhagen in 2009.*

The fulldome production provides a highly engaging visual journey into North American desert landscapes. It features ancient Native American rock art, and the production culminates in a representation of a very distinctive component of rock art. The site featured is reported as the Horseshoe Canyon, Canyon Lands National Park, Utah.

The “Crossing Worlds” fulldome production contains several elements which have contributed to the success of the production:

- The fulldome production utilises 360° imagery overlaid onto a 3D map of the various landscapes, with renderings to produce a realistic 3D effect.
- The production is based on a combination of natural landscapes, together with ancient cultural sites.
- The sound track is compelling, and strongly complements the style of the production.
- There is no narration, the “story” is told entirely by the visual imagery, and music sound track.
- The style can be described as haunting, evocative, meditative, and calm.
- The production duration is 5 minutes, making it particularly suitable for viewing by exhibition audiences.
- The production is readily viewable and accessible online. The interface for viewing the production is efficient and easy to use.
- The project was presented at a major conference (COP15 Global Climate Summit in Copenhagen in 2009).
- An indicator of the success of the production is its award at DomeFest 2009 (Best design category).

## 5.4 Digital imaging

Digital imaging is a research, documentary and communication tool that has a wide range of applications. In the previous sections, we have seen digital imaging applied to the Canning Stock Route exhibition, the Gascoyne “astro-cinematography” exhibition, and international examples from

the XRez Studio, in which digital imaging is applied to document important cultural sites. In the following section, I present the application of digital imaging technologies for the documentation of places of particular importance to Aboriginal astronomy. Methods used include mosaic panoramic imaging, timelapse and 360° imaging. I apply digital imaging techniques to document daytime and night-time contexts of key landscapes and sites featured in this research, including the Murchison Radio-astronomy Observatory and Kandimalal, Wolfe Creek Crater. The visual resources are then used in the production of new educational resources, which are based on the original research of this thesis.

#### **5.4.1 Overview**

Recent advances in photographic image processing have substantially extended the capabilities and application of digital photographic cameras. Innovative digital photography methods are presented, including the use of 360° spherical images and time-lapse photography, as useful tools for recording natural and cultural places of significance. There are a wide range of techniques available to support digital photographic site documentation. These techniques include:

- Conventional photography.
- Panoramic mosaic photography.
- Spherical (mosaic) photography (360° by 180° imaging).
- Timelapse photography.
- Multiple exposure photography.
- Stereoscopic (3D) imaging.
- Animation based photography.
- Long time exposure photography (e.g. star trails).
- High dynamic range photography.
- Multispectral photography.
- Aerial and Satellite based imaging (e.g. Google Earth).

The techniques of digital photography can be applied in several ways to document places of natural and cultural significance. The enhancement of digital photographs is a particularly useful tool for researching and investigating Aboriginal heritage sites in general, and rock art in particular. Through methods such as contrast enhancement and the selective emphasis of colour, the visibility of faint markings, which may otherwise be very difficult to perceive, can be increased (Anon. 2009). Methods of re-scaling and saturating colours in digital photography have been described by David et al. (2001) and David et al. (2002). The application of digital technology for the documentation and management of rock art has been described by Ogleby (1995) and examples of the use of enhanced digital photography (for Torres Strait rock-art) are described by McNiven et al. (2000) and David et al. (2002), in addition to “Computer Technology Rocks Indigenous Art” 2009.

The capabilities of digital photography continue to expand with the use of digital photography techniques, including panoramic photography, 360° spherical images and time-lapse photography.

These techniques lend themselves to creating useful records of sites. The creation of 360° spherical images is a specialised form of panoramic photography, which has become possible mainly due to advances in computer software. Digital photographs are assembled and processed in a mosaic form to create a 360° view. The extreme wide-angle views of 360° images lend themselves to ‘immersing’ the viewer into a virtual landscape, giving a realistic sensation of the site and its form. In this way, viewers can gain an appreciation of a site, without needing to actually visit the site. Mercator, planar, cylinder and spherical projections are different kinds of image projection, with spherical projection used for the production of 360° images, hence the term 360° spherical image.

Highly portable digital photographic equipment can be used to record 360° images, which lends itself to documenting sites which are difficult to access. These photographic techniques have considerable potential to be applied advantageously to Australia’s Aboriginal sites, which are often located in remote places.

360° spherical images are being developed as a tool for exhibitions, displays and public education. These techniques therefore can play a role in raising public awareness. A key example of this is the PLACE-Hampi exhibition, which documented:

*... high resolution stereoscopic panoramas that present the most significant archaeological, historical, and sacred locations at the site of the World Heritage of Vijayanagara (Hampi) in southern India.*

(Kenderdine et al. c. 2008, par. 1). The PLACE-Hampi exhibit uses 360° images in a public exhibition context. It is a key example of panoramic documentation because it provides a:

*...framework for a new approach to the rendering of the cultural experience, whose aesthetic and representational features give the general public a dramatic new appreciation of the many layered significations of such historical, archaeological, and architectural spaces.*  
(Kenderdine et al. c. 2008, par. 6).

#### **5.4.2 Methods, techniques and equipment**

I describe the methods, techniques and equipment used for the site photography conducted for this research, for:

- (1) Digital panoramas.
- (2) 360° imaging.
- (3) Digital timelapse and subsequent imaging productions such as digital star trail images, which are derived from the timelapse sequences.

For all digital imaging, I used Canon digital SLR cameras (5DII and 40D models). For the Canon 5DII model, I used Canon lenses (24mm F1.4 and the 8-15mm F4 lens). For the Canon 40D digital

SLR camera, I used the Canon 18-200mm F3.5 / 5.6 lens. The digital photography documentary methods used are described by my paper in *Rock Art Research* (Goldsmith, 2011a). For all photography, RAW and JPEG format images are obtained. Additional equipment includes tripods (Manfrotto #055C and the heavier grade Manfrotto 058), memory cards (Sandisk 32GB), battery grips (for extended battery life) and remote switches or intervalometer controllers, to enable camera control for timelapse sequences. Once the original photography is accomplished, images are processed in different ways, depending upon the technique used. The original photographs are downloaded, archived and organised ready for processing. The following sections detail specific aspects of panoramic, 360° spherical and timelapse imaging used in this research.

### 5.4.3 Digital panoramas

'Panorama', in the digital photography context, is defined as a "stitching of several individual images aiming towards increasing the field of view, the dynamic range or the depth of field of the resulting image, or any combination of the three" (Kolor 2009, 3). The photomosaic method is highly suitable for recording high resolution, wide angle (panoramic) views, or even 360° panoramics. I used AutoPano Giga 2.5 software to process panoramic images.

An example of a panoramic mosaic image, featuring Wolfe Creek Crater, is shown in Figure 64. The upper images show a sample of the individual photographs, and the lower image shows the completed, processed panoramic image. Various high resolution mosaic panoramic images can be generated from each of the 360° spherical images.

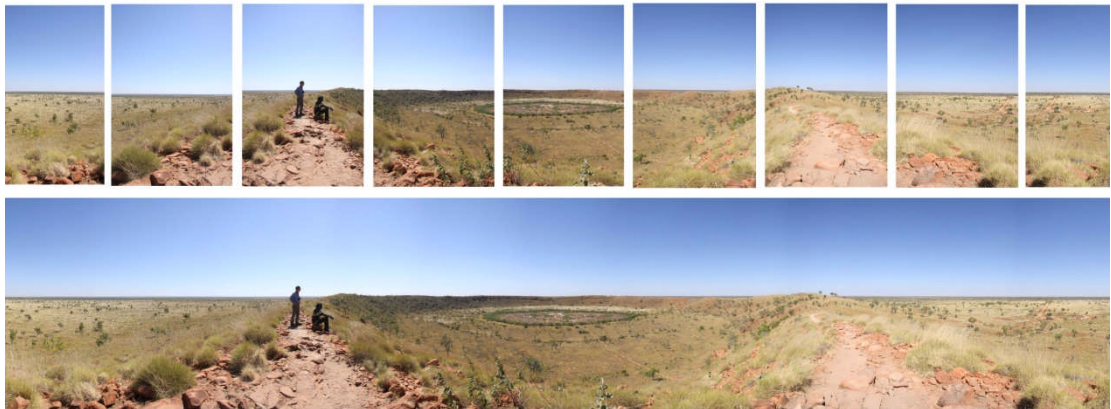


Figure 64. Panoramic mosaic photograph of Wolfe Creek Crater.

(Image: John Goldsmith)

Another example of a panoramic mosaic image generated from this research is Figure 4 (see Chapter 2) which shows the *Ilgarijiri- Things Belonging to the Sky* exhibition at Curtin University, 2009.

### 5.4.4 Time-lapse digital photography

Time-lapse photography is a very useful technique, which can be used to show the apparent motion of the stars above earthly landscapes. By taking a series of consecutive photographs, it is possible to

animate the photographs into full motion picture, thereby converting a series of photographs into video. In the motion picture field, time-lapse photography of astronomical scenes is being used to great effect in a variety of film productions. Some examples include *Tnorala* (2007), *Spirit Stones* (Film Finance Corporation Australia et al. 2007), *Night* (2008) and *Salt* (2008).

A typical workflow for timelapse photography is shown in Figure 65, for the production of digital SLR timelapse imaging.

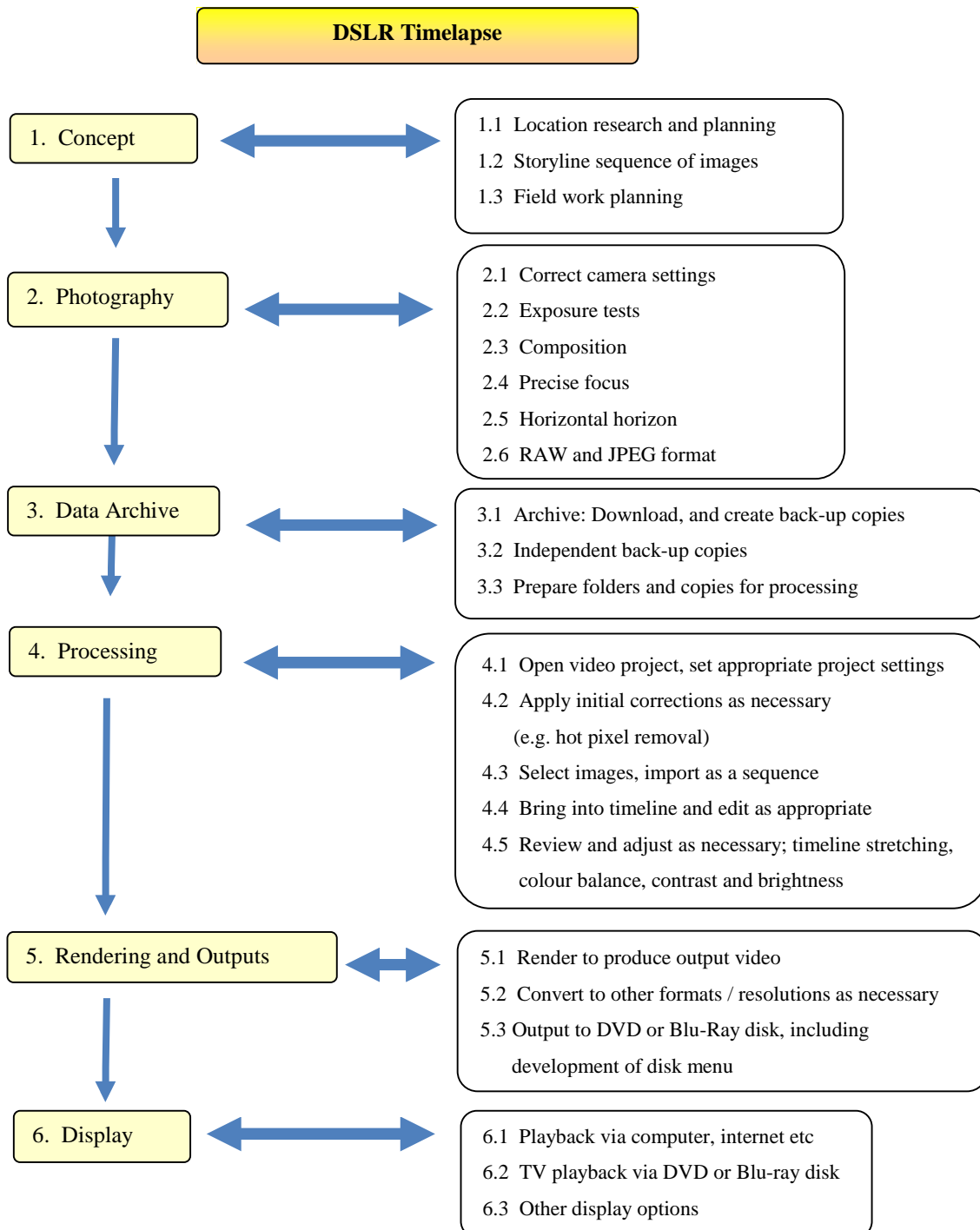


Figure 65. DSLR Timelapse workflow process. (Schematic by John Goldsmith).



Similar workflows also apply for other digital photographic methods, such as panoramic mosaic imaging, 360° spherical imaging and digital star-trail imaging.

Both the Canon 5DII and the Canon 40D digital SLR cameras can produce high-quality images for timelapse that have are considerably higher resolution than high-definition video (1920 by 1080 pixel resolution). For astronomical timelapse, photography is timed to coincide with the (approximately first quarter) phase of the moon, so that the landscape is partially illuminated. A typical exposure is 20 to 30 seconds, F=3.5, 1250 ASA, but exposures depend on the specific lighting conditions. A shutter release cable (remote switch or intervalometer controller) is used to control timelapse sequences. Timelapse is processed via video editing software. I use Vegas Pro 10, and a sequence of JPEG timelapse images are imported (as “new media”), and opened as a continuous sequence. Various adjustments can then be applied (e.g. colour balance), and then rendered into HD video, in a variety of formats. A typical format is a WMV file, 1920 by 1080 (high definition) resolution. In addition to timelapse video, “digital star-trail” images can be generated from astronomical timelapse sequences. Software, such as “Star Trails” ([www.startrails.de](http://www.startrails.de)) is used is merge timelapse sequences to create what is in effect a long time exposure in a single image. Examples featuring Wolfe Creek Crater are shown in Figures 21 & 22 (see Chapter 4). Sample timelapse video is provided in Appendix 17 (DVD disk), and scenes (individual frames) of a selection of timelapse sequence are provided below (Figure 66):



Figure 66. Timelapse: Murchison Widefield Array, Wolfe Creek Crater and Wave Rock.  
(Photos: John Goldsmith)

Several astronomical timelapse sequences have been accomplished at Wolfe Creek Crater (western, southern, northern and north-eastern rim of the crater), in addition to the Murchison Widefield Array, and Wave Rock. Typical exposures range between 20 to 40 seconds duration, and continuous sequences range from 1 to 5 hours duration. When converted into High Definition (HD) video, these sequences reveal the apparent motion of the stars above the crater landscape.

#### 5.4.5 360° spherical photography

The equipment I use for 360° spherical image panoramic photography is highly portable, light and compact, making it ideal for use in remote locations or places which are difficult to access (Figure 67). The positioning of the camera during site photography needs to be done with care, to ensure an appropriate overlap of consecutive images, in addition to the correct positioning of the camera in relation to the axis of rotation. Various panoramic tripods 'heads' are commercially available. I use the Manfrotto 303SPH, multi-row panoramic head. The number of photographs required to produce a 360° spherical image depends mainly upon the focal length of the lens used and the amount of overlap chosen in consecutive photographs. I typically take between 50–100 photographs per 360° spherical image. However, the number of images required can be reduced to as few as six, if a fisheye camera lens is used (on a full frame digital camera).



Figure 67. John Goldsmith at Wolfe Creek Crater.  
(Photo: John Goldsmith)

There is a wide range of software available for the creation of panoramic images. I use AutoPano Giga 2.5 software to process spherical 360° images. The JPEG images are selected, imported, and then processed to generate the spherical mosaic image, which is then rendered into a final (merged and corrected) image. This software combines multiple digital photographs, with advanced and automated methods for blending images, to produce a seamless and high-quality final image. The

360° by 180° spherical image can then be converted into a virtual tour type image (either QuickTime or flash format), via Pano2VR software. High definition video can also be generated from the 360° imaging, using Pano2Movie software. 360° spherical images are best viewed using a planetarium-style projection system, to appreciate the wrap-around 360° view. However, such images can also be viewed in other ways such as on computer screens, when presented in ‘Quicktime’ movie format. When viewed in this format, the user can navigate around the image, including a zoom function. Viewing in this way becomes a very interactive experience for the viewer.

This research has generated a substantial digital photographic record of key Western Australian sites including Wolfe Creek Crater, the Bibbullmun Dreamtime story at Claisebrook, the “*Ilgarijiri-Things Belonging to the Sky*” exhibition, the Murchison Widefield Array radio telescope facility, Wave Rock, Mulka's Cave, Horizon Planetarium (Scitech) and the International Centre for Radio Astronomy Research. For example, more than 98 GB of photography was completed during the 2010 field project to Wolfe Creek Crater alone. The 360° spherical panoramic images represent a more advanced form of the panoramic mosaic images, because they cover the full 360° by 180° field of view, and are technically more demanding to produce. This research has also produced a substantial collection of 360° spherical images, detailed below (Table 21);

Table 21. Location and number of spherical images.

Location	Number of 360° spherical images	Figure Number(s)
Kandimalal, Wolfe Creek Crater	10	69
Claisebrook (Bibullmun Dreamtime story)	3	73
Murchison Widefield Array radio telescope facility	2	72
Cosmology Gallery, Gravity Discovery Centre	1	74
Wave Rock	1	71
Mulka's Cave	2	70
Horizon Planetarium (Scitech)	1	75
International Centre for Radio Astronomy Research	1	76
	<b>Total: 21</b>	

Results for the 360° spherical imaging photography are presented below. A total of ten 360° images of Wolfe Creek Crater have been achieved to date (Figures 68 and 69). These unique images document the crater from various locations including outside the crater, the western, northern and eastern rim, and also several images from the crater floor, including the soakwater areas near the centre of the crater. The 360° images are used to create a virtual tour of the crater, which is described in section 5.5.3 (virtual tour supplied on DVD disk, Appendix 17).

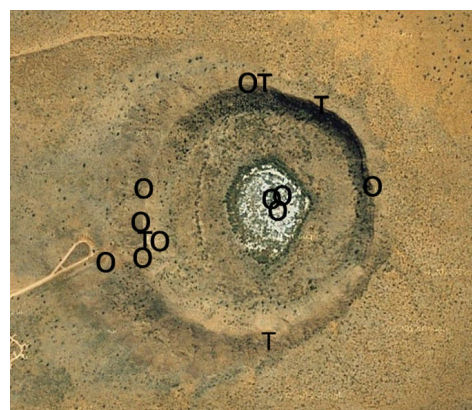


Figure 68. Approximate location of field photography (O=360° and T=timelapse).

(Base image: Google, overlay: John Goldsmith)

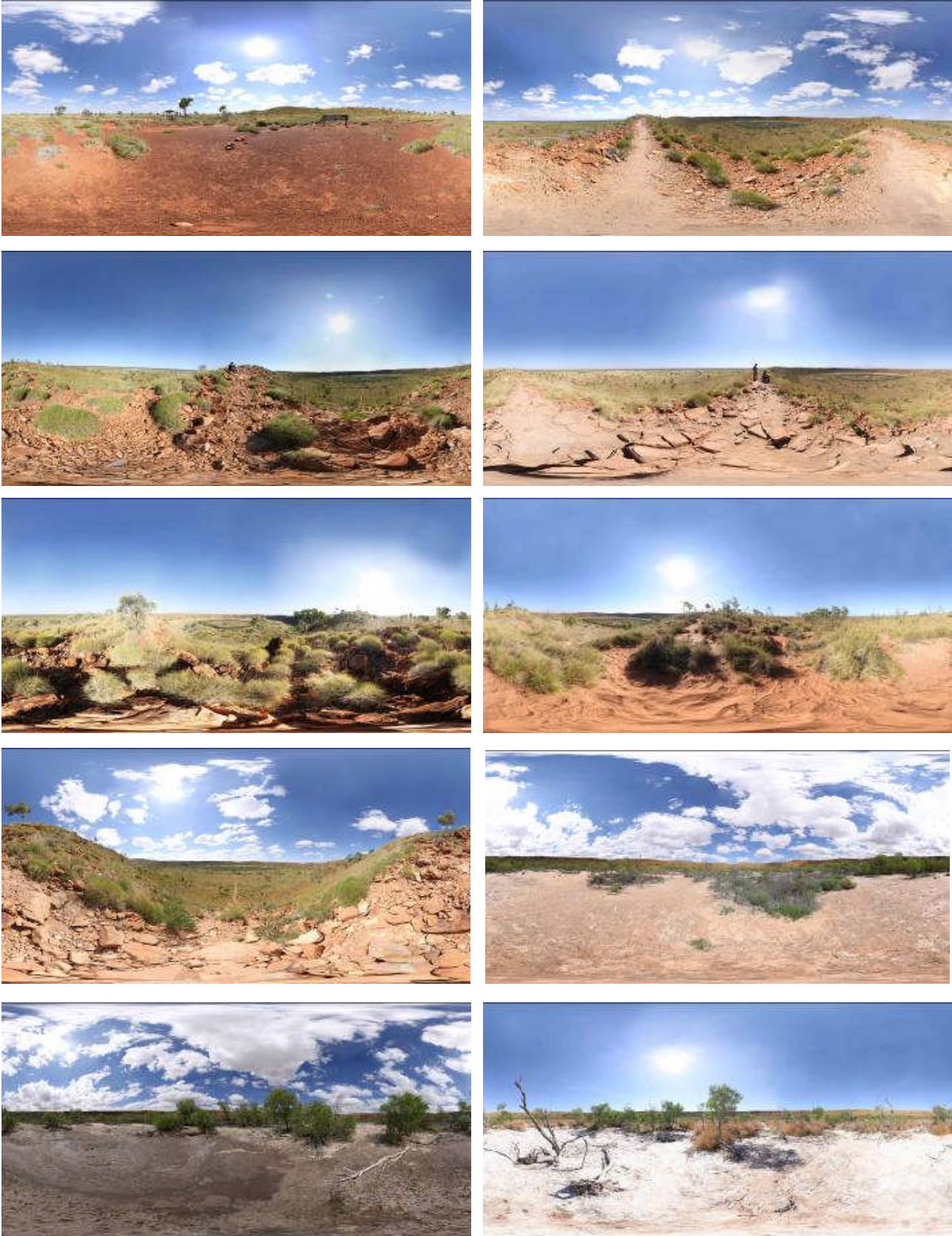


Figure 69. Ten 360° by 180° images of Wolfe Creek Crater.  
(Images: John Goldsmith).

In section 4.4, I examined an account of Aboriginal sky knowledge, as described by Noongar people of the South West of Western Australia. Key places of importance included Mulka's Cave (Figure 70) and Wave Rock (near Hyden, some 300km east of Perth, Figure 71). Mulka's Cave is an Aboriginal rock art site about 14 km north of Wave Rock, and is described by Serventy (1952) and Gunn (2006). Significant erosion is evident at Mulka's Cave (Rossi and Webb, 2007) and this has been attributed to the impact of visitors at this site. In 2009 I photographed a 360° spherical image of the interior of Mulka's Cave, and I re-photographed the site in October 2010. The resulting image shows the extensive Aboriginal artwork in considerable detail. This 360° spherical image helps to document the interior of Mulka's Cave (Figure 70).



Figure 70. Mulka's Cave 360° by 180° image (October 2011).

(Image: John Goldsmith)

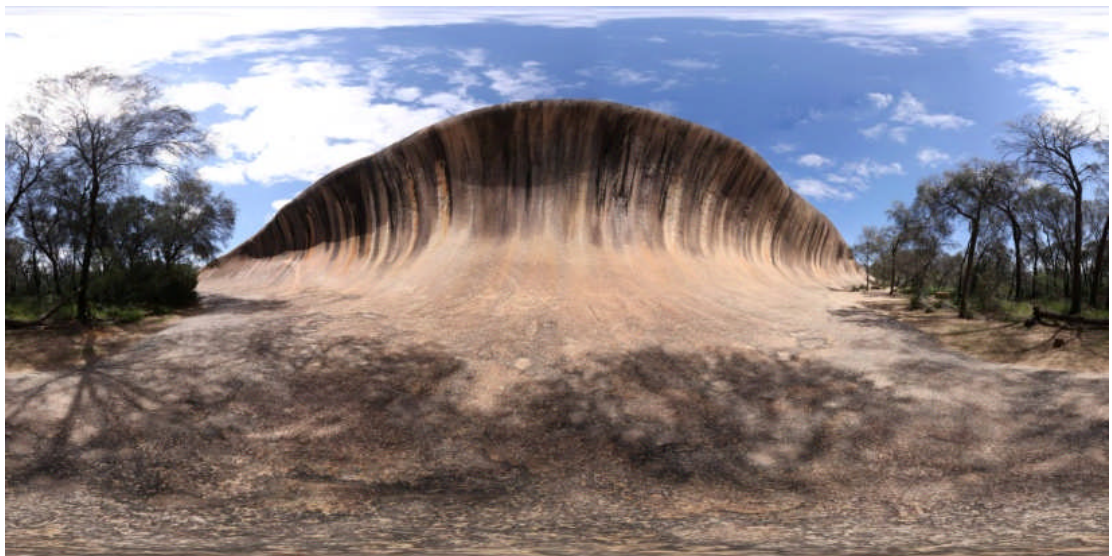


Figure 71. Wave Rock.

(Image: John Goldsmith)

Imaging of the Murchison Widefield Array accomplished two 360° images, in November 2012 (Figure 72). The first was taken in the central core of the dipole antenna field, and the second was taken in the proximity of a prominent ridgeline.



Figure 72. Two 360° by 180° images of the Murchison Widefield Array.  
(Image: John Goldsmith)

The Claisebrook Dreamtime story site (Perth), was photographed in March 2012 (Figure 73).



Figure 73. 360° by 180° imaging of the Claisebrook site.

(Images: John Goldsmith)

The contemporary work of artist Toogarr Morrison, as featured at the Cosmology Gallery, Gravity Discovery Centre (Figure 74), and Horizon Planetarium (Figure 75), was documented in 360° imaging, in 2011 and 2012. The results are provided below:



Figure 74. Cosmology Gallery, Gravity Discovery Centre.  
(Image: John Goldsmith)

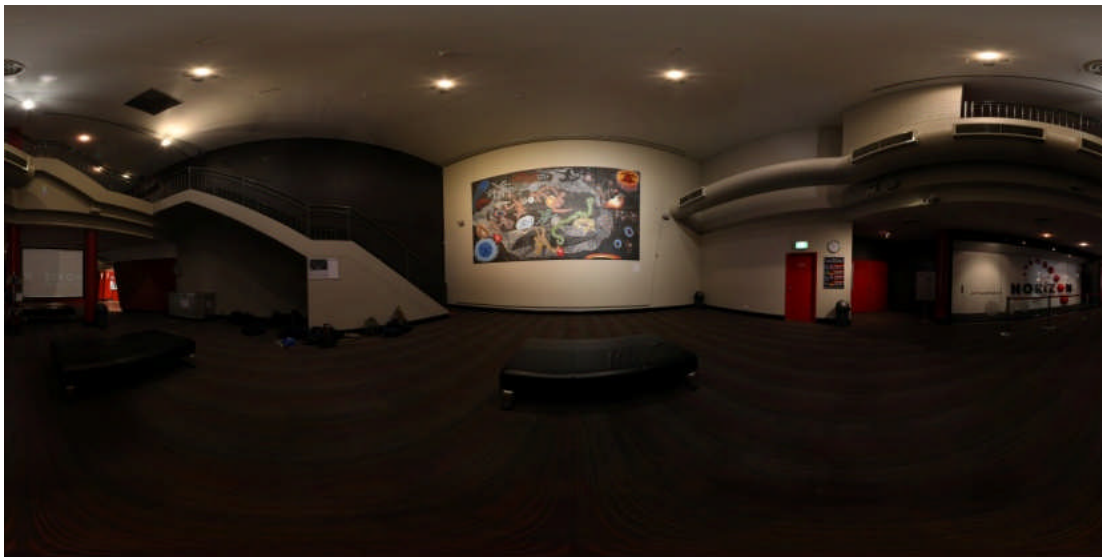


Figure 75. Toogarr Morison's Indigenous artwork at Horizon Planetarium.  
(Image: John Goldsmith)

An example of the *Ilgarijiri* art featured at the office of the International Centre for Radio Astronomy Research is provided in Figure 76.





Figure 76. 360° by 180° imaging ICRAR Office, showing *Ilgarijiri* artwork.  
(Image: John Goldsmith)

#### 5.4.6 Discussion

Digital documentation of landscapes and sites can provide an important visual context for understanding and communicating Aboriginal sky knowledge. For remote sites, such as Wolfe Creek Crater, this approach has a number of benefits and advantages. The site itself is remote and requires a substantial effort to visit. Creating a digital documentation of the landscape, whether in the form of a video, or as a virtual tour, enables people and audiences to be able to visually experience the crater landscape, in considerable detail, without having to physically travel to the site. In the case of sites which are fragile or environmentally sensitive, this approach has the benefit of reducing visitor impact on such sites. From an educational point of view, the resources created via this project have considerable potential to assist and support learning and educational activities.

The digital imaging techniques I describe demonstrate a great degree of versatility provided by these methods. The methods and techniques can be combined into a variety of formats, including video (standard definition, high definition), fulldome productions, virtual tours and the like. Also demonstrated are the highly effective results in a variety of digital formats, which can be achieved, even for sites located in remote locations with difficult terrain. This project has developed the most extensive 360° by 180° spherical image documentation of the Wolfe Creek Crater, from multiple site locations.

## 5.5 Creating new resources

In this section, I describe the development of three new resources which have been developed from my original research. The resources include: (1) the Cosmology Gallery exhibition video (from the De Laeter Science Engagement Scholarship); (2) the *Ilgarijiri- Things Belonging to the Sky* exhibition video and (3) the Aboriginal astronomy virtual tour. I describe each project, what was done and the results, for all three projects, and then I review the factors of success (as described in the start of this chapter), and relate my projects according to the factors.

### 5.5.1 The De Laeter science engagement scholarship

In Chapter 2, the role of the Gravity Discovery Centre and the Cosmology Gallery was introduced, together with the De Laeter science engagement scholarship. In late 2010, I developed a proposal for the inaugural De Laeter Scholarship, and in early 2011, I was awarded the first De Laeter Tertiary scholarship for Science Engagement. The scholarship enabled the development of a video exhibit for the Cosmology Gallery, which is described below. I incorporated various digital imaging studies of Wolfe Creek Crater into the 8 minute video exhibit, which presents Aboriginal and scientific views about the crater (Goldsmith, 2000). The concept for the De Laeter Scholarship proposal was based on several elements:

- Develop a public exhibit for the Cosmology Gallery, suitable for a general introduction to gallery visitors.
- Feature Kandimalal, Wolfe Creek Crater.
- Present both scientific and Aboriginal perspectives about the crater, via a brief introduction.
- Enable Aboriginal people to share their own stories about the crater, via video interviews.
- Use visually engaging methods and advanced imaging techniques, for the production.
- Ensure that appropriate cultural standards are maintained with the exhibit.
- Have a strong link to the research interests of the late Em. Prof. De Laeter (e.g., his 2002 publication “Meteorites, A Journey Through Space and Time”).
- Relate to the practical scientific gravity experiments and demonstrations that can be conducted at the Leaning Tower, Gravity Discovery Centre.
- Ensure that the exhibit is engaging and of an appropriate duration.

The development of the video exhibit began with a review of the photographic and video resources I had developed, relating to Wolfe Creek Crater, since 1998. In reviewing scientific research about meteorites, I sourced a variety of resources, including the “Mundrabilla meteorite” which is on display at the Gravity Discovery Centre (and on loan from the Western Australian Museum). In addition, I obtained permission to include an image of the first meteorite to be photographed and then recovered from the Nullarbor plain, Western Australia, via an automated meteor detection system, developed by Professor Phil Bland (2004).

The basic structure of the video exhibit was developed in conjunction with a script. Independent advice regarding the script was sought from the Western Australian Museum. A professional narrator was engaged to narrate the production (via Curtin FM). The prior interviews of Elders and Aboriginal artists associated with Wolfe Creek Crater provided interview resources suitable for the exhibition video. In particular, the interviews with deceased elder Jack Jugarie (Figure 77), and interviews with Elder Stan Brumby (Figure 78), provided a very suitable introduction to the crater, for the video. Prior permissions regarding these interviews, including for use in this PhD research project, were obtained. I decided to seek additional permissions from Elder Stan Brumby and Keith Jugarie (the eldest son of Jack Jugarie), regarding the proposed use of the video interviews in the exhibit video. This was the primary reason for revisiting Halls Creek in August 2011, in which I met directly with both parties. Their endorsement and support for the use of the interviews is acknowledged in the exhibit video.

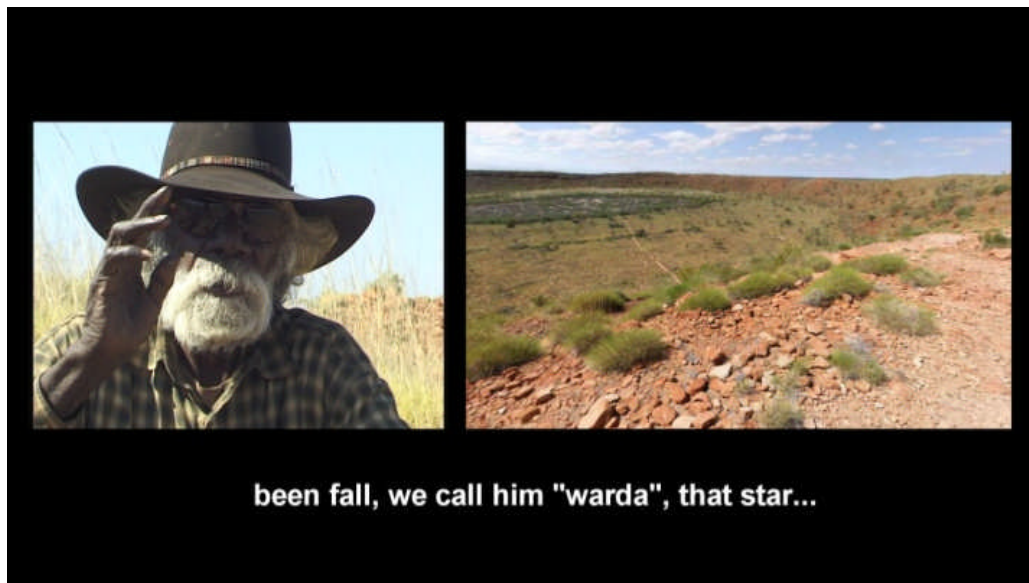


Figure 77. Elder Jack Jugarie at Wolfe Creek Crater.  
(Images: John Goldsmith)



Figure 78. Elder Stan Brumby.

(Image: John Goldsmith)

One visual resource was sourced from a commercial stock image library (the simulated view of the meteor entering the Earth's atmosphere). A Google Earth view was also sourced and licensed for use in the video, showing a zoom from outer space towards the Earth, to the impact site of Wolfe Creek Crater. This particular scene was included to give viewers the point-of-view vantage of the meteor which created Wolfe Creek Crater. In searching for an appropriate HD video scene, I noted that most commercially available video resources and scenes featuring meteors and meteorite craters are not particularly scientifically accurate.

Advanced digital imaging was utilised for the video production. I used my 360° imaging of Wolfe Creek Crater (as detailed in Section 5.4), and I rendered High Definition video, from the Quicktime 360° image (Goldsmith 2011a). This approach was used to create a smooth, pan and tilt scene, featuring the crater and its rim. The production of this video render, converting from Quicktime 360° imagery to HD video, was accomplished using “pano2movie” software, version 2.2 (build 83). The title sequence utilised an astronomical timelapse sequence which was recorded during one of my site visits to the crater (Figure 79). Other sequences include the “Timeline of the Universe” exhibit at the Cosmology Gallery, which also features Wolfe Creek Crater (Figure 80). Links between the crater, and educational investigations at the Gravity Discovery Centre were developed by including a scene featuring the balloon drop experiment, from the “Leaning Tower of Gingin” (adjacent to the Cosmology Gallery) (signage shown in Figure 81).



Figure 79. Title and timelapse sequence.  
(Image: John Goldsmith)



Figure 80. Wolfe Creek Crater featured in the Timeline of the Universe exhibit.  
(Image: John Goldsmith)



Figure 81. Signage at the "Leaning Tower".  
(Image: John Goldsmith)

The completed video exhibit is produced in HD video format and runs for approximately 8 minutes. The script for the exhibition is provided in Appendix 15, and a .WMV format video is provided on DVD in Appendix 17. The video exhibit was installed on the ground floor of the Cosmology Gallery in late 2011, and presented via a large HD monitor. Screen shots from the production are provided in Figures 77-81. Copies of the final video production were sent to both Elder Stan Brumby and Keith Jugarie.

### **5.5.2 “Ilgarijiri- Things Belonging to the Sky”, exhibition tour video.**

As described in Section 4.3, the “*Ilgarijiri- Things Belonging to the Sky*” project has presented the work of Aboriginal artists from the Murchison region of Western Australia, associated with the radio astronomy developments including ASKAP, the Murchison Radio-astronomy Observatory and the Murchison Widefield Array (Tingay 2011). The cross-cultural collaboration resulted in the sharing of knowledge about the night sky, between ICRAR research scientists, Aboriginal Elders, and artists. Based on the video interviews with Aboriginal Elders and artists, it is clearly demonstrated that the collaboration has been valued by the Aboriginal people who participated in the project, with evidence of self motivated learning about astronomy, and a variety of spin-off projects developing from the collaboration. Artists from the Mullewa community indicated that it was the Aboriginal artworks that featured sky knowledge, such as the Seven Sisters, that attracted the most attention and helped to develop their artistic reputation at state, national and international levels.

As the *Ilgarijiri- Things Belonging to the Sky* project developed, and new international tours occurred, the need for a supporting resource was recognised, to enable artists and Elders to share their story about the *Ilgarijiri* collaboration. An exhibition video was developed for the Washington DC (USA) exhibition (which commenced on 27 October 2011) and this video was further developed and refined for the subsequent exhibitions during the European tours in 2012, which included The Hague, Netherlands (27 February to 3 March 2012), European Parliament, Brussels, Belgium (5 March to 9 March 2012) and the Australian Embassy, Berlin, Germany (13 March to 17 March 2012). The video is supplied in Appendix 17, the transcript in Appendix 14, and screenshots from the video provided in Figures 82-84.



Figure 82. *Ilgarijiri* title.  
(Image: John Goldsmith)

The exhibition video production was primarily interview based, with inserted images of the *Ilgarijiri* artworks. The exhibition video was produced in DVD format, with a run time of 12 minutes 37 seconds. The main interviews featured the Mullewa artists including Christine Collard, Susan Merry and Wendy Jackamarra, and also featured Debra Maher and Barbara Comeagain (Figure 83). The main interviews of the Geraldton (Yamatji) artists included: Kevin Merritt; Barbara Merritt; Charmaine Green; Margaret Whitehurst and Olive Boddington (now deceased). Whilst the Geraldton based artists were happy to have individual interviews, the Mullewa based artists preferred to be interviewed together as a group.



Figure 83. The Mullewa artists.  
(Image: John Goldsmith)

The main themes and content of the exhibition video included:

- a contextual introduction.
- a welcome to the exhibition by the artists.
- an account of “the hunter” and the “Seven Sisters”, and their relation to Aboriginal law.
- developing the exhibition, and the site visit to Boolardy Station.
- firsthand accounts of the cross-cultural interaction with the ICRAR radio astronomy scientists.
- accounts of sharing the Emu sky pattern with non-Aboriginal people.
- motivations of the *Ilgarijiri* artists.
- reactions to viewing deep space objects through telescopes (e.g. the Jewel Box cluster).
- positive outcomes via publicity.
- loss of Elders knowledge, and the need for Aboriginal people to embrace such knowledge.
- Aboriginal people reclaiming the right to tell their own stories.



Figure 84. Interview with Barbara Merritt and Charmaine Green.

(Images: John Goldsmith)

During the 2012 European tour of *Ilgarijiri*, Professor Steven Tingay made anecdotal observations of visitor interaction at the exhibition, together with the exhibition video. It was noted that the video attracted the attention of visitors, and that many visitors watched the production. The video provided important scene setting and context, by which visitors could then experience and interpret the remainder of the exhibition.

### 5.5.3 Development of the “Aboriginal Astronomy Virtual Tour”

In section 5.4, I described the digital photographic methods used to document sites of significance related to Aboriginal sky knowledge, including Kandimalal, Wolfe Creek Crater, the Claisebrook Bibbulmun Dreaming Story Site, Horizon Planetarium, Mulka's Cave and Wave Rock. These methods have also been applied to help document and visualise the Western Australia radio astronomy site, including the Murchison Radio-astronomy Observatory (MRO), at Boolardy Station, ASKAP and the Murchison Widefield Array. Field photography and 360° panoramic images of the MRO have also been documented by Dr Peter Morse and a virtual visualisation produced in Second Life by Professor Paul Bourke (The University of Western Australia). The Second Life virtual site of the SKA project can be found at the ‘WASP’ site on Second Life, adjacent to The University of Western Australia Second Life site. ‘Avatars’ (virtual persons) can walk around and interact with the visual landscape in Second Life ([www.secondlife.com](http://www.secondlife.com)). Leonard (2002) has described an application of virtual reality, applied to Noongar Aboriginal narrative, relating to the Swan River. Leonard discusses the various approaches and challenges encountered when attempting to construct a virtual reality interpretation of an Aboriginal creation narrative story. Whilst Leonard's efforts centred mainly on a virtual reality reinterpretation, the virtual tour developed from my research is based on 360° images of actual places, linked together in a theme and storyline.

The resources used to create the virtual tour include the 360° by 180° images of Wolfe Creek Crater, and other sites of importance in relation to Aboriginal sky knowledge, as described in section 5.4. This original documentation is used as the primary visual resource for the subsequent development of virtual tours. The 360° image resources developed from this research also can be developed into other formats and applications. For example, they can be used for planetarium dome projections, high



resolution panoramic images, and virtual tours accessed in a variety of ways, including internet based tours, tablet and mobile devices. The 360° images are imported into panoramic tour software (Kolor Panotour 1.7) to develop and create the virtual tour. Kolor (2009) has published a range of spherical images from around the world, demonstrating the very diverse application of this type of photography. In the panoramic tour development, hotlinks are established between images to enable transitions between different locations. The tour begins with the Bibbilmun Dreaming Story (the Claisebrook site), and the tour links to sites such as Mulka's (Bates) Cave and Wave Rock. Other tour options include the *Ilgarijiri* exhibition and a tour of Kandimalal Wolfe Creek Crater. The crater tour includes examples of Aboriginal artworks which feature the crater, and these provide examples of Aboriginal sky knowledge expressed through contemporary artworks. A menu option is included on all scenes to enable rapid and easy navigation within the tour.

The virtual tour is supplied on DVD disk in Appendix 17. It requires an appropriate web browser to view the tour. Sample screenshots from the virtual tour are provided below (Figure 85).

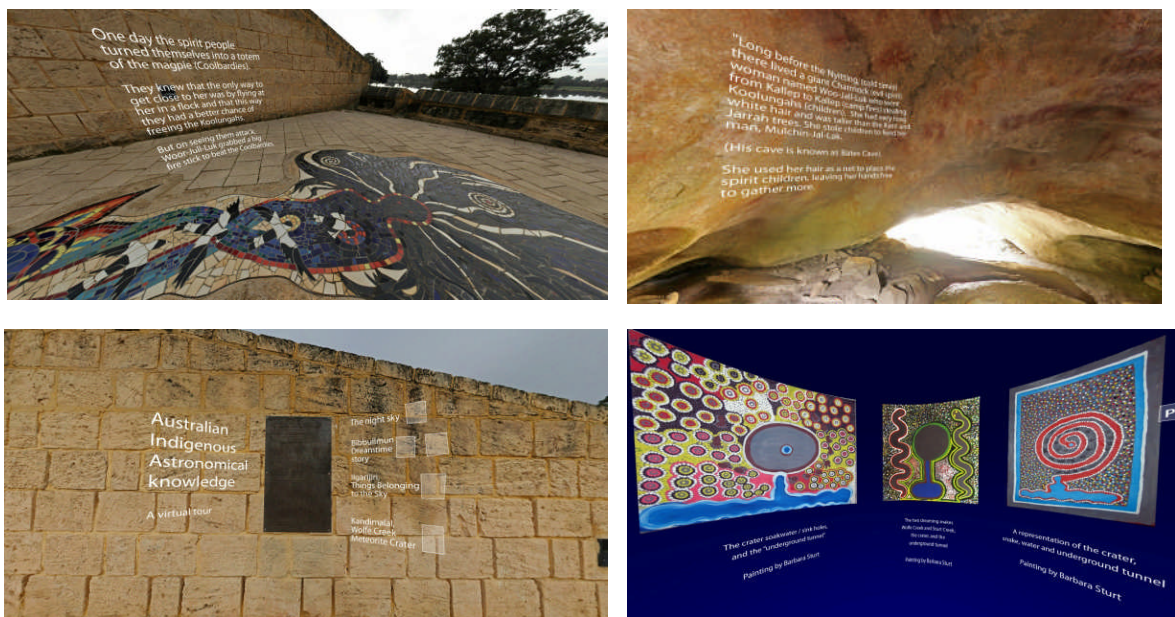


Figure 85. Screenshots from the Cosmos, Culture and Landscape virtual tour.  
(Images: John Goldsmith)

#### 5.5.4 Applying the virtual tour for online education

In 2011, I was invited by Questacon to give a live online talk to Australian schools, about Wolfe Creek Crater and its importance and values. Questacon provided a video link-up with schools and organisations located in Alice Springs, Perth and Tasmania. A virtual tour of the crater was delivered live to schools, and this enabled a virtual experience of the crater for the students (Figure 86). The video link-up and virtual tour demonstrated its use in an educational setting, and its use in remote and online education. This experience demonstrated how such technology can be used to link remote educational facilities with live presentation and instruction, using digital tours.



Figure 86. John Goldsmith presenting the virtual tour via video link.  
(Image: John Goldsmith)

### 5.5.5 Applying success factors to the three new resources.

Having described the three new resources, and the factors for successful and effective communication of Aboriginal sky knowledge, a comparison of all three projects is provide in Table 22.

Table 22. Success factors.

<b>Factor</b>	<b>Cosmology Gallery exhibition video</b>	<b><i>“Ilgarijiri- Things Belonging to the Sky”</i> exhibition video</b>	<b>Aboriginal astronomy virtual tour</b>
Leadership and motivation.	Supported by the featured Aboriginal interviewees / family.	Supported by the representative Aboriginal art organisation (Yamaji Arts) and each of the featured Aboriginal interviewees.	Supported by the research committee including the cultural advisor.
Consultation and collaboration.	Collaboration with two Aboriginal interviewees, with consultation conducted with interviewees and/or their family representatives.	Collaboration with more than 30 Aboriginal artists, via a the Aboriginal managed and led Yamaji Art (Geraldton), and ICRAR	Collaboration and consultation with Yamaji Art, Elder Toogarr Morrison & Department of Environment & Conservation
Interdisciplinary skills amongst the project team.	Interview skills, photography and video production, planning and implementing remote field work.	Interview skills, photography and video production, field work planning and implementation.	Photography, advanced digital imaging and virtual tour development.

<b>Factor</b>	<b>Cosmology Gallery exhibition video</b>	<b>“Ilgarijiri- Things Belonging to the Sky” exhibition video</b>	<b>Aboriginal astronomy virtual tour</b>
Project scale.	# of Aboriginal interviewees = 2	# of Aboriginal interviewees = 7	# of Aboriginal interviewees = NA # of sites featured = 5
Utilisation and harnessing of emerging technologies.	Yes. Uses advanced digital imaging applied to HD video	Partial. Uses some astronomical timelapse sequences	Yes. Uses extensive advanced digital imaging and virtual tour
Orientation towards education and research.	Yes, the exhibition video is a centre piece of the Cosmology Gallery.	Yes, the resource is part of the <i>Ilgarijiri</i> exhibition.	Yes, has been trialled in a live video link up with school students
Logistics and resourcing.	Onsite visits are relatively expensive, work is generally budget constrained. PhD scholarship funding enabled site visits and onsite interviews. Interviews and site visits were also resourced privately. Video production funding supported by De Laeter Scholarship.	Adequate.	Resourcing for the virtual tour was via the PhD scholarship and privately funded.
Alignment to “big issues”.	No.	Partial: presented at prestigious international venues.	No.
Multi format productions.	Resources used to develop the exhibition video are multiformat and have the potential to be developed further in formats such as HD video productions, planetarium and virtual tour resources.	The resource is an HD video production, and supports the <i>Ilgarijiri</i> exhibition.	Resources used to develop the exhibition video are multiformat and have the potential to be developed further in formats.

The comparison of the three projects (Table 22) has shown how success factors have been incorporated and applied in each project. I conclude that the projects have been successful to the extent of their budget resources, scope and purpose, and that further opportunities exist for wider application, particularly for the virtual tour, and also for alignment of projects to “big issues”.

## **5.6 Educational Opportunities**

### **5.6.1 Introduction**

Aboriginal astronomical and sky knowledge provides educational opportunities at several levels, including formal education (primary, secondary and tertiary), as well as informal and community education. Improving awareness about Aboriginal culture and issues in general, and Aboriginal sky knowledge in particular, can promote greater understanding between Aboriginal and non-Aboriginal

people in Australia, which also contributes towards Reconciliation. The subject of astronomy is of general interest to a wide range of people and the subject of Aboriginal sky knowledge is one that is relatively poorly understood (an indication of this is derived from the surveys conducted as part of this research and presented in Chapter 3). Despite this, there is often a curiosity, interest, or desire to learn about the subject. There are various ways of including Aboriginal knowledge systems into education programs. One example is the “Embedding Aboriginal Science” initiative, which is promoted by organisations such as the New South Wales Board of Studies and the “Aboriginal Perspectives in Science Project” via the Aboriginal Science Network, while the new Australian national curriculum presents a step forward in regards to formalising education around Indigenous perspectives, as outlined in the following section.

### **5.6.2 Context: national curriculum**

In Australia, curriculum for primary and secondary schools is determined on a national basis, via the Australian Curriculum Assessment and Reporting Authority (ACARA, 2013). The following discussion is based on information sourced from the ACARA web site ([www.acara.edu.au](http://www.acara.edu.au)), which is the primary source of information in relation to the Australian Curriculum. The curriculum is organised according to year levels, starting with the foundation level (F), and then years 1 to 10, and then a senior secondary curriculum. For Foundation to Year 10, the three key components of the curriculum include (1) Learning Areas (e.g. English, Mathematics, Science, History & Geography), (2) General Capabilities (which are defined by seven main capabilities), and (3) Cross Curriculum Priorities. The seven “General Capabilities” comprise:

- Literacy.
- Numeracy.
- Information and communication technology capability.
- Critical and creative thinking.
- Personal and social capability.
- Ethical understanding.
- Intercultural understanding.

Special attention has been paid in the Australian Curriculum to ensuring that the curriculum is relevant to the contemporary issues faced by students. The three “Cross Curriculum Priorities” are:

- Aboriginal and Torres Strait Islander histories and cultures.
- Asia and Australia's engagement with Asia.
- Sustainability.

These three cross curriculum priorities are “embedded” within the learning areas of the Curriculum. It is recognised by ACARA that the three priorities have a “strong, but varying presence depending upon their relevance to the learning area” (ACARA, 2011). The areas of Australian Curriculum that most strongly relates to Aboriginal culture in general, and Aboriginal knowledge of the night sky in particular, includes:

- (1) Learning Areas (History & Geography, Science).
- (2) General capabilities (Intercultural understanding, Ethical understanding, Critical and creative thinking).
- (3) Cross Curriculum Priorities (Aboriginal and Torres Strait Islander histories and cultures).

The main purpose of the Cross Curriculum Priority (Aboriginal and Torres Strait Islander histories and cultures) is to encourage all students in Australia to develop their “*understanding and appreciation of Aboriginal and Torres Strait Islander histories and cultures, deep knowledge traditions and holistic world views*” with the express aim of enriching the ability of students to “*participate positively in the ongoing development of Australia...*” (ACARA, 2011). This goal also contributes towards the process of Reconciliation via improving awareness, understanding and appreciation of Aboriginal culture in Australia. ACARA goes on to articulate three key underlying concepts:

- Country/Place- highlights the physical and spiritual connection between people and land, via unique belief systems.
- Peoples- recognises the diversity of Aboriginal people, which is examined via history, politics and social perspectives. The importance and diversity of Aboriginal languages is also recognised.
- Cultures- focuses on Aboriginal societies and the importance of kin-ship structures within such societies.

These three key concepts provide the foundation upon which subsequent learning is based and developed.

### **5.6.3 Senior secondary Australian curriculum**

The Senior secondary Australian Curriculum develops and expands upon the Foundation to Year 10 curriculum. For the Senior Secondary, curriculum for 14 subjects have been developed including English (Essential English, English, Literature, English as an Additional Language), Mathematics (Essential Mathematics, General Mathematics, Mathematical Methods, Specialist Mathematics), Science (Biology, Chemistry, Earth and Environmental Science, Physics), and History (Ancient History, Modern History). Senior secondary curriculum is also required to address the Cross Curriculum Priorities. The way in which subjects address these priorities is broadly described by ACARA, in relation to each subject (ACARA, 2011). For example, ACARA identifies ways in which Cross Curriculum Priorities can be applied in all subjects. In English subjects, Aboriginal and Torres Strait Islander literature can be used as educational resources. For Biology, students can examine the development of knowledge of ecosystems and the interaction between Aboriginal people and the plants and animals of Australia, and changes within the natural environment over tens of thousands of years. For Chemistry, the chemical properties of bush medicine plants can be examined, and the use of mineral ores for adornment and artwork. For Earth and Environmental Science, students can examine processes of the Earth, environment and resources, which can provide insights into ways of

knowing by Aboriginal people. Physics offers ways of exploring Aboriginal peoples understanding of physical phenomena, and specific mention is made of astronomical phenomena (ACARA 2013). Ancient History provides opportunities to examine sites of significance to Aboriginal people, including the conservation of such sites. Modern History provides for learning about the contemporary and ongoing processes such as Reconciliation, and Geography can promote an understanding of geographical conditions (e.g. ecological hazards) and their implications for Aboriginal people and communities.

The proceeding discussion about the Australian Curriculum, for both Foundation to Year 10, and for Senior Secondary students, demonstrates the role and context of Aboriginal culture and history in relation to all subjects. The specific applicability of Aboriginal culture and history is highlighted via the Cross Curriculum Priority. Aboriginal astronomical and sky knowledge has direct educational applicability within National Curriculum, for all students.

#### **5.6.4 Tertiary education**

Virtually all of the 39 universities across Australia, as identified by the Australian Education Network, have organisations that support or facilitate Aboriginal education, engagement, participation and research (Australian Education Network, 2013). Organisations within the universities include School departments, institutes, student support services and Cooperative Research Centres. Some prominent Australian examples include:

- Australian National University / National Centre for Indigenous Studies.
- Charles Darwin University / Australian Centre for Indigenous Knowledges and Education (ACIKE).
- Charles Sturt University / Centre for Indigenous Studies.
- Curtin University / Centre for Aboriginal Studies.
- Edith Cowan University / Kurongkurl Katitjin, Centre for Indigenous Australian Education and Research.
- James Cook University / School of Indigenous Australian Studies.
- La Trobe University / The Lowitja Institute.
- Macquarie University / Department of Indigenous Studies.
- Murdoch University / Kulbardi Aboriginal Centre.
- Southern Cross University / Gnibi College of Indigenous Australian Peoples.
- Swinburne University of Technology / Centre for Indigenous Knowledge and Design Anthropology (CIKADA).
- University of Canberra / Ngunnawal Indigenous Higher Education Centre.
- University of Melbourne / Murrup Barak, Melbourne Institute for Indigenous Development.
- University of New South Wales / Nura Gili, Centre for Indigenous Programs.
- University of Notre Dame / Nulungu Centre for Indigenous Studies.
- University of Southern Queensland / Centre for Australian Indigenous Knowledges.

- University of Western Australia / School of Indigenous Studies.

Most Universities offer undergraduate and postgraduate opportunities for education or research into Aboriginal culture and history.

### **5.6.5 Informal education**

Several informal educational programs and initiatives also contribute towards education in relation to Aboriginal culture in general, and in some cases, specifically about Aboriginal knowledge of the night sky. Informal education can be characterised as community courses and are not necessarily linked to Australian Curriculum requirements. Such initiatives tend to be one-off or small scale educational activities, but may be part of a larger informal educational initiatives, such as the extensive range of courses regularly offered by “UWA Extension” delivered by the University of Western Australia. Examples of informal educational initiatives include the occasional public presentations given at Horizon Planetarium by Elder Toogarr Morrison on Aboriginal sky knowledge. Public events have also been offered by groups such as Gingin Observatory, situated at the Gravity Discovery Centre, Gingin Western Australia, where Aboriginal astronomy talks have been offered as part of the public astronomy “viewing nights”.

### **5.6.6 Educational initiatives**

A default approach is for educational initiatives to be developed on an ad hoc basis. However, a national approach to such educational initiatives could provide a more systematic and consistent approach. Key principles for developing such educational programs and resources could include:

- A national perspective for the development of consistent educational programs.
- Consultation and participation.
- Approved by relevant communities.
- Locally relevant examples featured.
- Encourages cross-cultural sharing of knowledge.
- Promoting awareness of, understanding, and respect toward Aboriginal perspectives and knowledge.
- Harness online access to educational resources to assist access for remote schools.

Ideally, educational programs and resources would be developed to cater for the educational needs of both Aboriginal and non-Aboriginal people in Australia. Formal educational programs could be developed at appropriate levels for primary, secondary and tertiary settings. Informal educational opportunities could include community courses and eco-cultural tourism ventures. The emerging areas of online educational resources and widespread access to the internet, provides for increasing opportunities to develop such programs and resources. The development of the National Broadband Network (Australia) will further support and facilitate the use of digital content in a variety of settings, including for educational purposes.

## 5.7 Discussion and conclusions

The case studies presented in this chapter provide insight into how successful Aboriginal / non-Aboriginal collaborations can be approached, to support the communication and sharing of Aboriginal knowledge, and sky knowledge in particular. There are several elements that are apparent from these projects, which can inform and guide future initiatives. For example, the concept for the Gascoyne Astro-cinematography project was developed from the Gascoyne community and emerged out of the needs and priorities of the community itself. Collaboration and consultation are vital approaches, demonstrated very effectively by the “*Stories of the Canning Stock Route*” project. The approach of having consultations that are sustained, significant, and repeated over time, clearly can be very beneficial for projects. Depending upon local circumstances, the engagement of local experts, and language translators, can also be very important, with interviews conducted in language wherever possible. The “*Stories of the Canning Stock Route*” project also highlights the use and application of cultural protocols, such as approaches for working with male and female groups from communities. Most projects also demonstrate a range of project team members, each with their own expertise. The “*Stories of the Canning Stock Route*” project ensured a high proportion of Aboriginal people directly involved in the project. Fundamental to all successful projects is the sourcing of adequate funding to enable field and production work. In cases where Intellectual Property may be a significant issue, successful projects have proactively managed this issue, such as that achieved by the “*Stories of the Canning Stock Route*” project. The Crossing Worlds fulldome production found a very successful way of leveraging its profile, by exhibition at a major international conference, in addition to being awarded a prize for its production. Several of the projects featured in Chapter 5 used innovative and advanced visualisation and imaging techniques, such as the use of the digital touch tables in the “*Stories of the Canning Stock Route*” project, the Gascoyne Cultural Centre fulldome project, and in particular, the Crossing Worlds production. Increasing use of multimedia and using technology to increase access to multiple sources of data are notable. The collaboration and consultations with communities are also leading to the development and implementation of methods to return knowledge, and project results, back to the communities and individuals involved in the project.

The Cosmic Africa production, and the interview discussions with Dr Thebe Medupe, highlight how cultural astronomy can be applied in very practical ways in two major fields: education and tourism. Dr Medupe has expressed his wish that cultural astronomy curriculum be developed, particularly for secondary schools. In addition, he notes examples of how South African tourism is incorporating Aboriginal sky knowledge into tourism experiences.

The use of digital imaging techniques, as a suite of tools to help communicate Aboriginal sky knowledge, has been highlighted in this chapter. The use of digital photography as a means of recording places of natural and cultural significance provides several opportunities. From a public exhibition point of view, 360° spherical images provide an exceptional opportunity to document highly realistic and ‘immersive’ images of a given site. There are several ways in which such images can be viewed, including in an exhibition setting, via the Internet, in a dome or planetarium setting,



and in virtual reality settings such as 'Second Life'. This provides the potential for sites to be viewed in a virtual setting, rather than visitors having to visit a site physically. Rossi and Web (2007) drew attention to the erosive impact of visitors on Mulka's Cave. A 'virtual' experience of a site could be used to help lessen the physical impact of visitors on sensitive sites, by providing a way in which visitors can experience a site visually without needing to physically visit a site. This approach has potential to be applied at any site in which a 'virtual' experience of a site is beneficial. A further benefit of 360° spherical images, in relation to rock art, is that the spatial relationship between different rock art motifs can be readily perceived by the viewer. Groupings of rock art, and their relationship to each other and the surfaces upon which they are located, can be readily perceived. With the interactivity available in 360° spherical images including zoom functions and movement in any 360° direction, the viewer can gain a very good appreciation of the appearance of a site and its rock art.

One application of 360° spherical imaging, and time-lapse photography is to record the astronomical context of a particular landscape or environment. These methods have potential in archaeo-astronomy research, which focuses on the relationships between the movement of astronomical bodies (e.g. solstice, equinox) and the landscape. This technique could be particularly useful to record the appearance of celestial bodies from a given location in relation to a particular cultural place. Norris et al. (2013) notes the stone arrangement site of Wurdi Youang (Victoria) and its relation to the setting sun at the solstices and equinoxes. This is one such site in which time-lapse techniques could be applied.

Considering the constraints and limiting factors for this type of digital imaging, budgets remain a constraining factor. A budget of approximately \$10,000 is needed to cover the expense of camera equipment, specialist panoramic equipment, computer equipment and software, in addition to travel and field work expenses. The overall cost can be a substantial barrier for the uptake of this technology.

Computer processing speed is also a significant issue regarding the rendering and production of spherical imagery, and rendering of video from spherical imagery. It is typical for a single render to take more than 30 minutes. Reducing the time it takes to process and render imagery will dramatically improve the production process. In addition to processing speed, the storage and management of large amounts of data can also be an issue, particularly in relation to long term archiving.

These digital photographic techniques provide great opportunities to enable audiences to experience and explore digital versions of landscapes, whether they be terrestrial landscapes or astronomical. There is considerable scope to apply the approaches used in this research at other locations throughout the world, and, in particular, in educational, research and tourism settings. The digital documentation of places of great scientific, cultural and/or heritage places, has the potential to provide an accessible

heritage to all. The development of the Aboriginal astronomy virtual tour and its application in an educational setting demonstrates the use of such a resource. The review of the Australian Curriculum clearly indicates the context and role of Aboriginal astronomical and sky knowledge, as part of the “Cross Curriculum Priorities”, with Australian curriculum.

In conclusion, in this chapter, I have presented a framework which distils the factors that contribute towards successful collaborations for the communication of Aboriginal astronomical and sky knowledge. Several case studies are examined regarding how Aboriginal sky knowledge has been communicated in a variety of settings, for both Australian examples (*Ilgarijiri*), and international examples (e.g. The “Crossing Worlds” production, and the South African Lloyd Bleek digital archive). I then described the development of three new resources, arising from my research, and based upon the documentary research as presented in Chapter 4, including video interviews and the use of advanced digital imaging methods. The three new resources comprise the Cosmology Gallery exhibition video, which features scientific and Aboriginal perspectives of Wolfe Creek Crater, the *Ilgarijiri* exhibition video, and the Aboriginal astronomy virtual tour. These new resources have been informed and developed according to the framework of factors that lead to successful and effective collaboration and communication of Aboriginal astronomical and sky knowledge.

## Chapter 6

### Conclusions and future work

*“Indigenous peoples have the right to practice and revitalise their cultural traditions and customs. This includes the right to maintain, protect and develop the past, present and future manifestations of their cultures, such as archaeological and historical sites, artefacts, designs, ceremonies, technologies and visual and performing arts and literature”.*

Declaration on the Rights of Indigenous People, Article 11 (1),  
adopted by United Nations General Assembly on 13 September 2007  
Allen and Unwin, and Amnesty International (2009, Article 11).

Research from Chapter 6 has been presented in the following conference posters:

Goldsmith, J., Tingay, S., & Hamacher, D. 2011, “Building bridges between cultures, communicating and sharing Australian Indigenous sky knowledge”. Poster presented at the ninth “Oxford” International Symposium on Archaeoastronomy, Lima, Peru, January 2011.

Goldsmith, J., & Brocx M. 2012, “A virtual tour exploring Wolfe Creek Meteorite Crater’s geoheritage, cultural and educational values”. Poster presented at the 34th International Geological Congress (IGC): Brisbane, Australia, 5 – 10 August 2012.

#### 6.1 Conclusions

The cosmos and the night sky in particular is a cultural and scientific heritage for all people. A rich, ancient, dynamic and ongoing cultural heritage exists, not only for Australian Aboriginal people, but for all people and cultures of the planet. By its very nature the cosmos cannot be exclusively possessed by any one person, culture or civilisation. Its richness for human culture stems from the night sky as a valued source of scientific discovery, inspiration and wonder to the lay person, and also a source of valued cultural knowledge which subsequent generations learn, share, respect and pass on to successive generations. Rather than being seen as obsolete knowledge which has no value to modern communities, Aboriginal sky knowledge and its sharing opens up important bridges between cultures, bringing people together in an open sharing of knowledge of the night sky, and its many wonders and mysteries. The cosmos is a shared asset, one that can be understood and interacted with in many different ways by individuals, communities and cultures.

This research is one attempt to investigate the role of the night sky, the cosmos and astronomical knowledge in selected contemporary Australian Aboriginal cultures. This research is, in many ways, a beginning, as there are many other Aboriginal cultural groups in Australia that would benefit from the cross-cultural sharing of such knowledge. Researchers in other countries are also conducting new work into cultural astronomy, with one leading example being the South African astrophysicist and cultural astronomer, Dr Thebe Medupe, who played a key role in the development of the “Cosmic Africa” documentary film production, investigating numerous examples of cultural astronomy in a variety of African cultures and settings.

The development of radio astronomy in Western Australia, and Australia's role in the Square Kilometre Array radio telescope project, has provided a strong focus and opportunity to collaborate with Aboriginal communities. This has resulted in the sharing of knowledge and mutual respect of both scientific astronomical knowledge and Aboriginal cultural knowledge of the night sky. In this way, radio astronomy initiatives in Australia have provided a means to respectfully learn, share, communicate and celebrate Aboriginal knowledge of the night sky.

The principles of mutual exchange and sharing of knowledge, as exemplified by the *Ilgarijiri- Things Belonging to the Sky* exhibition, provide a direction for future initiatives involving scientific astronomy and Aboriginal sky knowledge. The insights gained from this research can be applied to the relatively new and developing field of Aboriginal astronomy research in Australia, as well as contributing to such research in international contexts, particularly with the Australian and Southern African collaborations emerging from the Square Kilometre Array radio telescope initiative.

The substantial efforts occurring in contemporary radio astronomy research provide strong examples of the scientific quest to comprehend, investigate and understand the workings of the cosmos, a journey that has preoccupied humanity. The long term future of radio astronomy in Australia is supported with three key approaches (Commonwealth of Australia 2010): (1) by the development of major new facilities and instruments; (2) the development of supporting research programs; and (3) the protection of the radio quiet site attributes via long term legislative methods.

The development of radio astronomy facilities will expand our capability of conducting scientific investigations. Examples of the Western Australian facilities include the Murchison Radio-astronomy Observatory (MRO), the Murchison Widefield Array (MWA) (Williams et al. 2012, Lonsdale et al. 2009), and the Australian Square Kilometre Array Pathfinder (ASKAP) (Johnston et al. 2007). As these facilities lead to new scientific insights into the Universe, communication of findings to both scientific communities and the broader public, will be essential.

This PhD research has investigated Australian Aboriginal sky knowledge, particularly in the context of Western Australia. This research is a substantial contribution towards our understanding of collaborative Aboriginal sky knowledge projects. The research has investigated and documented the

collaboration between astronomers and Aboriginal Elders and artists from the Murchison region, in addition to detailed research in complementary areas such as Kandimalal, Wolfe Creek Crater, and the South West of Western Australia. The collaborative approaches used have resulted in the successful sharing of scientific and Aboriginal knowledge. The approach has been to respect and value Aboriginal knowledge and to develop meaningful and effective opportunities to inform, educate and share such knowledge with our broader community. The success of *Ilgarijiri- Things Belonging to the Sky* project, is clearly evident by the international exhibitions and showcasing of Aboriginal artworks, all based on Aboriginal astronomical themes. Murchison Aboriginal Elder Kevin Merritt provided an insight into the value and importance of ancient cultural knowledge, and its relevance to our contemporary circumstances:

*...the older people (i.e. ancestors) had to exist, somehow and to be able to... to exist, just exist. To show the younger people that, you know,... ...the world has been changing and their world will be changing soon too. It doesn't always remain the same, so really a learning curve for them because growing up I'd never thought I'd see the things that I see now in the world today, and you know, if my Grandparents ever came back, they'd never believe what's in the world today and I think this project (Ilgarijiri) will show the young people that what the past was because the past is very important to everybody, for our ancestors and for those who are going to come after us. I think it is very important. No matter whether you are Aboriginal or non-Aboriginal.*

So the view expressed by Kevin Merritt helps to address the attitude which is sometimes encountered, which fails to see the value, significance and importance of Aboriginal sky knowledge for both Aboriginal and non-Aboriginal people. Rather than being viewed as an obsolete body of knowledge, no longer relevant to today's needs, Aboriginal sky knowledge can be seen to be part of the rich cultural heritage of knowledge, which has assisted communities in their survival and thriving in the past and part of a pre-requisite for the existence of future generations. The view put forward by Kevin Merritt logically leads to a state of thankfulness and gratitude towards ancestors. It also provides a strong reminder for current generations to expect change and to be ready to adapt as changing circumstances arise. This insight alone, provides a strong reminder for both Aboriginal and non-Aboriginal people, that ancestors have played a vital role, enabling the opportunity of current generations to exist and prosper.

In this concluding chapter I summarise the main findings of my research and draw out the overarching themes which have emerged from this work. I then conclude with a discussion of the implications of this research and opportunities for future research.

### **6.1.1 Summary of findings related to hypotheses & research objectives**

The key research findings of this thesis are presented below in relation to each of the six hypotheses and four research objectives that were established in Chapter 1, and restated below.

**Hypothesis 1:** That some Australian Aboriginal astronomical and sky knowledge is open and available for appreciation and learning by the general public.

This research has clearly demonstrated diverse examples of the communication and sharing of Aboriginal sky knowledge, as presented in Chapter 2. In addition, there are various examples of Aboriginal leaders actively encouraging Aboriginal people to document and share their own knowledge, with non-Aboriginal communities in Australia. My research (section 2.3) presents 28 examples, in nine categories of the communication and sharing of Aboriginal sky knowledge, almost all examples being Australian examples. I have extended this research by investigating and presenting two international case studies, which look at South African cultural astronomy, and the communication of aspects of North American sky knowledge communicated via the use of advanced digital imaging methods. My documentation is further strengthened by the presentation of two Western Australian case studies, featuring the Canning Stock Route project (as an example of Aboriginal and non-Aboriginal collaboration), and the Gascoyne astro-cinematography project. I have distilled nine factors for the effective and successful communication of Aboriginal sky knowledge, and I have then applied these factors in the development of new resources that document and share Western Australian Aboriginal sky knowledge.

**Hypothesis 2:** Collaborative, cross-cultural projects can act as an important catalyst to encourage the appreciation and respect of Aboriginal and scientific astronomical knowledge.

Based on the original research, investigation and applications presented in Sections 4.3 and 5.5.2 of this research, significant evidence has been identified in support of hypothesis 2. The *Ilgarijiri-Things Belonging to the Sky* project (Tingay, 2011), has clearly demonstrated its success as a cross-cultural exchange of scientific and Aboriginal knowledge. Based on extensive first hand interviews with the Elders and artists who participated in the project, I have documented that the Aboriginal and non-Aboriginal participants valued the project, and experienced it as a culturally affirming and positive experience. The participants described the complexities involved in the project, and the ways in which these complexities were addressed. The interviews also documented that the project acted as a catalyst for informal learning amongst the Aboriginal artists and Elders, who pro-actively learnt about astronomy, via a range of educational resources including DVD films about astronomy. Artists from the Mullewa community noted that it was the astronomically inspired artworks that they felt contributed most to their emerging reputation in the art world, and they based their view on the sales and demand of artworks from their centre.

Successful collaborations between Aboriginal and non-Aboriginal people occur when key issues and sensitivities are recognised, and addressed effectively. The video interviews with participants provides strong evidence of the value to Aboriginal people of the ICRAR / Yamaji Art *Ilgarijiri-Things Belonging to the Sky* collaboration, including social, cultural, economic, educational aspects,

indicating that it is an important catalyst as a cross-cultural learning opportunity between Aboriginal and non-Aboriginal cultures. Other indicators of the importance of the *Ilgarijiri* project include the state, national and international reach the project has achieved via exhibitions which have taken place in Western Australia (Geraldton and Perth), Australia (Canberra), and internationally (Cape Town South Africa, Washington DC, USA, Netherlands, Brussels and Germany).

**Hypothesis 3:** That cultural astronomy and Aboriginal sky knowledge can be used as a tool to support Aboriginal and non-Aboriginal contemporary learning and education.

The results of the three surveys conducted for this research, as presented in Chapter 3, have established a baseline of knowledge, attitudes and beliefs in relation to Aboriginal sky knowledge. In particular, the Indigenous Astronomy Symposium survey, which focussed on knowledge and attitudes of the symposium participants including expert researchers, identified a belief that most people have little understanding of Aboriginal sky knowledge, and that both art and storytelling are an important way of sharing Aboriginal culture and sky knowledge.

In Chapter 4, Interviews with *Ilgarijiri* artists, as described in Chapter 4, detail examples of spontaneous, self motivated learning, on the part of the artists and their families. Such reports indicate that the *Ilgarijiri* project had a substantial positive effect in encouraging learning and informal education, particularly for the artists. The interviews also document significant changes in opinion about the project, as expressed by some artists. Also documented is the intergenerational learning which took place between an *Ilgarijiri* artist and their grand-daughter, in relation to seeing and recognising the Emu in the sky.

In Chapter 5, I investigated and discussed the communication of Aboriginal sky knowledge (and culture in general). I presented four case studies, two from Australia, and two contrasting international examples, from South Africa and the USA. Insights gained from the case studies have been used to help inform the creation of new resources, including the De Laeter Science Engagement Scholarship, which facilitated the development of the Cosmology Gallery public video exhibit, featuring scientific and Aboriginal perspectives of Kandimalal (Wolfe Creek Crater). The video exhibit is now part of the Cosmology Gallery and its exhibits. The Cosmology Gallery features creative artwork interpretations of the Universe, as viewed from Aboriginal, Christian, Buddhist, Islamic, Hindu and non-religious perspectives (Gravity Discovery Centre Foundation, 2008). I then went on to discuss the development of the *Ilgarijiri* video exhibit, which accompanied the latest tour of the *Ilgarijiri* project, in Europe during 2012.

This PhD research has made a major contribution in relation to advanced digital imaging, of important Western Australian sites relating to Aboriginal sky knowledge. The original and new documentation of Kandimalal, Wolfe Creek Crater, with 360° imaging, has established a valuable documentary

record of the landscape, from which Aboriginal knowledge relating to the crater can be better contextualised and visualised. The digital imaging of the crater is likely to be the most extensive digital documentation of the crater ever accomplished. The importance of this method is highlighted by the diverse ways in which such digital imaging can be used to encourage a better appreciation of the landscape, and its cultural dimensions. The digital imaging has been used to document multiple 360° views of key sites, including Kandimalal (Wolfe Creek Crater), and other important places which help to communicate Aboriginal sky knowledge, such as the Claisebrook Dreaming Story and solar monument, Wave Rock, and the Cosmology Gallery. Secondly, these digital resources have then been applied to create a new 360° virtual reality tour. This new and original visual and educational resource has considerable potential for future applications. These uses are diverse and can include the development of planetarium “fulldome” immersive programs, online virtual tours, and formal educational applications such as the use of virtual tours during live video link ups with remote and widely dispersed schools (as demonstrated by the “Questacon” video link experience). This research has demonstrated how such visual resources can be used to support further learning and sharing of Aboriginal sky knowledge. The use of the advanced digital imaging methods provide additional benefits, such as providing an alternative to expensive and remote site visits. Virtual tours also provide the potential to reduce the impact of visitors on sites that are physically or culturally sensitive, thereby helping to protect such sites. There are also cross-over opportunities with related image technologies. For example, the digital imaging used to create virtual tours can readily be combined or applied to planetarium software such as the “Stellarium” planetarium software.

A range of educational opportunities in relation to Aboriginal sky knowledge have been identified, as described in sections 5.6 and 6.2.2, which articulate the role of the Australian national curriculum in facilitating learning about Aboriginal cultures in general, and specific links to Aboriginal sky knowledge. The context of secondary school and tertiary based education is examined.

**Hypothesis 4:** That certain places and/or landscapes have particular astronomical importance within Aboriginal culture.

This research has supported hypothesis 4 and a prime example is Kandimalal (Wolfe Creek Crater). An indicator of this is the representation of the crater by a number of Kimberley Aboriginal artists, and in particular, Elder Stan Brumby. The artworks feature and highlight aspects of the crater including the physical landscape and context of the crater (Wolfe Creek and Sturt Creek) and stories recounting the “star” which fell to the earth, to form the crater, and beliefs associated with the “sinkholes” located in the centre of the crater. This association of a meteor and the formation of the crater should not be interpreted to mean that Aboriginal people witnessed the impact that caused Wolfe Creek Crater. The crater is estimated to be at least 300,000+ years old (Bevan & De Laeter 2002) and this clearly predates the known occupation of Australia by Aboriginal people. Rather, the account of the meteor and the crater formation should be attributed either to a deduction by



Aboriginal people, derived in part from observation of large meteor events, or attributed to the adoption of relatively recent knowledge (i.e. post 1947), from scientific explanations of the crater by non-Aboriginal people.

The video documentation of interviews with Elders and artists associated with the crater demonstrate specific astronomical knowledge, based on personal experience, and cultural beliefs. The demonstrated knowledge of, and use of a Jaru language word referring to the rare sonic phenomena caused by large meteors, provides evidence that some Aboriginal people have paid considerable attention to night sky phenomena.

The research has also noted several other areas in the South West of Western Australia, which have astronomical importance to Aboriginal people. The Dreaming Story, as expressed at the Claisebrook (Perth) solar monument, refers to sites including Wave Rock and Mulka's (Bates) Cave, and their significance in the astronomically themed dreamtime story.

**Hypothesis 5:** That there exists in contemporary Aboriginal society, significant astronomical and sky knowledge, which is largely un-recognised.

In chapter 4, I presented the findings of my investigations into Aboriginal sky knowledge of three key areas, the Murchison region, Kandimalal, Wolfe Creek Crater, and the South West of Western Australia. The research supports hypothesis 5. This was demonstrated by the Aboriginal knowledge documented in relation to Kandimalal, Wolfe Creek Crater. In particular, the research has documented cultural beliefs relating to the Large and Small Magellanic Clouds, and their connection with murder, as reported by Aboriginal participants. Various accounts exist of beliefs about mysterious deaths and this research has identified a direct association between such beliefs and the Large and Small Magellanic Clouds. I suspected that this knowledge may be of a secret or restricted nature, however, according to the informants, such knowledge is neither restricted nor secret. Therefore, it has been included in this research. The insights gained from the knowledge of Elder Jack Jugarie (now deceased), in relation to Kandimalal, Wolfe Creek Crater, are particularly important. During the research, I specifically asked whether anyone had enquired with him about his knowledge of the night sky, and his response was clear that they had not. Despite this, Jack Jugarie indicated knowledge of rare astronomical events, such as that demonstrated by knowledge of, and a name given to, the sound associated with a meteor. It is also quite apparent that knowledge about the night sky is quite variable amongst different community members, for example, Jack Jugarie's eldest son, Keith Jugarie, indicated less familiarity with the night sky. The findings of this research indicates that, prior to this research, some Aboriginal knowledge was indeed un-recognised. However, care should be taken not to generalise this statement too broadly, across whole communities.

Of fundamental importance here is the issue of the potential for the loss of cultural knowledge, due to the passing of Elders. The preliminary work and field visits to the Kimberley, for this research began in 1998 and led to the timely documentation of knowledge of Elder Jack Jugarie. His remarkable insights into the night sky and openness in sharing and passing on his knowledge to others, was almost lost forever due to his sudden and unexpected passing in 1999, just one month after the main video interviews and discussion were held with him at Wolfe Creek Crater. Unexpectedly, the 1999 field visit to the crater became Jack Jugarie's last visit back onto country, before his passing. During the research, Aboriginal Elders Stan Brumby (Halls Creek) and Olive Boddington (Geraldton) also passed away, and their interviews as contained within this research, now provides a unique record of their knowledge of the night sky.

Discussions with Elders regarding meteors, and Wolfe Creek Crater, revealed previously unknown insights about rare astronomical phenomena. Elder Jack Jugarie clearly stated that the account of the “star” that fell to the earth (forming Wolfe Creek Crater) was an old story, which almost certainly predates the first recognition of the crater by a non-Aboriginal person, in 1947. His description of the story being passed down the generations in his family “*from my old Grandfather,... by his father again, all the way back...*” provides evidence of the origin and antiquity of the story.

Jack Jugarie's account of the “*coolungmurru*”, or a meteor that “*shakes the country*” clearly indicated that Aboriginal people actively and intentionally listened after the appearance of a large meteor (to hear the “country shake”). This reveals knowledge of the rare phenomenon of sound associated with large meteors. Evidence that this is new knowledge includes the fact that the word “coolungmurru” does not appear in the Jaru dictionary (Wrigley, et al. 1992).

Another example of un-recognised Aboriginal knowledge of the night sky relates to the documentation of a “new” star pattern in the East Kimberley, known as “the camel”. I first encountered a reference to this star pattern in 2000, however, at that time, I assumed that it was a mis-naming of the well recognised Emu sky pattern. However, the 2010 field visit and interviews with Elder Bonnie Deegan, clearly documented knowledge and awareness of “the camel” star pattern, and the very clear recognition that it was not a “Dreamtime” story, but a relatively recent star pattern to be recognised (the camel being an introduced animal to Australia). This example also clearly shows that such Aboriginal knowledge is dynamic and changing over time.

**Hypothesis 6:** That cross-cultural exchanges, based on Aboriginal sky knowledge, can encourage and facilitate reconciliation.

An unexpected, but important theme has emerged from this research, namely that the night sky provides opportunities to encourage reconciliation between Aboriginal and non-Aboriginal people in Australia. At the national level, this insight is explicitly recognised and incorporated into the

Reconciliation Place monument in Canberra. The universal and unifying idea expressed in the Reconciliation Place sculpture / monument states; “*It reflects the idea that all Australians share their experiences under the same stars*” (National Capital Authority, n.d.).

The underlying approach of the *Ilgarijiri- Things Belonging to the Sky* project, which has been to share Aboriginal and non-Aboriginal knowledge of the night sky in a respectful and collaborative way, provides a strong example of reconciliation put into action, without necessarily drawing obvious attention to that fact.

The video interviews with *Ilgarijiri* artists and Elders, gathered significant first hand documentary evidence of the impact of the *Ilgarijiri* collaboration. For example, the interviews documented how Aboriginal views were altered in a positive way in relation to the *Ilgarijiri* collaboration (in the context of the scientific endeavours with radio astronomy in the Murchison). We have seen the reaction of Aboriginal people to the naming of the ASKAP radio telescope antennas, with Wajarri names, and the respect that is clearly demonstrated towards Aboriginal people, by this action.

The essential aspects of reconciliation, including mutual learning, and mutual respect, are clearly evident in the *Ilgarijiri* project, even though this was not initially a primary objective of the project. The video interviews with Elders and artists of the Murchison region have documented the changing dynamics of the participants in the *Ilgarijiri* project. Beginning with initial apprehensions on the part of the Elders and artists, the video interviews have documented how the Elders and artists identified, addressed and successfully overcame various issues associated with the *Ilgarijiri* project, ultimately resulting in a highly successful collaboration together with astronomers. The video interviews have documented the two way collaboration that took place, and the respect for each other's knowledge which developed during the project. There is considerable evidence of the Aboriginal participants valuing the *Ilgarijiri* project, and examples of this include the reported improvement in confidence that the project engendered, the reporting of self motivated learning (about astronomy), the appreciation of the Elders and artists regarding the *Ilgarijiri* internationally touring exhibition, and the expressed desire for future collaborations.

Whilst the focus has primarily been on the Aboriginal participants of the *Ilgarijiri* collaboration, the experiences and perspectives of radio astronomers were also documented. The interviews with Dr Megan Argo showed that her first experiences with Aboriginal communities occurred during the course of astronomy public outreach activities she participated in, which led to her further involvement in the *Ilgarijiri* project. Dr Argo recognised the distinct difference between city based students, and those of remote regional locations, such as the Yulga Jina Aboriginal community situated near the ASKAP site in the Murchison region. “*The first thing that struck me.... is that the kids are far less inhibited than a lot of the city kids...*”, ... “*they all want to climb on your telescope...*”. The experiences of conducting astronomy outreach activities in remote communities was seen to be an important component of Dr Argo's work, and in particular engaging with

communities likely to be affected by the Square Kilometre Array radio telescope project; *“it's important to go out there and talk to the communities that are there, so that they have an understanding what is happening...”*

The interviews with the South African astrophysicist Dr Thebe Medupe (Cosmic Africa) and the then South African Astronomical Observatory Education Outreach Officer, Sivuyile Manxoyi, also lent unexpected support to hypothesis 5, via the statements recorded in the video interviews, discussed in section 5.3.3. In these cases, the context was in relation to the South African apartheid experience, and the role that astronomy can play, in uniting people.

Key research findings are presented below in relation to the four research objectives:

**Research objective 1:** Investigate the variety of ways in which people engage with Australian Aboriginal astronomical knowledge in our contemporary society.

In Chapter 2, I set out to investigate how people engage with Aboriginal sky knowledge. The scope of this work extended across Australia, with a diverse range of examples documented primarily from Western Australia, but also with important examples from the Northern Territory, the Australian Capital Territory, Victoria, and a range of national examples. Section 2.3 presented twenty eight examples in nine categories that illustrate the ways in which people engage with Australian Aboriginal astronomical knowledge. The examples I have provided are intended to illustrate the diverse ways in which people engage with Aboriginal sky knowledge. Undoubtedly, other examples exist, with new projects developing in Australia. The examples discussed provide important insights into the various issues and sensitivities.

**Research objective 2:** Gain an understanding of the issues and sensitivities regarding such cultural knowledge and the ways in which these issues can be addressed.

Chapter 2 begins with an examination of key issues and sensitivities relating to the communication and sharing of Aboriginal sky knowledge. The key issues presented include:

- the night sky as a means of bringing people together.
- maintaining and passing on valued knowledge.
- research ethics / permissions.
- sharing knowledge beyond Aboriginal communities.
- language or English.
- interpretation.
- facilitating Aboriginal people to speak for themselves.
- the dynamic nature of stories and knowledge.
- dealing with sensitive or restricted cultural information.
- issues relating to recently deceased people.

- management of intellectual property.
- practical issues / travel / logistics.

In section 2.2, I describe how I have addressed these issues in relation to the current research. For example, conducting interviews with Elders associated with Wolfe Creek Crater was a very high priority, due to the risk of loss of knowledge from the passing of Elders. This was borne out during the research. Irreplaceable documentary interviews were achieved with key Elders associated with the crater, who have since passed away. Had this research not achieved this, it is very likely that the Aboriginal astronomical knowledge of such Elders would have never been documented, and therefore never recognised or appreciated. Permission for the use of such knowledge in this research has been generously provided by the participants and family members. Cultural practices regarding the people who have passed away have been respected, and advice sought directly from the families concerned. This research transcribes the video interviews, for the first time. The overall consultation approach that has contributed towards this research has been based on consultation conducted over an extended period of time. In the case of the discussions with Elders, artists and interview participants associated with Wolfe Creek Crater, preliminary discussions took place in 1998, and further developed from multiple face to face meetings and discussions, twice in 1999, 2000, 2003, 2010 and 2011. These examples illustrate the ways in which key issues have been addressed and managed in relation to this research.

**Research objective 3:** Collaborate with Aboriginal people to document and communicate in a culturally appropriate manner contemporary astronomical knowledge, including cultures from the south west of Western Australia, Mid West (Geraldton / Murchison) region, and the Kimberley (Wolfe Creek Crater) area.

Research towards this objective has involved significant collaboration over an extended period of time with a range of Aboriginal communities and individuals. Mr Kevin Cameron (Aboriginal cultural advisor) provided guidance regarding culturally appropriate ways of collaborating in this research, in addition to advice and support provided by the Centre for Aboriginal Studies at Curtin University, the Department of Aboriginal Affairs (Western Australia), and various other individuals and organisations (including the Australian Institute of Aboriginal and Torres Strait Islander Studies, Canberra). Multiple site visits to Kandimalal, Wolfe Creek Crater, between 1998 and 2011, and discussions with Aboriginal Elders, artists and family members over that period, has led to appropriate documentation and data collection for this research. The use of permission forms for the inclusion of interview material and photographs / videos as part of this research has ensured that content was endorsed by participants. Strong support was received from artists and elders, and management of Yamaji Art, associated with the *Ilgarijiri- Things Belonging to the Sky* project. The participation of several artists and Elders in the exhibition video (developed as part of this research) also illustrates the level of support received. For the De Laeter Science Engagement Scholarship (Gravity Discovery Centre Foundation), I developed the Cosmology Gallery video production,

introducing scientific and Aboriginal perspectives of Kandimalal, Wolfe Creek Crater. Permissions were granted in relation to the two Aboriginal people featured in the production (including family representatives, for the deceased Aboriginal Elder Jack Jugarie). In accordance with appropriate cultural advice for such a production, the video production featured viewer advice indicating that it contains the image/voice of a person who has since passed away. The above summary demonstrates that research objective 3 is accomplished.

**Research objective 4:** To examine and apply the use of survey methodologies to assess knowledge, attitudes & beliefs relating to astronomy, and awareness in relation to Aboriginal Astronomy initiatives, with a focus on Western Australian populations.

In Chapter 3, I presented the results of three surveys which have enabled a quantitative assessment of astronomical knowledge. The three surveys are:

- Post International Year of Astronomy 2009 Evaluation Survey.
- The (International) Sky in Our Lives Survey.
- The Aboriginal Astronomy Symposium survey.

Survey participants in the Post IYA 2009 survey (n=97), and The Sky in Our Lives survey (n=45), were predominantly Western Australian participants. The participants of Aboriginal Astronomy Symposium survey (n=13) were primarily Australian respondents. The Sky in Our Lives survey has also provided comparative data from South Africa (n=23), by researcher Jarita Holbrook.

The surveys provided a different and complementary approach towards data collection, as compared to the qualitative video based interviews. The quantitative surveys have established a baseline of information regarding the knowledge, attitudes and beliefs of the respondents. Survey results have provided significant insights, and examples of key results are provided below.

The Post IYA 2009 survey documented that more than half of Western Australian adults surveyed (53.8%) knew that 2009 was the International Year of Astronomy, however, awareness in WA students was much lower, at 28.1%. Overall, 40.2% of respondents were aware that 2009 was the International Year of Astronomy. A total of 57.7% of respondents indicated that they learnt something new about astronomy during IYA 2009 and 17 respondents (17.5%) gave specific details regarding their knowledge of Aboriginal astronomy. Of those people who participated in Aboriginal astronomy events during IYA 2009, 85% reported that their awareness was raised, regarding Aboriginal astronomy.

The Sky in Our Lives survey conducted in this research represents the largest known application of this international survey in Australia to date; it captured data regarding demographics, direct

experience with the night sky, attachment to the sky, astrology and an astronomy attitude survey (n=45). The comparative data between the Australian and South African survey results indicates some notable differences. Australian survey respondents scored higher results in relation to naming stars, asteroids and constellations.

The Australian survey respondents generally showed that spiritual & religious beliefs, cultural beliefs and astrology had little or no effect on the attitudes, practices, stories and knowledge of the respondents in relation to the night sky, whilst the reported effect of education was more moderated. This contrasted with the South African survey respondents, who generally reported a low or moderate effect in relation to spiritual & religious beliefs, cultural beliefs and astrology, and education.

Australian survey respondents indicated a relatively low level of emotional attachment to the night sky, with approximately 80% being neutral, disagreeing or strongly disagreeing with statements that suggest an emotional attachment to the night sky. This contrasts with that of the South African survey respondents, who scored approximately 25% for the same indicators. Both the Australian and South African survey responses in relation to attitudes towards astronomy, were similar.

The survey successfully identified several examples of Aboriginal sky knowledge or cultural astronomy knowledge. However, responses were typically concise. For future surveys, additional qualitative methods (such as video interviews), could be used in conjunction with the quantitative surveys when additional detail is desired. In general, survey participants could not be defined precisely as a subset of a larger population, in part due to the entirely voluntary participation of respondents in the survey. Some inherent sample biases are therefore expected within the results, and generalisations to broader populations should be avoided; the results best reflect the views of the survey participants.

The Aboriginal Astronomy Symposium survey focussed on the participants of the 2009 Symposium held at AIATSIS. The survey respondents (n=13) can be regarded broadly as people with significant or expert level of knowledge in relation to Aboriginal culture. A total of 92.3% of respondents valued cultural stories about the night sky, have a general interest in Aboriginal astronomy, and believed that Aboriginal sky knowledge should be recorded for the benefit of future generations. A total of 84.6% of respondents believe most people have little understanding of Aboriginal sky knowledge, 76.9% would like to be involved in future research on Aboriginal astronomies, and believed that storytelling is an effective way to learn about Aboriginal culture and sky knowledge. Given that the survey participants generally represented well informed “expert” people, with a strong interest in Aboriginal culture, these views should be taken as a strong indicator regarding the value of cultural knowledge associated with the night sky, and the need to document, investigate and appreciate it further.

The surveys used for this research have produced a baseline of quantitative data regarding astronomical knowledge. There is potential for future initiatives to be assessed using the surveys, in particular for future Australian Aboriginal Astronomy Symposiums.

## **6.2 Future opportunities**

### **6.2.1 Research opportunities**

#### **6.2.1.1 Online data mining**

In this research I applied a novel use of online data mining to gather information about Aboriginal sky knowledge. My approach was to review available online Aboriginal art centres, and to review the online catalogues or galleries, to identify artworks which included astronomical themes. This approach was useful in that it enabled a rapid appraisal of such knowledge, across a large extent of Western Australia, without costly travel or site visits. The approach has future potential to identify places, stories or Aboriginal people who have astronomical knowledge. My application of this approach was restricted to online art centres located in Western Australia. However, the approach could be applied elsewhere in Australia, and also to overseas based Aboriginal art centres. Of course, the limitations of this approach need to be recognised, and information gained via this method critically appraised. The method has the potential to identify useful insights, because local and cultural knowledge is often incorporated into Aboriginal art.

It is expected that research based on analysis of digital archival data will continue to be of major importance, particularly in radio astronomy, but also for other research areas, including the field of Aboriginal sky knowledge. My description of the Lloyd Bleek digital archive, (Cape Town, South Africa) is one example of the development of a major digital archive of unique ethnographic records (primarily featuring cultural knowledge of the African San people, sourced from the 1870's). The importance of this archive is highlighted by its status as a UNESCO registered Memory of the World. The archive is a primary source of information for many subsequent research projects, one example is the major publication "Claim to Country" (Skotnes, 2007).

#### **6.2.1.2 Surveys**

The Post IYA 2009 survey, The Sky in Our Lives survey and the Aboriginal Astronomy Symposium survey provide a baseline of quantitative and qualitative information about astronomical knowledge, beliefs and attitudes. There is considerable scope for applying The Sky in Our Lives survey in the future, for research both in Australia, and internationally. The research has suggested ways to refine the three surveys for future use. Depending upon future needs and objectives, I recommend that a revised version of The Sky in Our Lives be developed, to provide for a more concise survey. The Aboriginal Astronomy symposium survey has the potential to be applied directly to future symposium participants.



### **6.2.1.3 Extending research to other Australian Aboriginal language groups**

One of the challenges of the current research is scope. There are a very large number of distinct Aboriginal language groups which have existed in the past, and continue to exist today, across Australia. It was felt that for the current research, it was better to focus on three key areas, rather than attempting to investigate Aboriginal sky knowledge of all language groups across Australia. This approach has provided considerable focus for the research. My emphasis has been on three Western Australian areas, the Murchison region (associated with the contemporary radio astronomy developments), the South West of Western Australia, and the East Kimberly region centred on Kandimalal, Wolfe Creek Crater. The latter was chosen because relatively little research has been conducted regarding Aboriginal perspectives of the crater. Documenting cultural perspectives of the meteorite crater landscape is of considerable importance, due to the relative rarity of this landform in Australia. The principles established as part of this research could be applied in relation to future research and collaboration, in many other parts of Australia. From a research point of view, two key areas of research opportunity include: (1) the exploration and discovery of previously unknown Aboriginal sites; and (2) additional research of known Aboriginal sites.

Such research could take the form of exploration and discovery of previously unrecognised Aboriginal sites. There are the ongoing efforts to document and assess known archaeological and ethnographic sites. In addition, there are opportunities for the re-appraisal or reinterpretation of past research, particularly data derived from Aboriginal heritage site databases, such as the Western Australian Department of Aboriginal Affairs site database. One significant issue is the lack of consistent, detailed and accurate mapping of archaeological sites. This is particularly important for research testing astronomical alignment hypotheses with stone arrangement sites, key examples being research relating to the Victorian Wurdi Youang stone arrangement site located in Victoria (Norris and Norris 2009, Norris et al., 2013). New discoveries are likely to emerge from ongoing research, such as the rock art of the Burrup Peninsular (Dampier, Western Australia). For example, a rock art solar motif is shown in “Burrup Rock Art” by Mike Donaldson (2009), and there are opportunities for greater site documentation of sites such as this, using advanced digital imaging techniques detailed in chapter 5. New archaeological sites are likely to be discovered, via systematic field research, heritage assessments associated with proposed development projects, and also by accidental discoveries.

A broader issue is the major importance of protecting Aboriginal heritage sites from disturbance or destruction. For future research associated with testing astronomical hypotheses for stone alignments, this is of great importance, because disturbance to rock alignments can irretrievably lose information thereby eliminating the prospect of future analysis of such sites. The use of 360° imaging, and the development of virtual tours enables people and researchers to virtually experience and interact with such sites, without causing physical impacts.

#### **6.2.1.4 Applying success factors to collaborative Aboriginal knowledge research**

In sections 5.2 & 5.3, I reviewed several examples of collaborative projects dealing with Aboriginal knowledge and I identified factors that have contributed to successful Aboriginal / non-Aboriginal collaborations in the past. From that basis, I described a series of key attributes that contribute toward successful and effective collaborative research into Aboriginal sky knowledge, including:

- Leadership and motivation.
- Consultation and collaboration.
- Interdisciplinary skills amongst the project team.
- Project scale.
- Utilisation and harnessing of emerging technologies.
- Orientation towards education and research.
- Multi format productions.
- Alignment to “big issues”.
- Logistics and resourcing.

The experiences gained via this research for successful collaboration and cross-cultural projects has the potential to inform other areas of Aboriginal knowledge research, particularly in the knowledge rich areas of ethno-botany, fauna, ecology, geology and Aboriginal land management practices. The emerging multidisciplinary areas of collaboration between art and science also provide areas in which the insight gained from this research can be applied to new collaborative projects. There are several groups in Australia that support such collaborative work, such as the Collaborative Research in Art, Science and Humanity (CRASH, Curtin University, Western Australia), and the Australian Network for Art and Technology (ANAT).

#### **6.2.2 Educational opportunities**

Cross-cultural explorations of sky knowledge, such as Aboriginal sky knowledge, and scientific perspectives, provide a rich and engaging way of bringing together different ways of relating to, perceiving and understanding the night sky. As a result, the subject is an ideal one to apply to educational settings and awareness raising for both Aboriginal and non-Aboriginal people in non-formal educational settings. Whilst the subject does not need to explicitly refer to reconciliation in Australia between Aboriginal and non-Aboriginal people, the act of sharing perspectives and learning about different views of the night sky can also contribute towards the broader and long term reconciliation goals in Australia.

I propose that a comprehensive educational program be developed, to support education about Australian Aboriginal sky and astronomical knowledge. I propose that the elements of the program include the following:

- Development of curriculum material for primary, secondary and tertiary levels.
- Developed on a national basis, as a joint collaboration with key Aboriginal and educational organisations.

- Achieve a national perspective, in addition to localised examples.
- Be based on appropriate cultural protocols.
- Develop accessibility of such resource for delivery and accessibility to remote areas.
- Utilise and harness the capabilities of digital media technologies, and internet communication, for delivery of educational programs, and accessibility to resources.

The first national symposium on Aboriginal sky knowledge took place in 2009 in Canberra (AIATSIS), and since that time, there has been active research and collaborations investigating Aboriginal sky knowledge. The 13th Australian Space Science Conference, held at the University of New South Wales (October 2013) included a session on Indigenous sky knowledge and this provided an opportunity for new research findings to be reported, since the 2009 national symposium. With further research progress in this field, it will be timely to propose that another Aboriginal Astronomy Symposium be held to review progress to date.

### **6.2.3 Developing visual resources**

#### **6.2.3.1 Digital imaging**

The digital imaging applied in this research is summarised here in relation to the new and original digital imaging results gained, their application for the creation of new digital resources, the benefits offered by and application of such resources, and future opportunities and priorities for such imaging. This research has demonstrated the application of digital imaging, including the use of 360° imaging and timelapse photography, for the creation of new visual resources to support the communication of Aboriginal astronomical knowledge. The new visual resources have been applied to generate new content, in the form of an Aboriginal astronomy virtual tour, resources for the De Laeter Scholarship video exhibition, and exhibition video for the *Ilgarijiri* collaboration. The use of such methods for site documentation using digital imaging at Wolfe Creek Crater, clearly demonstrates the practicality of such techniques, even when applied at remote field sites (Goldsmith, 2011).

One major benefit of the use of virtual tours is that audiences are able to visually experience in high quality a given landscape, without the need to visit the site in person. This has direct applicability for sites that are difficult to access due to their remoteness, or the physical sensitivity of a given site. In the case of a sensitive site, a virtual tour enables people to engage with such places without physically being present, and thereby cause no physical impact.

The flexibility afforded by digital imaging enables tailored solutions to be developed for particular applications. For example, virtual tours can be produced on DVD disk, or can be made accessible via the internet, thereby dramatically increasing accessibility to new audiences. The 360° imaging, from which virtual tours are derived, can also be presented via a range of advanced projection systems, including full scale planetarium projectors.

The newly developed Aboriginal astronomy virtual tour has been applied in a practical educational initiative in collaboration with Questacon, in which a virtual tour of Wolfe Creek Crater was provided to a selection of schools across Australia, via a live internet link.

There is considerable scope to apply digital imaging to document numerous sites of interest, including places of importance to Aboriginal communities, places of astronomical significance, and other sites, such as the emerging radio astronomy facilities in Western Australia. Key priorities for the 360° documentation of sites could include:

- all known meteorite impact sites in Australia.
- sites of Aboriginal significance.
- places of current research focus for Aboriginal astronomy in Australia (e.g. Wurdi Youang).

The Wurdi Youang site in Victoria is one such archaeological site which would greatly benefit by digital imaging documenting of the site, in both 360° and timelapse. For example, timelapse is very suitable for document the contemporary relation between the stone arrangements, and that of the sun alignments associated with the solstices and equinoxes. As many sites such as Wurdi Youang are sensitive to impact by visitors, digital imaging provides a research and documentary tool to aid the research and protection of such sites.

#### **6.2.3.2 Multimedia**

My case study of “Stories from the Canning Stock Route” noted the use of multimedia via touch screens. This approach can be readily applied to astronomical information. I propose that a public exhibit could be developed, using multimedia information, overlaid on a base map which could comprise a star atlas, a 360° photographic image of the night sky, or a similar all sky dataset, or simulated (e.g. planetarium) data.

### **6.3 Protecting radio quietness, and dark sky assets**

Fundamental to the long term progression of radio astronomy research in Western Australia is the maintenance of the radio quiet attributes of the Murchison Radio-astronomy Observatory site. I have noted the legislative measures that have been put in place to protect this vital attribute of the site, via Federal legislation (e.g. Australian Government 2011: the Radiocommunications (Mid-West Radio Quiet Zone) Frequency Band Plan 2011, prepared via the provisions of section 32 of the Radio Communications Act 1992). I have also noted that very significant Aboriginal knowledge relating to the Southern Milky Way is dependent upon dark skies, which can be seriously disrupted by light pollution. International efforts at preserving and maintaining access to unpolluted, dark skies are the focus of international meetings, which have given rise to the “International Initiative in Defence of the Quality of the Night Sky and the Right to Observe the Stars” (e.g. “Starlight; A Common Heritage”, Marin & Jafari, 2007 & Marin, 2011). Atkinson (2007) has described an Australian Aboriginal perspective on this issue. The concept of dark sky reserves, and their application in conjunction with

major radio astronomy developments in Australia, could be investigated. Such an approach, which would be highly supportive and consistent with the goals of maintaining radio quietness at the Murchison Radio-astronomy Observatory, could provide a highly practical way of recognising the importance of both Aboriginal and non-Aboriginal knowledge of the night sky in Western Australia.

## 6.4 Final comments

Contemporary radio astronomy in Australia has acted as a catalyst for renewed interest in cultural astronomy and Aboriginal sky knowledge. Examples of this include the *Ilgarijiri- Things Belonging to the Sky* project, and the sponsorship and support for this research. One of the special attributes of radio astronomy is its ability to observe through the obscuring dust lanes of our own galaxy, the Milky Way, thereby revealing parts of our own galaxy which would otherwise remain hidden from view. It is somewhat ironic that the very same dust lanes in the Milky Way, so clearly visible to the unaided eye from a dark sky location, are of key importance to many Aboriginal communities in Australia. The formation of the Emu sky pattern is defined not by the stars forming a pattern, but by the dark dust lanes in the Milky Way, between the Southern Cross and Scorpius.

The insights gained as a result of this research have demonstrated that Aboriginal sky knowledge is part of an ongoing, living body of knowledge, which can play an active and very positive role in the sharing and communication of cross-cultural knowledge about the night sky. The documented interviews have provided significant insight into the role of astronomical and sky knowledge in contemporary Aboriginal communities. They illustrate examples of personal knowledge of the night sky, built up from a lifetime of experience. I have gained a new perspective, and respect towards, the value and importance of Aboriginal knowledge in general, and of the sky in particular. The night sky is indeed a rich cultural resource, accessible to all people throughout the world, unable to be possessed by any one individual or community, and a resource which will continue to provide inspiration and endeavour into the foreseeable future.

I envisage considerable opportunities for future cross-cultural projects engaging Aboriginal and non-Aboriginal people in a positive, exploratory, respectful and engaging way, which can be culturally affirming for Aboriginal people, and insightful for non-Aboriginal people. The developing relationship between southern Africa and Australia, as a result of the Square Kilometre Array radio telescope project will provide opportunities for greater collaboration in the field of cultural astronomy in the future. The insights from this research are highly relevant to our contemporary fields of endeavour, whether they be in astronomy, radio astronomy or in the cultural advancement of Aboriginal and non-Aboriginal people in Australia.

The research, as presented in this thesis, has evaluated the research hypotheses and has accomplished the research objectives. Substantial insight has been gained into the sharing, learning and communication of Aboriginal sky knowledge, and the successful collaboration of Aboriginal and non-Aboriginal groups. Factors of success have been identified and distilled, which can provide

significant guidance for the development of future collaborative projects in this field. In addition, the approaches used for researching Aboriginal sky knowledge can help to inform other fields of research involving Aboriginal knowledge systems. This thesis has made a significant and original contribution, particularly in the use of advanced digital imaging methods for the purpose of documentation of important sites. This imaging technology and approach has tremendous potential to be applied to Australian and international efforts to document cultural important sites. This thesis has provided extensive evidence and documentation in support of a new appreciation of the value, importance and significance of Aboriginal sky knowledge, the ways in which such knowledge can bring Aboriginal and non-Aboriginal people together and to respectfully honour the sharing of knowledge.

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## Appendix 2 Western Australian astronomically themed Aboriginal artwork

(Listed alphabetically according to the Art Centre name)

Table 23. Online catalogue review.

Art Centre	Locality	Website	Total number of artworks / astronomically themed artworks, (%)	Notes, artists, titles of artworks
Aboriginal Art by Artlandish	Kununurra	www.aboriginalartshop.com	943 / 22, (2.3%)	Cassius Nulgit / Falling Star over Warmun Mabel Juli / Moon and Star Dreaming Maria Nampijinpa Brown / Star Dreaming Wendy Nungarrayi Brown / Star Dreaming Sheila Puruntatameri / Half Moon at Sunset (x11) Gabriella Possum Nungurrayi / Seven Sisters Dreaming Reggie Sultan / Seven Sisters Dreaming Jock Mosquito / Piccaninny Crater (x2) Jock Mosquito / Wolfe Creek Crater (x2) Stan Brumby / Wolfe Creek Crater
Aboriginal Indigenous Fine Art gallery	Fremantle	www.aboriginart.com.au/	77 / 2, (2.6%)	(x2) Gabriella Possom Nungarrayi / (untitled)
Art Gallery of WA	Perth	www.artgallery.wa.gov.au/	67 / 2, (3.0%)	Mathaman Marika / The Morning star dance. Banumbirr Ceremony

Art Centre	Locality	Website	Total number of artworks / astronomically themed artworks, (%)	Notes, artists, titles of artworks
				Paddy Simms / Yuwarri Jukurrpa - Milky Way Dreaming
Gecko Gallery	Broome	www.geckogallery.com.au	30 / 1, (3.3%)	David Ross Pwerle / Night story and tree wallaby dreaming
Grasree Gallery	Albany	www.grasreegallery.com.au	294 / 1, (0.4%)	Gabriella Possom Nungarrayi /
Japingka Gallery	Fremantle	www.japingka.com.au	3188 / 36, (1.1%)	<p>Jack Dale- Narrungunni / God Star.</p> <p>Jock Mosquito / Piccaninny Crater</p> <p>(x2) Polly Jackson / Seven Sisters</p> <p>Clifton Mack / Evening Starlight</p> <p>Clifton Mack / Morning Starlight</p> <p>Wendy Darby / Colours of the Night</p> <p>(x29) Alma Nungarrayi Granites / Yanjirpirri Jukurrpa - Seven Sisters Dreaming</p>
Laverton Outback gallery	Laverton	www.laverton-outback-gallery.com.au	215 / 40, (18.6%)	<p>Audrey Goulding / Seven Sisters</p> <p>Pauline Goulding / Seven Sisters and Yula</p> <p>Pauline Goulding / Seven Sisters</p> <p>Pauline Goulding / Seven Sisters and Yula</p> <p>Vivian Sullivan /Tjartijimpu, the evening star and the Seven Sisters</p> <p>Vivian Sullivan / Seven Sisters</p> <p>Agnes Munroe / Seven Sisters story, Two brothers going for ceremonies</p>

Art Centre	Locality	Website	Total number of artworks / astronomically themed artworks, (%)	Notes, artists, titles of artworks
				<p>around Warnan</p> <p>Ann Walkabout / Seven Sisters</p> <p>Ann Walkabout / Seven Sisters looking for bush tucker</p> <p>Anne Walkabout / Seven Sisters and cousins digging for food</p> <p>Ann Walkabout / Seven Sisters and one man watching them</p> <p>Beryl Jennings / Seven Sisters and one man</p> <p>Claire Robertson / Seven Sisters</p> <p>Claire Robertson / Seven Sisters gathering food</p> <p>Claire Robertson / Seven Sisters Warnan chased by Yula</p> <p>Connie West / Seven Sisters and bush tucker</p> <p>Dominique and Barry McKenzie / Tjartijimpu, the Evening Star and the Seven Sisters</p> <p>Doreen Harris / Seven Sisters</p> <p>Irwin Sullivan / Seven Sisters on hunting ground</p> <p>Janita Robertson / Seven Sisters</p> <p>Jenny Dear / Seven Sisters</p> <p>(x3) Joan West / Seven Sisters gathering food</p> <p>Joan West / Seven Sisters getting chased by 1 man</p> <p>(x2) Joan West / Seven Sisters</p>

Art Centre	Locality	Website	Total number of artworks / astronomically themed artworks, (%)	Notes, artists, titles of artworks
				<p>Joan West / Seven Sisters at Warnan, one was lost while getting bush tucker</p> <p>Joan West / Seven Sisters and bush tucker</p> <p>Judith Laidlaw / 7 Sisters at campfire gathering food</p> <p>Lorreta Jennings / Seven Sisters looking for bush food</p> <p>Lorreta Jennings / Seven Sisters</p> <p>Louisa Ward / 7 Sisters Kutharra Wat Hunting</p> <p>Myra Richards / One man chasing seven sisters</p> <p>Nerida Robertson / Story about the Seven Sisters and the two men chasing them around</p> <p>Nicole Smythe / Seven Sisters</p> <p>Phillipa Smythe / Seven Sisters and bush tucker</p> <p>Roberta Sullivan / Story about the Seven Sisters around Warakuna</p> <p>Robin Smythe / Seven Sisters and bush tucker</p> <p>Veronica Holland / Seven Sisters hiding in a cave from the man, country other side of Wanarn</p>
Mangkaja Arts Resource Agency Aboriginal Corporation	Fitzroy Crossing	www.mangkaja.com	89 / 0, (0%)	

Art Centre	Locality	Website	Total number of artworks / astronomically themed artworks, (%)	Notes, artists, titles of artworks
Mowanjum Art and Culture Centre Artists Spirit of the Wandjina	Derby	www.mowanjumarts.com	44 / 2, (4.5%)	(x2) Leah Umbagai / (Emu sky pattern)
Roebourne Art Group	Roebourne	www.roebourneart.com.au/	6 / 0, (0%)	
Short Street gallery	Broome	www.shortstgallery.com.au	129 / 3, (2.3%)	Timothy Cook / Star and moon Jennifer Mintaya Connelly / Seven Sisters Tjayanka Woods / The Seven Sisters 2010
Turnbridge Gallery	Margaret River	www.turnbridgegallery.com.au	224 / 1, (0.4%)	Anawari Mitchell / (Seven Sisters)
Urban Dingo Gallery	Fremantle	www.urbandingogallery.com.au	92 / 2, (2.2%)	Vincent Forrester-Mutitjulu / Southern Cross Wedge Tail Eagle Chick Coming Out of Nest Vincent Forrester-Mutitjulu / Seven Sisters Pursued by Watiniyru (Morning Star)
Warakurna Artists	(Via Alice Springs)	www.warakurnaartists.com.au	31 / 0, (0%)	
Waringarri Arts	Kununurra	www.waringarriarts.com.au	132 / 0, (0%)	

Art Centre	Locality	Website	Total number of artworks / astronomically themed artworks, (%)	Notes, artists, titles of artworks
Warlayirti Artists	Balgo Hills	www.balgoart.org.au	119 / 1, (0.8%)	Marie Mudgetell / Purkitji
Warmun Art Centre	Warmun (Turkey Creek)	www.warmunart.com	63 / 5, (7.9%)	(x3) Mabel Juli / Wardel and Garnkiny Eileen Juli / (Untitled) Mabel Juli / Garnkiny Ngaranggarni
Yarlilil Arts	Halls Creek	www.yarliylil.com.au	176 / 1, (0.6%)	Stan Brumby /Wolfe Creek Crater- Ochre
<b>TOTALS</b>			<b>5913 / 119, (2.0%)</b>	<b>2 % of the sample of online artwork contains astronomical themes.</b>

### Appendix 3 The impact of urban light pollution on the night sky

The “Emu in the sky” is recognised very widely across Australia by many Aboriginal language groups. As described in Chapter 4, the Emu features very prominently in the *Ilgarijiri* project. The Emu pattern differs to most commonly recognised Aboriginal sky patterns in that it is formed by the dark areas in the Milky Way between Scorpius and Crux (Southern Cross). However, to be able to see the Emu pattern requires dark sky conditions, largely free of moonlight or urban light pollution.

Degradation of the night sky, caused by excessive urban and city lighting, has resulted in a serious loss of quality of the night sky. This has potentially profound implications for our society, as generations will no longer have regular access to truly dark night skies. The cultural heritage of the night sky is therefore becoming increasingly difficult to experience.



Figure 87. Southern Milky Way: dark sky (above) and light polluted (below).  
(Images: John Goldsmith)



Two examples are provided here to demonstrate the impact of urban light pollution on the visibility of the night sky. Figure 87 shows two views of the sky corresponding to the “Emu in the sky”. The dark sky view was photographed 150km north east of Perth, Western Australia, and the second image was taken 15km east of the centre of Perth, in 2012. The comparative photos clearly show the substantial loss of visibility of the Emu sky pattern, as viewed from light polluted skies.

The implication of this is that most people living in urban city environments have poor access to the night sky and are therefore unable to appreciate dark sky conditions, conditions that are very important to experience and appreciate the Emu sky pattern. From a global perspective, more than half of the world's population now live in city urban environments and consequently have largely lost the ability to experience a dark sky.



Figure 88. Two 360° panoramic views of Comet Lovejoy (Dec 2011), Dark sky (above) and light polluted views (below). (Photos: John Goldsmith).

The second example shows the remarkable impact that city and urban light pollution causes. Figure 88 shows two 360° panoramic images of Comet Lovejoy, in 2011. The upper photo (taken 70 kilometres east of Perth, in relatively dark sky conditions) shows Comet Lovejoy appearing above the pre-dawn eastern horizon. The lower photo was taken in the centre of Perth (Kings Park), and shows the combined effects of urban light pollution, and some light from the crescent moon. The two images are orientated and scaled in the same way. Comet Lovejoy is barely visible in the lower image, whilst the upper image shows a dramatic view of the comet with a 20° tail. The upper image also shows the dome of urban light pollution from Perth, which can be detected at several hundred kilometres distance.

These two examples illustrate the impact that city and urban light pollution has on the visibility of the night sky.

## Appendix 4A Post IYA 2009 Survey

### The Post International Year of Astronomy (2009) Survey



#### Background

You are invited to participate in the following survey, which seeks to find out about the effect of the International Year of Astronomy (2009) in Western Australia. Your participation in this survey is greatly appreciated. This research is part of a PhD project by John Goldsmith, under the supervision of Professor Steven Tingay, which is being conducted at the International Centre for Radio Astronomy Research, Curtin University. Information about the research, contact details and research ethics is provided at the end of this document, and is also available online at [www.icrar.org/survey/IYA2009/](http://www.icrar.org/survey/IYA2009/)

#### Aims of the research

This research aims to find out about the effect of the International Year of Astronomy (2009) in Western Australia. The information is being gathered as part of a PhD research project “Cosmos, Culture and Landscape”, by John Goldsmith, under the supervision of Professor Steven Tingay, which is being conducted at the International Centre for Radio Astronomy Research. The research project focuses on cultural aspects of astronomy and Aboriginal astronomical knowledge in particular.

#### About the survey

“The International Year of Astronomy 2009” survey should take about 15-20 minutes to complete. Your participation in this survey is entirely voluntary. You may withdraw from the survey at any point. There are no known risks related to completing this survey. There is no financial compensation for participation in the survey.

#### Privacy and survey data

Survey respondents may complete the survey anonymously. The data gathered from this survey will be securely stored. The survey does not seek your name or contact details. However, if you chose to provide these details, no such individually identifiable information will appear in any publication or presentations of results.

#### Publication of results

Information gathered from this survey may be used as part of the thesis “Cosmos, Culture and Landscape”, and communicated via related reports, published in academic journals, presented at conferences, or otherwise made available (e.g. via the internet). Individuals will not be identifiable from published or presented data. Results from the survey may include summaries, aggregate data, and/or survey response extracts.

### **Research ethics**

This survey has been approved by the Curtin University Human Research Ethics Committee, protocol approval RD-15-10.

### **How to participate in the survey**

- complete the survey online (see [www.icrar.org/surveys/IYA2009/](http://www.icrar.org/surveys/IYA2009/)),
- download the survey (see [www.icrar.org/surveys/IYA2009/](http://www.icrar.org/surveys/IYA2009/)), and e-mail the completed survey back to us (e-mail to [astrophdsurveys@icrar.org](mailto:astrophdsurveys@icrar.org)). Surveys returned by post should be sent to the address below.
- we can send you a prepaid hardcopy survey, which you can fill out and post back to us.
- please indicate your survey responses with a .

### **Enquiries / Further information, contact:**

Attention	PhD researcher, John Goldsmith
Email	<a href="mailto:John.Goldsmith@icrar.org">John.Goldsmith@icrar.org</a>
Phone	(+61 8) 9266 4678
Fax	(+61 8) 9266 9246
Mail	International Centre for Radio Astronomy Research Curtin University GPO Box U1987 Perth, Western Australia 6845

Thank you for your participation !

**John Goldsmith, PhD Candidate**

**Professor Steven Tingay**

International Centre for Radio Astronomy Research  
Curtin University

## Part 1 Survey Questions

### Astronomy awareness

1. Are you aware that 2009 was the International Year of Astronomy (IYA 2009)?

Yes

No

2. During 2009, did you;

read astronomy related newspaper or news items?

participate in astronomy related activities?

visit astronomy related websites?

3a. Did your first experience of astronomy occur in 2009?

Yes

No

3b. If you answered no, please briefly describe your previous astronomy experiences.

### New knowledge and observing experiences

4. During 2009, did you;

use a telescope?

visit an observatory?

watch astronomy related events via internet webcasts?

own a telescope?

buy or make a telescope?

photograph the stars?

meet a scientist or an astronomer?

learn something new about astronomy?

### Astronomy education

5. During 2009, did you participate in any of the following astronomy educational activities?

A community course in astronomy

Primary school astronomy class

Secondary school astronomy class

University (undergraduate) level astronomy course

Postgraduate studies in astronomy

Other educational course

6. During 2009, did you visit;

- Scitech
- Gravity Discovery Centre
- Perth Observatory
- Gingin Observatory

**Radio Astronomy awareness in Western Australia**

7a. Do you know what the Square Kilometre Array (SKA) project is?

- Yes
- No

7b. Do you know what radio astronomy developments are proposed for Western Australia?

- Yes
- No

**Aboriginal Astronomy**

8a. Do you know about any International Year of Astronomy 2009 events relating to Aboriginal astronomy?

- Yes
- No

8b. Did you participate in Aboriginal astronomy events in 2009?

- Yes
- No

8c. Did the International Year of Astronomy 2009 increase your awareness of Indigenous astronomy?

- Yes      How?
- No

8d. Can you list any specific examples of Aboriginal astronomy you are aware of? Please be as specific as possible.

**The image of science and scientists**

9a. How many popular astronomy talks did you attend in 2009?

- None
- One
- Between two and four
- Five or more

9b. In 2009, did you see astronomy related news on;

- TV
- Internet
- Newspaper
- Magazine
- Internet webcast or podcast

9c. Which scientists / astronomers did you see or hear about during 2009?

9d. How would you describe them?

### **Networks**

10a. During 2009, were you a member of one or more astronomy groups?

- Yes
- No

10b. Did you join such a group for the first time?

- Yes
- No

### **Gender representation of scientists / astronomers**

11. Do you think that females are adequately represented in science and astronomy?

- Yes
- No, they are under represented
- I don't know

### **Protecting the night sky**

12a. Are you familiar with the term "light pollution" ?

- Yes
- No

12b. During 2009, did you see the night sky away from bright city lights?

- Yes
- No

12c. Did you participate in Earth Hour 2009 or 2010?

- Yes

- No
- Don't know about Earth Hour

12d. Do you know how excessive night-time lighting can be avoided?

- Yes
- No

12e. Are you aware of any laws or guidelines for preserving dark skies?

- Yes
- No

### **Future astronomy activities**

13. What sort of Astronomy activities would you like to be involved in, in the future?

### **Part 2 Some information about you**

(This is anonymous information, your privacy is protected).

14. Your gender?

- Male
- Female

15. What is your age?

16a. Do you live in Western Australia?

- Yes
- No

16b. What is your postcode?

17. Are you of Aboriginal or Torres Strait Islander origin?

- Yes
- No

18. Are you from a culturally or linguistically diverse background?

- Yes
- No

19. Please provide any other comments you would like to make here.

Thank you for taking part in our survey. Your response will help improve our understanding of Astronomy in Western Australia. For more information about this research, please visit [www.icrar.org/surveys/IYA2009](http://www.icrar.org/surveys/IYA2009).

**Remember:**

E-mail your completed word document survey, to [astrophdsurveys@icrar.org](mailto:astrophdsurveys@icrar.org) or post your hardcopy survey to;

Attention:        PhD researcher, John Goldsmith  
                      International Centre for Radio Astronomy Research  
                      Curtin University  
                      GPO Box U1987  
                      Perth, Western Australia 6845



## Appendix 4B Post IYA 2009 Survey Results

Results are presented according to the main definable sub-populations, which comprise Western Australian students (primary and secondary schools), Western Australia non-students, and others, which include interstate and international respondents.

### Definitions:

- WA Students (=Western Australian, < age 17, and/or indicated survey from primary or secondary school), n=64
- WA Non-students (all Western Australians who are not primary or secondary students), n=26
- Other (All remaining respondents, includes Australians other than Western Australians, and international respondents), n=7

Table 24. Question 1-3a.

	Response	WA students (n=64)	WA non-students (n=26)	Others (n=7)	All respondents (n=97)
1. Are you aware that 2009 was the International Year of Astronomy (IYA 2009)?	Yes	18 (28.1%)	14 (53.8%)	7 (100.0%)	39 (40.2%)
	No	45 (70.3%)	11 (42.3%)	0 (0.0%)	56 (57.7%)
	NR	1 (1.6%)	1 (3.8%)	0 (0.0%)	2 (2.1%)
2. During 2009, did you:					
read astronomy related newspaper or news items?	Yes	14 (21.9%)	14 (53.8%)	5 (71.4%)	33 (34.0%)
	NR	50 (78.1%)	12 (46.2%)	2 (28.6%)	64 (66.0%)
participate in astronomy related activities?	Yes	7 (10.9%)	8 (30.8%)	4 (57.1%)	19 (19.6%)
	NR	57 (89.1%)	18 (69.2%)	3 (42.9%)	78 (80.1%)
visit astronomy related websites?	Yes	12 (18.8%)	13 (50.0%)	4 (57.1%)	29 (29.9%)
	NR	52 (81.2%)	13 (50.0%)	3 (42.9%)	68 (70.5%)
3a. Did your first experience of astronomy occur in 2009?	Yes	23 (35.9%)	1 (3.8%)	3 (42.9%)	27 (27.8%)
	No	41 (64.1%)	24 (92.3%)	4 (57.1%)	69 (71.1%)
	NR	0 (0.0%)	1 (3.8%)	0 (0.0%)	1 (1.0%)

3b. If you answered “no” to 3a, please briefly describe your previous astronomy experience:

Of the 69 respondents who answered yes to 3a, 62 responses were received to 3b (89.6%), and 7 no responses (10.1%). Responses itemised and grouped according to themes in Table 76. Comments have been grouped according to themes.

Table 25. Question 3b.

Theme	# of responses	Examples
No previous experience	7	<ul style="list-style-type: none"> <li>• I have not had any previous astronomy experiences.</li> </ul>
Experience in school / university / science centre	24	<ul style="list-style-type: none"> <li>• In school science programs.</li> <li>• In year 7 I learnt about space, planets, stars, nebula's etc when we went to scitech.</li> <li>• In year 5 I went to an observatory.</li> <li>• School - finding south using the Southern Cross and the pointers.</li> <li>• I enjoyed studying space when I was younger (grade 2+) and I liked reading about it.</li> <li>• In Infant and Junior school we learned a bit about it and watched some DVDs and videos about it.</li> <li>• On a camp we had to study a little bit of astronomy.</li> <li>• Learnt about planets, space and the whole solar system.</li> <li>• I have been interested in astronomy and the stars since childhood. I attended some astronomy courses (though not enrolled) while I was studying my Science and Engineering degrees.</li> <li>• When I went to scitech in Perth when they had an astronomy based theme.</li> <li>• Stellar navigation and visiting scitech.</li> <li>• In my youth was my astronomy experience, and also visiting Gingin Observatory.</li> <li>• I did it in school for a number of years.</li> <li>• I had a book about planets in year three.</li> </ul>
An observatory / telescope	12	<ul style="list-style-type: none"> <li>• A previous visit to Gingin Observatory.</li> <li>• I went to an observatory in 2006 and learnt some interesting things.</li> <li>• Gazing the stars almost every night with my bare eyes. Visiting the Siding Spring Coonabarabran scientific site.</li> <li>• In my youth was my astronomy experience, and also visiting Gingin Observatory.</li> <li>• January 26th 2007, I went to an astronomy observatory, and saw Jupiter through a telescope etc.</li> <li>• I used a telescope.</li> <li>• It's an interest of mine. I have a (very) cheap Newtonian.</li> <li>• Telescope as child, did honours level astronomy at uni.</li> </ul>

Theme	# of responses	Examples
		<ul style="list-style-type: none"> <li>• Looking at the sky through telescope.</li> <li>• Have been interested in Astronomy since 1969, and at one time made telescopes.</li> <li>• My brother and his friends built a telescope during high school. My earliest memory is being woken up, as a small child, to see a comet through a telescope, in our lounge room.</li> </ul>
Astronomical group or society	3	<ul style="list-style-type: none"> <li>• Amateur astronomical society membership.</li> <li>• Owner of a telescope and member of an astronomy association since 2001, so many viewing nights and experiences.</li> <li>• A few years of reading and participating in the Astronomical Society of Western Australia (ASWA) activities.</li> </ul>
Other	16	<ul style="list-style-type: none"> <li>• General past experience only.</li> <li>• Just looking at the stars trying to find things like “the big dipper”. And I learned about space a little bit in year eight and down.</li> <li>• Started with the Voyager missions in the 1970's.</li> <li>• Going out specifically to watch: Eclipse, Europe, 1999 and various meteor showers and various conjunctions.</li> <li>• First astronomy experience occurred in 2010.</li> <li>• In the star dome when a science teacher visited my school in yr 5.</li> <li>• My first was in 2007 when I had to learn to navigate by the stars. Went to astronomy classes with my dad.</li> <li>• I'm an amateur astronomer.</li> <li>• Part of studies for BSc degree; school activities with daughter when in primary school, comet watching, reading for interest.</li> <li>• I watched a movie on space.</li> <li>• Merchant navy (prior experience).</li> <li>• First astronomy experience occurred in 2010.</li> <li>• stellar navigation and visiting scitech.</li> <li>• First experience was 7 years ago.</li> </ul>

Table 26.

4. During 2009, did you:	Response	WA students (n=64)	WA non- students (n=26)	Others (n=7)	All respondents (n=97)
use a telescope?	Yes	25 (39.1%)	8 (30.8%)	5 (71.4%)	38 (39.2%)
	NR	39 (60.9%)	18 (69.2%)	2 (28.6%)	59 (60.8%)
Visit an Observatory.	Yes	5 (7.8%)	2 (7.7%)	4 (57.1%)	11 (11.3%)
	NR	59 (92.2%)	24 (92.3%)	3 (42.9%)	86 (88.7%)
Watch astronomy related events via internet webcasts.	Yes	6 (9.4%)	6 (23.1%)	4 (57.1%)	16 (16.5%)
	NR	58 (90.6%)	20 (76.9%)	3 (42.9%)	81 (83.5%)
Own a telescope.	Yes	16 (25.0%)	8 (30.8%)	2 (28.6%)	26 (26.8%)
	NR	48 (75.0%)	18 (69.2%)	5 (71.4%)	71 (73.2%)
Buy or make a telescope.	Yes	3 (4.7%)	1 (3.8%)	2 (28.6%)	6 (6.2%)
	NR	63 (98.4%)	25 (96.2%)	5 (71.4%)	91 (93.8%)
Photograph the stars.	Yes	10 (15.6%)	3 (11.5%)	2 (28.6%)	15 (15.5%)
	NR	54 (84.4%)	23 (88.5%)	5 (71.4%)	82 (84.5%)
Meet an astronomer or scientist.	Yes	7 (10.9%)	6 (23.1%)	3 (42.9%)	16 (16.5%)
	NR	57 (89.1%)	20 (76.9%)	4 (57.1%)	81 (83.5%)
Learn something new about astronomy.	Yes	38 (59.4%)	14 (53.8%)	4 (57.1%)	56 (57.7%)
	NR	26 (40.6%)	12 (46.2%)	3 (42.9%)	41 (42.3%)

Table 27.

Astronomy Education 5. During 2009, did you participate in any of the following astronomy educational activities?	Response	WA students (n=64)	WA non- students (n=26)	Others (n=7)	All respondents (n=97)
A community course in astronomy	Yes	4 (6.2%)	1 (3.8%)	2 (28.6%)	7 (7.2%)
	NR	60 (93.8%)	25 (96.2%)	5 (71.4%)	90 (92.8%)
Primary school astronomy class	Yes	12 (18.8%)	1 (3.8%)	2 (28.6%)	15 (15.5%)
	NR	52 (81.2%)	25 (96.2%)	5 (71.4%)	82 (84.5%)
Secondary school astronomy class	Yes	20 (31.2%)	0 (0.0%)	1 (14.3%)	21 (21.6%)
	NR	44 (68.8%)	26 (100.0%)	6 (85.7%)	76 (78.4%)
University (undergraduate) level astronomy course	Yes	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	NR	64 (100.0%)	26 (100.0%)	7 (100.0%)	97 (100.0%)
Postgraduate studies in astronomy	Yes	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	NR	64 (100.0%)	26 (100.0%)	7 (100.0%)	97 (100.0%)
Other educational course	Yes	9 (14.1%)	3 (11.5%)	1 (14.3%)	13 (13.4%)
	NR	55 (85.9%)	23 (88.5%)	6 (85.7%)	84 (86.6%)

Table 28.

Astronomy Education	Response	WA students (n=64)	WA non-students (n=26)	Others (n=7)	All respondents (n=97)
6. During 2009, did you visit: Scitech	Yes	39 (60.9%)	8 (30.8%)	2 (28.6%)	49 (50.5%)
	NR	25 (39.1%)	18 (69.2%)	5 (71.4%)	48 (49.5%)
Gravity Discovery Centre	Yes	5 (7.8%)	2 (7.7%)	0 (0.0%)	7 (7.2%)
	NR	59 (92.2%)	24 (92.3%)	7 (100.0%)	90 (92.8%)
Perth Observatory	Yes	2 (3.1%)	1 (3.8%)	0 (0.0%)	3 (3.1%)
	NR	62 (96.9%)	25 (96.2%)	7 (100.0%)	94 (96.9%)
Gingin Observatory	Yes	1 (1.6%)	2 (7.7%)	0 (0.0%)	1 (1.0%)
	NR	63 (98.4%)	24 (92.3%)	7 (100.0%)	96 (99.0%)

Table 29.

Radio Astronomy Awareness in Western Australia	Response	WA students (n=64)	WA non-students (n=26)	Others (n=7)	All respondents (n=97)
7a. Do you know what the Square Kilometre Array (SKA) project is?	Yes	10 (15.6%)	16 (61.5%)	5 (71.4%)	31 (32.0%)
	No	54 (84.4%)	9 (34.6%)	2 (28.6%)	65 (67.0%)
	NR	0 (0.0%)	1 (3.8%)	0 (0.0%)	1 (1.0%)
7b. Do you know what radio astronomy developments are proposed for Western Australia?	Yes	11 (17.2%)	12 (46.2%)	3 (42.9%)	26 (26.8%)
	No	53 (82.8%)	12 (46.2%)	4 (57.1%)	69 (71.1%)
	NR	0 (0.0%)	2 (7.7%)	0 (0.0%)	2 (2.1%)

Table 30.

Aboriginal Astronomy	Response	WA students (n=64)	WA non-students (n=26)	Others (n=7)	All respondents (n=97)
8a. Do you know about any International Year of Astronomy 2009 events relating to Aboriginal astronomy?	Yes	4 (6.2%)	4 (15.4%)	2 (28.6%)	10 (10.3%)
	No	60 (93.8%)	22 (84.6%)	5 (71.4%)	87 (89.7%)
	NR	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
8b. Did you participate in Aboriginal astronomy events in 2009?	Yes	5 (7.8%)	1 (3.8%)	1 (14.3%)	7 (7.2%)
	No	59 (92.2%)	23 (88.5%)	6 (85.7%)	88 (90.7%)
	NR	0 (0.0%)	2 (7.7%)	0 (0.0%)	2 (2.1%)
8c. Did the International Year of Astronomy 2009	Yes	2 (3.1%)	2 (7.7%)	2 (28.6%)	6 (6.2%)
	No	61 (95.3%)	24 (92.3%)	5 (71.4%)	90 (92.8%)

Aboriginal Astronomy	Response	WA students (n=64)	WA non-students (n=26)	Others (n=7)	All respondents (n=97)
increase your awareness of Aboriginal astronomy?	NR	1 (1.6%)	0 (0.0%)	0 (0.0%)	1 (1.0%)

There were 6 “yes” responses (n=97) to question 8c “Did IYA 2009 increase your awareness of Aboriginal astronomy?”. Comments included:

- The mural in Scitech's foyer helped show some of the astronomy observations of local elders.
- Yes because of aboriginal astronomy made more aware of the astronomy.
- Meanings of the stars and what they represent to the aboriginal people.
- Scienceworks Planetarium gave talks/lectures relating to indigenous astronomy.
- Article in Australian Sky and Telescope magazine.
- The society had a dvd shown about aboriginal astronomy.

8d. “Can you list any specific examples of Aboriginal astronomy you are aware of? Please be as specific as possible”.

17 responses were provided and have been sorted according to themes, derived from the survey respondent answers (Table 11).

8d. “Can you list any specific examples of Aboriginal astronomy you are aware of? Please be as specific as possible”.

17 responses were provided and have been sorted according to themes, derived from the survey respondent answers.

Table 31. Question 8d.

Theme	# of responses	Examples
Aboriginal star patterns	9	<ul style="list-style-type: none"> <li>• The emu in the milky way.</li> <li>• Emu constellation.</li> <li>• The emu in the sky.</li> <li>• The “Emu” which I have viewed several times. Unlike “western” astronomical constellations which are based purely on shapes created by groupings of individual stars, the “Emu” is based on multiple stars, nebulae and everything in between, and describes the shape and colouring of an emu stretched across the entire sky.</li> </ul>

Theme	# of responses	Examples
		<ul style="list-style-type: none"> <li>• That there is an emu shape observable in the dark spaces outlined by stars.</li> <li>• The big emu, a shape made of dust and junk to form the shape of an emu.</li> <li>• An Aboriginal pattern in the sky.</li> <li>• An interesting interpretation of Orion involving canoes.</li> <li>• Seven Sisters and emu.</li> </ul>
Where people learnt about Aboriginal sky knowledge	2	<ul style="list-style-type: none"> <li>• General talks with Aboriginal people.</li> <li>• All I know is from a simple aboriginal star map we have at home.</li> </ul>
Other comment	6	<ul style="list-style-type: none"> <li>• They used to navigate with the stars...?</li> <li>• No, not that I am aware of, except rocks and paintings.</li> <li>• The paintings and the way they track things.</li> <li>• This was historical in nature, and not a current operational project in professional astronomy that was being conducted by Aboriginals.</li> <li>• Not Australian Aboriginal, but sites like Stonehenge, or Isle of Lewis.</li> <li>• Stars.</li> </ul>

Table 32.

The image of science and scientists	Response	WA students (n=64)	WA non-students (n=26)	Others (n=7)	All respondents (n=97)
9a. How many popular astronomy talks did you attend in 2009?	None	53 (82.8%)	19 (73.1%)	1 (14.3%)	73 (75.3%)
	One	8 (12.5%)	1 (3.8%)	1 (14.3%)	10 (10.3%)
	Between two and four	2 (3.1%)	2 (7.7%)	3 (42.9%)	7 (7.2%)
	Five or more	0 (0.0%)	3 (11.5%)	2 (28.6%)	5 (5.2%)
	No response	1 (1.6%)	1 (3.8%)	0 (0.0%)	2 (2.1%)
9b. In 2009, did you see astronomy related news on;	TV	47 (73.4%)	14 (53.8%)	4 (57.1%)	65 (67.0%)
	Internet	15 (23.4%)	12 (46.2%)	4 (57.1%)	31 (32.0%)
	Newspaper	12 (18.8%)	14 (53.8%)	3 (42.9%)	29 (29.9%)
	Magazine	5 (7.8%)	13 (50.0%)	5 (71.4%)	23 (23.7%)
	Internet, webcast or podcast	3 (4.7%)	5 (19.2%)	4 (57.1%)	11 (11.3%)

Table 33. Question 9c. Which scientists / astronomers did you see or hear about during 2009?

Response No.	Response
1	Dr Karl, Phil Plait, Pamela Gay, Fraser Cain.
2	Peter Birch.
3	Richard Dawkins.
4	Anthony Foyed.
5	Mark Giampapa, Debra Fisher.
6	Patrick Moore, Stephen Hawking.
7	Lots from Mt Stromlo.
8	Tanya Hill, Hubble, Peter Ward.
9	Tanya Hill.
10	NASA.
11	Professor Fred Watson, Sir Patrick Moore, Michio Kaku, Professor Steven Tingay.
12	I was in United States, lots about Hubble, versus legend etc. Gallileo; lots about his life, controversy of his beliefs.
13	Too many to name in fact. Immediate ones that I recall were Fred Watson, Rachel Webster, Chris Fluke, Chris Smith (the “naked astronomer”).
14	Guy from the Gravity Centre.
15	Hawking, Curtin/UWA group for SKA project.
16	Hubble Kepler.

9d. How would you describe them?

Positive descriptions (x9), example: “Brilliant speakers, great minds, all made a complex subject seem straightforward to a layperson”, and “inspiring”.

Neutral descriptions (x2), example “old”.

Negative descriptions (x1) example: “Nerdy and earnest”.

Other (x1) “don't know any”.

Itemised results:

- Brilliant.
- Astute; knowledgeable.
- Intelligent.
- Don't know any.
- Inspiring.
- Old.
- Very knowledgeable.
- Very knowledgeable. Very informative.
- Smart.



- Brilliant speakers, great minds, all made a complex subject seem straightforward to a layperson.
- Excellent and engaging public speakers.
- Nerdy and earnest.
- Heroic and genius.

Table 34.

Networks	Response	WA students (n=64)	WA non-students (n=26)	Others (n=7)	All respondents (n=97)
10a. During 2009, were you a member of one or more astronomy groups?	Yes	1 (1.6%)	4 (15.4%)	3 (42.9%)	8 (8.5%)
	No	63 (98.4%)	20 (76.9%)	4 (57.1%)	87 (89.7%)
	NR	0 (0.0%)	2 (7.7%)	0 (0.0%)	2 (2.1%)
10b. Did you join such a group for the first time?	Yes	2 (3.1%)	2 (7.7%)	1 (14.3%)	5 (5.2%)
	No	57 (89.1%)	22 (84.6%)	6 (85.7%)	85 (87.6%)
	NR	5 (7.8%)	2 (7.7%)	0 (0.0%)	7 (7.2%)

Table 35.

Gender representation of scientists / astronomers	Response	WA students (n=64)	WA non-students (n=26)	Others (n=7)	All respondents (n=97)
11. Do you think that females are adequately represented in science and astronomy?	Yes	18 (28.1%)	9 (34.6%)	3 (42.9%)	30 (30.9%)
	No	11 (17.2%)	7 (26.9%)	1 (14.3%)	19 (19.6%)
	I don't know	34 (53.1%)	10 (38.5%)	3 (42.9%)	47 (48.5%)
	NR	1 (1.6%)	0 (0.0%)	0 (0.0%)	1 (1.0%)

Table 36.

Protecting the night sky	Response	WA students (n=64)	WA non-students (n=26)	Others (n=7)	All respondents (n=97)
12a. Are you familiar with the term "light pollution"?	Yes	29 (45.3%)	21 (80.8%)	5 (71.4%)	55 (56.7%)
	No	34 (53.1%)	5 (19.2%)	1 (14.3%)	40 (41.2%)
	NR	1 (1.6%)	0 (0.0%)	1 (14.3%)	2 (2.1%)
12b. During 2009, did you see the night sky away from bright city lights?	Yes	45 (70.3%)	24 (92.3%)	6 (85.7%)	75 (77.3%)
	No	18 (28.1%)	2 (7.7%)	0 (0.0%)	20 (20.6%)
	NR	1 (1.6%)	0 (0.0%)	1 (14.3%)	2 (2.1%)

Protecting the night sky	Response	WA students (n=64)	WA non- students (n=26)	Others (n=7)	All respondents (n=97)
12c. Did you participate in Earth Hour 2009 or 2010?	Yes	27 (42.2%)	6 (23.1%)	2 (28.6%)	35 (36.1%)
	No	20 (31.2%)	12 (46.2%)	2 (28.6%)	34 (35.1%)
	“Don't know about Earth Hour”	17 (26.6%)	8 (30.8%)	2 (28.6%)	27 (27.8%)
	NR	0 (0.0%)	0 (0.0%)	1 (14.3%)	1 (1.0%)
12d. Do you know how excessive night-time lighting can be avoided?	Yes	27 (42.2%)	13 (50.0%)	4 (57.1%)	44 (45.4%)
	No	34 (53.1%)	10 (38.5%)	2 (28.6%)	48 (49.5%)
	NR	3 (4.7%)	1 (3.8%)	1 (14.3%)	5 (5.2%)
12e. Are you aware of any laws or guidelines for preserving dark skies?	Yes	6 (9.4%)	3 (11.5%)	2 (28.6%)	11 (11.3%)
	No	58 (90.6%)	23 (88.5%)	3 (42.9%)	84 (86.7%)
	NR	0 (0.0%)	0 (0.0%)	2 (28.6%)	2 (2.1%)

Table 37.

Future astronomy activities	Response	WA students (n=64)	WA non- students (n=26)	Others (n=7)	All respondents (n=97)
13. What sort of Astronomy activities would you like to be involved in, in the future?	# (%) of comments	26 (40.6%)	14 (53.8%)	3 (42.9%)	43 (44.3%)
	# (%) of no comment	38 (59.4%)	12 (46.2%)	4 (57.1%)	54 (55.7%)

43 respondents (44.3%, n=97) provided additional comments to question 13. Comments have been grouped according to the main themes derived from the comments. Examples of comments are provided in Table 82.

Table 38. Question 13 responses.

Theme	# (%) of responses	Examples
Star watching / using a telescope / astrophotography	17 (17.5%)	<ul style="list-style-type: none"> <li>• Direct observation and astrophotography.</li> <li>• Star watching.</li> <li>• Looking at the stars, going to the moon.</li> <li>• Go star gazing.</li> <li>• To go star gazing.</li> </ul>

Theme	# (%) of responses	Examples
		<ul style="list-style-type: none"> <li>• Star gazing.</li> <li>• Star gazing Looking through a large telescope.</li> <li>• Like to look at stars.</li> <li>• Look at the stars at night, and see what light pollution is and how it effects the dark skies.</li> <li>• Viewing the night sky with a telescope. Visiting Wolfe Creek Meteorite Crater.</li> <li>• Conjunctions, meteor showers, eclipse viewing and photography and art.</li> <li>• I want to be able to look through a huge telescope and identify the stars and constellations.</li> <li>• Looking at stars and planets through a telescope.</li> <li>• Looking at the stars through a telescope.</li> <li>• When I can afford it, buy a good telescope with goto abilities and also get involved with photography.</li> <li>• Astrophotography.</li> <li>• Camp outs and actually being taught more about the sky.</li> </ul>
Observatories / visits / activities	8 (8.2%)	<ul style="list-style-type: none"> <li>• School to visit an observatory.</li> <li>• I would like to participate in some activities with that stuff at my school.</li> <li>• Some interesting activities that are fun and we learn something.</li> <li>• Some fun and interesting activities that doesn't make science seem boring.</li> <li>• Visit an observatory.</li> <li>• Public viewing nights, school viewing nights.</li> <li>• Visiting Perth Observatory.</li> <li>• An astronomy tour.</li> </ul>
Learning / education / research / clubs & groups	10 (10.3%)	<ul style="list-style-type: none"> <li>• Learn more about the stars.</li> <li>• Learning more about the Stars.</li> <li>• I would like to be involved with studying the planets in the future.</li> <li>• Learn about the star formations.</li> <li>• I'd like to learn more about the night sky - my awareness is negligible.</li> <li>• University Astronomy Club (Curtin).</li> <li>• An astronomy club.</li> </ul>

Theme	# (%) of responses	Examples
		<ul style="list-style-type: none"> <li>Join a group.</li> <li>Collaborative observation and research.</li> <li>Organised amateur - professional collaborations of a practical nature, particularly where these can be done remotely.</li> </ul>
Other comments	8 (8.2%)	<ul style="list-style-type: none"> <li>I've never used a telescope.</li> <li>Whatever there is.</li> <li>Inhabiting another planet.</li> <li>Anything. I am new to Perth and to Curtin Uni, and would LOVE to be involved in some kind of astronomical activity!</li> <li>Any that are fun.</li> <li>Going to space.</li> <li>Voluntary activities.</li> <li>Interested in learning how Aboriginal people thought of the stars.</li> </ul>

Table 39.

Questions 14-16. Some information about you.	Response	WA students (n=64)	WA non-students (n=26)	Others (n=7)	All respondents (n=97)
14. Your gender?	Male	36 (56.2%)	16 (61.5%)	4 (57.1%)	56 (57.7%)
	Female	27 (42.2%)	10 (38.5%)	2 (28.6%)	39 (40.2%)
	NR	1 (1.6%)	0 (0.0%)	1 (14.3%)	2 (2.1%)
15. Your age?	0-10	1 (1.6%)	0 (0.0%)	0 (0.0%)	1 (1.0%)
	11-15	62 (96.9%)	0 (0.0%)	0 (0.0%)	62 (63.9%)
	16-20	1 (1.6%)	1 (3.8%)	0 (0.0%)	2 (2.1%)
	21-30	0 (0.0%)	4 (15.4%)	1 (14.3%)	5 (5.2%)
	31-45	0 (0.0%)	5 (19.2%)	2 (28.6%)	7 (7.2%)
	46-70	0 (0.0%)	10 (38.5%)	2 (28.6%)	12 (12.4%)
	71+	0 (0.0%)	3 (11.5%)	0 (0.0%)	3 (3.1%)
	NR	0 (0.0%)	3 (11.5%)	2 (28.6%)	5 (5.2%)

Table 40.

Question 16.	Response	WA students (n=64)	WA non- students (n=26)	Others (n=7)	All respondents (n=97)
16. Do you live in Western Australia?	Yes	64 (100.0%)	26 (100.0%)	0 (0.0%)	90 (92.8%)
	No	0 (0.0%)	0 (0.0%)	6 (85.7%)	6 (6.2%)
	NR	0 (0.0%)	0 (0.0%)	1 (14.3%)	1 (1.0%)

Table 41.

Postcode	General locality	WA students (n=64)	WA non- students (n=26)	Others (n=7)	All respondents (n=97)
6000-6025	Perth northern suburbs	1 (1.6%)	4 (15.4%)	0 (0.0%)	5 (5.2%)
6026	Perth northern suburbs (e.g. Kingsley / Woodvale)	6 (9.4%)	0 (0.0%)	0 (0.0%)	6 (6.2%)
6027-6096	Perth northern suburbs	7 (10.9%)	9 (34.6%)	0 (0.0%)	15 (15.5%)
6103-6164	Perth southern and south-eastern suburbs	0 (0.0%)	7 (38.5%)	0 (0.0%)	7 (7.2%)
6220-6255	South West (regional)WA (e.g. Australind, Eaton, Harvey/Myalup)	49 (76.6%)	1 (3.8%)	0 (0.0%)	50 (51.5%)
6770	Halls Creek	0 (0.0%)	1 (3.8%)	0 (0.0%)	1 (1.0%)
Not specified / invalid		1 (1.6%)	4 (15.4%)	7 (100.0%)	13 (13.4%)

Table 42.

Questions 17-18.	Response	WA students (n=64)	WA non- students (n=26)	Others (n=7)	All respondents (n=97)
17. Are you of Aboriginal or Torres Strait Islander origin??	Yes	3 (4.7%)	2 (7.7%)	3 (42.9%)	6 (6.2%)
	No	60 (93.8%)	24 (92.3%)	3 (42.9%)	89 (91.8%)
	NR	1 (1.6%)	0 (0.0%)	1 (14.3%)	2 (2.1%)
18. Are you from a culturally or linguistically diverse background?	Yes	11 (17.2%)	3 (11.5%)	3 (42.9%)	17 (17.5%)
	No	52 (81.2%)	23 (88.5%)	3 (42.9%)	78 (80.4%)
	NR	1 (1.6%)	0 (0.0%)	1(14.3%)	2 (2.1%)

Question 19. Please provide any other comments you would like to make here.

22 respondents (22.7%, n=97) provided additional comments. Results provided below.

Table 43. Question 19.

Theme	# of responses	Examples
Comments about the survey	5 (5.2%)	<ul style="list-style-type: none"> <li>• I really liked this survey.</li> <li>• Very good survey.</li> <li>• This was very interesting :)</li> <li>• Well done.</li> <li>• This was fun.</li> </ul>
Comments indicating respondent wishing to learn more, or aware of lack of knowledge.	10 (10.3%)	<ul style="list-style-type: none"> <li>• I would like to have more chances to learn about astronomy.</li> <li>• I want to learn more about astronomy.</li> <li>• This survey has reminded me of how little I know about astronomy and may stir me to learn more.</li> <li>• Have very little knowledge... but it would always be good to know more.</li> </ul>
Comments about astronomy	5 (5.2%)	<ul style="list-style-type: none"> <li>• Sometimes astronomy can be really interesting but other times, people stretch it out and it is boring.</li> <li>• Star maps are much too difficult to understand.</li> <li>• I loved John Goldsmith's talk on 27 Oct. 2010, and feel delighted to know that there are astronomers at Curtin Uni, with my deep interest in the night sky and my work with Aboriginal people at CAS. You may wish to access my PhD-thesis as it also refers - though only in a limited way - to the awareness of humanity in relation to the cosmos: Van den Akker, Josina W.I.M. (2009). Understanding and working with the dynamics in cross cultural education (doctoral dissertation). University of Western Sydney, Library Digital repository, publication number 8081/1959.7/40745 (<a href="http://handle.uws.edu.au:8081/1959.7/40745">http://handle.uws.edu.au:8081/1959.7/40745</a>).</li> <li>• Jupiter is pretty.</li> <li>• Uranus is my favourite planet.</li> </ul>
Other	2 (2.1%)	-
TOTAL	22 (22.7%)	



## **The Sky in Our Lives Survey**

### **Background**

This survey seeks to assess the knowledge, attitudes and opinions of West Australians towards astronomy. Your participation is greatly appreciated. For information about the research project, research ethics approval and contact details for enquiries, please refer to [www.icrar.org/surveys/TheSkyInOurLives](http://www.icrar.org/surveys/TheSkyInOurLives).

### **Aims of the research**

This research aims to find out about the knowledge, attitudes and opinions people have relating to the night sky. The information is being gathered as part of a PhD research project “Cosmos, Culture and Landscape”, by John Goldsmith, under the supervision of Professor Steven Tingay, which is being conducted at the International Centre for Radio Astronomy Research. The research project focuses on cultural aspects of astronomy and Aboriginal astronomical knowledge in particular. The survey is intended mainly for use in Western Australia. Even if you feel that you do not know anything about the sky, your answers are still important for this study.

### **About the survey**

“The Sky in Our Lives” survey is an international survey, which is being used in Western Australia for the first time. The survey should take about 30-45 minutes to complete. Your participation in this survey is entirely voluntary. You may withdraw from the survey at any point. There are no known risks related to completing this survey. There is no financial compensation for participation in the survey.

### **Privacy and survey data**

Survey respondents may complete the survey anonymously. The data gathered from this survey will be securely stored. The survey does not seek your name or contact details. However, if you choose to provide these details, no such individually identifiable information will appear in any publication or presentations of results.

### **Publication of results**

Information gathered from this survey may be used as part of the thesis “Cosmos, Culture and Landscape”, and communicated via related reports, published in academic journals, presented at conferences, or otherwise made available (e.g. via the internet). Individuals will not be identifiable from published or presented data. Results from the survey may include summaries, aggregate data, and/or survey response extracts.

### **Research ethics**

This survey has been approved by the Curtin University Human Research Ethics Committee, protocol approval RD-15-10.

### **How to participate in the survey**

- complete the survey online (see [www.icrar.org/surveys/TheSkyInOurLives/](http://www.icrar.org/surveys/TheSkyInOurLives/)),
- download the survey (see [www.icrar.org/surveys/TheSkyInOurLives/](http://www.icrar.org/surveys/TheSkyInOurLives/)), and e-mail the completed survey back to us (e-mail to [astrophdsurveys@icrar.org](mailto:astrophdsurveys@icrar.org)). Surveys returned by post should be sent to the address below.
- we can send you a prepaid hardcopy survey, which you can fill out and post back to us.
- please indicate your survey responses with a .

### **Enquiries / Further information, contact:**

Attention	PhD researcher, John Goldsmith
Email	<a href="mailto:John.Goldsmith@icrar.org">John.Goldsmith@icrar.org</a>
Phone	(+61 8) 9266 4678
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Mail	International Centre for Radio Astronomy Research Curtin University GPO Box U1987 Perth, Western Australia 6845

Thank you for your participation !

John Goldsmith, PhD Candidate  
Professor Steven Tingay

International Centre for Radio Astronomy Research  
Curtin University



### Part 1 Demographic Information

This is personal but ANONYMOUS information about you that will allow us to look for patterns of responses.

1a. Are you an Australian citizen?

Yes

No

1b. If you answered no to the question above, please indicate your country of Citizenship:

2a. I consider myself to be (ethnic group, like African American, Armenian etc)

2b. Are you of Aboriginal or Torres Strait Islander origin?

Yes

No

3. I am;

Male

female

4. My age is;

5. My spiritual/religious tradition is (e.g. Buddhist, Christian etc);

6. I have (check all that apply);

Attended Primary / Grammar School

Attended Secondary / High School

Attended College / University

Graduated from College / University

Attended Graduate School

Earned a professional degree / Master's / MBA / MFA

Earned a Ph.D./ Ed.D./ J.D./ M.D.

7. I am (check all that apply);

- An astronomer
- An amateur astronomer
- An Astronomy major (at University)
- An Astrologer
- An Astrology Student
- Military
- None of these

8. I have learned some astronomy from (check all that apply);

- From other children
- From my mother
- From my father
- in Primary / Grammar School
- in Secondary / High School
- in an astronomy class at College / University
- in a class in graduate school
- Other

9. I have spent most of my time living in (Check one);

- A city
- A town
- The suburbs
- The country
- The wilderness
- An island
- The desert

## **Part 2 The Sky in Your Life**

This section explores how you use the sky in your everyday life or have used the sky in the past. These questions refer to things you have seen in the sky with your own EYES or through a TELESCOPE – not in a photograph or on TV unless specifically asked.

1. Have you ever seen the moon up during the daytime?

- Yes  No  Not sure

2. Have you ever seen an eclipse of the sun or moon?

- Yes  No  Not sure

3. Do you like to watch the sunset?
- Yes  No  Not sure
4. Have you ever seen a shooting star?
- Yes  No  Not sure
5. Have you ever seen a comet?
- Yes  No  Not sure
6. Do you like to see movies that take place in outer space?
- Yes  No  Not sure
7. Do you like to read futuristic books that take place in outer space?
- Yes  No  Not sure
8. Have you ever visited a planetarium?
- Yes  No  Not sure
9. Have you ever used a telescope?
- Yes  No  Not sure
10. Have you ever visited an observatory?
- Yes  No  Not sure
11. Have you watched a rocket or space shuttle launch in person, on TV, or on the Internet?
- Yes  No  Not sure

Long Answers: Please write a few sentences answering each of the following questions.

12. Other than sleep, what activities do you usually do between sunset and midnight?
13. Do these activities tend to take place indoors or outside?
14. How often do you take time specifically to view the night sky?
- Once a year
- Once every few months
- Once a month

- Several times a month
- Several times a week
- Every night

a. What prompts you to look skyward?

b. Do you look at the night sky more casually like when you are driving or walking outside?

- Yes    No         Not sure

c. Why do you look at the sky then?

15. Would you describe the night sky as (circle all that apply)?

- |                                     |                                      |                                    |                                 |
|-------------------------------------|--------------------------------------|------------------------------------|---------------------------------|
| <input type="checkbox"/> Romantic   | <input type="checkbox"/> Empty       | <input type="checkbox"/> Cold      | <input type="checkbox"/> Dark   |
| <input type="checkbox"/> Numinous   | <input type="checkbox"/> Informative | <input type="checkbox"/> Magical   | <input type="checkbox"/> New    |
| <input type="checkbox"/> Changeable | <input type="checkbox"/> Mysterious  | <input type="checkbox"/> Important | <input type="checkbox"/> Bright |
| <input type="checkbox"/> Distant    | <input type="checkbox"/> Beautiful   | <input type="checkbox"/> Heavenly  |                                 |

Other words ?

16. Write the names of the planets that you know;

17. How did you learn the planets?

- From other children
- From my mother
- From my father
- in Primary / Grammar School
- in Secondary / High School
- in an astronomy class at College / University
- in a class in graduate school
- Other

18. Write any asteroid names that you know;

19. How did you learn the asteroids?

- From other children
- From my mother
- From my father
- in Primary / Grammar School
- in Secondary / High School
- in an astronomy class at College / University
- in a class in graduate school
- Other

20. List up to 20 star names;

21. List up to 20 constellation names;

22. How did you learn the stars and constellations?

- From other children
- From my mother
- From my father
- in Primary / Grammar School
- in Secondary / High School
- in an astronomy class at College / University
- in a class in graduate school
- Other

23. Do you have a favourite constellation?

- Yes  No  Not sure

23a. Can you describe or draw a picture of your favourite constellation (Please use the back of the page if you need more space).

24. Have you ever used the stars to find your way at night?

- Yes  No  Not sure

24a. If yes, can you write down the names of the stars or constellations you used? (You can use the back of the page).

24b. Describe the situation when you used the stars to find your way at night and how often you do this (you can use the back of this page if needed).

24c. How did you learn to do this?

25. What do you wish you knew about astronomy/the night sky, and why?

26. Do you participate in ceremonies or festivals on celestial days like at the full moon, Easter, Ramadan, or on the longest or shortest day of the year?

Yes       No       Not sure

26a. If yes, please describe the festival or ceremony and give what day it occurs (You can use the back of the page)?

26b. Does this festival or ceremony occur every year?

Yes    No       Not sure

26c. Do you know of other festivals or ceremonies connected to the sky? Please write about them here and on the back of the survey pages if needed.

27. How much do your **SPIRITUAL/RELIGIOUS** beliefs shape your;

a. Attitudes about the sky?

Not at all    Very little    Moderately    Very much    Greatly

b. Practices with respect to the sky?

Not at all    Very little    Moderately    Very much    Greatly

c. Stories you know or were told about the sky?

Not at all    Very little    Moderately    Very much    Greatly

d. Knowledge about the night sky?

Not at all    Very little    Moderately    Very much    Greatly

28. How much do your **CULTURAL** beliefs shape your;

a. Attitudes about the sky?

Not at all    Very little    Moderately    Very much    Greatly

b. Practices with respect to the sky?

Not at all    Very little    Moderately    Very much    Greatly

c. Stories you know or were told about the sky?

Not at all    Very little    Moderately    Very much    Greatly

d. Knowledge about the night sky?

Not at all    Very little    Moderately    Very much    Greatly

29. How much does **ASTROLOGY** shape your;

a. Attitudes about the sky?

Not at all    Very little    Moderately    Very much    Greatly

b. Practices with respect to the sky?

Not at all    Very little    Moderately    Very much    Greatly

c. Stories you know or were told about the sky?

Not at all    Very little    Moderately    Very much    Greatly

d. Knowledge about the night sky?

Not at all    Very little    Moderately    Very much    Greatly

30. If you know what your Zodiac sign is please write it here

31. How much does your **FORMAL EDUCATION** shape your;

a. Attitudes about the sky?

Not at all    Very little    Moderately    Very much    Greatly

b. Practices with respect to the sky?

Not at all    Very little    Moderately    Very much    Greatly

c. Stories you know or were told about the sky?

Not at all    Very little    Moderately    Very much    Greatly

d. Knowledge about the night sky?

Not at all    Very little    Moderately    Very much    Greatly

32. Do you look at the sky to predict the weather?

Yes  No  Not sure

32a. If yes, what are you looking for and what does it predict?

32b. If yes, how did you learn to do this?

33. Do you or other people in your community know other things about the sky?

Yes  No  Not sure

33a. If yes, first, how would you describe your community?

33b. Can you please write down the other things that you and other people in your community know about the sky? A list is fine, but the more details the better.

33c. Was there a special situation in which you learned this, like over dinner, while camping, or in religious classes? Please give details.

34. Do you know any stories, legends, or myths about the sky that are particular to your community ?

Yes  No  Not sure

34a. If yes, how did you learn these stories?

34b. If yes, please describe these stories in detail (you can also e-mail additional documents, drawings, photos etc to [astrophdsurveys@icrar.org](mailto:astrophdsurveys@icrar.org)).

### **Part 3 Attachment to the sky**

This part of the survey measures your attachment to the sky. Using the following scale, please mark the ONE answer which best indicates how much you typically disagree/agree with each statement. That is, how would you describe yourself in general.

SD = Strongly disagree

D = Disagree



N = Not Sure or Neutral (neither agree or disagree)

A = Agree

SA= Strongly Agree

1. I feel an emotional attachment to the night-sky.

SD       D       N       A       SA

2. I become mesmerized while looking at the night-sky.

SD       D       N       A       SA

3. I could spend all night just looking at the sky.

SD       D       N       A       SA

4. I like to go outside and look at the sky at night often.

SD       D       N       A       SA

5. Having time to look at the night-sky is important to me.

SD       D       N       A       SA

6. I find more pleasure in looking at the night-sky than most people.

SD       D       N       A       SA

7. Looking at the night-sky pleases me.

SD       D       N       A       SA

8. I somehow feel connected to the night-sky.

SD       D       N       A       SA

9. I'm very fond of the night-sky.

SD       D       N       A       SA

10. I very much adore the objects in the night-sky.

SD       D       N       A       SA

#### **Part 4 Astrology Survey**

The questions below test your knowledge about astrology. There are no right or wrong answers please circle ONE answer which best indicates what you think. It is important that you do not go back and change your answers.

1. The Sun, Moon, and Planets are Gods and Goddesses.

Believe       Not sure about       Don't believe       No opinion

2. Astrology and Astronomy are the same.

Believe       Not sure about       Don't believe       No opinion

3. Astrology has NOT been scientifically proven.

Believe       Not sure about       Don't believe       No opinion

4. Astrology or that the position of the stars and planets can affect people's lives.

Believe       Not sure about       Don't believe       No opinion

5. A birth chart with explanations created by an astrologer is very accurate.

Believe       Not sure about       Don't believe       No opinion

6. Horoscopes in newspapers and magazines are NOT very accurate.

Believe       Not sure about       Don't believe       No opinion

7. Astrology can be successfully used to make financial and romantic decisions.

Believe       Not sure about       Don't believe       No opinion

8. Your personality is NOT determined by your astrological sign.

Believe       Not sure about       Don't believe       No opinion

9. The Zodiac is part of the night sky.

Believe       Not sure about       Don't believe       No opinion

### **Part 5. The Astronomy Attitude Survey**

The questions below are designed to identify your attitudes about astronomy. The item scale has 5 possible responses;

SD = Strongly disagree

D = Disagree

N = Not Sure or Neutral (neither agree or disagree)

A = Agree

SA= Strongly Agree

Please read each question. Please mark the ONE answer which best indicates how much you typically disagree/agree with each statement. Try not to think too deeply about each response; there are no correct or incorrect answers.

1. I have trouble understanding astronomy because of how I think.

SD       D       N       A       SA

2. Astronomy concepts are easy to understand.

SD       D       N       A       SA

3. Astronomy is irrelevant to my life.

SD       D       N       A       SA

4. Learning astronomy requires a great deal of discipline.

SD       D       N       A       SA

5. I have no idea of what's going on in astronomy.

SD       D       N       A       SA

6. I like astronomy.

SD       D       N       A       SA

7. What I learn about astronomy is not useful in my career.

SD       D       N       A       SA

8. Most people have to learn a new way of thinking to do astronomy.

SD       D       N       A       SA

9. Astronomy is highly technical but still understandable.

SD       D       N       A       SA

10. I find it difficult to understand astronomy concepts.

SD       D       N       A       SA

11. I would enjoy taking an astronomy course.

SD       D       N       A       SA

12. Astronomy involves memorizing a massive collection of facts.

SD       D       N       A       SA

13. Astronomy is a complicated subject.

SD       D       N       A       SA

14. I can learn astronomy.

SD       D       N       A       SA

15. Astronomy is worthless.

SD       D       N       A       SA

16. I am scared of astronomy.

SD       D       N       A       SA

Thank you for completing this survey. Your responses will help to improve our understanding of people's knowledge and attitudes relating to the night sky in Western Australia. For more information about this research, please visit [www.icrar.org/surveys/TheSkyInOurLives](http://www.icrar.org/surveys/TheSkyInOurLives).

Remember:

E-mail your completed word document survey (or additional content) can be e-mailed to [astrophdsurveys@icrar.org](mailto:astrophdsurveys@icrar.org) or post your hardcopy survey to;

Attention:      PhD researcher, John Goldsmith  
International Centre for Radio Astronomy Research  
Curtin University  
GPO Box U1987  
Perth, Western Australia 6845

## Appendix 5B The Sky in Our Lives Survey Results

Table 44. (Part 1) Demographic Information

	Australian survey # (%) of responses	South African survey # (%) of responses
<b>1. Nationality</b>		
Australian	38 (84.4%)	-
Great Britain	5 (11.1%)	-
USA	1 (2.2%)	-
New Zealand	1 (2.2%)	-
South Africa	-	17 (73.9%)
Zimbabwe	-	1 (4.3%)
Swaziland	-	1 (4.3%)
Lesotho	-	1 (4.3%)
Cameroon	-	1 (4.3%)
Other / not specified	-	2 (8.7%)
<b>Total</b>	<b>45 (100.0%)</b>	<b>23 (100.0%)</b>
<b>2a. Ethnicity</b>		
No response	19 (42.2%)	-
Australian	10 (22.2%)	-
Caucasian / Australian	2 (4.4%)	-
European/American	1 (2.2%)	-
White	1 (2.2%)	-
English	1 (2.2%)	-
Anglo Australian	1 (2.2%)	-
British Indian	1 (2.2%)	-
Pakeha	1 (2.2%)	-
White/British	1 (2.2%)	-
American	1 (2.2%)	-
Chinese	1 (2.2%)	-
Australian / Italian	1 (2.2%)	-
Chinese/Malaysian Australian	1 (2.2%)	-
Christian	1 (2.2%)	-
Tswana	-	6 (26.1%)
Motswana	-	4 (17.4%)
Sotho / Southern Sotho	-	2 (8.7%)
African	-	7 (30.4%)
Shona	-	1 (4.3%)
Swazi	-	1 (4.3%)
NR or not specified	2 (4.4%)	2 (8.7%)
<b>Total</b>	<b>45 (100.0%)</b>	<b>23 (100.0%)</b>
<b>2b. Aboriginal or Torres Strait Islander origin</b>		
Yes	0 (0.0%)	NA
No	3 (6.7%)	NA
NR	42 (93.3%)	NA
<b>Total</b>	<b>45 (100.0%)</b>	<b>NA</b>
<b>3. Gender (male / female)</b>		

	Australian survey # (%) of responses	South African survey # (%) of responses
Male	31 (68.9%)	17 (73.9%)
Female	13 (28.9%)	5 (21.7%)
NR / Other	1 (2.2%)	1 (4.3%)
Total	45 (100.0%)	23 (100.0%)
<b>4. Age</b>		
0-10	2 (4.4%)	0 (0.0%)
11-15	16 (35.6%)	0 (0.0%)
16-20	1 (2.2%)	2 (8.7%)
21-30	7 (15.6%)	15 (65.2%)
31-45	6 (13.3%)	5 (21.7%)
46-70	10 (22.2%)	0 (0.0%)
71 +	1 (2.2%)	0 (0.0%)
NR	2 (4.4%)	1 (4.3%)
Total	45 (100.0%)	23 (100.0%)
<b>5. Spiritual/religious tradition</b>		
None	11 (24.4%)	3 (13.0%)
Undecided	2 (4.4%)	0 (0.0%)
Christian	9 (20.0%)	16 (69.6%)
Buddhist	3 (6.7%)	0 (0.0%)
Indian-Muslim	1 (2.2%)	0 (0.0%)
Bahai	2 (4.4%)	0 (0.0%)
Atheist	10 (22.2%)	0 (0.0%)
Agnostic	1 (2.2%)	0 (0.0%)
Rastafarian	0 (0.0%)	2 (8.7%)
African Religion- Spirituality	0 (0.0%)	1 (4.3%)
Other	2 (4.4%)	1 (4.3%)
NR	4 (8.9%)	0 (0.0%)
Total	45 (100.0%)	23 (100.0%)
<b>6. Education</b>		
Attended Primary / Grammar School	40	22
Attended Secondary / High School	39	22
Attended College / University	21	16
Graduated from College / University	16	3
Attended Graduate School	14	2
Earned a professional degree / Master's / MBA / MFA	9	0
Earned a Ph.D./ Ed.D./ J.D./ M.D.	6	0

	Australian survey # (%) of responses	South African survey # (%) of responses
<b>7. Profession</b>		
An astronomer	5	0
An amateur astronomer	12	3
An Astronomy major (at University)	0	0
An Astrologer	1	0
An Astrology Student	0	0
Military	2	0
None of these	29	20
<b>8. I have learnt some astronomy from;</b>		
From other children	9	0
From my mother	5	1
From my father	9	0
In Primary / Grammar School	26	0
In Secondary / High School	22	2
In an astronomy class at College / University	10	0
In a class in graduate school	7	0
Other	23	0
<b>9. I have spent most of my time living in;</b>		
A city	14 (31.1%)	6 (26.1%)
A town	22 (51.1%)	9 (39.1%)
The suburbs	3 (6.7%)	3 (13.0%)
The country	5 (11.1%)	3 (13.0%)
The wilderness	0 (0.0%)	0 (0.0%)
An island	0 (0.0%)	0 (0.0%)
The desert	0 (0.0%)	0 (0.0%)
Not specified	0 (0.0%)	2 (8.7%)
Total	45 (100.0%)	23 (100.0%)

## Part 2 The Sky in Your Life

This section explores how you use the sky in your everyday life or have used the sky in the past. These questions refer to things you have seen in the sky with your own EYES or through a TELESCOPE – not in a photograph or on TV unless specifically asked. Results are provided in Table 45.

Table 45. Australian survey results: Part 2, The Sky in Your Life.

	Yes	No	Not Sure	NR
<b>1.</b> Have you ever seen the moon up during the daytime?	43 (95.6%)	1 (2.2%)	0 (0.0%)	1 (2.2%)
<b>2.</b> Have you ever seen an eclipse of the sun or moon?	35 (77.8%)	7 (15.6%)	2 (4.4%)	1 (2.2%)
<b>3.</b> Do you like to watch the sunset?	35 (77.8%)	7 (15.6%)	2 (4.4%)	1 (2.2%)
<b>4.</b> Have you ever seen a shooting star?	36 (80.0%)	8 (17.8%)	0 (0.0%)	1 (2.2%)
<b>5.</b> Have you ever seen a comet?	30 (66.7%)	9 (20.0%)	5 (11.1%)	1 (2.2%)
<b>6.</b> Do you like to see movies that take place in outer space?	30 (66.7%)	8 (17.8%)	6 (13.3%)	1 (2.2%)
<b>7.</b> Do you like to read futuristic books that take place in outer space?	20 (44.4%)	17 (37.8)	7 (15.6%)	1 (2.2%)
<b>8.</b> Have you ever visited a planetarium?	34 (75.6%)	7 (15.6%)	3 (6.7%)	1 (2.2%)
<b>9.</b> Have you ever used a telescope?	41 (91.1%)	3 (6.7%)	0 (0.0%)	1 (2.2%)
<b>10.</b> Have you ever visited an observatory?	28 (62.2%)	15 (33.3%)	1 (2.2%)	1 (2.2%)
<b>11.</b> Have you watched a rocket or space shuttle launch in person, on TV, or on the Internet?	43 (95.6%)	1 (2.2%)	0 (0.0%)	1 (2.2%)

Table 46. South African survey results: Part 2, The Sky in Your Life.

	Yes	No	Not Sure	NR
<b>1.</b> Have you ever seen the moon up during the daytime?	12 (52.2%)	7 (30.4)	2 (8.7%)	2 (8.7%)
<b>2.</b> Have you ever seen an eclipse of the sun or moon?	19 (82.6%)	2 (8.7%)	1 (3.4%)	1 (3.5%)
<b>3.</b> Do you like to watch the sunset?	17 (73.9%)	2 (8.7%)	3 (13.0%)	1 (4.3%)
<b>4.</b> Have you ever seen a shooting star?	20 (87.0%)	1 (4.3%)	1 (4.3%)	1 (4.3%)
<b>5.</b> Have you ever seen a comet?	4 (17.4%)	0 (0.0%)	18 (78.3%)	1 (4.3%)



	Yes	No	Not Sure	NR
<b>6.</b> Do you like to see movies that take place in outer space?	17 (73.9%)	5 (21.7%)	1 (4.3%)	0 (0.0%)
<b>7.</b> Do you like to read futuristic books that take place in outer space?	15 (65.2%)	7 (30.4%)	1 (4.3%)	0 (0.0%)
<b>8.</b> Have you ever visited a planetarium?	5 (21.7%)	13 (13.0%)	4 (17.4%)	1 (4.3%)
<b>9.</b> Have you ever used a telescope?	8 (34.8%)	15 (65.2%)	0 (0.0%)	0 (0.0%)
<b>10.</b> Have you ever visited an observatory?	2 (8.7%)	18 (78.3%)	2 (8.7%)	1 (4.3%)
<b>11.</b> Have you watched a rocket or space shuttle launch in person, on TV, or on the Internet?	20 (87.0%)	3 (13.0%)	0 (0.0%)	0 (0.0%)

Table 47. Question 12.

	Australian survey # of responses	South African Survey # of responses
<b>12.</b> Other than sleep, what activities do you usually do between sunset and midnight?		
Watch TV	27	9
Astronomy related activity	14	3
Other	13	9
Eat / drink	12	0
Read	11	10
Use Computer	10	0
Homework / study	9	6
Socialise	6	1
Use internet / skype	6	1
Sport or other physical activity	6	6
Cooking	3	1
Work	3	1
Relaxation	1	2
Listen to radio	1	5

The categories have been derived from grouping similar responses together. Note that due to multiple responses, columns do not add to the total number of respondents.

Table 48. Questions 13 - 14.

	Australian survey # (%) of responses	South African Survey # (%) of responses
13. Do these activities tend to take place indoors or outside?		
Indoors	18 (40.0%)	10 (43.5%)
Mostly Indoors	8 (17.8%)	2 (8.7%)
Outdoors	2 (4.4%)	3 (13.0%)
Both Indoors and Outdoors	11 (24.4%)	6 (26.1%)
Mostly Outdoors	0 (0.0%)	1 (4.3%)
NR	6 (13.3%)	1 (4.3%)
Total	45 (100.0%)	23 (100.0%)
14. How often do you take time specifically to view the night sky?		
Once a year	5 (11.1%)	4 (17.4%)
Once every few months	10 (22.2%)	0 (0.0%)
Once a month	2 (4.4%)	3 (13.0%)
Several times a month	7 (15.6%)	5 (21.7%)
Several times a week	11 (24.4%)	5 (21.7%)
Once a week	1 (2.2%)	1 (4.3%)
Every night	7 (15.6%)	4 (17.4%)
NR	2 (4.4%)	1 (4.3%)
Total	45 (100.0%)	23 (100.0%)

14a. What prompts you to look skyward?

A total of 39 responses from the Australian survey have been sorted according to themes, derived from the survey respondent answers.

Table 49. Question 14a. (Australian survey responses).

Theme	# of responses	Examples
Interest / Curiosity	10	<ul style="list-style-type: none"> <li>• Interest in natural world.</li> <li>• The magicalness of the sky.</li> <li>• Just curiosity.</li> <li>• Curiosity about what's out there.</li> <li>• Curiosity, fascination, scientific interest.</li> <li>• Interest.</li> <li>• New interest in astronomy.</li> <li>• It is interesting.</li> <li>• It is just fascinating to watch the sky.</li> <li>• Because I find it interesting.</li> </ul>

Theme	# of responses	Examples
Astronomical objects or special astronomical events	13	<ul style="list-style-type: none"> <li>• Visually a special event like an eclipse, close up planet or the moon changing colour.</li> <li>• Clear skies, specific astronomical events.</li> <li>• If I hear about something interesting happening (eclipse or something like that). Really enjoy a nice sunrise or sunset. If I happen to find myself in an unpopulated area with little to no light pollution I could stare for hours at the milky way, not with a telescope but just staring at the wonder of it all :)</li> <li>• Fireworks or a phenomenon of some sort.</li> <li>• Anything special.</li> <li>• Either a public or school viewing night, or there is some specific observation project I'm doing at the time.</li> <li>• Stars, moon.</li> <li>• The Southern Cross.</li> <li>• Like to look at the stars, and I like to look when I know a certain planet is visible.</li> <li>• Constellations.</li> <li>• The Stars because they are sparkly!!!!</li> <li>• I want to spot the shiniest star.</li> <li>• Stars, planets / moon coming close to the Earth.</li> </ul>
Awe / Beauty	6	<ul style="list-style-type: none"> <li>• Awe.</li> <li>• It's there, I like it, it amazes me. I think about space and all those millions and millions of kilometres and years represented. It is humbling.</li> <li>• A sense of wonder, amazement and longing for humanity to travel between them.</li> <li>• Awe, interest, seeing what's in the sky on that night.</li> <li>• It's beautiful. Marking the passing seasons (I look forward to seeing Orion in the early evening as it means summer is on its way, and cringe when I see Scorpio because I know winter is coming).</li> <li>• The fact that it's beautiful, and there's so much to see, even in a town.</li> </ul>
Other	14	<ul style="list-style-type: none"> <li>• Childhood habit.</li> <li>• Colour.</li> </ul>

Theme	# of responses	Examples
		<ul style="list-style-type: none"> <li>• I'm an astronomer; I have a young son; I work quite a lot with school kids on observational projects.</li> <li>• A clear night, nice stars, general awareness of my surroundings.</li> <li>• I love the colours of the sky I like the stars.</li> <li>• Relaxation / boredom.</li> <li>• When I'm bored.</li> <li>• The darkness.</li> <li>• The blackness.</li> <li>• The colours of the sunset.</li> </ul>

(South African survey). A total of 23 responses, grouped according to the following predominant themes.

Table 50. Question 14a. (South African survey).

Theme	# of responses	Examples
Enjoyment / love of the sky	5	<ul style="list-style-type: none"> <li>• I love watching stars.</li> <li>• Admiring nature.</li> <li>• I like the night sky, is calming.</li> <li>• Just for fun.</li> <li>• I feel good because it's amazing and also because I like researching and knowing new things.</li> </ul>
Beauty	4	<ul style="list-style-type: none"> <li>• The beauty of the sky and its beautiful objects e.g. moon, stars and others.</li> <li>• The beauty of constellations.</li> <li>• The beauty of the stars and the moon.</li> <li>• The beauty and natural reflection of the sky.</li> </ul>
Moon / stars / constellations /planets	5	<ul style="list-style-type: none"> <li>• I like to follow the moon cycle.</li> <li>• Moons and stars.</li> <li>• The stars shine very bright sometimes.</li> <li>• Check which constellation and planets.</li> <li>• When there is a full moon. To predict the weather.</li> </ul>
Other	9	<ul style="list-style-type: none"> <li>• Time.</li> <li>• The planetarium program on Linux.</li> <li>• The nature.</li> <li>• Interested in what the stars, moons, sun means to our</li> </ul>

Theme	# of responses	Examples
		<p>everyday lives.</p> <ul style="list-style-type: none"> <li>• I never look at the sky during the night with the intention to specifically view the night sky.</li> <li>• The vastness of the sky in the rural areas. The sky is very big and much more clearer.</li> <li>• Stars looks different and exciting.</li> <li>• Nature.</li> <li>• My dream career to become an astronomer / astrophysicist which involves study about the sky.</li> </ul>

Table 51. Questions 14b, 14c.

	Australian survey # (%) of responses	South African Survey # (%) of responses
14b. Do you look at the night sky more casually like when you are driving or walking outside?		
Yes	34 (75.6%)	17 (73.9%)
No	3 (6.7%)	4 (17.4%)
Not sure	5 (11.1%)	1 (4.3%)
NR	3 (6.7%)	1 (4.3%)
Total	45 (100.0%)	23 (100.0%)
14c. Why do you look at the sky then?		
Responses supplied	41 (91.1%)	20 (87.0%)
NR	4 (8.9%)	3 (13.0%)
Total	45 (100.0%)	23 (100.0%)

(Australian survey). A total of 41 responses have been sorted according to themes, derived from the survey respondent answers.

Table 52. Question 14c (Australian survey).

Theme	# of responses	Examples
Interest / Curiosity / Fascination / Wonderment	14	<ul style="list-style-type: none"> <li>• Because it amazing and there is always something to look at.</li> <li>• Interest.</li> <li>• Curiosity.</li> <li>• Wonderment.</li> <li>• Interest in natural world, share with partner, aesthetics.</li> </ul>

Theme	# of responses	Examples
		<ul style="list-style-type: none"> <li>• I've always been fascinated with the night sky, the planets, the prospect of life. As I learned more, I realised just how little we know.</li> <li>• Fascination at the beauty of the stars, galaxy and universe!</li> <li>• It's there, I like it, it amazes me. I think about space and all those millions and millions of kilometres and years represented. It is humbling.</li> <li>• It's an amazing sight once you appreciate what you're looking at. It's also nice to wonder if somebody might be looking back.</li> <li>• Because it is very interesting.</li> <li>• Because the stars are sparkly!</li> <li>• It is cool.</li> <li>• Interest.</li> <li>• Interesting.</li> </ul>
Seeing Astronomical objects	12	<ul style="list-style-type: none"> <li>• Because you can see it everywhere unless you are inside.</li> <li>• Stars, moon.</li> <li>• See how fast Jupiter is moving. To try and work out the shape of Sagittarius constellation - that thing makes no sense. The milky way is near unfathomable and reminds me of who I am not.</li> <li>• Moon and Southern Cross.</li> <li>• Childhood habit, like to see what's in the sky.</li> <li>• To see what's up (plus to check the weather and look for bats in summer!)</li> <li>• To see the stars and the moon.</li> <li>• To look at the stars.</li> <li>• To see what's visible that night.</li> <li>• Looking for changes from night to night.</li> <li>• Nice to watch.</li> <li>• Milky way, deep sky objects.</li> </ul>
Beauty	3	<ul style="list-style-type: none"> <li>• Appreciate beauty whether that's clouds, stars, sunsets. Find it very relaxing and calming, while at the same time challenging and stimulating to think of our place in the universe.</li> <li>• I think it is pretty.</li> </ul>

Theme	# of responses	Examples
		<ul style="list-style-type: none"> <li>• I love the colours. It makes me feel expanded.</li> <li>• Curiosity. Sense of being part of history. It is beautiful.</li> </ul>
Other	12	<ul style="list-style-type: none"> <li>• Heaven is yang and Earth is yin.</li> <li>• Why not?</li> <li>• Just because.</li> <li>• The sky is cool.</li> <li>• Boredom.</li> <li>• If I am bored.</li> <li>• Boredom, Fireworks or a phenomenon of some sort.</li> <li>• I get bored or nothing else to do.</li> <li>• Not sure.</li> <li>• I do not know.</li> <li>• There is a wealth of information, it also provides philosophical grounding for life on earth.</li> <li>• Because it's relaxing.</li> </ul>

A total of 20 responses from the South African survey are grouped according to the following predominant themes.

Table 53. Question 14c (South African survey).

Theme	# of responses	Examples
Admiring / looking / curiosity / beauty of the sky	13	<ul style="list-style-type: none"> <li>• Admiring nature.</li> <li>• To see if I can see other stars.</li> <li>• Most of the time I'm wondering about stuff,- it's the only place that can show me a picture of oblivion.</li> <li>• Fascinating things like man-made satellites, especially spy satellites in orbit, targeting certain areas on the ground.</li> <li>• Because I want to see the beauty of nature.</li> <li>• I am fascinated by the natural beauty portrayed by the natural sky.</li> <li>• To view the beauty and look for shooting stars.</li> <li>• To see if I can see new things in the sky.</li> <li>• For the natural beauty.</li> <li>• Same as above but sometimes to appreciate the beauty of the night sky.</li> </ul>

Theme	# of responses	Examples
		<ul style="list-style-type: none"> <li>• The sky itself is attractive so every time I keep on looking upward.</li> <li>• To count the stars.</li> <li>• Trying to find any mysterious things happening in the sky.</li> </ul>
Weather	3	<ul style="list-style-type: none"> <li>• The moon is up, to predict the weather.</li> <li>• To check for cloud cover.</li> <li>• To check the weather.</li> </ul>
Other	4	<ul style="list-style-type: none"> <li>• Mostly the moon, during summer.</li> <li>• To relax and look for any shooting stars and how the moon looks like.</li> <li>• Look at the sky to especially when I am at the village where there are no street lights.</li> <li>• It catches my attention. It sparkles.</li> </ul>

Table 54. Question15.

	Australian survey # (%) of responses	South African Survey # (%) of responses
15. Would you describe the night sky as?		
Beautiful	29	13
Distant	26	6
Mysterious	24	13
Important	21	4
Changeable	20	4
Romantic	19	12
Dark	18	5
Other words	17	NA
Magical	14	6
Informative	13	11
Bright	12	7
Cold	10	3
Heavenly	8	10
Empty	4	2
New	4	1
Numinous	3	0



Several multiple responses were provided by respondents. In the Australian survey, respondents were provided an opportunity to give comments or other descriptive words. A summary of the 17 responses are provided below:

“awesome/awe inspiring/amazing” (x5)

“fascinating” (x2)

other (including multiple answers) (x10). Responses include:

- Illustrative.
- Gives a sense of perspective.
- Unfathomable! distressing, real, inhuman, wonderful, sparkly, communicative, elastic, mechanical, rotating, belittling.
- Strange, alien (foreign), peaceful, calm.
- Infinite, evolving, immense.
- What do you mean by heavenly?
- Interesting in the shape of the moon and stars.
- Sparkly.
- Pleasant.
- I think it's interesting that even though I'm a scientist (biology, not astrophysics) I have ticked all the words that make me connect emotionally, not scientifically, with the night sky.

Particularly notable is the final response (above) which commented on their selection of emotive, rather than scientific words to describe the night sky.

Elaborations to question 15 were not asked in the South African survey.

For question 16, only currently recognised planets, from our solar system, have been included in the following summary. Some respondents correctly identified Pluto as being a “dwarf planet”, whereas some respondents listed Pluto still as a current planet. Planets from other star systems were also identified in some case, in addition to asteroids and moons of other planets in our solar system. None of these have been included in the summary below.

Table 55. Questions 16-23a

	Australian survey # (%) of responses	South African Survey # (%) of responses
16. Write the names of the planets that you know		
8 correct answers	27 (60.0%)	2 (8.7%)
7 correct answers	10 (22.2%)	2 (8.7%)
6 correct answers	1 (2.2%)	2 (8.7%)
5 or fewer correct answers	7 (15.6%)	17 (73.9%)

	Australian survey # (%) of responses	South African Survey # (%) of responses
Total	45 (100.0%)	23 (100.0%)
17. How did you learn about the planets?		
From other children	7	0
From my mother	9	2
From my father	13	1
In Primary / Grammar School	35	11
In Secondary / High School	23	15
In an astronomy class at College / University	7	1
In a class at Graduate School	0	0
Other	15	0
18. Write any asteroid names that you know;		
More than 10 names	1 (2.2%)	0 (0.0%)
8-10 correct names	2 (4.4%)	0 (0.0%)
4-7 correct names	3 (6.7%)	0 (0.0%)
3 correct names	1 (2.2%)	0 (0.0%)
2 correct names	2 (4.4%)	1 (4.3%)
1 correct name	6 (13.3%)	3 (13.0%)
NR or incorrect response	30 (66.7%)	19 (82.6%)
Total	45 (100.0%)	23 (100.0%)
Incorrectly naming a planet as an asteroid	1 (2.2%)	0 (0.0%)
Incorrectly naming a comet(s) as an asteroid	3 (6.7%)	0 (0.0%)
19. How did you learn about the asteroids?		
From other children	3	0
From my mother	3	0
From my father	5	0
In Primary / Grammar School	21	0
In Secondary / High School	14	0
In an astronomy class at College / University	7	1
In a class at Graduate School	3	0
Other	17	2
20. List up to 20 star names		
20 correct answers	4 (8.9%)	1 (4.3%)
15-19 correct answers	2 (4.4%)	0 (0.0%)
10-14 correct answers	2 (4.4%)	0 (0.0%)
5-9 correct answers	3 (6.7%)	1 (4.3%)

	Australian survey # (%) of responses	South African Survey # (%) of responses
1-4 correct answers	19 (42.2%)	5 (21.7%)
0 correct answers	15 (33.3%)	16 (69.6%)
Total	45 (100.0%)	23 (100.0%)
<b>21. List up to 20 constellation names</b>		
20 correct answers	7 (15.6%)	1 (4.3%)
15-19 correct answers	3 (6.7%)	0 (0.0%)
10-14 correct answers	7 (15.6%)	1 (4.3%)
5-9 correct answers	6 (13.3%)	1 (4.3%)
1-4 correct answers	12 (26.7%)	1 (4.3%)
0 correct answers	10 (22.2%)	19 (82.6%)
Total	45 (100.0%)	23 (100.0%)
<b>22. How did you learn about the stars and constellations?</b>		
From other children	6	0
From my mother	7	1
From my father	10	2
In Primary / Grammar School	23	5
In Secondary / High School	19	5
In an astronomy class at College / University	8	2
In a class at Graduate School	4	0
Other	18	0
<b>23. Do you have a favourite constellation?</b>		
Yes	25 (55.6%)	5 (21.7%)
No	17 (37.8%)	3 (30.4%)
Not sure	2 (4.4%)	5 (21.7%)
NR	1 (2.2%)	10 (43.5%)
Total	45 (100.0%)	23 (100.0%)
<b>23(a). Itemisation/frequency of favourite constellations:</b>		
Orion (including "Orion's Belt")	8	1
Southern Cross	6	
Scorpius	4	
Seven sisters (or Taurus)	2	
Sagittarius	1	
Lyra	1	
Perseus	1	
Leo	1	
Big Dipper	1	

	Australian survey # (%) of responses	South African Survey # (%) of responses
Other	1	
Total	26	1

Extracts from the 26 responses from the Australian survey are provided below:

**(Orion)**

- “Orion” / “Orion's Belt” (x4).
- Orion is because there is so much around the constellation to be seen.
- Orion: symmetry, colour, nebulae, a means for identification of neighbouring stars and constellations.
- Orion, as one of the few visible across the hemispheres. Roughly makes out the shoulder, head and leg points of a person, wearing a belt and sword. The amazing thing is that not all the “stars” are stars in Orion, some a nebulae and clusters.
- Orion - the belt consists of three stars in a line, with two stars at the shoulders and another two stars at the knees. From the belt, the dagger as a line of stars and nebulae protrudes.

**(Scorpius)**

- “Scorpius” (x2).
- Scorpius is scorpion-like in appearance, at odds with the general ancient tradition of associating any old nonsense with a “pattern” of stars...

**(Sagittarius)**

- Sagittarius... Looks like a teapot in the sky with steam rising out of it, and the spout pointing to the very centre of our galaxy and its black hole. Awesome.

**(Southern Cross)**

- “Southern Cross” (x3).
- The Southern Cross represents a way of finding south, and orienting myself. It also is on my country's flag (Australia). I like epsilon, as the shy star.
- Southern Cross, it is Australian and the one constellation I can't miss. Absolutely beautiful.

Other responses

- Leo.
- Taurus.
- Lyra, because it contains the ring nebula which is one of my favourite Messier objects. It's sort of a parallelogram with Vega just off one corner.
- Southern cross, orion, scorpius.
- The Big Dipper.
- In a lot of astronomical detail! Specifically Cham, Lupus, Orion, Taurus.
- Drawing of Perseus supplied.
- Seven Sisters.

- It's fairly elongated, sickle-shaped at one end and diverging into 'pincers' at the other. One of the central stars is red.

Only one comment was provided in the South African survey to this question (constellation Orion).

Table 56. Questions 24 - 25.

	Australian survey # (%) of responses	South African Survey # (%) of responses
24. Have you ever used the stars to find your way at night?		
Yes	17 (37.8%)	3 (13.0%)
No	25 (55.6%)	16 (69.6%)
Not sure	1 (2.2%)	4 (17.4%)
NR	2 (4.4%)	0 (0.0%)
Total	45 (100.0%)	23 (100.0%)
24a. If yes, draw or write the names of the stars or constellations you used?		
	<ul style="list-style-type: none"> <li>• Summary of 19 responses:</li> <li>• “Southern Cross” and/or “Pointers” or “Alpha and Beta Centauri” (x9)</li> <li>• Ursa Major and/or Polaris. (x3)</li> <li>• Orion and other constellations. (x2)</li> <li>• Venus. (x1)</li> <li>• Other combinations of constellations. (x4)</li> <li>• Responses</li> <li>• Pointers and Southern Cross.</li> <li>• Southern cross and its pointers.</li> <li>• Southern Cross.</li> <li>• Southern cross, polaris.</li> <li>• Polaris in the Northern Hemisphere.</li> <li>• Used Ursa Major in the northern hemisphere.</li> <li>• Venus.</li> <li>• Generally just the Crux and Scorpius.</li> <li>• Southern cross and the two pointers.</li> <li>• Southern Cross and the pointers - can indicate geographic south through intersection of line joining up most distant stars of Southern Cross with line perpendicular to the mid-point of the Pointers. Very useful - as useful as an</li> </ul>	4 responses <ul style="list-style-type: none"> <li>• Southern Cross.</li> <li>• Southern Cross and Pointers.</li> <li>• Venus.</li> <li>• I do not know the technique.</li> </ul>

	Australian survey # (%) of responses	South African Survey # (%) of responses
	<p>analogue clock during the day with the sun can indicate north.</p> <ul style="list-style-type: none"> <li>• Polaris, Ursa Major/Minor.</li> <li>• The asterism the Big Dipper and Polaris just to find north, I've also used Jupiter to find an approximate south when it's been cloudy.</li> <li>• Southern Cross.</li> <li>• Polaris (North Star) - Ursa Minor Crux, Pointers, Magellanic clouds.</li> <li>• Orion, Crux plus pointers.</li> <li>• Overlap of the perpendicular bisector of alpha and beta centauri and the extension of alpha and beta crucis to find due south.</li> <li>• Southern Cross.</li> <li>• Orion and Crux, Orion's Belt and sword, I (concert?) to an arrow shaft and head (always points to north horizon).</li> <li>• Southern Cross (know, but don't use it).</li> </ul>	
<ul style="list-style-type: none"> <li>• 24b. Describe the situation when you used the stars to find your way at night and how often you do this.</li> </ul>		
	<p>Summary of 17 responses</p> <ul style="list-style-type: none"> <li>• “camping” (including scouts/guides) (x4).</li> <li>• “walking”, “hiking”, “orienteering” (x6).</li> <li>• “driving” (x2).</li> <li>• “general” (x2).</li> <li>• “boating” / “yachting” (x1).</li> <li>• “other” (x2).</li> </ul> <p>Responses</p> <ul style="list-style-type: none"> <li>• Used when camping.</li> <li>• It is non-descript. I often look for the south pole to try and figure out what Jupiter is up to.</li> <li>• Camping.</li> <li>• Walking in the hills after dark...maybe once or twice a year.</li> <li>• Camping while a boy scout. Although I often look to southern cross these days to get</li> </ul>	<p>3 responses</p> <ul style="list-style-type: none"> <li>• It was during the late 80's when we had only a map and no compass for our nightly hikes (walk through the wilderness). If the map was not co-relating with landscape, we would have to use star positions with respect to time and distance we walked.</li> <li>• I used the stars to find the direction to go home, because I was lost in the field at could not find my way.</li> <li>• I never tried.</li> </ul>

	Australian survey # (%) of responses	South African Survey # (%) of responses
	<p>my bearings.</p> <ul style="list-style-type: none"> <li>• On a girl guides camp.</li> <li>• Yachting.</li> <li>• Used their general location in the sky to determine N, S, E, W.</li> <li>• When driving my car or hiking for fun.</li> <li>• Have used in as a orientation marker when leaving camp sites in the bush, so as to know which direction I went in when I left, enabling me to get back.</li> <li>• Had taken a couple of wrong turns trying to get home late one evening, and needed to orient myself with my map. So I found Polaris, and oriented my map.</li> <li>• Not very often, maybe a couple of times a year when I'm trekking and am too lazy to get my compass out. Typically when I'm not far from my intended camping spot and just need to orientate a map.</li> <li>• Not often.</li> <li>• North: Polaris (easy) South: measure longer axis of Crux and line between pointers, where they intersect is roughly south. Use the Magellanic Clouds to triangulate pole (makes roughly equilateral triangle).</li> <li>• Very often for orientation, even casually when not doing anything to do with astronomy.</li> <li>• Bushwalking.</li> <li>• When I'm in the country walking back at night to get back to the tent or caravan.</li> </ul>	
24c. How did you learn to do this?		
	<p>(Summary of 19 responses)</p> <ul style="list-style-type: none"> <li>• “can't recall” (x3).</li> <li>• “university” (x2).</li> <li>• “scouts”, “cadets”, “military” (x3).</li> <li>• “primary school” (x2).</li> </ul>	<p>Responses</p> <ul style="list-style-type: none"> <li>• Survival mode kicked in.</li> <li>• Taught at University.</li> </ul>

Australian survey # (%) of responses	South African Survey # (%) of responses
<ul style="list-style-type: none"> <li>• “girl guides” (x2).</li> <li>• “deduction/prior knowledge” (x2).</li> <li>• “other” (x5).</li> </ul> <p>Responses</p> <ul style="list-style-type: none"> <li>• I didn't learn this till I was in my 30's. I got taught at uni.</li> <li>• Once you can identify a southerly or northerly constellation, you can figure the rest out.</li> <li>• Get my bearings- once a month?</li> <li>• Can't remember.</li> <li>• ?</li> <li>• From girl guides leader.</li> <li>• Hearsay.</li> <li>• Probably at uni.</li> <li>• Scouts.</li> <li>• Can't remember, might have been my dad when I was a kid.</li> <li>• Just by knowing that Polaris is the north star and more or less lies directly above the line of the earth's rotational axis.</li> <li>• Watching the cartoon Rugrats as a kid, there is a camping episode where the father, Stew, tells the babies how to find their way home using the stars. He pointed out the Big Dipper and the North Star.</li> <li>• Girl Guides, but I'm not sure.</li> <li>• Read it.</li> <li>• Cadets at High School.</li> <li>• Reading in primary school.</li> <li>• Scouts, military.</li> <li>• I might have read this and/or heard it from my lower school science teacher, Mr Johnson.</li> <li>• Did not do, but know. School?</li> </ul>	



	Australian survey # (%) of responses	South African Survey # (%) of responses
25. What do you wish you knew about astronomy / the night sky, and why?		
Responses	30 (66.7%)	18 (78.3%)
NR	15 (33.3%)	5 (21.7%)
Total	45 (100.0%)	23 (100.0%)

(Australian survey). 30 responses have been categorised according to five main themes.

Table 57. Question 25. Australian survey responses grouped according to themes.

Thirty responses from the Australian survey have been categorised according to five main themes.

Theme	# of responses	Examples of responses
Physics / Cosmology	8	<ul style="list-style-type: none"> <li>I wish I understood general relativity and particle physics so that I could make sound arguments about anything astronomical.</li> <li>How did it get there? Big bang theory??</li> <li>Where does the universe end? Because nobody knows.</li> <li>I wish I understood more about the big bang event.</li> <li>It is a fascinating field. I would have loved to have studied it and the physics of the cosmos at Uni. I didn't and can't now. I'd like to be better at naming stars and constellations - have a better 'geography' of the sky.</li> <li>I wish I had a better understanding of the physics which are at work on everything.</li> <li>Dark matter. Whether other universes. Role of relativity in perception of the universe.</li> <li>I wish I knew more about the Lagrange points and these asteroids that are in an unstable equilibrium. Why? Perhaps asteroid impacts are cyclical?</li> </ul>
Curiosity	5	<ul style="list-style-type: none"> <li>Everything about the stars and constellations.</li> <li>Everything! I have taught myself enough to teach astronomy to beginners, but I would love to know a whole lot more. It's just a thirst for knowledge of what's out there.</li> <li>I wish I knew more because that's what I am.</li> <li>More.</li> <li>Everything.</li> </ul>

Theme	# of responses	Examples of responses
Life in the Universe	3	<ul style="list-style-type: none"> <li>• If there is life on other planets. How big the galaxy is.</li> <li>• I wish I knew when we will make contact with extraterrestrial life, or know through other means that it exists.</li> <li>• Planets, Life on planets.</li> </ul>
The night sky; practical observing / astronomical events / navigation	8	<ul style="list-style-type: none"> <li>• I wish I knew more stars &amp; constellations in the night sky! I know them theoretically, but cannot usually tell their locations by looking up.</li> <li>• I wish I knew more of the star names and constellations.... It would make my hobby as a planetarium presenter a lot easier!</li> <li>• I wish I knew how to identify more constellations.</li> <li>• I wish I did know more about stars and constellations and how to navigate by them, not for any particular practical purpose, but it's a sort of romantic type of skill to have.</li> <li>• How it can help find my way. For safety.</li> <li>• How to find my way around using stars.</li> <li>• How to use the stars to find your way home.</li> <li>• How to be sure to see a good meteor shower.</li> </ul>
Other	6	<ul style="list-style-type: none"> <li>• I wish I had a more powerful telescope.</li> <li>• No because I would probably forget or get mixed up.</li> <li>• In some ways I wish I knew less, I've seen astronomers results too closely!</li> <li>• What happened yesterday, not tens of thousands of years ago, but that is cool too.</li> <li>• That's the same as asking what I want to know that I don't know I don't know.</li> <li>• I study Chinese astronomy and would like to know more about Southern Hemisphere sky.</li> </ul>

A total of 21 responses from the South African survey are grouped according to the following predominant themes.

Table 58. Question 25. South African survey responses grouped according to themes.

Theme	# of responses	Examples
About the stars	7	<ul style="list-style-type: none"> <li>• What makes the stars to shine so brightly and to shoot.</li> <li>• What causes the stars to shoot?</li> <li>• To be able to know stars' names.</li> <li>• What makes the stars float in the air and how come they don't fall.</li> <li>• How to communicate with them (the stars), read them, use them. To be able to use in my everyday day life.</li> <li>• How many stars are there in total. The largest star and the smallest. Also how large is space or the sky that it contains all these bodies.</li> <li>• How many stars are there?</li> </ul>
Life from space	2	<ul style="list-style-type: none"> <li>• How does astronomy deal with finding the life form in other planets because it would be an advantage should global warming and any other situations worsen on earth.</li> <li>• If there are other living things in outer space.</li> </ul>
About the weather	2	<ul style="list-style-type: none"> <li>• What causes rain to fall, what forms the clouds and why sometimes is it cold and sometimes warm.</li> <li>• What causes rain and makes day different from the night and what makes the stars so bright, even when there is no sun.</li> </ul>
Moon	3	<ul style="list-style-type: none"> <li>• If the moon is hot or cold.</li> <li>• I would like to visit the moon.</li> <li>• Why does earth have one Moon?</li> </ul>
Planets	2	<ul style="list-style-type: none"> <li>• What to know if there are other planets other than in our solar system.</li> <li>• The relationship of planets.</li> </ul>
Other	5	<ul style="list-style-type: none"> <li>• How does it (space) relate to the people and animals.</li> <li>• How it happens.</li> <li>• How does Space manipulate time.</li> <li>• Building my own spy satellite tracker. The template for that is available online.</li> <li>• How Africans interpret the night sky and it will help me to have an idea about cultural Astronomy.</li> </ul>

Table 59. Question 26.

	Australian survey # (%) of responses	South African Survey # (%) of responses
26. Do you participate in ceremonies or festivals on celestial days like at the full moon, Easter, Ramadan, or on the longest or shortest day of the year?		
Yes	20 (44.4%)	7 (30.4%)
No	21 (46.7%)	11 (47.8%)
Not sure	3 (6.7%)	4 (17.4%)
NR	1 (2.2%)	1 (4.3%)
Total	45 (100.0%)	23 (100.0%)

**26a.** If yes, please describe the festival or ceremony and give what day it occurs?

Twenty responses from the Australian survey are provided below.

Table 60. Question 26a. (Australian survey).

Theme	# of responses	Examples
Easter / Christmas	11	<ul style="list-style-type: none"> <li>• “Easter” (x9)</li> </ul> <p>Examples of responses:</p> <ul style="list-style-type: none"> <li>• Easter, after a certain number of full moons, Friday to Monday.</li> <li>• Easter, Winter and Spring Solstices for the southern hemisphere. The day of these varies from year to year.</li> <li>• “Easter” &amp; “Christmas” (x1)</li> <li>• “Christmas” (x1)</li> </ul>
Chinese New Year	2	<ul style="list-style-type: none"> <li>• Chinese New Year, Moon cake festivals.</li> </ul>
Other	7	<ul style="list-style-type: none"> <li>• Passover and Jewish New Year, plus Easter holidays.</li> <li>• I celebrate Ramadan as a Muslim, and we also have special prayers at the beginning of each Lunar Month, i.e. the night of the New Moon.</li> <li>• Acknowledgement with friends, not an overt celebration.</li> <li>• Solstice, equinox, eclipses.</li> <li>• The shortest day of the year. 22nd of June.</li> <li>• Bahai's, like Christmas, (except New Year) for Bahais.</li> <li>• Longest Day, St Hans, from Denmark.</li> </ul>

South African survey. Examples, from 6 responses:

- Easter (x2).
- We dance and sing all night, praying for good fortune.
- Solar eclipse.

- Well, as a kid we use to dance at night when there was a full moon; I still remember. Today I don't celebrate or dance.
- Full moon.

Table 61. Question 26b.

	Australian survey # (%) of responses	South African Survey # (%) of responses
26b. Does this festival or ceremony occur every year?		
Yes	20 (44.4%)	7 (30.4%)
No	2 (4.4%)	2 (8.7%)
Not sure	2 (4.4%)	6 (26.1%)
NR	21 (46.7%)	8 (34.8%)
Total	45 (100.0%)	23 (100.0%)

26c. Do you know of other festivals or ceremonies connected to the sky?

Table 62. Question 26c.

Australian survey	South African survey
10 responses <ul style="list-style-type: none"> <li>• There's a Chinese festival, also celebrated in Japan, held on the seventh day of the seventh month. It celebrates the day when Vega and Altair can cross the Milky Way to meet each other. Or something like that, anyway.</li> <li>• Many connected - solstices, etc.</li> <li>• Pagan festivals, Planting by the moon phases, summer and winter solstice celebrations by retreat group.</li> <li>• I like the Japanese one (forgotten the name) where the two star lovers appear over opposite horizons (or something like that..?).</li> <li>• Mooncake Festival, Hungry Ghost festival.</li> <li>• Pesach (passover) starts at the full moon in NH spring (Jewish month of Nisan) in March or April. Rosh Hashanah (Jewish new year) occurs on the new moon of Jewish month Tishri (September-October) Easter is the Sunday after the full moon (after the equinox).</li> <li>• Beltane.</li> </ul>	3 responses <ul style="list-style-type: none"> <li>• Moon eclipse.</li> <li>• September month, because it is well known as the beginning of the new year.</li> <li>• Feast of the Ramadan.</li> </ul>

Australian survey	South African survey
<ul style="list-style-type: none"> <li>• I'm aware of Wikka festivals but usually don't take part in them.</li> <li>• Solstice.</li> <li>• Astrofest!</li> </ul>	

Table 63. Question 27. (Australian Survey)

	Not at all	Very Little	Moderately	Very much	Greatly	NR
27. How much do your spiritual / religious beliefs shape your:						
a. Attitudes about the sky?	27 (60.0%)	8 (17.8%)	4 (8.9%)	3 (6.7%)	2 (4.4%)	1 (2.2%)
b. Practices with respect to the sky?	34 (75.6%)	4 (8.9%)	5 (11.1%)	0 (0.0%)	1 (2.2%)	1 (2.2%)
c. Stories you know or were told about the sky?	26 (57.8%)	8 (17.8%)	8 (17.8%)	1 (2.2%)	1 (2.2%)	1 (2.2%)
d. Knowledge about the sky?	25 (55.6%)	7 (15.6%)	9 (20.0%)	1 (2.2%)	2 (4.4%)	1 (2.2%)
Summed results	112 (62.2%)	27 (15%)	26 (14.4%)	5 (2.8%)	6 (3.3%)	4 (2.2%)

Table 64. Question 27. (South African survey)

	Not at all	Very little	Moderately	Very much	Greatly	NR
27. How much do your spiritual / religious beliefs shape your:						
a. Attitudes about the sky?	7 (30.4%)	1 (4.3%)	6 (26.1%)	5 (21.7%)	2 (8.7%)	2 (8.7%)
b. Practices with respect to the sky?	4 (17.4%)	3 (13.0%)	8 (34.8%)	4 (17.4%)	2 (8.7%)	2 (8.7%)
c. Stories you know or were told about the sky?	2 (8.7%)	5 (21.7%)	8 (34.8%)	4 (17.4%)	2 (8.7%)	2 (8.7%)
d. Knowledge about the sky?	1 (4.3%)	7 (30.4%)	9 (39.1%)	2 (8.7%)	2 (8.7%)	2 (8.7%)
Summed results	14 (15.2%)	16 (17.4%)	31 (33.7%)	15 (16.3%)	8 (8.7%)	8 (8.7%)

Table 65. Question 28. (Australian survey)

	Not at all	Very little	Moderately	Very much	Greatly	NR
28. How much do your cultural beliefs shape your:						
a. Attitudes about the sky?	26 (57.8%)	6 (13.3%)	7 (15.6%)	2 (4.4%)	3 (6.7%)	1 (2.2%)
b. Practices with respect to the sky?	30 (66.7%)	7 (15.6%)	4 (8.9%)	1 (2.2%)	2 (4.4%)	1 (2.2%)
c. Stories you know or were told about the sky?	25 (55.6%)	9 (20.0%)	6 (13.3%)	3 (6.7%)	1 (2.2%)	1 (2.2%)
d. Knowledge about the sky?	23 (51.1%)	8 (17.8%)	8 (17.8%)	2 (4.4%)	3 (6.7%)	1 (2.2%)
Summed results	104 (57.8%)	30 (16.7%)	25 (13.9%)	8 (4.4%)	9 (5.0%)	4 (2.2%)

Table 66. Question 28. (South African survey)

	Not at all	Very little	Moderately	Very much	Greatly	NR
28. How much do your cultural beliefs shape your:						
a. Attitudes about the sky?	3 (13.0%)	5 (21.7%)	7 (30.4%)	3 (13.0%)	3 (13.0%)	2 (8.7%)
b. Practices with respect to the sky?	4 (17.4%)	4 (17.4%)	8 (34.8%)	4 (17.4%)	1 (4.3%)	2 (8.7%)
c. Stories you know or were told about the sky?	2 (8.7%)	5 (21.7%)	9 (39.1%)	4 (17.4%)	1 (4.3%)	2 (8.7%)
d. Knowledge about the sky?	2 (8.7%)	6 (26.1%)	9 (39.1%)	2 (8.7%)	2 (8.7%)	2 (8.7%)
Summed results	11 (12.0%)	20 (21.7%)	33 (35.9%)	13 (14.1%)	7 (7.6%)	8 (8.7%)

Table 67. Question 29. (Australian survey)

	Not at all	Very little	Moderately	Very much	Greatly	NR
29. How much does astrology shape your:						
a. Attitudes about the sky?	29 (64.4%)	6 (13.3%)	8 (17.8%)	1 (2.2%)	1 (2.2%)	0 (0.0%)

	Not at all	Very little	Moderately	Very much	Greatly	NR
b. Practices with respect to the sky?	31 (68.9%)	4 (8.9%)	9 (20.0%)	1 (2.2%)	0 (0.0%)	0 (0.0%)
c. Stories you know or were told about the sky?	26 (57.8%)	7 (15.6%)	11 (24.4%)	0 (0.0%)	1 (2.2%)	0 (0.0%)
d. Knowledge about the sky?	20 (44.4%)	8 (17.8%)	14 (31.1%)	0 (0.0%)	2 (4.4%)	1 (2.2%)
Summed results	106 (58.9%)	25 (13.9%)	42 (23.2%)	2 (1.1%)	4 (2.2%)	1 (0.6%)

Table 68. Question 29. (South African survey)

	Not at all	Very little	Moderately	Very much	Greatly	NR
29. How much does astrology shape your:						
a. Attitudes about the sky?	5 (21.7%)	7 (30.4%)	6 (26.1%)	2 (8.7%)	1 (4.3%)	2 (8.7%)
b. Practices with respect to the sky?	5 (21.7%)	7 (30.4%)	5 (21.7%)	3 (13.0%)	1 (4.3%)	2 (8.7%)
c. Stories you know or were told about the sky?	4 (17.4%)	9 (39.1%)	4 (17.4%)	3 (13.0%)	1 (4.3%)	2 (8.7%)
d. Knowledge about the sky?	4 (17.4%)	8 (34.8%)	3 (13.0%)	3 (13.0%)	2 (8.7%)	3 (13.0%)
Summed results	18 (19.6%)	31 (33.7%)	18 (19.6%)	11 (12.0%)	5 (5.4%)	9 (9.8%)

Table 69. Question 30.

	Australian survey # (%) of responses	South African Survey # (%) of responses
30. If you know what your Zodiac sign is, please write it here;		
Responses	43 (95.6%)	18 (78.3%)
NR	2 (4.4%)	5 (21.7%)
Total	45 (100.0%)	23 (100.0%)



Table 70. Question 31. (Australian survey)

	Not at all	Very little	Moderately	Very much	Greatly	NR
31. How much does your formal education shape your:						
a. Attitudes about the sky?	11 (24.4%)	9 (20.0%)	8 (17.8%)	9 (20.0%)	8 (17.8%)	0 (0.0%)
b. Practices with respect to the sky?	14 (31.1%)	5 (11.1%)	11 (24.4%)	7 (15.6%)	5 (11.1%)	3 (6.7%)
c. Stories you know or were told about the sky?	10 (22.2%)	12 (26.7%)	12 (26.7%)	6 (13.3%)	5 (11.1%)	0 (0.0%)
d. Knowledge about the sky?	7 (15.6%)	9 (20.0%)	12 (26.7%)	8 (17.8%)	9 (20.0%)	0 (0.0%)
Summed results	42 (23.3%)	35 (19.4%)	43 (23.9%)	30 (16.7%)	27 (15.0%)	3 (1.6%)

Table 71. Question 31. (South African survey)

	Not at all	Very little	Moderately	Very much	Greatly	NR
31. How much does your formal education shape your:						
a. Attitudes about the sky?	0 (0.0%)	8 (34.7%)	7 (30.4%)	5 (21.7%)	1 (4.3%)	2 (8.7%)
b. Practices with respect to the sky?	0 (0.0%)	7 (30.4%)	10 (43.5%)	3 (13.0%)	1 (4.3%)	2 (8.7%)
c. Stories you know or were told about the sky?	0 (0.0%)	7 (30.4%)	9 (39.1%)	2 (8.7%)	2 (8.7%)	2 (8.7%)
d. Knowledge about the sky?	0 (0.0%)	5 (21.7%)	11 (47.8%)	3 (13.0%)	2 (8.7%)	2 (8.7%)
Summed results	0 (0.0%)	27 (29.4%)	37 (40.2%)	13 (14.1%)	6 (6.5%)	8 (8.7%)

Table 72. Question 32.

	Australian survey # (%) of responses	South African Survey # (%) of responses
32. Do you look at the sky to predict the weather?		
Yes	28 (62.2%)	19 (82.6%)
No	14 (31.1%)	2 (8.7%)
Not sure	2 (4.4%)	1 (4.3%)
NR	1 (2.2%)	1 (4.3%)
Total	45 (100.0%)	23 (100.0%)

32a. If yes, what are you looking for and what does it predict?

Table 73. Question 32a.

Australian survey	South African survey
<p>Summary</p> <ul style="list-style-type: none"> <li>• “clouds” / “sky” / “cloud descriptions” / “clouds as a predictor of rain” (x11).</li> <li>• “clouds” / “cloud type” / “wind direction” (x5).</li> <li>• “clouds” / “cloud type” / “colour” (x 2).</li> <li>• “colour of sunset / dusk” (x3).</li> <li>• “moon / halo” (x2).</li> <li>• “atmospheric steadiness” (x1).</li> <li>• “UV exposure” (x1).</li> </ul> <p>Responses</p> <ul style="list-style-type: none"> <li>• Type and height of cloud if any, wind direction and strength. Different aspects predict different likelihoods.</li> <li>• Clouds, the type of cloud, predict fine weather or if it will rain etc.</li> <li>• Grey clouds.</li> <li>• Colours, shapes, types of clouds.</li> <li>• Clouds - humidity weather to the west - prevailing wind related weather flat bottomed clouds - less chance of rain lightning in the distance - rain.</li> <li>• Cloud patterns for predicting rain!</li> <li>• Clouds and wind and colour of sunset.</li> <li>• Colour &amp; clouds.</li> <li>• Clouds (or lack of), plus things like rings around the moon.</li> <li>• Clouds = rain!</li> <li>• Night sky not so much, but there are tell tale signs of some weather, especially oncoming rain. Requires a moonlit night though - so you can see the shapes of the clouds and even sometimes the halo around the moon. Not an exact science, but provides some practical</li> </ul>	<p>Summary</p> <ul style="list-style-type: none"> <li>• “clouds” / “sky” / “cloud descriptions” / “clouds as a predictor of rain” (x14).</li> <li>• “clouds” / “cloud type” / “wind direction” (x1).</li> <li>• “smell of rain” (x1).</li> <li>• “birds as an indicator of weather” (x1).</li> <li>• “other” (x2).</li> </ul> <p>Responses</p> <ul style="list-style-type: none"> <li>• If there's no sun and the sky is dark, it might rain.</li> <li>• Cloud cover.</li> <li>• If there's no sun and the sky is dark, it might rain.</li> <li>• The clouds formation and movement.</li> <li>• The clouds for rain and clear sky for a hot day.</li> <li>• The gathering clouds and if it smells like rain.</li> <li>• Cloud cover to predict rainfall.</li> <li>• I am looking at the sky to see if it is going to rain or sunny.</li> <li>• The clouds, whether it will rain or not.</li> <li>• Stars and the moon.</li> <li>• I look for clouds, if overcast I know it's going to rain.</li> <li>• Clouds and daylight.</li> <li>• I look for the small birds to predict the rain, dark clouds for a storm. Birds in the morning for a bright</li> </ul>

Australian survey	South African survey
<p>evidence of the formal predictions.</p> <ul style="list-style-type: none"> <li>• Red at night shepherd's delight, red at morning shepherd's warning. Signs of rain, changing wind direction, unusual atmospheric conditions.</li> <li>• Wind, rain, flying conditions.</li> <li>• Red dusk (good weather next day).</li> <li>• Clouds. Rain.</li> <li>• Clouds predicts rain Clear sky predicts sunny day.</li> <li>• If it is cloudy then I expect rain or very high UV rays so I use my sun cream. Clear skies I avoid wearing pants and apply sun cream.</li> <li>• Dark clouds predict a storm.</li> <li>• I look to the west to see the weather that is approaching (clouds, type and density, rain).</li> <li>• Looking for weather that evening will be clear and steady for telescope usage. Thus looking for mackeral clouds to indicate a change is coming, or whether clouds are in obvious layers and are moving quickly or not.</li> <li>• clouds and wind, and temperature. predicts changes in weather.</li> <li>• Clouds.</li> <li>• Cloud, cloud type, wind direction.</li> <li>• Clouds, where they come from, direction, to predict rain.</li> <li>• Clouds.</li> </ul>	<p>sunny day. A gray sky for a cold day. Dusty sky for a windy day.</p> <ul style="list-style-type: none"> <li>• The cloudless sky will cause coldness, jointed cloud will cause rain.</li> <li>• When the clouds are clustered the rain is expected and when the night sky is clean that means no rains to be expected.</li> <li>• Dark clouds for rain.</li> <li>• Clouds can tell if it is going to rain and if the cold weather is coming. During winter sky very clear and stars are bright.</li> <li>• Absence of sun predicting rain dark clouds predicting rain. Thunder storms and lightening predicting rain. Bright sun predicting rain a sunny day. Neither sun, clouds, storm, predicting on uncertain day.</li> <li>• Looking for the rain and prediction is always correct.</li> </ul>

32b. If yes, how did you learn to do this?

Table 74. Question 32b.

Australian survey	South African survey
<p>Summary</p> <ul style="list-style-type: none"> <li>• “school” / “lesson” (x4).</li> <li>• “experience” (x4).</li> <li>• “training” (x2).</li> <li>• “family” / “community” (x1).</li> </ul>	<p>Summary</p> <ul style="list-style-type: none"> <li>• “school” / “lesson” (x4).</li> <li>• “experience” (x1).</li> <li>• “family” / “community” (x6).</li> <li>• “TV” (x1).</li> </ul>

Australian survey	South African survey
<ul style="list-style-type: none"> <li>• “TV” (x1).</li> <li>• “learning” / “observation” (x2).</li> <li>• “multiple sources” (x3).</li> <li>• “other” (x4).</li> <li>• “reading” (x1).</li> </ul> <p>Responses</p> <ul style="list-style-type: none"> <li>• School, books, TV weather reports.</li> <li>• Program I went on in school.</li> <li>• My Pop.</li> <li>• Primary school.</li> <li>• Meteorology class mixed with common sense.</li> <li>• By living in the UK for a long time.</li> <li>• Hearsay.</li> <li>• The experience of clouds bringing rain :)</li> <li>• Experience.</li> <li>• Doesn't everyone do this?</li> <li>• Aviation training.</li> <li>• Read it (although it's not reliable).</li> <li>• School.</li> <li>• From school.</li> <li>• The weather channel.</li> <li>• Logic.</li> <li>• Astronomy society.</li> <li>• Through life and topical literature.</li> <li>• Look up, darker clouds, heavy clouds, rain / storms.</li> <li>• Planet Earth 1010, WAIT 1981.</li> <li>• By observing.</li> <li>• By experience.</li> </ul>	<ul style="list-style-type: none"> <li>• “learning” / “observation” (x1).</li> <li>• “multiple sources” (x5).</li> <li>• “other” (x4).</li> </ul> <p>Responses</p> <ul style="list-style-type: none"> <li>• It is our culture.</li> <li>• By observation.</li> <li>• In school.</li> <li>• From geography in high school.</li> <li>• From experience as I grew up.</li> <li>• I just learnt it by myself.</li> <li>• It is just general.</li> <li>• For geography lessons.</li> <li>• From my grandfather.</li> <li>• I just learned by myself.</li> <li>• From my folks and other people who are nearby and most of the time it was true.</li> <li>• The knowledge about the night sky is from my parents and it has been passed from generation to generation. That is how I learnt about the weather predictions by looking at the sky.</li> <li>• Geography class.</li> <li>• Oral knowledge from parents.</li> <li>• Through conversations.</li> <li>• From our parents or grandparents.</li> <li>• Through the interaction with my elders in my community.</li> </ul>

Table 75. Question 33.

	Australian survey # (%) of responses	South African Survey # (%) of responses
33. Do you or other people in your community know other things about the sky?		
Yes	12 (26.7%)	6 (26.1%)
No	8 (17.8%)	0 (0.0%)
Not sure	21 (46.7%)	15 (65.2%)
NR	4 (8.9%)	2 (8.7%)
Total	45 (100.0%)	23 (100.0%)

33a. If yes, first, how would you describe your community?

Table 76. Question 33a.

Australian survey	South African survey
<ul style="list-style-type: none"> <li>• Isolated agricultural.</li> <li>• Scientific.</li> <li>• I live and work in an urban setting, but moved to the hills to be able to see the night sky more readily.</li> <li>• Small country town.</li> <li>• Family orientated, fun, caring!</li> <li>• I am a self selected science geek by choice in my online and professional community.</li> <li>• My neighbours. A few friends. People I meet at work and uni.</li> <li>• Normal.</li> <li>• Very westernized Muslim. We're a community that's attempted to integrate with local culture and populations.</li> <li>• Urban.</li> <li>• Just a typical British market town in the south west of England. Mostly white population of the working/middle class with an average education.</li> <li>• Random intellectuals.</li> <li>• Professional astronomers :)</li> <li>• Bad.</li> <li>• Very unaware of the importance of the sky.</li> </ul>	<ul style="list-style-type: none"> <li>• Very vigilant.</li> <li>• Looking for clouds and twinkling stars, clouds can only tell one about rain, twinkling stars observing bad conditions.</li> <li>• As having the connection with the past with the sky because dead people are said to turn into stars.</li> <li>• It is a rural village where you can still find elderly people over the age of 75. Most of them still believe in their indigenous cultures and can tell fantastic stories.</li> <li>• Culture follower community and knowledge seekers.</li> <li>• My community believes in every knowledge that is generated within it. And they use all these different knowledges in respect from the elders as holders of most of the knowledge.</li> </ul>

Australian survey	South African survey
<ul style="list-style-type: none"> <li>• Pretty smart.</li> <li>• I presume this means ethnically speaking.</li> <li>• Weird.</li> <li>• Informed and interested. My community includes my students, my nephews, my son, and other family members. They know basic astronomy to varying degrees, all provided unobtrusively.</li> <li>• Bahai.</li> </ul>	

33b. Can you please write down the other things that you and other people in your community know about the sky? A list is fine, but the more details the better.

Table 77. Question 33b.

Australian survey	South African survey
<ul style="list-style-type: none"> <li>• The full moon and when they will occur.</li> <li>• Study Chinese metaphysics.</li> <li>• My family love peering through my telescope and looking at the planets, especially saturn!</li> <li>• Have worked with and know of people involved in astronomy research and education.</li> <li>• My neighbour is into Astrology. We frequently argue over this. It's clearly not what she knows, rather what she thinks she knows!</li> <li>• I'm not sure what other people know.</li> <li>• All the visible planets follow the ecliptic across the sky. With some pretty basic kit you can see 4 of Jupiter's moons, Andromeda is the closest proper Galaxy to our own and may collide with the Milky Way within the Suns lifetime.</li> <li>• Too much for their own good.</li> <li>• Aboriginal stories.</li> <li>• The constellations, Milky Way.</li> <li>• Heaps.</li> </ul>	<ul style="list-style-type: none"> <li>• Stars.</li> <li>• When its dark and the is no sun they predict the rain.</li> <li>• The cloud formation in terms of weather and rainfalls. The moon when it gets full and half.</li> <li>• When the moon predicts the rain.</li> <li>• Community based on local knowledge.</li> <li>• It is just space. It is vast and endless. It is different from Earth, You need to be prepared and wear protective clothing- the higher you go.</li> <li>• When there is lighting during the calm day something bad will happen/ happened.</li> <li>• When someone died and rains, that person died peacefully.</li> <li>• By the shape of the moon they can predict many things that is: When it faced down more rain has to be expected and when faced up no</li> </ul>

Australian survey	South African survey
	rains and more diseases. <ul style="list-style-type: none"> <li>• Some of our cultural activities depend on the moon.</li> <li>• Where God lives.</li> </ul>

33c. Was there a special situation in which you learned this, like over dinner, while camping, or in religious classes? Please give details.

Table 78. Question 33c.

Australian survey	South African survey
<ul style="list-style-type: none"> <li>• Talking to my family.</li> <li>• We learned this by having family BBQ's.</li> <li>• Through science educational programs I have been involved in working on.</li> <li>• Don't remember, probably through mixing with other Amateur Astronomers at observing sessions or in the pub when it's cloudy.</li> <li>• In class.</li> <li>• When doing homework.</li> </ul>	<ul style="list-style-type: none"> <li>• In school (x2).</li> <li>• When the farmers where waiting for rain so that they can start farming.</li> <li>• My community have different tswana names to refer to various times that is; in the morning and evening.</li> <li>• I learnt it on tv.</li> <li>• Around fire during the night, at school, and nearby people.</li> <li>• Most of these ones will learn about them when there is time for the family to meet and talk with their ancestors, that mostly happens during the night.</li> <li>• Religious classes and biblical knowledge.</li> </ul>

Table 79. Question 34.

	Australian survey # (%) of responses	South African Survey # (%) of responses
34. Do you know any stories, legends, or myths about the sky that are particular to your community ?		
Yes	7 (15.6%)	4 (17.4%)
No	26 (57.8%)	11 (47.8%)
Not sure	5 (11.1%)	6 (26.1%)
NR	7 (15.6%)	2 (8.7%)
Total	45 (100.0%)	23 (100.0%)

34a. If yes, how did you learn these stories?

Table 80. Question 34a.

Australian survey	South African survey
<ul style="list-style-type: none"> <li>• Astrological.</li> <li>• My Feng Shui master.</li> <li>• Picked up from all sources (media, books, friends etc) over the years!</li> <li>• I'm sure I've heard Aboriginal Dreaming stories, but can't remember them. It would be from when I was a kid.</li> <li>• From my grandfather.</li> <li>• Primary school.</li> <li>• Reading.</li> </ul>	<ul style="list-style-type: none"> <li>• I was told by Elders.</li> <li>• My grandma told me.</li> <li>• My grandmother.</li> <li>• When the lightning strikes during the day, means something bad is to be expected within the community.</li> <li>• Storytelling and during a full moon dance.</li> </ul>

34b. If yes, please describe in detail.

Table 81. Question 34b.

Australian survey	South African survey
<ul style="list-style-type: none"> <li>• Read the Women's Weekly / publications.</li> <li>• The weaving girl and the cowherd boy live on either side of the yellow path (the ecliptic) and every year for one day in August they come together on the same side of the ecliptic. This is the day that girls are allowed to propose to boys.</li> <li>• My memory is not that good for old stories that I don't place much store in.</li> <li>• The main one was the reason for the sky... The sky and all the objects in it that we can see, either with our naked eye or with telescopes are there to be discovered and understood. That is their purpose.</li> <li>• There is a Maori myth about Rona who tripped over a root in the forest, cursed the moon, who took her into the sky. Now Rona is the woman in the moon.</li> <li>• Too many.</li> </ul>	<ul style="list-style-type: none"> <li>• Shooting stars are a sign of a death of a king.</li> <li>• There was a man, a king who owned the world, he had three wives- one had the sun at her nose, the other had the moon and the other the stars. One day the stars-woman and the moon-woman conspired against the sun-women. They convinced her to take the sun out so that they can see it. This occurred while the husband was away. When she brought it out, it flew to the sky and there was light always, the husband was so furious, he confiscated his stars and moon and threw them up in fury.</li> <li>• Lightning during the day.</li> <li>• A lady carrying a baby on her back and chopping wood in the moon.</li> </ul>



Table 82. Part 3, Questions 1-10. (Australian survey)

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	NR
Part 3 Attachment to the sky						
1. I feel an emotional attachment to the night-sky	4 (8.9%)	6 (13.3%)	13 (28.9%)	12 (26.7%)	9 (20.0%)	1 (2.2%)
2. I become mesmerized while looking at the night-sky	2 (4.4%)	7 (15.6%)	11 (24.4%)	13 (28.9%)	11 (24.4%)	1 (2.2%)
3. I could spend all night just looking at the sky	4 (8.9%)	7 (15.6%)	10 (22.2%)	11 (24.4%)	12 (26.7%)	1 (2.2%)
4. I like to go outside and look at the sky at night often	4 (8.9%)	2 (4.4%)	8 (17.8%)	16 (35.6%)	14 (31.1%)	1 (2.2%)
5. Having time to look at the night-sky is important to me	4 (8.9%)	5 (11.1%)	12 (26.7%)	12 (26.7%)	11 (24.4%)	1 (2.2%)
6. I find more pleasure in looking at the night-sky than most people	3 (6.7%)	9 (20.0%)	13 (28.9%)	10 (22.2%)	9 (20.0%)	1 (2.2%)
7. Looking at the night-sky pleases me	2 (4.4%)	3 (6.7%)	8 (17.8%)	16 (35.6%)	14 (31.1%)	2 (4.4%)
8. I somehow feel connected to the night-sky	4 (8.9%)	6 (13.3%)	11 (24.4%)	12 (26.7%)	9 (20.0%)	3 (6.7%)
9. I'm very fond of the night-sky	1 (2.2%)	5 (11.1%)	7 (15.6%)	18 (40.0%)	11 (24.4%)	3 (6.7%)
10. I very much adore the objects in the night-sky	2 (4.4%)	6 (13.3%)	17 (37.8%)	8 (17.8%)	11 (24.4%)	1 (2.2%)
Summed results	30 (6.7%)	56 (12.4%)	110 (24.4%)	128 (28.4%)	111 (24.7%)	15 (3.3%)

Table 83. Part 3, Questions 1-10. South African survey

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	NR
Part 3 Attachment to the sky						
1. I feel an emotional attachment to the night-sky	3 (13.0%)	5 (21.7%)	8 (34.8%)	3 (13.0%)	2 (8.7%)	2 (8.7%)
2. I become mesmerized while looking at the night-sky	3 (13.0%)	9 (39.1%)	4 (17.4%)	3 (13.0%)	2 (8.7%)	2 (8.7%)
3. I could spend all night just looking at the sky	6 (26.1%)	2 (8.7%)	7 (30.4%)	3 (13.0%)	3 (13.0%)	2 (8.7%)

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	NR
4. I like to go outside and look at the sky at night often	8 (34.8%)	3 (13.0%)	8 (34.8%)	1 (4.3%)	1 (4.3%)	2 (8.7%)
5. Having time to look at the night-sky is important to me	4 (17.4%)	10 (43.5%)	5 (21.7%)	0 (0.0%)	2 (8.7%)	2 (8.7%)
6. I find more pleasure in looking at the night-sky than most people	3 (13.0%)	7 (30.4%)	4 (17.4%)	6 (26.1%)	1 (4.3%)	2 (8.7%)
7. Looking at the night-sky pleases me	5 (21.7%)	11 (47.8%)	3 (13.0%)	1 (4.3%)	1 (4.3%)	2 (8.7%)
8. I somehow feel connected to the night-sky	7 (30.4%)	8 (34.8%)	1 (4.3%)	4 (17.4%)	1 (4.3%)	2 (8.7%)
9. I'm very fond of the night-sky	4 (17.4%)	9 (39.1%)	6 (26.1%)	0 (0.0%)	2 (8.7%)	2 (8.7%)
10. I very much adore the objects in the night-sky	4 (17.4%)	9 (39.1%)	6 (26.1%)	0 (0.0%)	2 (8.7%)	2 (8.7%)
Summed results	47 (20.4%)	73 (31.6%)	52 (22.6%)	21 (9.1%)	17 (7.4%)	20 (8.7%)

Table 84. Part 4, Questions 1-9. Australian survey.

	Don't Believe	Not sure about	No Opinion	Believe	NR
<b>Part 4 Astrology Survey</b>					
1. The Sun, Moon, and Planets are Gods and Goddesses	28 (62.2%)	4 (8.9%)	2 (4.4%)	10 (22.2%)	1 (2.2%)
2. Astrology and Astronomy are the same.	32 (71.1%)	5 (11.1%)	2 (4.4%)	4 (8.9%)	2 (4.4%)
3. Astrology has NOT been scientifically proven	6 (13.3%)	5 (11.1%)	2 (4.4%)	31 (68.9%)	1 (2.2%)
4. Astrology or that the position of the stars and planets can affect people's lives	25 (55.6%)	12 (26.7%)	3 (6.7%)	4 (8.9%)	1 (2.2%)
5. A birth chart with explanations created by an astrologer is very accurate	32 (71.1%)	9 (20.0%)	3 (6.7%)	0 (0.0%)	1 (2.2%)
6. Horoscopes in newspapers and magazines are NOT very accurate	10 (22.2%)	6 (13.3%)	1 (2.2%)	27 (60.0%)	1 (2.2%)

	Don't Believe	Not sure about	No Opinion	Believe	NR
7. Astrology can be successfully used to make financial and romantic decisions	32 (71.1%)	2 (4.4%)	3 (6.7%)	7 (15.6%)	1 (2.2%)
8. Your personality is NOT determined by your astrological sign	8 (17.8%)	6 (13.3%)	2 (4.4%)	28 (62.2%)	1 (2.2%)
9. The Zodiac is part of the night sky	12 (26.7%)	7 (15.6%)	4 (8.9%)	21 (46.7%)	1 (2.2%)

Table 85. Part 4, Questions 1-9. (South African survey)

	Don't Believe	Not sure about	No Opinion	Believe	NR
<b>Part 4 Astrology Survey</b>					
1. The Sun, Moon, and Planets are Gods and Goddesses	2 (8.7%)	7 (30.4%)	4 (17.4%)	8 (34.8%)	2 (8.7%)
2. Astrology and Astronomy are the same.	6 (26.1%)	8 (34.8%)	2 (8.7%)	5 (21.7%)	2 (8.7%)
3. Astrology has NOT been scientifically proven	11 (47.8%)	4 (17.4%)	3 (13.0%)	3 (13.0%)	2 (8.7%)
4. Astrology or that the position of the stars and planets can affect people's lives	0 (0.0%)	9 (39.1%)	1 (4.3%)	10 (43.5%)	3 (13.0%)
5. A birth chart with explanations created by an astrologer is very accurate	4 (17.4%)	10 (43.5%)	4 (17.4%)	1 (4.3%)	4 (17.4%)
6. Horoscopes in newspapers and magazines are NOT very accurate	2 (8.7%)	6 (26.1%)	1 (4.3%)	10 (43.5%)	4 (17.4%)
7. Astrology can be successfully used to make financial and romantic decisions	6 (26.1%)	4 (17.4%)	4 (17.4%)	5 (21.7%)	4 (17.4%)
8. Your personality is NOT determined by your astrological sign	4 (17.4%)	12 (52.2%)	1 (4.3%)	4 (17.4%)	2 (8.7%)
9. The Zodiac is part of the night sky	8 (34.8%)	5 (21.7%)	1 (4.3%)	5 (21.7%)	4 (17.4%)

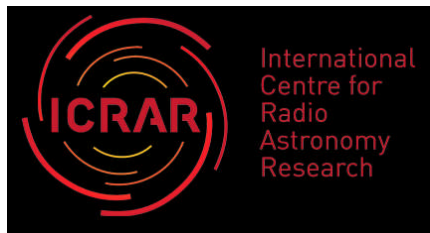
Table 86. Part 5, Questions 1-16. Australian survey.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	NR
<b>Part 5 The Astronomy Attitude Survey</b>						
1. I have trouble understanding astronomy because of how I think.	1 (2.2%)	2 (4.4%)	11 (24.4%)	15 (35.3%)	15 (35.3%)	1 (2.2%)
2. Astronomy concepts are easy to understand.	6 (13.3%)	6 (13.3%)	18 (40.0%)	10 (22.2%)	3 (6.7%)	2 (4.4%)
3. Astronomy is irrelevant to my life.	3 (6.7%)	2 (4.4%)	7 (15.6%)	16 (35.6%)	15 (35.3%)	2 (4.4%)
4. Learning astronomy requires a great deal of discipline.	5 (11.1%)	11 (24.4%)	15 (33.3%)	10 (22.2%)	2 (4.4%)	2 (4.4%)
5. I have no idea of what's going on in astronomy.	3 (6.7%)	5 (11.1%)	9 (20.0%)	12 (26.7%)	14 (31.1%)	2 (4.4%)
6. I like astronomy.	19 (42.2%)	12 (26.7%)	10 (22.2%)	1 (2.2%)	1 (2.2%)	2 (4.4%)
7. What I learn about astronomy is not useful in my career.	10 (22.2%)	10 (22.2%)	12 (26.7%)	6 (13.3%)	5 (11.1%)	2 (4.4%)
8. Most people have to learn a new way of thinking to do astronomy.	1 (2.2%)	4 (8.9%)	25 (55.6%)	8 (17.8%)	5 (11.1%)	2 (4.4%)
9. Astronomy is highly technical but still understandable.	9 (20.0%)	20 (44.4%)	12 (26.7%)	3 (6.7%)	0 (0.0%)	1 (2.2%)
10. I find it difficult to understand astronomy concepts.	2 (4.4%)	5 (11.1%)	15 (33.3%)	12 (26.7%)	9 (20.0%)	2 (4.4%)
11. I would enjoy taking an astronomy course.	13 (28.9%)	13 (28.9%)	12 (26.7%)	2 (4.4%)	3 (6.7%)	2 (4.4%)
12. Astronomy involves memorizing a massive collection of facts.	2 (4.4%)	8 (17.8%)	19 (42.2%)	10 (22.2%)	4 (8.9%)	2 (4.4%)
13. Astronomy is a complicated subject.	4 (8.9%)	22 (48.8%)	13 (28.9%)	3 (6.7%)	2 (4.4%)	1 (2.2%)
14. I can learn astronomy.	12 (26.7%)	21 (46.7%)	6 (13.3%)	3 (6.7%)	1 (2.2%)	2 (4.4%)
15. Astronomy is worthless.	2 (4.4%)	0 (0.0%)	6 (13.3%)	9 (20.0%)	26 (57.8%)	2 (4.4%)
16. I am scared of astronomy.	2 (4.4%)	0 (0.0%)	6 (13.3%)	7 (15.6%)	28 (62.2%)	2 (4.4%)

Table 87. Part 5, Questions 1-16. South African survey.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	NR
<b>Part 5 The Astronomy Attitude Survey</b>						
1. I have trouble understanding astronomy because of how I think.	0 (0.0%)	5 (21.7%)	9 (39.1%)	4 (17.4%)	3 (13.0%)	2 (8.7%)
2. Astronomy concepts are easy to understand.	3 (13.0%)	8 (34.8%)	5 (21.6%)	4 (17.4%)	1 (4.3%)	2 (8.7%)
3. Astronomy is irrelevant to my life.	1 (4.3%)	3 (13.0%)	4 (17.4%)	8 (34.8%)	5 (21.7%)	2 (8.7%)
4. Learning astronomy requires a great deal of discipline.	3 (13.0%)	8 (34.8%)	5 (21.7%)	4 (17.4%)	1 (4.3%)	2 (8.7%)
5. I have no idea of what's going on in astronomy.	2 (8.7%)	8 (34.8%)	5 (21.7%)	4 (17.4%)	1 (4.3%)	2 (8.7%)
6. I like astronomy.	6 (26.1%)	5 (21.7%)	7 (30.4%)	1 (4.3%)	1 (4.3%)	3 (13.0%)
7. What I learn about astronomy is not useful in my career.	6 (26.1%)	0 (0.0%)	3 (13.0%)	7 (30.4%)	5 (21.7%)	2 (8.7%)
8. Most people have to learn a new way of thinking to do astronomy.	5 (21.7%)	6 (26.1%)	7 (30.4%)	1 (4.3%)	2 (8.7%)	2 (8.7%)
9. Astronomy is highly technical but still understandable.	4 (17.4%)	8 (34.8%)	4 (17.4%)	3 (13.0%)	2 (8.7%)	2 (8.7%)
10. I find it difficult to understand astronomy concepts.	3 (13.0%)	7 (30.4%)	3 (13.0%)	6 (26.1%)	2 (8.7%)	2 (8.7%)
11. I would enjoy taking an astronomy course.	7 (30.4%)	8 (34.8%)	5 (21.7%)	0 (0.0%)	1 (4.3%)	2 (8.7%)
12. Astronomy involves memorizing a massive collection of facts.	5 (21.7%)	7 (30.4%)	6 (26.1%)	2 (8.7%)	1 (4.3%)	2 (8.7%)
13. Astronomy is a complicated subject.	3 (13.0%)	4 (17.4%)	10 (43.5%)	1 (4.3%)	2 (8.7%)	3 (13.0%)
14. I can learn astronomy.	9 (39.1%)	8 (34.8%)	2 (8.7%)	1 (4.3%)	1 (4.3%)	2 (8.7%)
15. Astronomy is worthless.	0 (0.0%)	1 (4.3%)	6 (26.1%)	8 (34.8%)	6 (26.1%)	2 (8.7%)
16. I am scared of astronomy.	1 (4.3%)	4 (17.4%)	4 (17.4%)	6 (26.1%)	6 (26.1%)	2 (8.7%)

## Appendix 6A Indigenous Astronomy Symposium Survey



### **Cosmos, Culture and Landscape**

#### ***A survey for participants of the “Things Belonging to the Sky”, Indigenous Astronomy Symposium, AIATSIS Canberra.***

Following the success of the “Things Belonging to the Sky” symposium on Indigenous Astronomy, November 2009 AIATSIS, Canberra, we are inviting everyone who attended the symposium to participate in the following survey. This survey is part of a PhD project seeking to learn about the ways in which Aboriginal Indigenous sky and astronomical knowledge is being shared and communicated.

Your responses will provide important information to help us better understand why people value Aboriginal astronomy knowledge and how this knowledge is being recorded, communicated and shared. A future symposium on Indigenous Astronomy may be held in late 2010, and your feedback will help to guide us to ensure future symposiums are useful, relevant and interesting.

You can fill in the questionnaire electronically (save your document before closing it) and email it back to us, or you can print it out and fax or post it. If you have any enquiries, please don't hesitate to phone or e-mail me.

**Phone** (for enquiries) John Goldsmith (08) 9266 4678 (Note: Perth time 9AM - 5PM)

**Email** John.Goldsmith.MSc@gmail.com

**Fax** (+61 8) 9266 9246

**Mail** International Centre for Radio Astronomy Research

Curtin University of Technology

GPO Box U1987

Perth, Western Australia 6845

**Please return your completed survey by 15<sup>th</sup> February 2010**

Thankyou

**ICRAR** *John Goldsmith & Steven Tingay*

**CSIRO** *Ray Norris*

**AIATSIS** *Cressida Fforde*

**12 January 2010.**

**Q1. My Values and Beliefs**

- I value cultural stories about the night sky
- Most people have little understanding of Aboriginal sky knowledge.
- Aboriginal sky and astronomy knowledge should be recorded for the benefit of future generations.

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Don't know / no opinion

**Q2. What best describes your interest in Aboriginal Astronomy?**

- It's part of my Aboriginal heritage
- I have an academic research interest
- I have a general interest in the subject


**Q3. Learning about Aboriginal Astronomies**

- Art is an important way of sharing Aboriginal culture
- Storytelling is an effective way to learn about Aboriginal culture and sky knowledge
- Some knowledge about the night sky is sensitive or restricted to certain people.
- There are inconsistencies between some Aboriginal cultural knowledge and scientific astronomical knowledge


**Q4. Has anything limited your understanding of Aboriginal astronomy?**

- Difficult to find information
- Don't know who to approach
- Complying with cultural protocols
- My knowledge about astronomy in general
- Other (please specify)

\_\_\_\_\_


**Q5. Future Symposiums & Research**

- I would like to be involved in future research on Aboriginal astronomies
- I would attend another Symposium on Aboriginal astronomies


**Question 6.** If you would be interested in attending another symposium on Aboriginal Astronomies, please indicate (✓) which topics you would be interested in attending:

Learning about Aboriginal Culture (general, introductory level) .....	<input type="text"/>
Aboriginal Art and Astronomy .....	<input type="text"/>
Field / site visits to Aboriginal sites .....	<input type="text"/>
Practical astronomy viewing sessions; Using telescopes. ....	<input type="text"/>
How is astronomical knowledge useful to Aboriginal people? .....	<input type="text"/>
Protecting and preserving Aboriginal astronomy knowledge .....	<input type="text"/>
Communicating Aboriginal astronomy knowledge to the general public .....	<input type="text"/>
Astronomy and cultures: comparison between cultures .....	<input type="text"/>
Valuing different knowledge systems; scientific, indigenous and cultural knowledge	<input type="text"/>
Eco/cultural tourism and Aboriginal astronomy .....	<input type="text"/>
Other .....please specify_____ .....	<input type="text"/>

**Question 7.** If you would like to be advised about future symposiums on Aboriginal Astronomy please provide your contact details here;

Name:

Full postal address:

E-mail:

Attachment 1 provides recent examples of Aboriginal astronomies being communicated and shared. (NOTE: Attachment 1 is not included in Appendix 5. It consisted of 1.5 pages of Indigenous astronomy information sources, references and website links).

**Question 8.** Can you provide any other examples? (please be specific)

**Question 9.** Any other comments?

Thank you for your comments.

**Please return your completed survey by 15<sup>th</sup> February 2010**

**Email** John.Goldsmith.MSc@gmail.com  
**Fax** 08 9266 9246  
**Mail** International Centre for Radio Astronomy Research  
Curtin University of Technology  
GPO Box U1987  
Perth, Western Australia 6845



## Appendix 6B Indigenous Astronomy Symposium Survey Results

Table 88.

Questions 1 - 5.

	Strongly Agree	Agree	Neither agree or disagree	Disagree	Strongly Disagree	Don't know / no opinion	NR
<b>1. My Values and Beliefs</b>							
I value cultural stories about the night sky	10 (76.9%)	2 (15.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (7.7%)
Most people have little understanding of Aboriginal sky knowledge.	9 (69.2%)	2 (15.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (15.4%)
Aboriginal sky and astronomy knowledge should be recorded for the benefit of future generations.	11 (84.6%)	1 (7.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (7.7%)
<b>2. What best describes your interest in Aboriginal astronomy?</b>							
It's part of my Aboriginal heritage	1 (7.7%)	0 (0.0%)	1 (7.7%)	0 (0.0%)	0 (0.0%)	3 (23.1%)	8 (61.5%)
I have an academic research interest	2 (15.4%)	1 (7.7%)	2 (15.4%)	0 (0.0%)	0 (0.0%)	2 (15.4%)	6 (46.2%)
I have a general interest in the subject	10 (76.9%)	2 (15.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (7.7%)	0 (0.0%)
<b>3. Learning about Aboriginal astronomies</b>							
Art is an important way of sharing Aboriginal culture	9 (69.2%)	2 (15.4%)	1 (7.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (7.7%)
Storytelling is an effective way to learn about Aboriginal culture and sky knowledge	8 (61.5%)	2 (15.4%)	1 (7.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (15.4%)
Some knowledge about the night sky is sensitive or restricted to certain people.	8 (61.5%)	4 (30.8%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (7.7%)

	Strongly Agree	Agree	Neither agree or disagree	Disagree	Strongly Disagree	Don't know / no opinion	NR
There are inconsistencies between some Aboriginal cultural knowledge and scientific astronomical knowledge.	3 (23.1%)	4 (30.8%)	3 (23.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (23.1%)
<b>4. Has anything limited your understanding of Aboriginal astronomy?</b>							
Difficult to find information	2 (15.4%)	6 (46.2%)	1 (7.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4 (30.8%)
Don't know who to approach	1 (7.7%)	6 (46.2%)	3 (23.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (23.1%)
Complying with cultural protocols	0 (0.0%)	3 (23.1%)	5 (38.5%)	0 (0.0%)	0 (0.0%)	1 (7.7%)	4 (30.8%)
My knowledge about astronomy in general	1 (7.7%)	6 (46.2%)	2 (15.4%)	1 (7.7%)	1 (7.7%)	0 (0.0%)	2 (15.4%)
Other (please specify)	0 (0.0%)	0 (0.0%)	1 (7.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	12 (92.3%)
<b>5. Future Symposiums &amp; Research</b>							
I would like to be involved in future research on Aboriginal astronomies	5 (38.5%)	5 (38.5%)	1 (7.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (15.4%)
I would attend another Symposium on Aboriginal astronomies	9 (69.2%)	3 (23.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (7.7%)

**Question 6.** If you would be interested in attending another symposium on Aboriginal Astronomies, please indicate which topics you would be interested in attending:

Learning about Aboriginal Culture (general, introductory level) .....	7
Aboriginal Art and Astronomy .....	11
Field / site visits to Aboriginal sites .....	10
Practical astronomy viewing sessions; Using telescopes. ....	10
How is astronomical knowledge useful to Aboriginal people? .....	11
Protecting and preserving Aboriginal astronomy knowledge .....	9
Communicating Aboriginal astronomy knowledge to the general public .....	9

Astronomy and cultures: comparison between cultures .....	9
Valuing different knowledge systems; scientific, indigenous and cultural knowledge	10
Eco/cultural tourism and Aboriginal astronomy .....	8
Other .....please specify_____ .....	2

**Question 7.** If you would like to be advised about future symposiums on Aboriginal Astronomy please provide your contact details here;

12 out of 13 respondents supplied their contact details.

**Question 8.** Can you provide any other examples (of Aboriginal astronomies being communicated and shared). Please be specific.

Four responses were received to question 8. The responses are provided below.

Respondent 1

I am a Civil Engineer by initial training and now call myself an Engineering Ecohydrologist. I retired from CSIRO as a Principal Research Scientist in 1992 but have a continuing engagement with the Unit I set up on Climate Variability and Climate Change. I have a lifelong interest in astronomy and cosmology and ancient cultures and beliefs. I have worked with archaeologists on the interpretation of paleo-hydrological features such as paleo-climate, paleofloods, sea-level timing and interpretation. Also ancient design of irrigation systems whilst also being a member of national and international working parties on estimation of crop water use and irrigation system design.

I have worked on climate modelling for hydrological and ecological purposes and know that even the latest and best GCM's of the atmospheric scientists are fundamentally flawed from no understanding of hydrology and ecoclimatologic factors. I have models which determine solar input to slopes and horizon obscurances on an hourly basis for any time and location and allowances for atmospheric properties including water vapour and CO2 and particulate matter and the presence and nature of clouds. For the last 16 years I have been a Voluntary Guide, or Docent, at the National Gallery of Australia with an interest in rational interpretation of Art and particularly Indigenous Art from all continents. This is how I first became interested in the ideas of Ray Norris and ended up at the Symposium.

Respondent 2

I thought I should try and convey why I thought the symposium was a tragic debacle. Tragic because I do strongly believe that traditional peoples around the world have knowledge traditions of immense value and importance, including star knowledge, but the actual event failed to provide real substance to that claim. Debacle because taking the position that western astronomy and aboriginal astronomy

are equivalent scientifically, epistemologically and ontologically is profoundly wrong and led to some of the most awful presentations I have ever been subjected to e.g. Bhatal. I think you should be aware that there is a large literature on how indigenous knowledge traditions and western science can be enabled to work together without one being subordinated to the other, and most importantly how their real and substantive differences can be acknowledged and valued. e.g. Turnbull, David. 1997. *Reframing Science and Other Local Knowledge Traditions*. *Futures* 29 (6):551-562. ———. 2003. 2nd ed. *Masons, Tricksters and Cartographers: Comparative Studies in the Sociology of Scientific and Indigenous Knowledge*. London: Routledge.

Yours in dialogue

(Full contact details supplied)

Respondent 3

I'd like to say thank you so much to the organisers and presenters of the symposium. It was wonderful for a lay person with no formal training in astronomy to have the opportunity to hear astronomers and researchers of various disciplines speak on their areas of specialisation and especially then to hear from the people themselves who are the custodians of not only wonderful interpretations of the night sky but also of their people's ancient cultures. I already had an interest in Indigenous astronomy before the symposium – my interest and respect for it was increased by the symposium.

It was a real eye-opener for me when different speakers – presenters and members of the audience – explained the responsibilities of the custodians of the interpretations not to disclose certain aspects of the stories relating to certain constellations or events. I hadn't really thought about this aspect before and hadn't realised for examples that this was part of what the Hindmarsh Bridge secret women's business issue was about.

So the symposium had a list of different aspects to it for me, and once again, I am very grateful for the opportunity to attend and to see presenters speak with them afterwards, as well as to see the wonderful paintings by the Yamaji artists.

I had moved house just before the symposium and afterwards took the opportunity many times of sitting outside at night and gazing up at the emu in the Milky Way, the young men in the canoe (I never really took to Orion anyway) and the sisters in the Pleiades.

I spoke of the symposium with my family and friends (and as you can see by my rather verbose style, I went into quite a lot of detail with them). When I asked them how could Indigenous interpretations become more widely known, one of them suggested that a supplement in one of the Sunday newspapers would be a good idea – similar to the nature or geography series that they run every now and then. Also what about primary schools teaching children at a young age and they then take it

home to their families. And when astronomy societies have their open nights when they show members of the public through their telescopes and give mini lectures, what about talking about how the First Australians have seen the night sky for thousands of years – it would be even better of course if a member of the local Aboriginal community were able to share some stories..

I also plan to follow up with Reconciliation Australia (I am a reconciliation action plan coordinator for a government employer and have contacts with RA). I saw one of their staff's nametag on the table, Rosie Southwood, but I didn't actually see her. I just thought that maybe they could help with publicising some of the stories.

One of the things I would like to see at another symposium is a chance to hear other researchers who do not necessarily agree with the presenters. For example when Ray Norris was speaking about the carving of the man and woman in Ku-ring-gai Chase and mentioned that possibly this could relate to an eclipse, a man, who was obviously known to Ray, disputed this supposition and suggested it could be a shelter. For those of us in the audience who know nothing of any debate about interpretation, it would be interesting to hear what the debates might be.

Thank you also for the list of references at the end of this document.

I've prattled on for long enough – I hope that some of my comments have helped to convey my appreciation and excitement at having attended the symposium and feeling like I am a part of something special to broaden non-Indigenous Australians' understanding of, and respect for, Indigenous Australians' rich culture and history.

#### Respondent 4

I very much enjoyed meeting such an interesting mix of people. The talks and poster displays were interesting and informative. The artworks displayed were interesting and beautiful. I felt I learnt a lot about Aboriginal Astronomy. It was a good mix of academics, researchers and Indigenous people all sharing their knowledge and ideas. The environment was positive, stimulating, collaborative and friendly. It was worth the effort to travel from QLD at a very busy time for me in my work schedule and to broaden my knowledge on Indigenous Culture, Aboriginal Astronomy and Astronomy in general. Thanks to all involved in organising it!

#### **Question 9.** Any additional comments?

Eight respondents provided additional comments. The responses are provided below.

Respondent 1

Norris and Norris, 2009, Basedow, Sollas, Berndt and Berndt, Sollas, Flood, Burnum

Respondent 2

My Daughter-in-law Dr. Anne Kerle has published an eco-tourism text for ULURU-KATA TJUTA & WATARRKA as one on the National Parks Field Guide Series published by UNSW PRESS ISBN0 86840 055 6. She has an 18 page section on the climate and skies of Central Australia in which she incorporates significant information in a non-specific way of Aboriginal interpretations of various constellations. She also raises the secret nature of the Tjukurpa and therefore most of the deep astronomical information is not available. This chapter is however I believe a model of ecotourism astronomy and climatology.

Respondent 3

I've come to astronomy from art. The symposium was the first I've experienced (exploring the connections). I can see that school communities could assist in opening our understandings of aboriginal astronomy. Any chance for school students to participate? Especially Indigenous students who can then pass on this knowledge on to their peers? Via cultural presentations and leadership programs. Thankyou for the wonderful "Things Belonging to the Sky" Symposium and art exhibition. I have an art education background and coordinate Indigenous Studies Centre at Melrose High School ACT. Aboriginal astronomies from the symposium is now being shared and communicated within our whole school community (through cultural presentations forming part of SOSE learning area).

Respondent 4

<http://members.ozemail.com.au/~mmichie/astronomy.htm>

Respondent 5

At least one primary school class (Bondi Beach Public School) presented a video conferencing session related to Aboriginal Astronomy during a project called Learn Astronomy From Our School as part of the DET NSW Connected Classroom Program. The student created and led presentation was shared with other similar age classes utilising the video conferencing equipment now readily available in schools.

Respondent 6

- Planetarium Show at Boulder, Colorado USA.
- Aboriginal Skies: John Stocke, Prof of Astronomy, University of Colorado with Paul Taylor. Bill Harney and Hugh Cairns have also taken part in the show. It is based on Hugh Cairns and Bill Harney's Book "Dark Sparklers". The first shows were in November 2004 followed by April and September 2005. It is still shown. This Planetarium also has shows on other cultures' sky knowledge such as Indians from North and South America.
- Katherine and Darwin Festivals 2009.

- Bill Harney and Ray Norris : night talk on The First Astronomers.

Australian Museum: 23 October 2008

Bill Harney and Hugh Cairns: Aboriginal Astronomy and Customary Law.

Respondent 7

The examples that I know of are simple but readily shared with people who come across them.

There is a wonderful example of Torres Strait Islander astronomy artwork and explanation of the Islanders' practical links with the sky at Reconciliation Place in Canberra. It depicts Tagai and shows a number of references to the night sky and the sun and fishing. There are photos on the National Capital Authority's site for the range of Aboriginal and Torres Strait Islander pieces of art and architecture. As the photos on the website don't show much, I have included a few photos that I took a few years ago. Mine aren't very good and I need to revisit the site and take more as I promised John Whop that I would send him some photos – he wasn't aware of the display and I wish that I had taken him there when he came to Canberra for the symposium in November. Here is the link to the site Methalu Tharri (Smooth Sailing):

[http://www.nationalcapital.gov.au/index.php?option=com\\_content&view=article&id=214&Itemid=203#2](http://www.nationalcapital.gov.au/index.php?option=com_content&view=article&id=214&Itemid=203#2)

At the centre of this pattern is a noon-marker - a simple sundial device that tracks the noonday sun throughout the year. Photos supplied by respondent. (Name withheld to maintain privacy).

Another example of acknowledging Indigenous astronomy is at Honeysuckle Creek, which I am sure you are aware is the site of the tracking station which broadcast the first pictures of Armstrong stepping onto the moon (a few minutes before Parkes Telescope was able to pick up the signal). It is located in Namadgi National Park, south of Canberra and when I first visited it in March 2009 I was surprised and pleased to see among the plaques dedicated to the wonderful work done by the Honeysuckle guys an acknowledgement of how the Southern Cross is understood by different Indigenous peoples. Here is a photo I took (sorry that it does not show the full display). The plaques and displays were erected in 2000. I don't know whose initiative it was to acknowledge the Indigenous interpretation of the Southern Cross. I must ask John Saxon, Operations Supervisor at HSK during the Apollo years (who still lives in Canberra and who organised a wonderful reunion last July for the 40<sup>th</sup> anniversary of the moon landing). The ACT 'Minister for Everything' at the time, Brendan Smythe is a Honeysuckle enthusiast and also a strong supporter of Aboriginal events in Canberra (I have seen him at Sorry Day events and the service to recognise Aboriginal and Torres Strait Islander service personnel at the special Indigenous memorial on ANZAC Day. He appears at such events without any posturing).

This next example does not really qualify as necessarily communicating Indigenous astronomy, but it is something that caught my eye in, of all places, the Canberra Tourist Information Centre – a fridge magnet in the Aboriginal arts section. It is a magnificent dot painting by Ron Potter of a bunya pine with the night sky behind and above it, with thousands of stars and one very large multi-pointed star. The tree roots and other symbols are shown below the ground. It is part of the Tobwabba Art merchandise and it is even on a pack of playing cards, which of course I also had to buy. I would love to see the original painting. The reason I raise it is because my visitors see this on my fridge or when we play cards and it's just a little way of spreading the word about Indigenous views of the night sky. I haven't tried yet, but I will try to find out the story of the painting, if possible. If you would like to see the image of the tree and sky, here is a link to the Tobwabba Art site where it is displayed down on the left hand side of the screen. <http://www.tobwabba.com.au/shopcontent.asp?type=features>.

#### Respondent 8

1. Aboriginal Night Skies Show The Planetarium University of Boulder Colorado USA 2004, April and Sept 05 (both shows to standing ovation) ... .. Shows at least once a year since with huge interest. Shows developed by Professor John Stocke in collaboration with Senior Elder Bill Harney (Wardaman People, NT), Dr Hugh Cairns and Paul Taylor (all participating in 2005 shows). Visually and Orally very effective and informative. Focus on Wardaman People's Night Sky (Dark Sparklers an important reference) and compared to Indigenous American Astronomy and General Astronomy in Northern and Southern Hemisphere.
2. USA Tour – organised by Paul Taylor with Senior Elder Bill Harney – to schools, universities, community groups – Australian Aboriginal Culture Focus specifically the Wardaman People and including their art, music, storytelling and astronomy
3. Aboriginal Night Skies Talk Australian Museum Sydney October 2008 with Senior Elder Bill Harney and Dr Hugh Cairns
4. Wardaman Night Sky Posters developed by Dr Hugh Cairns related to Dark Sparklers
5. Customary Law Talk Bond University Gold Coast October 2008 with Senior Elder Bill Harney and Dr Hugh Cairns – whilst the focus was Wardaman Customary Law, Aboriginal Astronomy as related to Wardaman people was referred to at times
6. Senior Elder Bill Harney - Artist in Residence Program – Bond University Gold Coast – October 2009 - whilst the focus was Wardaman Customary Law, at times Bill shared his knowledge on Aboriginal Astronomy e.g. Night Sky stories, paintings.



## Appendix 7 Bibullmun Religion, Toogarr Morrison

<b>Title</b>	Bibullmun Religion (2008)
<b>Artist</b>	Toogarr Morrison
<b>Medium</b>	Acrylic on canvas
<b>Dimensions</b>	Central work: 170 x 230 cm, Surrounding works 53 x 41 cm



Figure 89. "Bibullmun Religion" by Toogarr Morrison, Cosmology Gallery.  
(Photo: John Goldsmith)



Figure 90. Detail of exhibit.

(Photo: John Goldsmith)

Exhibition caption, reproduced with permission: Cosmology Gallery, Gravity Discovery Centre;

*As the Morrison Family sat around the camp fire in the bush where we lived, after finishing the evening meal, our attention was tuned into what our father was saying. He talked of the stars, and as he pointed upwards, our heads followed as our eyes focused, the surrounding foliage of the trees seemed to form a circle that represented a huge lens of which we could observe the universe.*

*The story of the stars, play an important role in a belief of our existence on mother earth. We were told of Woor-jall-luk and her camp fire burning bright near her kaunt (hut). The story of how she made our camping grounds on earth and how the Milky Way came to be a weaving net that held the stars together.*

*The bright stars clumped together to show the moral obligations that was adhered to before the coming of the white people to the shores of South West of Western Australia.*

*The story of the stolen children that were fastened into her long white hair also those prominent stars that Woor-jall-luk keeps behind her to feed her man when the time comes for*

*him to join her. These stars we know as the Seven Sisters but we were told we could not venture any further north pass the Mallee fowl because it was some other people territory.*

*We were told the story of the echidna that sat below the two stars that were near the law men and how these stars were separated by a spear being hurled at them. The reason they were together , so close talking, when they observed the spear hurling towards them , they jumped apart and that is how they have been ever since.*

*Woor-jall-luk's man, Mulchin-jal-lak was dismembered and his body parts were buried deep in the ground around Katanning. He cannot get back together again, if our laws break down then he can pull his body back together and join his partner in the sky and grow strong after eating the sisters and the other children.*

*We were told after the pair have finished their meal of the spirit stars then they will come to earth and start to devour the people who live on the earth. We were told that the law men, (Southern Cross) would travel around the sky and go under the ground to check on the body parts, the man could not get back together. The Law men would always be there to see that the two young lovers who were the wrong skin group would not get back together again. Because if they did get back together, they would come back to earth and cause big trouble with their family. We were told that if this did occur before the three Yorgahs (women elders) that were tracking Woor-jall-luk then the Law men would turn into emu's and be back on earth to warn the people. When the three yorgah elders reach Woor-jall-luk they will destroy her fire and bring the stolen children home again. The Dreaming of the Bibbullmun history and religion encompassed a great understanding of ritual that was endorsed into our understanding of our environment from child hood to adulthood as we looked through the circle of firelight to the light of our cosmology.*

## **Appendix 8 Artists participating in “*Ilgarijiri- Things Belonging to the Sky*”**

Olive Boddington	Karen Comeagain
Margaret Whitehurst	Teresa Lawson
Barbara Comeagain	David 'Krocette' Prior
Wendy Jackamarra	Susan Merry
Teddo Ryan	Bruce Bradfield
Sonya Edney	Sam Maher
Christine Collard	Ruby McIntosh
Debra Maher	Nicole Dickerson
Charmaine Green	Julie Kelly
Barbara Merritt	Jan Ronan-Williams
Melissa Jacobs	Sheree Chalk
Craig Chook Pickett	Charmaine Simpson
Margaret Danichewsky	Margaret Simpson
Maxine Gregory-Veitch	Angeleta Simpson
Manupa Butler (Kayili Artist)	Gwen Rackabula

*Ilgarijiri- Things Belonging to the Sky* (2010) <http://astronomy.curtin.edu.au/ilgarijiri/artist.html>, viewed 11 May 2011.

## Appendix 9 Transcript of sign at Wolfe Creek Crater

The following is a transcript record of signage located at Wolfe Creek Crater, which presents Aboriginal accounts of the crater. A photograph of the sign is provided in Figure 42. The transcript below is a part of the signage at the crater, which also describes features of the crater and its biology.

### *Wolfe Creek Meteorite Crater*

*About 300,000 years ago, a meteorite weighing thousands of tonnes crashed to earth here.*

*The crater formed by that impact measured about 850 metres across and is the second largest in the world from which meteorite fragments have been recovered (Meteor Crater in Arizona is larger).*

*It was not until 1947 that Europeans recognised the crater when it was observed by geologists during an aerial survey.*

### *Gandimalal*

***Jaru and Walmajari** Aboriginal people call the crater Gandiamal and have known of its existence for thousands of years. A **Jaru** story tells of two rainbow snakes moving across the land to form **Jurabalarn** (Sturt Creek) and **Ngurriny** (Wolfe Creek). **Gandimalal** is the place where one of the snakes came out of the ground.*

*A **Walmajarri** story tells of a rainbow snake named **Karlputa** who came to Gandimalal from Bidyadanga (La Grange) on the coast south of Broome. The crater rim is where **Karlputa** has pushed up the ground. The central area of the crater is salty because **Karlputa** came from the sea. **Karlputa** still lies under the crater.*

## Appendix 10 The desert lizard story

Chapter 4, (section 4.2.7.5) detailed an account by Jack Jugarie, Halls Creek, of a star pattern called “Kalarrcar”, the desert lizard footprint. This story unambiguously refers to a recognised star pattern, visualised by the footprint of a desert lizard, comprising the stars of Orion's belt and the Great Orion Nebula. During further interviews with Jack Jugarie and Jack Lannigan, an additional story relating to a desert lizard (“the ja-bu-dah”) was recorded. Whilst no direct link with the night sky was referred to, it is possible that the story relates to the “Kalarrcar” account. For the sake of completeness, the story is included here.

Jack Jugarie explained how a desert lizard got its dark mark on its chest. The lizard, which was described as about 25 centimetres in length, has a dark brown or black patch on its chest. It presumably is a native lizard near Halls Creek. The following paraphrased account was recorded by notes (not video), in 1999. The story involved a brief melody being sung:

A desert lizard went very close to a tree, and sung. (A pleasant but fairly short melody is sung). The lizard then went to another tree and sung again. (The same melody is sung). He then went to another large tree and sung. (The same melody is sung). This time, the tree fell on him, and he wasn't quick enough to get out the way. This is how the lizard got the black mark on his chest.

It seems that by the third occasion of approaching a tree, the lizard had become either provocative towards the trees, or overconfident, and risked having the trees fall on top of him. He was “caught out” when the last tree fell on him, causing the injury on his chest that he carries to this day. Jack Lannigan referred to a Sturt Creek lizard called Ja-bu-dah, a Walmajarri word, which may be associated with the above account. Interestingly, there is a story very similar to the “desert lizard story” recounted in “The World of the First Australians” by Berndt and Berndt (1964, 327):

*... The blood the sorcerer keeps may be given later on to a small lizard (with red colouring on the underbelly near the head). He names a certain place, and the lizard goes there and puts it in the roots of a tree. After about two or three years the sorcerer goes to the tree and finds the blood, which has become a congealed stone-like mass, a powerful magical substance. It gives him a clear vision: with its help he can find fish, turtle, and honey easily, and hunt meat successfully. Fragments may be traded.*

The similarities between the Berndt & Berndt account and the accounts by Jack Jugarie and Jack Lannigan suggest that the stories may be essentially the same, or perhaps a variation.

## Appendix 11 Aboriginal Paintings, the Goldsmith / Cosmos, Culture & Landscape Collection

The “Cosmos, Culture and Landscape” collection features Aboriginal artworks collected by John Goldsmith, which has developed out of Goldsmith’s research in relation to Aboriginal astronomical knowledge. The collection includes aboriginal perspectives of the landscape and astronomical knowledge, particularly relating to Wolfe Creek Crater. The collection includes paintings and pen drawings by Halls Creek Aboriginal artists such as Stan Brumby, Barbara Sturt, Bonnie Deegan, Jack Lannigan, Frank Clancy and Jack Jugarie. The following (Figures 91 - 104) are examples of painting that feature Wolfe Creek Crater (reproduced by permission, Yarliyil Art Centre, Halls Creek, and the respective artists).

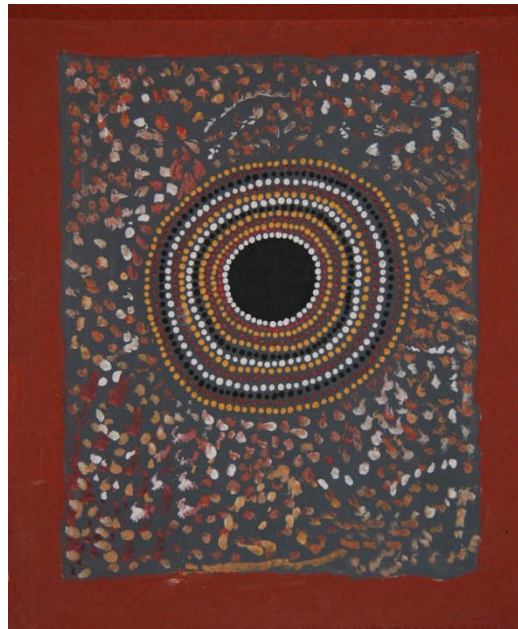


Figure 91. “Wolfe Creek Crater”. Artist: Frank Clancy.

Photo: John Goldsmith

<b>Title</b>	Wolfe Creek Crater
<b>Artist</b>	Frank Clancy
<b>Medium</b>	Acrylic on canvas
<b>Dimensions</b>	41.5 x 49 cm

Source: Yarliyil Art Centre.



Figure 92. “Wolfe Creek Crater”. Artist: Barbara Sturt.

Photo John Goldsmith.

<b>Title</b>	Wolfe Creek Crater
<b>Artist</b>	Barbara Sturt
<b>Medium</b>	Acrylic on canvas
<b>Dimensions</b>	71 x 71 cm
<b>Notes</b>	Catalogue number NM59. Purchased September 2000. The two snakes represent Wolfe Creek and Sturt Creek. The crater is the central grey circle, and the “underground tunnel” is shown as blue water. Source: Yarliyi Art Centre.
<b>Source</b>	Yarliyi Art Centre.





Figure 93. “Wolfe Creek Crater”. Artist: Barbara Sturt.

Photo: John Goldsmith

<b>Title</b>	Wolfe Creek Crater
<b>Artist</b>	Barbara Sturt
<b>Medium</b>	Acrylic on canvas
<b>Dimensions</b>	48 x 67 cm
<b>Notes</b>	The spiral snake of Wolfe Creek Crater, and the underground tunnel.
<b>Source</b>	Yarliyil Art Centre.



Figure 94. “Wolfe Creek Crater Landscape”. Artist: Stan Brumby.

(Photo: John Goldsmith)

<b>Title</b>	Wolfe Creek Crater
<b>Artist</b>	Stan Brumby
<b>Medium</b>	Acrylic (?) on reclaimed laminated board.
<b>Dimensions</b>	46.5 x 54 cm (approx)
<b>Notes</b>	Purchased 16 August 1999. This painting shows the landscape of Wolfe Creek Crater and the nearby landscape, including various bush tucker foods. Whilst the use of dark and light tones are suggestive of the night sky, the painting actually represents the landscape.
<b>Source</b>	Yarliyil Art Centre.



Figure 95. "Wolfe Creek Crater". Artist: Stan Brumby.  
(Photo: John Goldsmith)

<b>Title</b>	Wolfe Creek Crater
<b>Artist</b>	Stan Brumby
<b>Medium</b>	Acrylic on canvas mounted hardboard.
<b>Dimensions</b>	22 x 30 cm
<b>Notes</b>	Purchased August 1999. This small painting features Wolfe Creek Meteorite Crater, in a dot painting style.
<b>Source</b>	Yarliyil Art Centre.



Figure 96. "Wolfe Creek Crater". Artist: Stan Brumby.  
Photo: John Goldsmith

<b>Title</b>	Wolfe Creek Crater
<b>Artist</b>	Stan Brumby
<b>Medium</b>	Acrylic on canvas
<b>Dimensions</b>	90 x 90 cm
<b>Notes</b>	Purchased August 1999. Catalogue number 2003093.

*This is the dreaming story of bush women that live in that place with the sugar leaf at the spring and then that man he get angry and he wants that sugar leaf, so he comes down she gives him plenty of room and he came down and takes that leaf and try's to kill that bush women, but he never come out of that earth, he stays there and the bush women and that sugar leaf come back.*

**Source** Yarliyl Art Centre.



Figure 97. “Wolfe Creek Crater”. Artist: Stan Brumby.  
Photo John Goldsmith

<b>Title</b>	Wolfe Creek Crater
<b>Artist</b>	Stan Brumby
<b>Medium</b>	Acrylic on canvas
<b>Dimensions</b>	90.5 x 55 cm
<b>Notes</b>	Purchased 1999. Catalogue number: 2003176. <i>This is one story of Wolfe Creek Crater, Stan’s country, where he is from. The story is of the bush women that lives in that spring soak water and where the sugar leaf trees are. A star man comes and sees that bush women and he wants that sugar leaf so he comes down and that bush women runs away and that star man comes crashing into the earth and takes the sugar leaf and then he went into the earth never to come out again. That women comes back as well as the sugar leaf. There is still a soak water hole in the middle of the crater and the sugar leaf today, Stan tells.</i>
<b>Source</b>	Yarliyil Art Centre



Figure 98. Falling star and Wolfe Creek Crater paintings and artist Stan Brumby.  
(Photo: John Goldsmith)



Figure 99. “Star falling, Wolfe Creek Crater”. Artist: Stan Brumby.

(Photo: John Goldsmith)

<b>Title</b>	Star falling, Wolfe Creek Crater
<b>Artist</b>	Stan Brumby
<b>Medium</b>	Acrylic on canvas
<b>Dimensions</b>	40 x 68 cm
<b>Notes</b>	Purchased 1999. Catalogue number 2002104. This representations of the “star falling” is unusual in that it shows the meteorite fall in a semi-realistic form, as well as using the dot painting style extensively. Source: Yarliyil Art Centre.
<b>Source</b>	Yarliyil Art Centre.



Figure 100. “Star falling, Wolfe Creek Crater”. Artist: Stan Brumby.  
Photo: John Goldsmith

<b>Title</b>	Star falling, Wolfe Creek Crater
<b>Artist</b>	Stan Brumby
<b>Medium</b>	Acrylic on canvas
<b>Dimensions</b>	45 x 45 cm
<b>Notes</b>	Purchased August 1999. Catalogue number 2003009.

*Star comes from sky. Sugar leaf in bottom in tree, he was looking at one in the bush moolungal (wild women). In the spring water in the hill white water really milky water. Star looking at that star man a wild not nice man trying to kill the bush women. He was really hungry for that sugar leaf at the water spring, when he comes down. She takes off to give him plenty room. When he comes for the sugar leaf he gets it and goes into the earth and never comes out. But sugar leaf come back and grow and women comes back. And that is how the wolfe creek crater was made.*

**Source** Yarliyil Art Centre



Figure 101. “Star falling, Wolfe Creek Crater”. Artist: Stan Brumby.  
(Photo: John Goldsmith)

<b>Title</b>	Star falling, Wolfe Creek Crater
<b>Artist</b>	Stan Brumby
<b>Medium</b>	Acrylic on canvas
<b>Dimensions</b>	89 x 118 cm
<b>Notes</b>	Purchased August 1999. Catalogue number: 2003359.

*This is a story about Wolfe Creek Crater and how it came to be. There was one bush woman see been living there where that sugar leaf and that milky spring water was and one time this star man been seeing that bush women and he wants that sugar leaf and that spring water, and he gets very angry so he comes down and that women she sees him coming and she give him plenty room and then that star man comes into the earth and takes that all into the ground but he never comes out he been stay there and that leaf and that water and that women come back there now.*

**Source** Yarliyi Art Centre.





Figure 102. “Falling star, Wolfe Creek Crater”. Artist: Stan Brumby.

(Photo: John Goldsmith)

<b>Title</b>	Falling star, Wolfe Creek Crater
<b>Artist</b>	Stan Brumby
<b>Medium</b>	Acrylic on canvas
<b>Dimensions</b>	124 x 90 cm
<b>Notes</b>	Purchased August 1999. The falling star is represented in a very bold form, with the link clearly shown between the starry night sky and the landscape. The painting is structured so that the corners of the painting form a cross-like shape.
<b>Source</b>	Yarliyil Art Centre.



Figure 103. “Wolfe Creek Crater and the Underground Tunnel”. Artist: Barbara Sturt.  
(Photo: John Goldsmith)

<b>Title</b>	Wolfe Creek Crater and the underground tunnel
<b>Artist</b>	Barbara Sturt
<b>Medium</b>	Acrylic on canvas
<b>Dimensions</b>	65 x 54 cm
<b>Notes</b>	Purchased August 1999. Catalogue number 2002084. The theme of the underground tunnel at Wolfe Creek Crater, with water, is represented in this painting. Also notable are the footprints around the crater.

*This is the crater and the Sturt river, flowing into the crater during the wet season. All that water goes into the crater and right in the middle there is a big soak. Old man went hunting, looking for bush tucker, he took dingo pups, he followed them into that crater but he disappeared and he went into that crater underground into the river and when he comes out all his skin peeled off. The people were frightened. They thought he was gone for good but when they see him he had got those dingo pups.*

**Source** Yarliyl Art Centre



Figure 104. "Falling stars". Artist: Stan Brumby.

Photo: John Goldsmith

<b>Title</b>	Falling stars
<b>Artist</b>	Stan Brumby
<b>Medium</b>	Acrylic on canvas
<b>Dimensions</b>	55.5 x 55.5 cm
<b>Notes</b>	Purchased August 1999. Catalogue number Y598/99.

*Bandarr nganar (Kangaroo). Came from Nungurroo he followed the river right up from Gordan Down. That Milky water he followed. The stars were falling down he camped at Wirdila yard. The stars were trying to hit him. He bin look where, his Country. The stars were hitting him day time and night time. He stay now at Barungu. That is his home, now today, you will see lot of Kangaroo's.*

**Source** Yarliyil Art Centre

## Appendix 12 Goals and objectives of IYA 2009

The IYA2009 goals and objectives are detailed in the International Year of Astronomy 2009 final report (International Astronomical Union 2010). Additional information relating to evaluation estimators is also available from; <http://www.astronomy2009.org/general/about/goals/>.

Table 89. IYA 2009 Goals, objectives and evaluation estimator.

Goals	Objectives	Evaluation estimator
<p>1. Increase the scientific awareness among the general public through the communication of scientific results in astronomy and related fields, as well as the process of research and critical thinking that leads to these results.</p>	<ul style="list-style-type: none"> <li>• Make astronomical breakthroughs more visible in the daily lives of billions of people through all available means of communication (TV/radio documentaries, newspapers, web pages, exhibitions, stamps, blogs, web portals, advertising campaigns etc).</li> <li>• Facilitate individual astronomical observing opportunities.</li> </ul>	<ul style="list-style-type: none"> <li>• The number of people “touched”.</li> <li>• Number of press clippings and readership.</li> <li>• Number of people visiting national, regional and global webpages (webstats).</li> <li>• Number of activities.</li> <li>• Number of new products etc.</li> </ul>
<p>2. Promote widespread access to the universal knowledge of fundamental science through the excitement of astronomy and sky-observing experiences.</p>	<ul style="list-style-type: none"> <li>• Enable as many laypeople as possible, especially children, to look at the sky through a telescope and gain a basic understanding of the Universe.</li> </ul>	<ul style="list-style-type: none"> <li>• Number of laypeople, especially young people and children, viewing the Universe through a telescope at street astronomy events, star parties, professional observatory webcasts etc.</li> <li>• Number of “cheap” new telescope kits produced, assembled and distributed.</li> </ul>
<p>3. Empower astronomical communities in developing countries through the initiation and stimulation of international collaborations.</p>	<ul style="list-style-type: none"> <li>• Involve astronomical communities of the developing nations in the Year, thereby providing examples of how outreach and education is carried out in different parts of the world.</li> </ul>	<ul style="list-style-type: none"> <li>• Number of participating developing nations as measured by the establishment of National IYA Nodes.</li> <li>• Number of new international partnerships and joint programs</li> </ul>

<b>Goals</b>	<b>Objectives</b>	<b>Evaluation estimator</b>
		<p>formed.</p> <ul style="list-style-type: none"> <li>• Number of people reached by new initiatives.</li> </ul>
<p>4. Support and improve formal and informal science education in schools as well as through science centres, planetariums and museums.</p>	<ul style="list-style-type: none"> <li>• Develop formal and informal educational material and distribute all over the world.</li> <li>• Conduct focused training of event leaders and presenters.</li> </ul>	<ul style="list-style-type: none"> <li>• Number of participating teachers and schools.</li> <li>• Number of educational materials distributed.</li> <li>• Number of new event leaders and presenters trained.</li> </ul>
<p>5. Provide a modern image of science and scientists to reinforce the links between science education and science careers, and thereby stimulate a long-term increase in student enrolment in the fields of science and technology, and an appreciation for lifelong learning.</p>	<ul style="list-style-type: none"> <li>• Popular talks by scientists of all ages, genders, races.</li> <li>• Facilitate portraits - on TV, in web blogs, biographies - of scientists that break with the traditional “lab coat view” of scientists, showing the excitement of scientific discovery, the international aspect of scientific collaborations and portraying the social sides of scientists.</li> </ul>	<ul style="list-style-type: none"> <li>• Number of popular talks.</li> <li>• Number of scientist portraits.</li> <li>Public response questionnaires.</li> <li>• Evidence for penetration of astronomy into popular culture (media, web, TV, radio talk shows...)</li> </ul>
<p>6. Facilitate new, and strengthen existing, networks by connecting amateur astronomers, educators, scientists and communication professionals through local, regional, national and international activities.</p>	<ul style="list-style-type: none"> <li>• Connect as many individuals (named “IYA ambassadors”) as well as organisations (amateur and professional) in networks, for instance by creating of new internal and external electronic communication infrastructures. These networks will become part of the heritage of IYA 2009.</li> </ul>	<ul style="list-style-type: none"> <li>• Number of National IYA Nodes.</li> <li>• Number of new networks and partnerships formed.</li> </ul>
<p>7. Improve the gender-balanced representation of scientists at all levels and promote greater involvement</p>	<ul style="list-style-type: none"> <li>• Provide access to excellent role models and mentors, formally and informally, and publicise them.</li> </ul>	<ul style="list-style-type: none"> <li>• Number of active new role models and mentors.</li> <li>• Number of new international</li> </ul>

<b>Goals</b>	<b>Objectives</b>	<b>Evaluation estimator</b>
by underrepresented minorities in scientific and engineering careers.	<ul style="list-style-type: none"> <li>• Provide information about the female “dual-career” problem and possible solutions.</li> </ul>	partnerships, projects and activities.
8. Facilitate the preservation and protection of the world's cultural and natural heritage of dark skies in places such as urban oases, national parks and astronomical sites, through the awareness of the importance and preservation of the dark skies and astronomical sites for the natural environment and humanity heritage.	<ul style="list-style-type: none"> <li>• Involve the dark-sky community in the IYA 2009.</li> <li>• Collaborate on the implementation of the UNESCO and IAU “Astronomical and World Heritage” initiative.</li> <li>• Lobby the organizations, institutions, as well as local, regional and national governments to approve preservation laws for dark skies and historical astronomical sites.</li> <li>• Bring the issues of natural environment and energy preservation to the agenda of decision makers.</li> </ul>	<ul style="list-style-type: none"> <li>• Number of activities and events related with the night sky protection.</li> <li>• Number of countries/cities with the laws or guidelines for dark sky preservation.</li> <li>• Areas protected by dark sky laws.</li> <li>• Number of historical astronomical sites identified and protected under the UNESCO's World Heritage Convention.</li> </ul>

## Appendix 13 Video Transcripts and Notes

### In their own words: Indigenous Sky Stories.

This section provides transcripts of the video interviews, featuring more than 25 interviewees, including Aboriginal elders, artists, scientists and gallery managers (Figures 107-132).

The transcripts are, wherever possible, a verbatim record. Notable is the conversational style of the interviews and also notable are various idiosyncratic uses of English. Due to the conversational style of the discussions, many interviewees tend to repeat themselves. Some forms of language used in the interviews differ from standard English, or otherwise may be unfamiliar to readers. For example, with interviews with Jack and Keith Jugarie, the term “Blackfella” is used. This is simply a term referring generally to an Aboriginal person, and has no further connotations beyond that meaning. Interview questions have in some places been paraphrased rather than a verbatim record. The interviews have been grouped into the following: (1) Yamatji Wajarri (Murchison Region, Geraldton and Mullewa); (2) East Kimberley (Halls Creek), and Wolfe Creek Crater; (3) South West Western Australia and (4) International interviews.

The conventions I have used for presenting the transcripts are: (1) Interviewer questions or comments are indicated by “Q:” (and text is provided without italics); and (2) interviewee responses are shown as *italicised* indented text. Any non-italicised text in brackets, appearing in the interviewee responses, indicates that this is a brief explanatory comment. Italicised text within brackets indicate that such wording is from the interviewee. Phonetic spelling is used in places, and any non-transcribed text is indicated by ... (this may be caused by inaudible recordings, or content otherwise unable to be transcribed). I have attempted to record faithfully the wording or phrasing used by interviewees, even when this may make comprehension more difficult. Some interviewees tend to not verbalise some key words, probably because the meaning is clear, in the context of the discussion and setting. If I have found it necessary to specify such dropped words, I have done so by non-italicised text in brackets.

The organisations represented or associated with the interviewees include; Yamaji Art, International Centre for Radio Astronomy Research (ICRAR), CSIRO (Geraldton), Horizon Planetarium, Curtin University, Japingka Gallery, and the South African Astronomical Observatory. A summary of source material is provided below. Selected samples of source material have been transcribed, but not all material. Also included are some records of discussions that were not documented via video recordings. Such notes are not verbatim records, but provide paraphrased records of discussions.

**Part I. Yamatji Wajarri (Murchison Region, Geraldton and Mullewa)**

Kevin Merritt	6 August 2010
Olive Boddington	6 August 2010
Margaret Whitehurst	6 August 2010
Barbara Merritt	6 August 2010
Charmaine Green	6 August 2010
Robin Boddington	22 August 2011
Wendy Jackamarra	23 August 2011
Christine Collard	23 August 2011
Barbara Comeagain	23 August 2011
Susan Merry	23 August 2011
Debra Maher	23 August 2011

**Part II East Kimberley, Halls Creek, Wolfe Creek Crater**

Jack Jugarie	9, 10, 11 August 1999
Keith Jugarie	22, 23 August 2010, 8 August 2011
Jack Lannigan	12 September 2000
Bonnie Deegan	24 August 2010
Stan Brumby	8 September 2000, 13 September 2000, 24 July 2003, 15 August 2010, 22 August 2010.
Doreen Green	16 August 2010
Tanbar Banks	13 September 2000, 23 August 2010
Boxer Milner	22 July 2003
Speiler Sturt	22 July 2003

**Part III South West Western Australia**

Toogarr Morrison	19 September 2011
Josie Boyle	21 December 2011
David Wroth	15 September 2011
Ian Plunkett	2 August 2011
Megan Argo	9 March 2011

**Part IV International**

Dr Thebe Medupe	25 March 2010
Sivuyile Manxoyi	19 March 2010



## Part I. Yamatji (Geraldton and Mullewa) elders and artists

### 13.1.1 Kevin Merritt



Figure 105. Kevin Merritt.

(Photo: John Goldsmith)

Interview with Kevin Merritt, at Yamaji Art, Geraldton, 6 August 2010.

Q: Can you tell us what the (*Ilgarijiri*) exhibition is all about?

*Just in response to the SKA project, we were involved in the things belonging to the sky... when I first heard about it, I thought it was a really great thing for the artists in this region to be able to put on canvas stories that they've learnt and heard the old people, you know, while we are growing, to be able to display to the world as it is, you know, the stories of the stars, I thought that was really great.*

Q: ...and the Seven Sister are very prominent, what about some of the other constellations?

*The seven sisters with the hunter is a well known story with Aboriginal people in this area, and also the story of the milky way constellation where we can look at the sky at certain times of the year and know when the emus are laying their eggs, also the story of the Southern Cross, story from the Wajarri people from where that story is connected to, to that particular star system... ..*

Q: So the Southern Cross is one of the prominent features of the night sky?

*It's one of the prominent features of the sky, but not one of the prominent story. Not too many people know about that story, it's a story that people are just beginning to learn about that story, so that's one good thing that's come out of it, since that project started. It's the same version with the seven sisters and the hunter. Those two constellations ... and the milky way constellation, you know, very interesting, but not only interesting, but we relate that as our story, the Aboriginal story from the mid West here.*

Q: So it is particular to this area?

*It's not particular to our area, but we see it as the..., 'spose from the position where we are... we can see the emu in its different phases, as the months go by, we know when the emu is laying the eggs.*

Q: This can be a bit of a surprise to those people who are not that familiar with how the sky changes during the night and the seasons.

*Especially when the milky way seems to do a back-flip by the end of the evening, we see it in a south easterly to a north westerly direction, late in the morning, it is the opposite way around just about, confuses people sometimes.*

*I find it quite interesting, the stars are interesting to all races of people of the world,... We will always be searching amongst the stars for whatever reason we like to search the stars. When we come out at night, it just fascinates myself anyway you know, the brilliance and the enormity of our own little solar system, compared to what's out there, further out.*

*It would be so wonderful if we could see with our naked eye what's out there further out, without the use of telescopes... and we could see...*

*If we would have done that in the past, over the thousands of years we've been here, maybe there would have been other stories, that would've come out of it.*

Q: One aspect of the exhibition is the way in which artists have come together to help develop the exhibition;

*When we all started to think about what we can paint about, and what stories, it seemed to be the same story but the way each artist looked at it was different altogether when they put it on canvas and I thought it was quite interesting and it just shows how we look at things in our own (way), how we see things individually, and coming together, like a group of artists, and most of us from different backgrounds and different experiences in life, but we all came together and put this great exhibition together.*

Q: It sounds like the experience of painting was a positive one.

*It certainly was a positive experience and I think that's still flowing on today. That excitement we had in the beginning, is still there today. We'd like to see more of it.*

Q: and the visit on country to Boolardy station with the scientists?

*I thought that was very positive, because we were able to relate our stories, in the... They were able to show close-up views of the constellations that we looked at over our life, we could see that even though we thought it was just a star, it was another constellation, you know. It just blows your mind away... To be able to have their (the astronomers) expertise tell us about all these things, and I think some of the older people learnt a great deal more than what they knew before, about the stars and the constellations, about where we fit in, our own little world, where we fit in this great cosmos we live in.*

Q: May that have been their first experience using a telescope?

*It would have been (their) first experience to look at the stars, not only just to the moon and our local neighbours around us, even though they are so far away but beyond that, they could see, even if they were just small kids, it would have blown their minds away that the size the place where we live, you know, the sky, we are part of the sky, even though we are so distant, I think we could still feel we are part of the sky..*

Q: And the (Ilgarijiri) exhibition in Geraldton, Perth, Canberra and Cape Town?

*...In Canberra we had a great reception there and the one at Curtin University, that was a real success. and I think it's shown the Aboriginal people throughout Australia, that anything like this (i.e. Ilgarijiri) they can put some together, something that's very important to them in their beliefs, their dreaming and their stories, you know, and I think it's one of the greatest things that Aboriginal people here, when we did the paintings, that we were proud to show on canvas what our stories were, yeh.*

Q: For some in our community, this may be the first time they are learning about Aboriginal views about the environment and the night sky- for some people it's a learning experience. What's your experience in this respect?

*I thought it was a learning experience that we could look outside our own little, what they call the "sand pit" (i.e. solar system) and that outside and there is so much we can be a part of, you know, as far as the exhibition is concerned we are a part of the astronomy... ..people, I thought that was a great experience, not only for me but also for all the other artists. We are still telling people to come and join us a be a part of it. I think that's great, I think that's really great.*

Q: What sort of issues were encountered?

*Whether... the artists from this region were allowed to paint in different forms. Were we allowed to paint stories about the stars and also how do we put them down in traditional aboriginal painting or in the more popular dot paintings and most of us embraced the dot painting, which made the exhibition so much better, so much better...where it incorporated the Indigenous and the non indigenous perspective of the whole project, I thought that was really great, from that perspective.*

Q: Were there sensitive issues raised? How were these dealt with?

*It was only very isolated, just a couple, where some people thought that wasn't appropriate. We had to find out whether it was or wasn't and we overcome any of those difficulties.*

Q: And what of your aspirations, things that you would like to see, looking into the future, beyond the exhibition?

*What I'd like to see is an incorporation of our painting with photographs of the night sky in an exhibition, side by side so that when people look at it there shouldn't be any differences. Only the form that we put it in... you put it in. As a photography thing, they are really brilliant and then bring it down to the earth, to the Aboriginal people's perspective as to how we look at the sky, in paintings.*

Q: How can we understand what that perspective is?

*Like workshops, lectures, you know, Aboriginal people going on a tour, and explaining the stories, and how we put it in the painting in the art, what we see in the night sky.*

Q: What role do you see with working with the younger generations, teaching and education: do you see that as an aspect...

*That certainly is an aspect, whereas not much of the culture is taught these days, where we could incorporate in the art. When we tell them the different stories that we know, and they can do that in their own art work, in their paintings and so that they will always remember those stories. That would be a great step forward.*

Q: So the process of learning can be the creation of artwork? How do you see some of the links developing with the radio telescope project?

*I've never thought of it. When the younger people are able to view those pictures from outer space, and they can have a look at it and say that I've these stories for the old people, and they can have a connection, but as far as seeing further out in to the constellations, it will be a great experience for those younger people to be able to for the first time, that they'd be able to see so far out into space.*

Q: and images from “deep space”...

*And you say deep space. We don't have that con.... (concept) we don't see deep space. As Aboriginal people, we just see what is around us, what's above us and deep space is beyond anyone's comprehension we just can't understand, you know, how all these things have been created, you know.*

Q: How would it commonly be seen, looking at the night sky?

*Just what we see with our naked eye as far as the..., like the nearest stars that we see, the moon, the sun, some of the closest stars, that we see shining so bright in the sky, and we are a part of that but beyond that we don't have any connection to that.*

Q: So the visual, what people see and experience is important?

*It's very important... specially the stories in the paintings of the night sky as far as hunting and gathering, and things that we see in the sky, may determine our existence where we need to travel, at certain times. That was in the past but were very important to Aboriginal people*

Q: Some people wonder about knowledge that has come from ancestors, from the past?

*I think it's got a lot to offer, in the way that, you know, the older people had to exist, somehow and to be able to... to exist, just exist. To show the younger people that, you know, everything was never like this before and that there were...other...the world has been changing and their world will be changing soon too. It doesn't always remain the same, so really a learning curve for them because growing up I'd never thought I'd see the things that I see now in the world today, and you know, if my Grandparents ever came back, they'd never believe what's in the world today and I think this project will show the young people that what the past was because the past is very important to everybody, for our ancestors and for those who are going to come after us. I think it is very important. No matter whether you are Aboriginal or non-Aboriginal.*

Q: Some astronomy themes were not featured in the exhibition (e.g. the moon) ...do you have any comments about this?

*I don't know, not quite sure, what stories relating to the moon. I don't see many stories about the moon, anywhere*

Q: Because they were not aware about these stories?

*There are stories regarding the moon, but I haven't heard one from this region, there are stories about the moon and the sun, where Aboriginal people believe that the moon is always chasing the sun or vice versa, that is something I've never thought about it myself... either...*

Q: Any final comments about the exhibition?

*Personally I thought that it was really great for all of us to be included in this project. I think we are very proud to be a part of that and we'd like to continue to be a part of it too.*

### 13.1.2 Olive Boddington



Figure 106. Olive Boddington.

(Photo: John Goldsmith)

Interview with Olive Boddington, at Yamaji Art, Geraldton, 6 August 2010.

Q: How did you get involved in the art exhibition, the beginning?

*Well, I'm from the Murchison area, and I was asked if I'd be interested in doing art for the exhibition and from there I created paintings from the sky.*

Q: Is this something that you had done before, or was it new?

*I did the seven sisters before and the Emu but I haven't done anything else beside that from the sky.*

Q: What is the seven sisters story?

*There was the seven sisters, and there was ah, I can't think of the name, but there was one that, um, sort of away from the others most times, and she was really wanted by an old fellow, and she was, but the other sisters they kept calling her back and helping her to stay among them and that's what I think and in the painting she's a little bit away from the six (stars of the seven sisters).*

Q: How did you learn about this story?

*When we were little,... we had nothing else to do but lay down and look at the stars.*

Q: Were those chats mostly in the evening?

*Mostly at night-time.*

Q: Do you have a favourite painting (in the exhibition)? What's your preference?

*I like doing the Milky Way since I started doing the sky stories, I do that quite a bit,*

Q: Do you mean the Emu pattern?

*I did the Emu and the milky way, and the stars, and then I did Saturn and the Milky Way*

Q: When the field visit happened with the scientists, what was that meeting like?

*It was good, it was a bit hot though.... it was...because I'm so used to the bush and things, I just enjoyed it, learnt things from the scientist from other countries as well.*

Q: Do you think they learnt something from you as well?

*Oh, that's hard.*

Q: Perhaps I should ask the scientists?

*Yeh I think, I don't know, what they... I think they (the scientists) really enjoyed it to.*

Q: Looking to the future with the art exhibition... ..how would you like this subject (Aboriginal sky knowledge) to develop?

*I haven't thought of anything, but I reckon it's a good idea to keep, I'll still do the sky stories, I'm doing one now...for exhibition..*

Q: Is there sharing with other artists, to help them learn with their art? sharing and learning between artists?

*Oh yeh, because it's like.. (I) don't go anywhere much to do my art on my own. But when you come to the (art) centre and we bring our art together and one of them might ask if there is anything to be done to their painting, like this morning Margaret brought her painting in and she wanted to get ideas from someone who, so we sort of tell each other where the colours, you know, like that.....Looking at each other's painting it helps a lot.*

Q: I noticed in the exhibition, the Seven Sisters, the Emu, can you speak about that story?

*When you first see the emu, you don't see the whole of him, just you see the neck and the head part and as the months go by it shapes more into the emu, and then .. ...it's sort of lying and when it does that that's when the emu's laying eggs and everyone seems to hunt for them then...(the emu eggs) ... special time.*

Q: The emu pattern itself is the dark area in the Milky Way. Are there other dark areas in the sky?

*There are other dark areas but I don't know what the meanings are...*

Q: And what about Saturn through the telescope?

*I liked it, it's really, it's something to look at, that's why I did the painting of it.*



### 13.1.3 Margaret Whitehurst

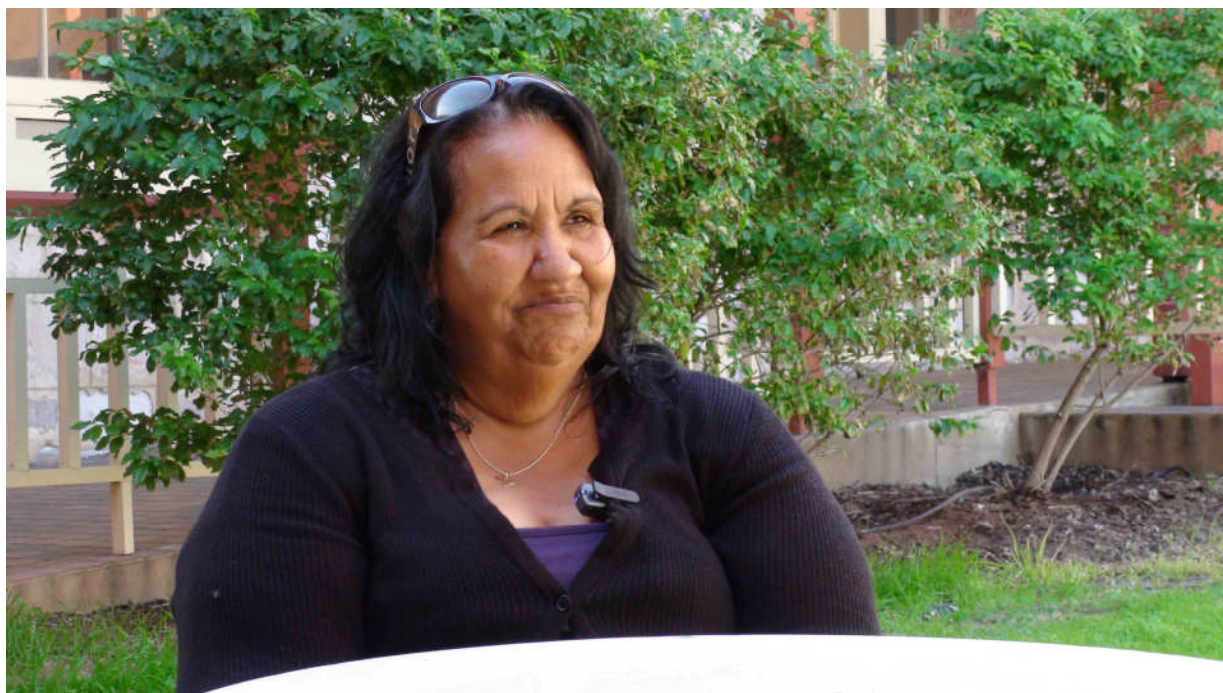


Figure 107. Margaret Whitehurst.

(Photo: John Goldsmith)

Interview with Margaret Whitehurst, at Yamaji Art, Geraldton, 6 August 2010.

Q: How did you first get involved in the (*Ilgarijiri*) project?

*As well kept coming into Marra, Kathryn kept telling us about the exhibition and about Mr Tingay and what he was doing and we all got excited about it because, we all enjoyed the things that he was saying and the things that he wanted us to do... ..When they said they wanted to do sky stories, and a lot of us ...didn't really know things about the skies, till we started doing this sky story, it was... because my Mum didn't tell us much about sky stories and things like that, I don't know, because... you know, I had to go away to school and things, and we didn't sort of talk much about the sky but since we've been doing this project, doing this art, it taught me a lot about the sky...*

Q: Can you give an example?

*Well specially like going out in the bush and I used to know that we can see the stars better out of town and everything but 'cos we moved into town, you don't get out there to see those things no more but when we went out there to the bush, and saw all the skies, and the people told us all about what was happening in the sky, I couldn't believe all the things that were up there and it was a good experience to me because that told us a lot of things that we can tell stories to our kids now, yeh, we can tell our*

*grandkids a lot of stories about the sky, that we didn't know, and like all these new things in the sky which we'd never seen before. Just amazing things that we've seen.*

Q: So it sounds like the visit with the scientists out on country was a quite a special time?

*It was a special time for me, because I didn't know a lot of the things that was up in the sky, till we met with them, it was great.*

Q: Did you get to see the sky through a telescope?

*I loved the colours. They were lovely colours in the sky. I forgot a lot of the names of them because we saw a lot and I just forgot a lot of the stars that we saw, but just looking at them made me look at all the colours and think of what's up there, we don't see it, like just looking through the telescope, it come back to you and it made us look for colours and what we wanted to do in our painting. It's just amazing how you can see things in a big telescope.*

Q: So the colours from the stars themselves, is that what you mean?

*It gave us a lot of ideas how to do our painting, just by looking at the colours, yeh, that was good.*

Q: Why do you think people liked the Jewel Box (star) cluster?

*Yeh, yeh, yeh... I think it was the colour and what they saw there... it was amazing you know, and me, my story was mainly about the emu in the sky because I knew a bit about that one that's why I did a lot of stories about that one. Most of my paintings were about the Seven Sisters and the emu in the sky and they were the main two stories because I knew about them two and I didn't know much about the others ones. But I got a lot of...If we do another one then, I know what I'm going to do because of the things we saw through the telescope that night, in Mullewa...it was ... ..it was so...and the kids enjoyed it too and all the people that was there, it's just that...Those colours can tell us a lot of things, even if you don't see the star exactly. If you see the colours and I just like the stories Mr Tingay told us. It was great... yeh. It was good... yeh.*

Q: So the Emu is one of the key stories that you painted?

*I done two of them (emu paintings) and they both got sold, so that story is about like the Emu's nest when the Emu's come out. It will start nesting and tells us when we can go out looking for emu eggs and the aboriginal people look forward to that because when they start seeing the Emu's head in the sky, and how he's laying he's got a special way he' got to lay and when they know that, that's when they know they are laying eggs that's when everyone starting to go out looking for eggs, yeh.*

Q: Can you remind us how emu eggs used?

*They like eating them, and they are lovely for baking cakes, the kids love going out, because they like tracking the emus, yeh, they like going out tracking the emus and the best part is going home, a lot of them go home and say that "I've found 8 eggs", they share it out to the family they don't keep them to themselves... After the eggs have been... they blow the eggs out, they keep the shells, and sell the shell to people, because people like carving eggs and things like that, a lot of non-Indigenous like buying the egg's like the shells, anyway, so that they can keep them. They do the carving on it, but there's not very many people doing that no more, there's a few still carving eggs around the Murchison, mainly in the Carnarvon they do them, they do a lot round Carnarvon, see a lot up there, up there, carving eggs.*

Q: Can you tell us about the meaning behind the Seven Sisters story?

*Well, really my parents didn't tell me about that one, it's just that I sort of got it from the other ladies here because we sit down and talk a lot about the Seven Sisters and I didn't really know much about it, but I did the story because we see it in the sky all the time, you know. We see it up there. My parents told us, the Seven Sisters. I didn't really know the story about it til I got to know like Barbara and Auntie Olive, cos she tells me a lot, that's my auntie and that's where I got my painting, from her. She told me the story about it and that's why I decided to paint about it. Because she told me the story about it, and Kathryn helps us to put the stories together, and you know. So I didn't really know that much about I done about three of them and sold them. So they helped us to put a story to them so I know Barbara will tell you a lot about it because she knows all about it, she knows a lot about the seven sisters. So I don't really know, I just knew about the emu in the sky, really. Yeh...*

Q: The impression I have is that the art centre has been a learning experience?

*Kathryn and Charmaine give us a lot of inspiration, you know. I'm here nearly twice a week, I come to them, and I'll sit down. If I do a painting and I think I don't like it I'll bring it in here, and Kathryn will sit with me and look at it, and she'll tell me what she thinks I should do to it or do extra to it so that's where we ... I going to be sad to see her go, I'm really going to be sad to see her go. She's done a lot for us.*

Q: Why do you think art activities are valuable? Why is it useful or valuable?

*I reckon because of the stories now-a-days, are dying out, nobodies telling the stories no more, people not telling stories no more, sort of dying out, and we are trying to keep the stories going through our painting, and I know that all my grand kids don't know nothing about art, but I am trying to teach them. Like it's hard because, I only started in the last 20 years, you know, 'cos I started late, doing painting. And it's hard to, now we have to sort of... and a lot of our old people have gone now, and you can't get stories no more, that's why we come into the centre, and we find...talk to each other, to tell each other*

*stories... That's how Charmaine and Cathryn, tell us stories and help us to put our paintings together all the time, that's where I get all my inspiration from, this centre. If we didn't have that I probably wouldn't be painting, 'cos, the older people now a days; 'cos we live in town and we don't go out there that much, we can't get stories from our older people now, and a lot of our older people are dying, and there's no one left to tell the stories. Like in my family I only got my Uncle and Aunty Olive. They are the only two oldest in my family and my mother and father have gone and it's just hard to get stories from elder no more, we got to try to pick it up by ourselves, you know, 'cos we can't go out to special places no more, you know. It's hard to go out to special places where we can get those sort of stories. It's just all gone.*

Q: What about your visit out on country, with what you have described with the astronomy night?

*That was...I really enjoyed that, because I haven't been out there for a while, and it was really enjoyable. I like it when we went out and up in the hills and went to where they were putting up the, everything and it looked so...thing... because it only had the two little, three little dongas (camp buildings) and they were doing all the artwork in there, and we went in there and they showed us things from the sky. They tried to give us some sound from the sky, but, we heard a bit of sound, I don't know if they were telling us the truth or not (laugh). I don't know if that was true or not, but they gave us a little sound there, they reckon that's come from the sky. I don't know if that was true. I think some of the people believed it. Yeh, it was quite good, I really enjoyed that and that night when we went home back to the station, sat around a big campfire and we told stories, and we even pointed out the sky, they saw the emu in the sky that night we pointed out up in the sky and the non-Indigenous people couldn't ....They got so excited when they saw the emu in the sky. Yeh, they really... they couldn't believe it... We'll show you the emu in the sky when it gets dark and we showed it to them...they just couldn't believe it because we saw it plain as thing out there at Boolardy. And all the stars, it was so... and Mr Tingay showed us a lot of other things that he saw, that we can see up in the sky and what we never seen before, that's where I saw a lot in the sky that night. I can't remember all the names but, because they were, some of them weren't Australian, so, but really enjoyed Boolardy. A good trip. It was wonderful out there, yeh.*

Q: And what of your hopes for the future (with the exhibition)?

*....Since we've been doing it I thought, that we were been getting it out to a lot of people, because, a lot of people coming up to us and saying we saw this in the paper and we saw what you've been doing with this story and I said yeh, it's a good thing because it's going to be going out to the people because nearly every second week we were in the paper about it and all the non-indigenous people coming up to me, and saying...That's a great thing you're doing, because it's going to get out to everybody, you know, everybody is going to see this,... and, what is that show, I forget now (Message Stick ABC TV program)...And everybody come and telling us... it's going to get out to everybody, and I hope it goes further, I just hope we can do more, story in the skies, and I just hope it will get back to the young kids,*

*you know, all the young kids growing up now, that there are stories in the sky that they can learn from... A lot of the stories, I didn't even see before in my life. I'm trying to teach my grand kids that, because it's a good thing for ...I reckon it's good thing for the non-Indigenous too because a lot of them didn't know a lot of things about the sky too but now they do after seeing what they saw, what we've been doing so I just hope we keep doing it, I just hope we keep doing the stories about the sky.*

Q: When people first try to learn about the subject, what sort of guidance or suggestions can you make? (about sensitive topics)?

*To me there is a lot of things that you can't touch and what you can do out there in the bush and but... a lot of the sky stories are not sacred, really, it's just, I don't reckon they are sacred, it's just a lot of stories like the Seven sisters, they say it's the sacred story, about the one special lady, but like looking at all the other stories, I don't reckon they're sacred, I reckon it's just that it's a good thing for aboriginal people to know about, and non-Indigenous people to, to know that there are things out there that you can still do, a lot of people don't like to touch things that you shouldn't touch, but... in the sky stories, I find that there is nothing secret out there, it's just stories we like to tell, about the sky.*

Q: What do you mean about “not touching”, what do you mean about that?

*See, a lot of the stories that we tell... Even if it's not sky stories, there's a lot of stories, that we, mainly stories that I tell that we can touch, we are allowed to touch, because, I haven't got any elders now, I've only got my uncle who can tell me what to do and what I can't do. So mainly my stories are all about the food, the land and the water... because there's a lot of things out there that you can't touch. So I try not to do anything in my painting that would offend an elder. Things like that, so but all the sky stories, it didn't offend anyone, so I think that there is nothing really that can offend the old people from up in the sky.*

Q: And when you say “the old people in the sky” do you mean the ancestors who have gone before?

*Yeh, gone before. You know, because I haven't heard much about the sky stories, so it's a bit hard to tell you about it, because my parents they died when I was pretty young, and it's a bit hard to tell, beside my father. His father was a white man, so he didn't much talk about things out in the bush. Like my uncles and auntie do now, they tell me all the stories and things because, they told us what we are allowed to touch and what we're not allowed to touch, and where we can go, and where we are not allowed to go, so...,*

Q: So it sounds like you may have a lot of stories for your family...

*I think I've got a lot of stories for my family now because when I got home from Boolardy I told them all about it and they don't believe it that those things are up there, you know. They don't believe those*

*things are in the sky and yeh, it was a great time, I really enjoyed it, I can tell my grand kids. See, I took my little granddaughter out and it was on "Message Stick" too. Took her showing pointing to the sky, and telling her where it was. She saw it and she couldn't believe it that there is an emu in the sky, she saw the whole pattern of it and we done it just out of town here, yeh, it was very good. It's something that I can tell my grandkids and children about it now. I hope that they can take over what I've been doing, I hope they can do that when...*

Q: How does it make you feel being a part of, being involved in the exhibition?

*..well, when I first started I thought, oh, well nah... it was going to be boring. I thought it was going to be boring. Nah...I haven't got much stories of the sky. When they first approached us and said that we are going to do these stories about the sky, look I don't know much about stories in the sky. All I knew was about this Emu in the sky and Charmaine and Kathryn said: "You go out and you look at the sky and you will see". So we did, and we went out and I just could believe all the things that we saw in the sky, you know. I didn't even know even half of the things that was in the sky, because we didn't look for them things. All we did was look for the seven sisters, and the pot in the sky, what they used to tell us, the seven sisters, the emu in the sky, that was it. I didn't know any more, till I saw the ones in the sky. Now I think I could do more stories of it, you know tell more stories about it. Just looking ... through the telescope, into the sky, yeh. It's really given me a lot of things that I can go back, and well, I went back and told my kids and my Grandkids all about it, but they didn't believe me. They didn't believe there were that many things in the sky. Yeh...*

Q: If they didn't believe you, how do you think they will believe?

*When I done the emu in the sky I showed them my pictures, because I took pictures of them. This is the things what we seen up in the sky and the things like what Barbara did. She did a lot of different things and I showed the kids all them paintings, and they reckon "that's really up in the sky?" and I said yeh, you should have come and had a look, because there was that many different things that you could look at you know. Now I'll be able to.. hopefully...I've got one of my little grand-daughters doing painting now so she'll keep doing it. So she could do more stories about the sky, Yeh.....*

Q: Are there any other things you would like to say about the exhibition that you would like to make?

*I just hope we can do another exhibition, I hope we can go and do another exhibition. Kathryn is talking about another exhibition, but she is leaving us. We just hope we can do another one, in the future, thankyou.*

### 13.1.4 Barbara Merritt



Figure 108. Barbara Merritt.

(Photo: John Goldsmith)

Interview with Barbara Merritt, at Yamaji Art, Geraldton, 6 August 2010.

Q: Can you tell us about your experience with *Ilgarijiri*?

*It's been a fantastic experience and I'd like to really think about things that are there, but you normally wouldn't do at any other time, sort of, um, captured you know, the things that are there, and like, hasn't forgotten, we haven't forgotten. Something that's there. I watch it every night, nearly now, things that are there.*

Q: How did you first become involved in *Ilgarijiri*, in the beginning?

*We were asked about it, and talked about it, and thought about it and we actually had to read a few things up which I did. My mind goes when I'm reading. I'll read all kinds of things that interest me, everything did kind of interest me, that were there and we didn't know where it was, so, we had that opportunity for like, specialists, scientists to give us more information on it. It was really good and then to go out bush. Just knowing about it at first, we had a battle of thinking, what are we going to do, you know, with the paint. This is where the blue came out in every painting, blue and white (paint). The things that we see, but because I've always done like colourful paintings and this is where I went. I went on that track like from doing like aboriginal paintings and that's normally animals and things we*

*see and food that we eat and that, and then in one way, it was put into those paintings with that, 'cos, those star stories, the old aboriginal people had to use the stars to live and tell them what date of the year it was and all that so it was good to really experience all that, Yeh...*

Q: The meeting with (Prof) Steven Tingay and the scientists, have you ever had the opportunity to meet astronomers before?

*never, no never, it was really .... it was... really a good experience, we were really excited about, because we knew that once we get around the storytelling place where we went to that he'd tell us all these stories about the stars.*

Q: Did you get to see through a telescope?

*That was really, really a big eye opener to, you know, see the stars that close and through the telescope and the colours, and the, yes... I'd think I'd look at them every day if I had the telescope, and night. I've have looked though a big one, down at Bickley, I went with a school group from here and they went out and had a look, but we couldn't see any stars because there was a bit of smoke around and so we got to see the moon.*

Q: And one of the star groups in the exhibition was the Jewel Box, did you get to see that?

*That's just amazing thing, sparkling pretty colours, so that's the first painting I drew, was the jewellery box, and that got sold very quickly.*

Q: So it sounds like the star groups like the jewel box made a big impression?

*It did, it made a big impression alright because, just the name alone, the jewellery box, jewellery box, a star called, you know, the jewellery box. As women, like, these are the things that we talk about, and do. Well, I do beading and things in my spare time and jewellery is in our lives, every day and then to see the jewellery box, ahh...*

Q: Have you spent much time watching the night sky?

*If I read it in the newspaper, and there is something on, I'd want to see that, so, the only part is that we don't have a telescope to look but a lot of it if you can just have a normal telescope you can see the things that's going on with the sky the recent ones, they had the mars closer to earth and quite a lot of other stars, Venus close together yes, and... What was the other one? You had to get up really early to see, the shooting stars, early in the morning which I don't get up that early, sleepy head, no I missed out on seeing the shooting stars I tried to ask someone to wake me up so I could get up and have a look. But where we live we've got a high wall, so I'd have to drive about an hour. So I didn't happen to*



*see it. But I saw the other one, that's the biggest star there now that's every night that you see in the in the sky now, and Mars and Venus and that were shaped around it for a couple of days and I saw a bit of that, it was great.*

*Yes, I enjoy it. You like to keep, you know, in track of it, the galaxies, specially the galaxies that are close to us, and like the Milky Way, that is coming closer now, really it comes to us in July, May, June, July, but it's still there, and we watch that.*

Q: Having been a part of the exhibition and exhibits, what difference has the exhibition made?

*I think that they really felt like that they were in that painting because of the stories and like they were really glad that these stories have come out and so that everyone can learn about these stories about, you know, from our own culture, and the people, and that, because we still have really cultural people, they're close, and we meet up with them, and talk with them, and they are really glad and happy about it and like to tell you more stories about it. But it's hard to catch up with the ones who live out in the bush. They're our main people, if we are allowed to, get the stories from and I know now that they will tell more, because seeing it on television and that every day. Well, they can see it on TV.*

Q: Do you mean that before the exhibition there was some reluctance?

*I think so, I think there was a bit of that amongst the group (reluctance), whether they were allowed to tell the story of the emu in the sky, because before, it was only a few families that told their children, like, that story, maybe for that reason, for getting in trouble with the really law people.*

Q: How do you think things have changed now, because you've mentioned being more open, I'm interested in the change?

*For me I was a bit reluctant... and hard to think but with a younger sister, you know, they want to know. The younger people, they want to know, really in Canberra, it opened my eyes. When I saw that elderly man talk about his there in the Northern Territory and like, he wasn't shy about it. He told all the stories, and he spoke up really well about the stories, and here we kind of, a lot of the elderly people didn't say much but I thought, well that's just wonderful, you know, to know these stories, that's the first time I've heard his stories like from the Northern Territory. So I thought well, that was really good that we had our artwork and the stories about our ancestors, really, we didn't know them or didn't know the stories, but we can really picture it. If you've got a story there. So you can picture, you know, what went on in those days, to tell our young people that. Their eyes just open up and they think "wow" this story is not us, but, it's a real story, so it's real real stories about the ancestors and what they did and how they gathered food and followed the stars to get from, say from here to down south, east or west. How east and west was important to them in them days. They didn't have any knowledge, you know, we do. We can read and things but, children these days, they don't know*

*anything really, unless you tell them. Because we didn't know, but our mother told us and it was always at that night that when we were outside, looking up at the sky, when they told us these stories.*

Q: Not during the day?

*Often at night, I don't know why. I had an Auntie, and she knew a lot about the stars and like, she read the stars every day but not only that, she knew where every stars was, and what was in the sky, the scorpion and that, she told us all that, so we weren't afraid to talk about the stars and I noticed a lot of friends, and they'd say "I don't know anything". Belonging to the stars, but we have stories there and I think back in the old days, they occupied the kids, by telling them that this story now...Don't you do this, because he'll be watching you, there like, someone on the moon, so the moon was something scary to look at, because we thought we would always see something, because of how they told us there was something on the moon.*

Q: So we were just talking about the moon?

*Yeh, the moon is looked upon as the male, and the sun as the woman, it's funny that, hey, so there obviously were a few more stories, we haven't heard of the moon and stars, and I'll try to find out more about that. The story I did was the Seven Sisters and that, captured a lot of ... (attention). Well the stories did. The story about the hunter, that's, I think its Leo, yeh, the Hunter that's chasing the girl and the seven sisters the one that is the fading star, that you can't see because in our story, there is a man chasing that girl and in our ancestors stories it probably goes back to where, when they did law, it fits in with the things they did at law time and I guess it's a romances kind of a story. When they do law, they are able to choose out of the group's (the girl), ohh... the elders choose the girl for the boys and that when they go through the law, and that, so, it's very interesting to me to know about that story the Seven Sisters.*

### 13.1.5 Charmaine Green



Figure 109. Charmaine Green.

(Photo: John Goldsmith)

Interview with Charmaine Green, at Yamaji Art, Geraldton, 6 August 2010.

Q: Can you tell us about your involvement in the *Ilgarijiri* project?

*...I work as the arts administrator in Yamaji Arts Centre and my involvement ranged from getting the artist ready, like talking the project up. Helping Kathryn with getting materials ready, then doing the media, I was sort of pushed to the front to be the spokesperson, when Kevin (Merritt) wasn't available, or one of the older artists weren't available, through to organising the bush trip out to Boolardy, and basically being an artist as well, involved, so right through the whole range of stuff for the project, really interesting... yeh...*

Q: So you have seen it from a number of points of view?

*So like from an administration, then from a creative and then doing the collaborative process with the astronomers, and then looking at the logistic side after when we are alone just with the artists. It's been a really fantastic project and it's part of us wanting to reclaim the right to tell stories from my perspective anyway, and this project's allowed this as well.*

Q: Can you tell us about the benefits / positives from the exhibition?

*One of the big positive things, like ....there is a range of things. There is the social and then there is the community, there's the building up of the artists, there is the exhibitions themselves, there's money that flows on from the exhibitions, there's the encouragement of artists, getting artists to come out of their shell and tell stories, it could be stories connected to the sky or could be stories that are actually in the sky or leaping from the sky onto the ground so that the activities we do because of something that happens in the sky. The artists just become really more confident, in saying yeh..., well I do have a story to tell, and I want to tell it via painting...so there is those benefits so really... ..You know, building our culture and getting the stories out there, and also that intergenerational type flow, there as well with maybe Barbara and Margaret including their grandchildren in looking at the sky, talking about the sky and then painting and the grandchildren and the children painting with them, so that's been really fantastic, that side of it.*

Q: What do you see as the main challenging aspects for this project?

*Well, anything with the sky is sort of culturally problematic and it took the committee at least eight months to even say yeh, we will go there. It took them along time sitting in with the board, throwing it back and forth, shall we do this?, Are we doing the right thing? Are we going to get in trouble? What sort of stories? But then the positive side of it out-weighed that because there is not enough a lot of opportunities to tell stories to the wider public and not enough opportunities to tell stories to our kids or our community, so that side of it, sort of... People knew their boundaries. They knew that there is stories connected to the sky that they can't tell, and they won't tell and a lot of the women concentrated on the relationship with bush tucker and the bush seasons, so yeh, that was really problematic, because there were some quarters saying well you can't do this and you can't do that. But their reasons may have not been, well, they weren't the reasons that the artist wanted to paint, because they know their cultural boundaries, what they can do and what they can't do. But you still have the people who say "well you can't paint about the sky". But then there are ways in which we can paint the sky, like Margaret took her granddaughter out to just out of town and we looked at the emu in the sky and it was that was the first time her daughter saw it and just making a lot of people aware, and that story, you know, is what we learnt. That story is not only unique to Western Australia, not unique to here, that happens to all indigenous people all over Australia, so we don't have sole ownership of that story. It belongs to all over Australia.*

*Same as the Seven Sisters. It's not something unique to Western Australia or this part of the world. So that was really interesting. Getting funds to do things was really a struggle. But Kathryn worked through that. We just had that really good support of Professor Steven Tingay, and ICRAR, Curtin University, Mid West Development Commission. So it was a bit of a struggle getting the people that*

*couldn't understand the importance of bringing the two cultures together to tell a story, they couldn't quite grasp that and what you would do with that. Yeh,*

Q: And the interaction and the field visit to the (ASKAP / MWA) site?

*It was hot, anyway. It was the hottest day in Summer. It was close to 50 degrees, when we went out there. It was really really hot and we stayed in a really old house and that is a whole set of different exhibition experiences away from the sky altogether. But um, everyone was quite anxious on how we were going to interact and how we were going to connect with the astronomers but the good thing was people like talking about the sky and just like looking at the stars. So the connection there was when the sun came down, people had lots to talk about. When we went out to the actual site at Boolardy and spoke to the scientist and talked about how they were going to capture sound waves to get images from what's happening in space. People were thinking, ohh... This is really something mind boggling. It's just really quite easier to think of our stories and our perspective on what happens with the sky. All this other stuff, well maybe that could stay over there. That was what we were thinking. But you know, then some of the artist that didn't come to Boolardy, they heard these stories, and that generated something in them, the younger ones and then, they went and painted about their interpretation of this story of the sound waves being captured, or just the sound waves, and it's quite a beautiful painting, I'll show you one of them later.*

*Out there... The sharing of stories like from a western perspective. Most of us didn't even think about, you know, the hunter being upside down in the, you know, it's made for the northern hemisphere, not for the southern hemisphere. So that was really quite strong, that came across. ...Some of the artist wanted to paint about different things. Barbara wanted to paint about, she just got right into Orion and Lupus and all these other things.*

*Doing checks on the internet, thinking what's this about, reading more stories. People were finding videos about astronomy. We had about 12 people sitting in my lounge room one night, just looking at this video on the universe, the sky and the planets, so it just opened a whole wide world of different discussions, and looking at the night sky.*

*You spoke to Olive (Boddington) today. She couldn't see through the telescopes, but she was listening to what was going on around it and she went away and produced a really beautiful photo (painting) about Saturn, and about what she thought the way the ring was, and the backdrop of the Milky Way*

*So, people who didn't look through telescopes, listened and engaged in that way. But some of the artists who looked through the telescopes were just so amazed that the colours that we see in the sky, with our naked eye, and then you look through the telescope, and you can see green, pink and blue. People couldn't believe it you know. There was just like this explosion of ah.. there is this jewellery*

*box out there, and we were getting paintings of the jewellery boxes, and all sorts of things, and that collaboration was really good.*

*Sharing of the stories with the Seven Sisters and the Emu in the sky, they were the main two focuses. But from that has flowed on a couple of other projects. We've had other projects in town, working on one with public art at the moment, still in its infancy stage, working through that. One of Barbara's paintings on the Seven Sisters was made into textiles and went into a fashion show with a fashion label in Perth and that was on the catwalk in London and Paris and Melbourne so there's been a flow on with lots of things then, yeh.*

Q: And you hopes for the future (in relation to *Ilgarijiri*)?

*...In regards to this project, because it is a really strong project. I think we have only just scraped the surface, like, you see that iceberg and all the rest of it underwater. I think we have only just scraped the surface of it, we've been able to get five exhibitions from the project branching off into different things but we still want people to paint and maybe leap from the sky to the ground, or to the land, and talk more about the stories, practices and the beliefs that come with linking the two together and people are starting to see now and starting to think about that a lot more and starting to say, yeh, we've got a right to tell our story, and yes this is important, people do want to see our cultural perspective on stuff. So there is still a lot to go and I think we could move the project further into the future and that's what we are hoping to do from Yamaji Art, anyway... yeh.*

The following interviews with the Mullewa Artists were conducted in a group setting at Marra Arts, Mullewa, on 23 August 2011. Interviews were held with Wendy Jackamarra, Christine Collard, Barbara Comeagain, Susan Merry and Debra Maher.



Figure 110. The Mullewa Artists.

(Photo: John Goldsmith)

### 13.1.6 Wendy Jackamarra



Figure 111. Wendy Jackamarra.  
(Photo: John Goldsmith)

Q: (Introductions)

*I'm Wendy Jackamarra. My mum comes from Mullewa. My Dad comes from Moora. I'm the coordinator of our art group.*

*It was a good experience to go to Boolardy, and to see all the different things in the sky... ...learnt how to paint, do all the sky stories, you know, from our elders.*

Q: What can you remember of the experience of meeting the astronomers out at Boolardy Station?

*It was very hot, it was good. Been out all day, don't have to go back by the camp fire, and sit and Steve (Tingay) showed us with his laser, pointed all the different things in the sky to us, things that we didn't know were there.*

Q: Why was the Jewellery Box so popular?

*I don't know, I think it's just all those different colours that you can see, yeh, we didn't think it was up there, all those colours.*

### 13.1.7 Christine Collard



Figure 112. Christine Collard.

(Photo: John Goldsmith)

Q: (Introductions)

*My name is Christine Collard. My father from Brookton, he's a Noongar and my mother is a Ray Papertalk which is from Mullewa area, She's a Yamatji woman.*

Q: Can you tell us about the beginnings of Marra Arts (art centre at Mullewa)?

*We were a working group, our aim was to have a place that we could call our own. It took us say three years of meeting together and getting organised, and getting incorporated. That was our entry to getting the funding, to actually opening our own centre. So, along with the Shire and the CDEP, we came up with a Shared Responsibility Agreement (SRA). So that helped us get into here and the money that we put in for, we were successful to renovate and bring this up to the standard that we are here now in this building, creating our art... So its inspired us all. We're really driven. It's driven us. We're just emerging now, so a lot of our art we paint with passion, and it comes from our heart and we all practically grew up here in Mullewa. So there are stories that we have and connection that we paint and, like from the sky. Like myself, personally I was told by an Elder, that my grandmother, which I didn't meet, her totum was the emu in the sky. So, you know, a lot of us do have connection and we do have stories, so we paint those stories and like I said it's from our heart. So um, yeh, I've*



*always had a passion for art. Since I was at school. And a lot of women are naturally talented, once they get into it, it's there, it just comes out.*

*Most of my artwork relates to the Seven Sisters, which I call the seven jijas. I did one with the Seven Sisters reflecting over Yamatji Country onto the Greenough River and that was a big lift for me, 'cos once I sold it and now it's actually, you know, they are using it as a logo on the government vehicles over in Adelaide and the station area. Not only myself but all the women, like, our artwork goes overseas, it goes all over Australia. So, I think the sky ones has really lifted and, you know, more noticed now, and more requests on the sky ones. The other work, they will buy it but you don't get commissioned, and like the ones that we are doing for the sky (i.e. Ilgarjiri), this is the second show, that's requested. This is the one that is really making us recognised.*

Q: What gave you the idea about the Seven Sisters reflection?

*I'm very creative within myself, I just like the idea of the reflecting off the water, and over our country over our land, so, yeh.*

Q: Do you see a connection between the colours chosen in the exhibition artworks and those of the country (e.g. wildflowers) and the colours of the stars (e.g. Jewel Box cluster)?

*We create our own colour. We mix, do a lot of experimenting with colour and our colour choice, you look at it, it is really so much like our country, like the wildflowers, as you say, so like Wendy she does a lot of beautiful colours. Debra does... and Auntie Barb and Sue. We do a lot of experimenting with our colours, it would say that it is related to our land and what's on it.*

Q: When you saw the Jewel Box cluster with the telescope...?

*I didn't get to see (the jewel box) cluster.*

Q: Would you like to see it?

*I'd love to see the jewel box cluster.*

Q: (Continued)

*...probably because in the exhibition, you would have saw that what caught most artist's eye, so Wendy's eye was caught by the Jewel Box, Sue was the emu, Auntie Barb, what one did you paint for the exhibition?... (Barbara Comeagain: ... meteorites). ...You hear a lot of stories about the night sky, you know, the Emu in the sky. You know it's the Emu season, you know, for emu eggs and you can relate to a lot of things, I remember, Seven Jijas (Seven Sisters), like Auntie Charmaine Green's Mum*

*used to tell a story of the Seven Jija's, that sort of stuck in my head, so you know, there's things that you get told as you are growing up and then you think I'd like to paint that, you know. You just paint what you hear and what you see, so it is probably just a lot of that coming out.*

Q: What is the meaning of the Seven Jijas?

*Jijas means sisters*

Q: and emu egg collecting?

*...Bush tucker... different seasons you get different types of food, bush tucker food, like even the sun, They call the sun "Ngarungu", that's when you get a lot of gum,(Bimbarr) off the tree, so you can work from the seasons, for your food, like your real wild bush food.*

Q: Did the topic of using the stars to tell the time come up in the exhibition?

*I know that it was used for time because my old Pop used to tell us different things about the sun and the moon and that so, but that never came up as a thought to use and interpret in our art, but it is something that we should consider.*

Q: What would you like people to learn and appreciate from the exhibition?

*With us painting, as I said earlier, its telling our story, but we interpret through art and we are using a lot of our language from this area, so we are more or less promoting it, so that people can understand. Yeh, we are really inspired and overwhelmed of us individual artists emerging, you know, so we are getting more recognisable, more notice, we are more out there, like with Marra (Art Centre). They are really supporting us, and helping us get more notice, not only in Australia, it's actually going international, so we are very proud of them and proud of ourselves, and we also help each other if we get confused in one area. We look at each other for support and we get that, so we appreciate each other, we don't knock each other's artwork, we are actually happy for each other and the success of ourselves and what we are becoming*

Q: How often do you get to see the night sky out here (in Mullewa)?

*We see it all the time, only when it's not cloudy. Mainly summer time. Summer time is the best time. We all sit around the campfire. Like Sue said, have a yarn. You tell your kids the stories, all what's up there in the sky. They get very interested in it too. Yes, so we love that, love sitting outside, we're outside people.*

*...Count the satellites, who can get (count) the most satellites....*

Q: Sitting around a camp fire at night is such a good time of the day... and then the stories start happening as well...

*There is therapy within yourself but for others too. You don't realise that, but it is good therapy. Sitting around the campfire, yarning. Everything comes into that place, like bonding and all that,*

Q: Is there anything else you would like to share about the exhibition (particularly the US Washington exhibition)

*For the America exhibition, in America, I'm very pleased to know that we are going international again and, America, you know, you hear a lot about America. Didn't think your heart would ever make it there, is another thing. I'm just so happy and thankful to Auntie Charmaine. She's our big inspiration. She just inspired us all and the support she has given us all. Alison who's actually taking the artwork over there. Unfortunately none of us are going to go on the plane, because we have a fear of flying, but we are just so happy and overwhelmed that it's (the exhibition) going over there.*

Q: Do you have any special message for the US (Washington) *Ilgarijiri* exhibition?

*We'd just like to say, hello from all the Yamaji (means Aboriginal), Naru (means Women) which are us, the women of Mullewa. We'd like to welcome and acknowledge all the past and present elders that are in Alison's country. We hope you all enjoy the exhibition that we are now going to produce to you. Thankyou.*

### 13.1.8 Barbara Comeagain



Figure 113. Barbara Comeagain.  
(Photo: John Goldsmith)

Q: (Introductions)

*I'm Barbara Comeagain. I came from down from south and my mother comes from Derby. I've been here since I've been 12. I've always been interested in the painting, since I was a kid.*

Q: Can you tell us about your involvement in the *Ilgarijiri* exhibition?

*We went to Boolardy, and I sold a painting... Boolardy (Station), so it was interesting going out there.*

Q: What gave you the idea to paint meteorites in your painting?

*I don't know. We had to do a sketch out there. It was the first thing that came to my mind.*

### 13.1.9 Susan Merry



Figure 114. Susan Merry.  
(Photo John Goldsmith)

Q: (Introductions)

*I'm Susan Merry. I was born and bred in the Murchison. When we went to with the scientists out to Boolardy, that was my home. Lived out there, used to travel out to Kelentine Mission school, then moved to Mullewa. I've been involved in painting for four years, a bit of art work. Been out there living, my mum was out there living and her partner was working on a station, mustering and doing ... fixing mills and things... on the station.*

*...The stars are called "wuondera". The emu is the "yellabidi". Every year, we look forward to emu eggs. So, we take the kids out emu egg hunting. So when we look into the sky we see that shape in the sky. We know that that is when they are laying ...starts forming...*

Q: That relates to emu egg collecting- bush tucker?

*Bush tucker, we take our granny's out and uncles.*

### 13.1.10 Debra Maher



Figure 115. Debra Maher.  
(Photo: John Goldsmith)

Q: (Introductions)

*My name is Debra Maher, I was born in Geraldton. Lived most of my life in Mullewa. I've been interested in painting since this centre opened.*

Q: When did you first begin to paint?

*About four years ago*

Q: Before the art centre (Marra Arts, Mullewa)?

*Nothing was happening, not like this now, everything is happening.*

### 13.1.11 Robin Boddington



Figure 116. Robin Boddington.

(Photo: John Goldsmith)

Interview with Robin Boddington at the CSIRO Office, Geraldton, on 22 August 2011.

Q: (Introductions)

*My name is Robin Boddington. I'm a Wajarri person, from the country from where the project is happening on the Boolardy site. My role is a liaison role, I liaise between the Wajarri Yamatji people of the country and CSIRO, contractors etc., and many other people that come into Geraldton, and working with the Indigenous Land Use Agreement. One of these is the naming project of the antennas, so I decided to go with like, to do with, because its scientific, with the moon, stars and sun, etc, the Milky Way. So there, the first antennas, the Milky Way, Moon and stars, are named in Wajarri language and also, we are going to use bird, old people's names and ... in the Murchison district, that's well received by the Wajarri people. They were all involved, a lot of them involved, still got another thirty antenna's to name plus many more. It's been really good with CSIRO and the Chinese people that work out there too. I do heritage out there too with the people. We also ...add an honour name of one elder, Ike Simpson. His dad's name is one of the road's Warrabundi. So he was an elder from Boolardy area, so Ike is one of the last elders left, so there was a road named in his honour.*

Q: So the first six antennas have been named?

*The first six were named, Wajarri names, and now discovering more names, now. So they'll name them as well.*

Q: Can you tell us about the names adopted so far, introduce the names to us?

*There's Wilara the Moon in Wajarri language, Bundara is the Stars. Biyarli is the Pink and Grey cockatoo and that's also one of our oldest Yamatji names as well, so two parts to that one, (elder and a bird) and Jirdilunga, Milky Way, so that's the Milky Way name and there's one called Balayi, Balayi Lookout, looking west, so they called it lookout Balayi. Diggiedumble was a hill top near table-top hill, so that's name of Diggiedumble, table tops where the rock fell down, so that's the name of one of the first antenna's was put there, so.*

*The Elders and the people from the area was really behind this process. We are also working on the Indigenous educational side of it. The Pia Wajarri kids, know all the galaxies, because Rob Hollows, our educational (officer) has been out there and they know all the galaxies, so we are doing an education package which soon should be put together by the end of November. So we got to trial it with the Pia kids first to see if it, go out to the Education Department...*

Q: Can you tell us about the Pia community, where it is and how big it is?

*Pia Wajarri is located 46 km south of Boolardy Station, 80 something km closer to project on site, about 30 people living on Pia. They have an office and school and housing. CSIRO have been working with them, they've got a sat. dish put up there, the first stage of the project (ILUA) land use agreement. The kids once a year go to site, to visit the site because it's in the ILUA. They look at the antenna's, do their educational side of it as well, so. Also Pia is involved, first started with ICRAR, they helped build those little..., I forgot what they are called..., they are on the ground, (MWA Low Frequency Dipole Antennas).*

*...Teddo Ryan and Len...worked in very hot weather, and put them up and Tim Simpson did some fencing for CSIRO, and Boolardy boundary, so they've been involved, Wajarri people in bits and pieces, and been involved in the project.*

Q: Could you tell us about the Murchison Astrofest event?

*...been working here with CSIRO and, to try to involve people that live on the land and new to the project. We have this idea of having astrofest, because people can't get to see the antennas, because at the moment it is site construction so no-one is allowed on site and so, the closest we could get is Murchison Shire to show them Astronomy and the antennas and getting people coming together who*



*are interested in science and astronomy, and so we sat on the committee, Priscilla and I, along with the Murchison Shire and Councillors, and we just put this together. So people can come out to the country and it was a good time as well, because it was wildflower season as well, so they had a bit of both, taste a bit of outback camping, stars, astronomy and different people all in that place at one time, so everyone was sort of happy. Must be something to do with the stars, I don't know.*

Q: Was this the first time for the Murchison Astrofest?

*We were aiming at 150, but we got 240. So we had great help around, the Councillors, the chef did it for free and we had volunteers that turned up and helped. So the place was really full you know. Aboriginal people were supposed to be involved. But there were two funerals, so that kept a few of our mob away. So but some did turn up and Greg also from Sydney, he's involved in Indigenous engagement.*

Q: So Murchison Astrofest could be a prospect for future years?

*They want one (an astrofest) every year. This one was a learning thing and next year will be bigger and better. Who knows where it could lead.*

Q: What was your impression of the views of the Milky Way out there?

*It's always clear out there in the bush, you know. You can always see a lot of stars. I enjoyed it. It was good to see different walks of people come together. I think, all different backgrounds, but something like this brings people together. Learning from everyone I think, you know, different levels where people are up to at it, information sharing. Some people haven't been in the bush, so I mean it brings the Shire to life, Murchison Shire. Because they are a quiet community... ..in itself, ...first of many more, I think.*

Q: and Geraldton Astronomy Group was involved in Astrofest?

*Yes, they did, and also we also had good sponsors, from Geraldton people, Department of Indigenous Affairs and so, it was really good, people helped out. We had also kids taking photos, so... Get them photos up, for next year's one...*

Q: Can you tell us about that, how did that idea come together?

*Because, like, we had some kids coming, and kids imagination is different to ours. We just wanted to see what they come up with. Give some sort of role to play. They were involved with that one, and they liked the, when you get on the different scales, they liked that... ..on other planets. (Scales simulating weight on different planets).*

*Did you see the film that Godfrey did? We took that to Banff (Alberta, Canada), for our bidding for Australia, so that was well received over there. People want to see that here now, so*

Q: And about the Banff presentation?

*Part of my role is liaison with my people. So Innovations Gerry Skinner rang me and asked me to set up people to make this movie and it all fitted well. Because we were having the naming ceremony, and I said right, you need to get out to country, take Elder Uncle Ross Boddington, and Godfrey and because I was getting some people to do dancing for the, so Uncle Ross did the practicing and with them, they had two or three practice runs and then they went out the day before and I just got the people ready for it and organised the accommodation at Wooleen (Station). I said he's the traditional owner from there, so you just ask what you need to know and Godfrey is educated, he knows the country, he knows the language. It just worked perfect. And people loved it over there.*

Q: and the response to the Banff video?

*Everybody just clapped and there was a few people crying, because they were touched about the way Godfrey spoke about his country. They were really moved by it and everyone wanted to know Godfrey the next day and get their photo taken with him. He was really well liked and also CSIRO has offered him work, if he wants to work with us, so looking for a cadetship, or something for him, and he wants to do astronomy.*

Q: ...and the Yamaji Art project and the field work on site. Could you tell us about your involvement in that project?

*...No, I've got no involvement in that because I came on board after that project.*

Q: Prior to your role?

*Yes, but I know the artists, and that, but from a woman's point of view, we can't talk about the stars and all that, I could give you the Aboriginal names. But I can't, because it's all related to men's law. Seven Sisters dreaming story and the Milky Way and the Emu, we could tell you that one, but I don't know how much the men could tell you. I can't speak for that...*

Q: Should some topics (i.e. for men/women) not be mixed? How can we try to learn or understand or appreciate more about this?

*I think the best way is to talk to the elders on what they are allowed to say, and just go with that, that's the only way. But I mean, some people today will talk today, but some won't, so because of the culture difference.*

Q: The role of elders is clearly of great importance on this subject?

*Everything I do, I talk to my Uncle first, or my husband who is a tribal man, so I won't say anything unless I'm allowed to. I just do my role as, liaison with the people, and if they were happy to share, that's up to them, but I won't because I'm, a tribal person, law person, but I will tell you what I can, and the cultural stuff.*

Q: The Things Belonging to the Sky exhibition; two of the main topics were the Seven Sisters and the emu, and there was a lot of diversity how these were expressed.

*It was lovely that art work...*

Q: Is there anything else you would like to add at this stage?

*I do heritage inductions. I do half an hour of those to all contractors, all visitors onsite, for 2 days. I do them. We are working on an Indigenous 2 day cultural heritage awareness package, that will all be on country, it won't be in my office, so it's a better way to go, to teach them and I think the, see this, first one was a bit like, we didn't have much aboriginal people, but the next one, and I mean, funerals are very important to our people, so they go there but the community was informed, and because, the other reason why they didn't come, is because, like with the Murchison's Shire and our people, there is a very bad history, like a dark history, so that will take a lot to work on, yeh. But slowly but surely, yeh. We got to work together, because neither of us are going to go away.*

Q: What is the purpose of the cultural heritage training?

*I do a cultural awareness heritage induction, I do that, as a small induction training, I cover the history of the Wajarri people...Understanding and stuff like that. Involvement into the project by the people. If you are out there, you stay on track and don't disturb. You don't pick up rocks. If you are a constructor, you are a digger, there's skeletal remains right throughout that country, where people were buried in the early days, so those briefings, bush medicine, grinding stones, I give them all that before they go out.*

*....and also working with the Murchison Shire, sitting on the first committee for Astrofest. I wanted "Welcome to Country" but because they don't do that, I said you need to do something, you must be the only people in Australia that don't do it. So, they did the acknowledgement. CSIRO acknowledges us in every way, but to hear the president of the Shire, acknowledge the Wajarri people, that's a start, so it grows you know. You got to do these things to help the relationship.*

*Thank you for coming out to see me. Thanks for coming out to country, that's even better. Thanks John.*

### 13.1.12 Dr Megan Argo



Figure 117. Dr Megan Argo.  
(Photo: John Goldsmith)

Interview with Dr Megan Argo at the International Centre for Radio Astronomy Research, Curtin University, held on 9 March 2011.

Q: Can you tell us about your role at ICRAR?

*So, I'm a radio astronomer, a postdoc, I've been here (at ICRAR) for three years. My job is basically to investigate widefield imaging with the VLBI array, so using large arrays of telescopes, to try to image large patches of the sky, which is not something that we're traditionally very good at, so a lot of my time has been spent doing that kind of work. At the moment we are trying to image M31...the Andromeda Galaxy, one of the nearest big galaxies in the Milky Way and trying to map an area basically the size of the full moon at milliarc second resolution, so it is going to be images that are sort of many gigapixels in size by the time we have finished, which is something that's very very foreign to VLBI astronomy.*

Q: So it sounds like extremely detailed imaging of a famous astronomy object, with the galaxy?

*It is, that's the idea, we picked M31 because it's such a famous, big target, it takes up an area of something like, its major axis is four degrees of the sky, so it is huge. The full moon is half a degree, that puts it in context. But a lot of the things we are actually seeing in the images are not part of the galaxy itself, because a lot of the things in the galaxy are sort of large structures that get resolved out when you look at them with the VLBI array, so what we are actually seeing is background quasars, so distant active galactic nuclei, AGN, lots of jets, that kind of thing, so we are actually seeing distant galaxies rather than more of the stuff of the local universe.*

Q: How does the radio image compare to visible light image?

*It depends upon what you are looking at, but the different parts of the spectrum tells you about different types of physics that are going on, so with optical you see light from stars but you see lots of dark dust lanes which is where you have got patches of dust that the light can't penetrate through. When you look with the radio waves, radio waves pass straight through all that dust and gas. So what you are actually doing is looking straight through the other parts of the galaxy that you can't see in the optical, so to try to get an understanding of the physics of what's going on in the universe, it's helpful to look at as many different wavelengths as you can, to try to get as much information as you can. And yeh, things with the radio, when you look at an optical picture with M31, you see big spiral arms, you see big dust lanes, but when you look in the radio and the infrared and the ultraviolet as well, what you actually see a ten kiloparsec ring of star formation around the central bulge of the galaxy. It shows up really really strongly in the radio at low resolution, not so much with the VLBI, but the low resolution and also the infrared and the ultraviolet where you've got all the young hot stars throwing out lots of ultraviolet emissions and the gas around them glowing in the infra-red as well.*

Q: So the dark dust lanes that are blocking the light from behind, in the radio image you are seeing right through it...

*We see completely through it, it's transparent at radio wavelengths, it's as if it's not there, at all.*

Q: Can you tell us about your role of public outreach?

*When I arrived at ICRAR, it didn't exist, so at the time, there was Curtin Institute for Radio Astronomy and the Astronomy Group at UWA and I became the outreach coordinator for the Curtin Group, which then became part of ICRAR, so I spent a lot of time doing schools outreach, and organising the presence for the open day every year, and the innovation display usually, as well as with the faculty stuff, responding to requests from the faculty, for various outreach events, and we've done triple s science fairs which we've participated in while they ran as well, and organising things like Astrofest, WA's biggest astronomy event during the International Year of Astronomy which brought 4000 people to Curtin for a whole day for astronomy events and talks, and observing as well, of course.*

Q: The other part of your work is the opportunity to travel to some of the remoter parts of WA and some of the Aboriginal communities.

*Outreach, we've done an awful lot within the city, because its close, and easy and you have a big audience there, but with the Murchison area, the candidate site for the Square Kilometre Array, it's important to go out and talk to the communities that are there, so that they understand what is happening, because if this big telescope ends up coming there, it's going to have an impact on the region. So the first trip I took up there was with Steven Tingay and Rob Hollow and Mary Mulcave from CSIRO, and it was part of the Wildflowers in the Sky project which was a CSIRO initiative, that provided a whole bunch of telescope in the region.... So Wildflowers in the Sky provided a whole bunch of schools in the region with their own telescope, they had 8 inch dobsonian telescopes that they could use to look at the sky with. Which is great, but part of the problem then is the turnover of teachers in the region is actually very very high, and certainly in the remote schools, a lot of teachers will go there once they have finished their training and spend the two years that they need to spend there, in order to get another job down in Perth, and then they will leave, so you take these telescopes into the schools and train the teachers how to use them, you come back two years later and the teachers have gone, the telescope is sitting on the cupboard accumulating dust, because nobody knows how to use it any more. So it's important in a lot of ways to actually keep going back to the region, and keep re-training the teachers, and keep doing the teachers PD (professional development), so that the equipment keeps getting used, so we have done some of that and we've visited quite a lot of schools in the region, including the remote schools such as the remote school Pia Wajarri which is the closest one to Boolardy Station, where ASKAP is currently under construction. So we've done quite a few visits to Pia Wajarri actually, we've done viewing nights, we've done class room activities, we've done model solar systems, we've had kids running around the school yard, pretending to be planets and comets, crashing in to each other, we've done water rockets, and things like that as well, there's quite a variety of things that we've done in the region with the schools.*

Q: Is this the first time you have worked with Aboriginal students?

*Pretty much, yeh, so there are quite a few communities in the Murchison, so you have got some schools in places like Meekatharra, Cue, the population is part Aboriginal, and part white, I guess you'd say. But places like Pia Wajarri and some of the other communities like Yulga Jina, they are largely Aboriginal. So you've got the teachers who will be from Perth and most of the students, most of the community will be Aboriginal in nature. It's certainly interesting, dealing with the... because the cultures are different. Some of the attitudes and some of the ideas that they have are quite interesting, so..*

Q: Impressions and experiences working with the Indigenous students?

*The first thing that struck me, when we went up there the first time we went up there and did a viewing night is that the kids are far less inhibited than a lot of the city kids. A lot of the city kids, you get them in a group, and they'll sort of, peer pressure will get them a little bit, and they don't want to ask questions. But you go out a talk to the kids in the remote communities and they all want to climb on the telescope, and ask you all sorts of questions...and some of the question they ask you, are completely... you get used to it, dealing with school groups in the city, you get the same questions over and over again "What happens if you fall into a black hole?", "Why is Pluto not a planet?","...But you go and talk to Aboriginal kids, and they have completely different sets of questions, which is really...Its challenging but its good. It makes a change to be asked something new.*

Q: Your impressions of being in the outback?

*Very very different. So I'm from Cheshire in north west England, which is very very green, and very very wet, but it does have some similarities with the outback in that it is also very flat. So the first time I went up there, the first thing that struck me was just how flat and big the region is. The other thing that struck me is that there are no contrails in the sky. So in England, Cheshire is very close to Manchester airport. You've got London, several airports down there, you've got airports all over the place. In Europe the airspace is very very busy so there are always aeroplane trails in the sky. But you go up to the Murchison, and you might see one a day, kind of be looking in the right place at the right time. So that is quite different and it's, the vegetation is of course, completely different from what you would find in the UK. In the UK it's just all green, but here it's very red, and even the green has a red tinge to it. So hey, it's beautiful, but in a very different way to Cheshire.*

Q: It sounds like it's been a good experience

*Absolutely, I always love seeing new places. It's a pretty spectacular place. It's very very different.*

## Part II. Kimberley based Elders and artists

### 13.2.1 Jack Jugarie

A record of a discussion held on 11 August 1999, at Wolfe Creek Crater with Jack Jugarie, whilst pointing out two sky patterns, (“Mowan”, a man hunting the “Emu”), both of which comprise dark areas in the Milky Way. The transcript is a non-verbatim record, due to the discussion arising from several people.

(Non-verbatim)

*...He's long one, somewhere up here. He's got no spear, long one, he's standing up, he's watching with that emu right now... ...that “Mowan” he should be up there somewhere, he's behind, (in north eastern sky, near Delphinus). ...That's the one now,... that's the man, he's watching that emu there, that emu on the front now, According to old people, you know, that's the old emu up front, You can see the man standing up, show up when that thing go down a bit more.... he's up here somewhere.*



Figure 118. Jack Jugarie.  
(Photo: John Goldsmith)

The following is a non-verbatim record of a story recounted by Jack Jugarie in Halls Creek, 10 August 1999. It is a story told to teach young people who they are permitted to marry, according to the right “skin” grouping, and the story invokes the moon.

*The moon (a single man) wanted to marry his cousin sister. A woman, who was a real bully, spoke up...Which one (i.e. young female), Who do you want? This one?... This one?... and the moon answered “No...no...”. She goes to another mob. Which one do you want to marry? This one?... This one? and the moon answers again “No...no...”. The woman goes to the last one. This one? The moon answers Yes. The moon broke the law and married his cousin sister.*



Presumably, the story continues, as this version did not describe what consequences occurred as a result of breaking the law and marrying his “cousin sister”. Another non-verbatim account from Jack Jugarie is provided below.

*A desert lizard went very close to a tree, and sung. (A pleasant but fairly short melody is sung). The lizard then went to another tree and sung again. (The same melody is sung). He then went to another large tree and sung. (The same melody is sung). This time, the tree fell on him, and he wasn't quick enough to get out the way. This is how the lizard got the black mark on his chest.*

Interview with Jack Jugarie on the western wall of Wolfe Creek Crater, 10 August 1999.

Q: So Jack, could you tell us the Aboriginal name of the crater?

*This place where we are here now, in this Wolfe Creek Crater, we call this place name Murring, that's the name of this Wolfe Creek Crater, Murring, that's it.*

Q: Could you tell us one of the stories about the crater, how do you think the crater came here?

*Well, this thing been fall, well, the Blackfellas reckon in the early days, the first mob, you know, they never saw any white people, or anyone, they only know their own colour, you know, like us. They reckon, star, second star from the big one, you know, been fall. Well we call him wada, that star. Wada it been fall in this ground and it makes big noise and shakes this country and... made a round, what's a name, rim right round, and he made a hole... there, and in the centre, down there, it's a hole there, no water stay in there. Doesn't matter how much rain can be here, the water don't stay here in the middle, it goes in the hole, and come out through down there, where we came, inside.*

Q: So you're talking about the sinkholes (soakwaters), can you tell us about that?

*Yeh, sink holes, right in the middle. Well, when this thing been fall, in those days, and it made a great big hole, and right in the centre it made another big hole. And I think that powerful that thing been fall inside, when it hit the ground, that half a piece would go inside, see, and made a big hole inside there and the water don't stay there; it go down the creek, from a little hole, you know, make 'im bigger and bigger, every rain come bigger and bigger inside,... hole. Water don't stay there,... that big rain...water don't stay, it go inside, go down to the river. Inside now...*

Q: Where did you hear that story from?

*From my old grandfather told me, yeh, Father Mike, yeh, from those one, and they got the word from their father (Grandfather Mike, and grandmother), from their father, and that father with them, he told by his father again, all the way like that, that word from the beginning, come little by little it come right*

*up big, right up to us fella..., I don't know from how many years, how long Blackfella been living here?  
From that time, that story.*

*One day..., this is the story I want to tell you. One day whitefella came in with the horses to find out how many Blackfellas you know, if they can know white people. They didn't come for fighting, they tried to quiet them down, people, you know. We got plenty tucker, but they didn't know English. This side, people talk Jaru. That side (i.e. south west of crater), Walmajarri. This side (i.e. west of crater), Buniba and Guniyan. That away (i.e. north of crater), Lunga and Gidja. And... people, that away. This way (i.e. east of crater), Gorinji, Mulgan and Wilburra. And this way (i.e. west of crater), Wilburra, Walmajarri, Jaru. At one place here, we have... four languages, we all mix here, Gidja, Walmajarri, Jaru and Lunga in Halls Creek, we here, Blackfella. That's the way... ...But we didn't know what they were speaking like Japanese, Chinese, Malayan...all that mob... I don't know much about Gooniyani (people) down this way (i.e. southwest of the crater)... He might be swearing at me. I don't know. We only speak one place Gidja and Jaru and Walmajarri... ...three languages, here, for this place, Goorinji (east of the crater), Lunga (north), Gooniyani (west) and that side Yilbarn and Walmajarri that away (south west) old people language right around us... Jaru and Gidja right here (at Wolfe Creek).*

Q: Could you tell me about the stars at night, and shooting stars? What names do you have for the stars at night?

*Wada. Each one moves because the other one wants to come in there, it gives him room to move, but what they reckon in the old days, that big star, (second to the moon), it was rising up in the afternoon, you know, the first one. They see 'im, you know. What's this fire coming up?, they reckon the Blackfella, early days, that's a fire, we'll watch him, like a bush fire. ...and keep watching him and it came out now, there is a big star, now see, that's the first one, come up a little bit up here now, and then they see another bright coming behind him, that's the moon, Ohh, that's we call glinda, yalgarn, you know, yalgarn, that moon we call yalgarn, yalgarn coming up behind him, that wada.... That wada been go up here a little bit here, and next time that moon, that yalgarn, coming very close to him, and blackfella reckon in early days, that moon been too hot for him, that's why him make him that thing lost and fall here, that that story from old people. That thing that come out and fall in the ground here. That moon was very hot...with that star, that's a star no more little one, like this round now (i.e. the crater) (that sort of star), he didn't want that moon to come closer, so he give him some room and he slip and fall here.. And big bright light came down, very quick, when him hit this ground,... when he hit this one, according to old people, you know, early days mob, wild people, they never seen gardia people, that's the mob...yeh. They reckon that noise went off, when it blew up, I tell you, that light that flash everywhere, you know, do you reckon Blackfella would wait here? They would go with their bloody lives and never come back again! he he (laugh)...later on, maybe two years down, they been come to look, what been happen here, Ahhhh, and old Blackfella reckons, you know what? That wada ... that wada, that first one, that morning star, second one that's morning star, the first one, that's the one that's been fall, nothing there with him, might be more to come along, later on in the morning,*

*...that thing been fall here, he coming out, that morning star, but it wasn't that a one, but the first one, the evening star (second to the evening star) that's the one that fall, that wada, we call it, that... wada...".*

Q: Can you tell us the name of a shooting star?

*... that's the wada that we call,... that wada, "coredibudy wundigum windigum wundigum burrum wundiar...". That means; He start off with the light and fall in the ground,...Blackfella says like that ...that means, English way, "that thing been fall that light that star in this hole,.. Kandimalal, that the Blackfella name of this place...*

Q: Jack, you mentioned the name of when a big shooting star is seen, and it makes a noise, can you tell us about that?

*"Coolungmurru". That the name of that (star) when he hit the ground. When the star, when he move, that's the one I'll tell you, that star been move, and he made a big light, you know, when he run, on the top, and the light go off, and they listen now,- keep quiet everyone, we listen for the Coolungmurru now, listen for a while, and when he hits the ground, he shakes this country,... and that's it, that's the Coolungmurru. That's a wada... a star been fall, we call him Coolungmurru, that a one, shooting star.*

Q: Do you hear the sound at the same time as the shooting star is seen?

*No, shooting star first, when he finished with the light, but listen for the sound now, everyone quiet, they shake the country, that's it, its fallen to the ground, like that. It's the Coolungmurru we call it, shooting star.*

Q: When you see the meteor and then hear the sound, how long does it take before the sound is heard?

*The light starts when the star moves, they see that wada run with the light,... well as soon as you're quiet there, you listen for the noise now and he fall... that's all,... seen with the light, right across, and... listen for sound when he falls. That's the Coollungmurru we call it, that sound.*

Q: So the shooting star happens first, and then the sound?

*No, sound goes after the light (of the meteor) go off.*

Q: How long after the meteor can you hear the sound is heard? Is it like half an hour or an hour or a couple of minutes?

*No, that's too far. As soon as the light starts off, when the star move, and he go off the lights, and he fall now, and you just listen, maybe five or ten minutes, you can hear him, ground shake,... in the ground.*

Q: So the sound can happen maybe five minutes...

*Something like that, makes the ground shake, you know, big star been fall, we call it wada, big star move and he fall, land there ...fall in the ground, moon, might be too big?*

Q: When you see a very bright meteor, how far in the sky can it travel?

*Well it might move from there or from this way, or from right across that away, from there it starts, shooting star, up there, finish the light, you know, and then we listen for the sound now, that's all. We used to listen for that one. Maybe 5 or 10 minutes, maybe something like that, but very quick he come down, you know, ah you can hear him, the ground shake, that's it, he's down on the ground. I don't know where, I can hear him now this time...*

Q: When you hear the ground shake, what is that like, can you show us?

*Yeh,*

Q: How big, what is it like?

(Jack demonstrated the movement by a slight shaking of a rock that he has picked up from the ground).

*He don't shake very hard. Sort of, you can see him, sort of, you in the top here like this (land) and when the star fall, and it sort, that land, sort of like that (vibration), see. You don't move very fast, this mob, this land, this one small,.. like that.*

Q: So when you feel the earth that moves...

*Yeh, we can feel it.*

Q: Just a little shake?

*Yeh, a little shake. I don't know about big one, great big one when he falls, I don't know about this one (Jack points to Wolfe Creek Crater)... formed that time, this thing been formed. I don't know how many years this one (i.e. Wolfe Creek Crater). This is the biggest star in the Kimberley. This thing been fall. Big one out of the mob, like. I don't know about other places, might be more bigger than this, in America they reckon?...*

Q: (Jack Jugarie to John Goldsmith) “You been hearing many star fall in other countries?”

John Goldsmith: *“There are some craters in other countries. Arizona, there is a similar crater in Arizona in America” (JG).*

Q: (Jack Jugarie), “How big? Like this one?” (pointing to Wolfe Creek Crater).

John Goldsmith: *Similar in size.*

Q: Jack Jugarie: “Ah, smaller in size, this one more bigger”.

John Goldsmith: *About the same size.*

Q: (Jack Jugarie continues)

*In those days, when country been new, because not many Blackfella been walking around that time, that thing been happen, this part here (i.e. when the crater formed). Not many blackfella in here...all round, everywhere, they used to live in the hill, Blackfellas frightened of whitemen (laugh). They didn't know, you know, when they see white people come up, to talk to Blackfella to make 'im friend, you know. And the Blackfella and he go shit at looking at you. Who is this fella going to come, what this?, what him?, he talk to another Blackfella. Whiteman been come in early days, you know, prospectors (looking for gold), one old fella whitefella he came to a place called “poperty” he come with a bag and a swag. And look like that, heh...That's the devil coming! You reckon the devil is white too? ... very quick and off, up to Turkey Creek and off to big high hills, big fright, till one day, young people, been grew up,.. one young fella we see 'im this one, I don't think he's the devil, maybe he's like a man like we. Maybe go and have a yarn with him. Blackfella didn't know English much. He talk this way (i.e. using gestures). Kardia, Whitefella... “You wantum this one? (i.e. do you want something to eat?). Yeh, Mungari, Yeh yeh Mungari. So he give him a bit of damper, all the prospectors, in the early days, give 'em damper, ...Mungari, what this one, ...pressed meat (corned beef) that's “corru”.... Well you want it, Yeh!.... well, from that time one Blackfella been teach about kardia, they learn 'im everyone, they know today all the kardia together, that from been starting.... make 'em understand Blackfella taken law from white people... They didn't know your colour. They reckon, there's the devil coming!... That's the story from the old people been telling me, and I've been thinking about what have they been frightened about, it might have been a good thing.... Munju, tobacco, you know,...that wild tobacco plenty in the bush, too, you know. They dry it out, let them get dry, they boil them up and put them in the ashes, make 'im more strong, that's the wild tobacco. What about this one, I been showing him, kardia tobacco. Old kardia been come along, “You see this one?”, “What you call this?” That young lad, they know white people a little bit too, grew up with white people some of them, “hey that kardia he bring munju (tobacco), yeh!”. Kardia, he would say, “Old Man, yeh, that munju, he knows what he's asking,... get the tobacco...the black one, and he chew 'im up, Blackfella get him that one, chew*

*him up and put 'im in the ashes,... mix with the ashes, tobacco, that's why Blackfella don't go without tobacco now... They used to bring in gold and give it to... here to buy some more tucker. They got money and everything, but they didn't know what that was, they reckon it was, just paper.*

Q: When Blackfella's first came to (Wolfe Creek) crater, what was their reaction?

*When they first came up, this one was flat country,...this one you know, like that country there, but he been higher, like ridges country, you know. Flat. Well, Blackfella don't stop around the high country, you know, they got to stop in the river side, where the water is, see. They reckon, they been camping down that place, that Murring, near Wolfe Creek Crater, called Murring, there's a big camp there, and when this thing been fall, this one (i.e. the crater), big wada (i.e. star) been coming, which way,... never saw, but him come down, and it made the light on top, that light, behind him, spark, but already hit the ground. Well, they were listening now, what thing been listening, when he hit the ground, that sound from what star been fall, we call Coolungmurru, he shakes the country, this one,... they said ohh, look at this ground maybe shake,... what been fall there? they can see big dust. Blackfella come from there, heh, you look round, red ground, red rock, no spinifex, look,... very frightened too, look from the top (i.e. of the crater), that side... great big hole. Everyone came in, all the Blackfella been come in, and have a look at this hole here, and they said, "What we call this country name this wada where been fall, that star?" Well, we'll call him, this hole, name is "Kandimalal", this one now, that's the wada, Kandimalal, name from Blackfella, this one, that shooting star.*

Q: When the first people came here, were they surprised?

*...I don't know what been happen.... They talk language...we got no water in this country. Water be laying there in the centre, there, where it's been keep raining, he made little by little hole, gone down. Water go inside, he don't stay inside,... Comes out down there (pointing towards Sturt Creek). Water don't live there, great big hole inside there, right down to the creek, like a pipe, down to the creek.*

Interview with Jack Jugarie, in the centre of Wolfe Creek Crater, (adjacent to one of the soakwaters), 10 August 1999.

Q: You mentioned the story about the sink holes, can you tell us about that story?

*This is the water, well sometime, when you get plenty mud, block that little bit of hole, when one great big hole inside there, he go right down the creek there, underneath this hill here, in the Wolfe Creek Crater, inside of it, he comes out there. But he might be a little blocked up with the mud inside and little bit of water staying here, where the birds can get him, or the kangaroo's, but most water down the river, but water living here, because this is a little bit a hollow place, where the water lives, this water to lay here, and that's why the water is right here now. That's it.*

Q: Can you tell us about the story about the crater sinkholes and the “tunnel”?

*That old fella before, he was mucking around with the hole, could be one of these (sinkholes in the centre of the crater). That's the story according from old people. And he couldn't find the water, must have been real clean in that time, no trees about this, that's the old days, you know. He went down this hole, and couldn't find the water. He went further down a little bit he went down see right through, clear inside, and he told his mate... “Hey mate, I'll have to take a walk, inside this hole here, I have to go get that river there, that's where the water is going down”. Anyway, he went inside the hole and that bloke he wait, I don't know for how many hours, waiting for him in the river now and he hear him coming out of the hole and he couldn't believe that. That's a story from the old people, that's it, and now today its blocked up and that's why the water lay here, see.*

Q: Do you think this really happen? Is it a story?

*No, that thing been happened before, according to old people, been telling me, I don't know whether they been telling me a lie or what, the story you know, might be a story, anyway, that's the story, been made up, with this old fella. He couldn't find the water, that's why he went down the road, and followed the wet ground,... That's that story, that's the Dreamtime Story, I think. He might have been mean to me. Dreamtime story. Because you can't go down this hole and you go inside, you'll die inside...*

Q: Jack, there's a lot of insects and butterflies that use this area, can you tell us about them?

*Butterfly this mob. When you see 'em, butterflies, and that hornet he flying around here. He tells you where the water is. Flying around with his body, right around, he tells you where the water is. He green colour that hornet, he tell you, and follow him, you follow that one, he go straight into that soak water, you can see a big mob of butterfly now from this soak water, ohh, there's water there all right, that thing don't tell you no lie, that hornet, he belong to this spring country, that's true.*

Q: So all sorts of insects come here?

*Flies and everything go into this water. Well you go down and kangaroo might come along and make the soakwater enough for him, butterflies and everything come down again here, because water, their getting all that mud, build up nests, them hornet. That's all you do. Bird finally get a little bit of water there, it's alright for bird,... but some birds don't dig holes, go out to the big river there, fly over this crater.*

Q: And Jack, in the water, you have made some sticks where the birds come and drink.

*...That's why I put that stick there, where the bird can have a drink there, might be too far to go over that crater and go down the river, so I had to put the stick across the water, there, little water, enough for bird to get a drink there, and that is why the stick is right here, where the birds will get a drink there,... and when we leave this water, the bird will come along and sit on this tree and drink water...That's why I put the stick there, for the little birds to have a drink.*

The following is an account of a comet witnessed by Jack Jugarie, when he was a small boy, when he was at Wave Hill Station, east of Wolfe Creek Crater. The following is a non-verbatim record of the discussions, held at Wolfe Creek Crater, 10-11 August 1999.

*What's that thing with a tail on it? Could be a comet? A star with a tail on...I've been watching every night... What's that star with a tail on it? Look at that star, it's got a tail. I've been watching every night. It's there in the evening, (Jack points to the part of the sky, which is due south about 20° above the horizon, very close to the South Celestial Pole). It's got a short tail, pointing down to the left (i.e. east). Everyone saw it, the small comet. White people said that if the star with the tail on it touched the Earth, it would "burn the country" (Jack said he found this frightening). The star with the tail on it was visible in the dry season, before the start of World War II. The first one; the big one (comet?), we never saw. The first mob saw that (i.e. Jack's ancestors). A long tail, like a rainbow, a curved tail, not straight. The old people saw it after the Sun went down (i.e. in the evening). The tail was like a spark from sharpening an axe, stretching across at least one third of the sky. Small comet, might get big. If it does, this country will be burnt to pieces. From when there were wild people, before Blackfella met white people, according to old people. They didn't know anyone with white colour, they thought they were devils. The big comet from the south, like a rainbow colour, real blue clean bright light. One night in the south, the next night higher, the next night it moved further, the next night toward the north. Need to be careful about it, the tail stretching across the sky, the comet moved slowly, not like a marril (shooting star). The tail, all in a line, like a spark which was blue; the big one mother or father of the small comet. This story came from blackfella, from old people. One day when you get old, you might see it again. Missionary; You got to come along to listen to the word (to church), about the "comet" we never saw this one; maybe one day; no good. Want to be careful, come and listen to the word. You belong to this ground, he (God) made this world.*

I asked Jack Jugarie whether he had ever seen the Sun become dark during the day. Jack Jugarie provided the following account (non-verbatim record).

*Ah yes,.. One time, Sun rising, coming to get dark, the Sun stopped for a while- Sun moving, and then the Sun became bright again. It was not really dark, just like a shade, for about two hours. The Sun had gone into the shade and came out, and make you warm again....We seen that one. About two years after World War II, after the small star with a tail from the south.*



Night interview at Caranya Station, 9 August 1999. This interview was conducted at night, under a clear sky. I pointed out specific objects in the night sky, such as the Magellanic Clouds, whilst discussing different features of the night sky with Jack Jugarie (verbatim record).

Q: So Jack, there are two whitish patches in the sky (pointing to the Large and Small Magellanic Clouds)

*That white one in the south... Down south this way,... like a bit of a smoke, round, another one down below...and this one....*

Q: Do you know those ones? (referring to the Large and Small Magellanic Cloud)

*That's a "torrel wada", sometimes you say "mukin wada".... But that like a Milky Way, inside that white one, that's the one, when anybody gets hurt, that thing drops down and drinks all the blood of that man, dead man, and makes him wake up and he come good, but, maybe one day, or maybe three days, then he dies. Little smokey thing (Small Magellanic Cloud)... this way, law, that's the one that drink all the blood out of the man, that's according to Blackfella law. ...Whiteman, that's the Milky Way,... always been like a smoke, one side, that's the fella that drink all the blood... When anyone gets killed, drinks all the blood, that's what the man did do... Take him all the blood out. That thing different one over there, he come out light, but that fella's drink all the blood,...*

Q: I remember you told me that story last year... (referring to our discussion at the front of Poinciana Roadhouse, in May 1998).

*I teach you ...If you want to go over and over, you'll get that word properly. I teach you more yet. That thing is a bad thing, that a one, that Milky Way law... That one like a smoke, one side of him, one in the top... another one in the bottom. You can't see him much, just a little bit.... Down south.*

The following record is based on field notes taken during discussions that took place over several days with Jack Jugarie, in August 1999, at Wolfe Creek Crater. It is a non-verbatim collated record, which described the Small Magellanic Cloud and its connection with murder.

*Two men go out (supposedly) on a kangaroo hunt, with spears. During the hunt, away from the others, one man spears the other and kills him (spears him in the side of the stomach). A bit of blood is placed on the (fatal) injury, and the person comes back to life. A piece of hair which is taken from the top of head of the murdered person is touched on the open cut on the elbow (left arm?) The speared man is dead. The Small Magellanic Cloud comes down, like a misty (smoky) cloud over the dead body. Blood is taken out of the dead body. He then comes back to life (wakes up), two days later he dies.*

*When someone is murdered, the (Small Magellanic Cloud) will take the blood out of the murdered person. The (Small Magellanic Cloud) is like smoke. It is bad. It will take the blood of the person who*

*was murdered. This one can get you quicker. The (SMC) will come down (to the person who was killed). "On the bottom". The (Large Magellanic Cloud), he is like a man, he does not do anything to you (i.e. anything bad to you). The (LMC) says "look out for the little one (SMC), no, don't do that, the (LMC) tries to help the murdered man". "On the top".*

*A little bit of hair is taken from the person who was murdered (hair taken from the very top of the head)... hair belt. Police get a man from a fingerprint, Blackfella cuts a little bit of hair from the dead person- this is used to identify the guilty person (the murderer). This always works, it never goes wrong, to find the person. The Blackfella way is faster than the Police way with fingerprints. The murderer tries to get away. A little bit of hair taken from the top of the head.*

*The spirit makes this noise,...Mmm, Mmm, Mmm. After two days, the man becomes sick in the camp. He feels hot and goes down to the water to cool down. Don't say anything. (Those people who know the identity of the murderer now sit back and watch, not letting on to the murderer, who is now identified, they watch as the person become ill). Then he dies. His family buries him. No fight, no argument, all clear. The body is wrapped up and placed in a tree (on a platform?- bowshed), maybe about 2 metres high. They must be positioned so that they are facing west (i.e. where the sun sets). On the third day, people may approach the body to see the spirit. They sneak up very quietly- no noise- you got to be very careful, noise will frighten the spirit. Two people approach, from downwind (the spirit can sense you from your smell). Two men go first, one in front of the other, crouching down, quiet, sneaking up, with grass over the face, the other person must wait. Slowly slowly. See, there, you can see the man (the spirit), sitting next to the dead body, he looks as real as you are. Peering intently to the spirit, (it's a long distance, 50 metres? to recognise the face). Is that him? (i.e. Have I recognised him?). Everyone waits, can you see him?, come closer, is that him?. Three men must see the spirit to recognise him. Take down the body- perhaps five old blokes. You cut up the body (put 'em in a bag) and put it in the fire, (while being upwind). The spirit of the dead man is in the fire. That fire burning in his spirit. The fire burning the guilty person. He dies. Since the guilty person has died, the matter is settled and there is no fighting amongst relations or mobs.*

*Another method instead of using the "hair belt" is to cut off the digit of the finger next to the thumb on the right hand of the murdered person. This method of finding a guilty person is still used today. The body is in the tree. A circle of rocks is placed around the tree, groups of rocks organised according to groups. On the third day, someone approaches from downwind. Two people approach, then one man moves closer very quietly. He can see a man sitting up next to the dead body. This is the spirit of the murderer. Once he is sure he has recognised the spirit, he stands up and speaks up. The spirit disappears. Rocks are placed around the tree, where the dead man is placed. The rocks are left around the tree when the body is taken away, and the rocks stay there for a long time. Each rock has a name. Does the blood land on the Jaru, Walmajarri, Gidja, Gorinji (rock)? The spirit tells the blood which rock to deposit on, to indicate who the murderer is (i.e. which group he is from). No-one can enter the circle until the matter is settled and the body is removed from the circle and is buried in the*

*fire/anthill. Ash is spread on the ground within the circle so that if anyone enters the circle, their footprints will be revealed. You got to lock him up good (inside the anthill), put the fire in and close it up so that no smoke escapes. The rocks are inspected for blood, this identifies the person (mob/skin) who was the murderer. The murdered person is then taken down from the tree platform, cut up, put in an anthill with fire on top. When identified, the murderer becomes sick and dies within 3 or 4 days. He tries to cool himself off by swimming. There is a rock circle located near Old Halls Creek. There is a camp behind the hill, and rock circle(s?) behind further.*

### 13.2.2 Bonnie Deegan



Figure 119. Bonnie Deegan.

(Photo: John Goldsmith)

Interview with Bonnie Deegan, at Halls Creek, 24 August 2010.

Q: (Introduction)

*My name is Bonnie Deegan. I was born on Margaret River Station, that's about 150km from Halls Creek on the road towards Fitzroy Crossing. So when I was four years old I was removed from my mother, who was a full-blood Aboriginal woman and my father was a white stockman. I was sent to Mulla Bulla and from Mulla Bulla, I was sent to Broome, where I grew up in an orphanage, by the Nuns. So I lost contact with my people on the Station, and everybody. The only person I could remember was my father. He was the only one who knew English and write to me. So hoping one day to meet up with him again, but he went as far as Tennant Creek on his way to Halls Creek back in 1974 and he passed away there. So all my people were removed from the Margaret River station, and sent to the leprosarium in Derby, whether they were sick or not. Some of them got sick there. So I finally did find my mother but she was more like a stranger, because I grew up in another kind of a world, Nuns. So never got really to know her well. And then coming to Halls Creek with my family, and the people talked to me in language all the time and I didn't understand one word they were saying to me. So I got interested to the language also, and that's when they had a language centre started up here in Halls Creek, and I thought to myself, it would be good if I could go and learn language. So I did go to the language centre and got mixed up with the people there. And many days and weeks we would go out with the old people out in the bush. They would talk in language and tell stories about the country.*

*So I got to learn a little bit about my language. That's the Jaru language and I've been with the language centre for nearly 16 years. So I was happy I could get to know some of my people and I saw them doing arts, that's when I got really interested with doing art. They would do dot paintings and I would sit with them and talk about their country, so I thought I'll do the same. I'll do something for my country. So I did, there's a dreaming on the 80 mile plain. That's a place where I grew up. My father took me there when I was only little, when he was doing stock work, and there's a dreaming area there, they call it the Barra (?), that's the eggs that the goanna laid in the Dreamtime and the story goes that the Goanna told the Sun up in the sky. Don't let anybody come near this area. Don't let them take the eggs away. It's called the Barra. If they do, they will get punished, bad things will happen to them. And a lot of people have found those eggs and the colour of those eggs is green, white and red, and its real. They took them all away and left only three. So when we went to visit, there were only three left, and we stood long way from where the eggs were, and hopefully they are still there today, and ... bare, no grass grows on it, because the sun looks after the eggs. The Goanna left and never returned. So that's one Dreamtime story from my people. So I do it on arts, and I got one art that represents all the eggs in the painting. So I got more interested in doing arts, and arts, and I'm still doing arts today.*

Q: Can you tell us about your painting (Milky Way and Emu painting) here?

*This one represents the night time sky, and when its dark, you can see the Milky Way very nice and clear and there's an emu up in the sky, and the camel, and their joined with one head and I didn't put the camel in this painting, I put the emu. And around it all the stars that shines at night and the bright blue and yellow, when the stars twinkle at night. Yeh.*

Q: Can you tell us about the Emu in the sky?

*The Old People told me the story about the Emu. The emu was really a fast runner. There was a race. And somebody said to the emu, bet you can't reach the skies, or reach the sun. So the emu started running running, and flying, and flying and flying until he went right up into the milky way, and stayed there for ever and then somehow the camel was up there, two heads joined together, and up there you can see that night when the sky is really clear and the stars are out bright, yeh, that's in the Milky Way.*

Q: Do you know if there are other stories about the night sky, such as shooting stars or things like that?

*The old people haven't told me, some stories they say, if we see a shooting star in any direction, especially if you see the big blue one that brings bad luck. That means, you know, someone is going to pass away, some relative or some friend. So I mean it has happened, it is true.*

Q: Do they tend to be the really bright shooting stars?

*Yes, you can see the real bright one, it starts falling, in whatever direction. That's where, brings bad luck.*

Q: So that can be a sign?

*That's a sign, and then you hear the next day, somebody passed away in that area or that community.*

Q: How old do you think that knowledge / belief is? Is that from a long time ago?

*I believe it's from a long time ago, because I believe it myself. Sometimes we see lovely coloured ones (meteors), but when it's the blue, that's the sign of bad luck.*

Q: Do you think quite a few of the older people around here would know about that?

*Some people would know about that, not many old people left now, like Stan (Brumby) ...most of the old people are in the frail age now, so they can't remember very much.*

Q: Is it important that this type of knowledge is preserved or recorded for the future generations?

*I think it is very important (to preserve this knowledge), because our grandchildren now growing up, they need to be told. When they go out at night and they look up into the sky and if they do see something like that, we tell them the story, so that they know. I've passed that story on already to a lot of my children, and a lot of the other people around, they also know that when they see a falling star, a blue one especially, it's a sign of misfortune.*

Q: How do you think this knowledge should be taught to younger people?

*Well I believe by telling stories, and have story books, so that they look through it as they get older, and they look through it, and read it, and then they can understand the stories from the older people. So they in turn will understand when they look up into the sky and they see something floating, or going in directions, so they will know that something is about to happen. And also the skies with the Milky Way, it's beautiful, to look at, at night.*

Q: So is that something that you would encourage young people to do, to look at the Milky Way?

*I do, I do, I tell all my grand children, at night when we sit outside and we look at the different directions, that the Milky Way is going, because it doesn't go in one way, it goes in different directions. And I sit and tell my grandchildren, you can see the camel, the emu up in the sky.*

Q: I'm interested to hear about the Camel, because I have not heard about that one before?

*...Some unknown reason the camel just formed up there, near the emu. So I mean the old people don't have much stories about the camel, but the emu because it's an Australian bird, they have stories about it.*

Q: And the camel pattern, so you say the head of the emu and the head of the camel are joined together?

*They are joined together... from the same head, it goes down and into another big hump, that's the camel, on your right side, when you stand up and look up into the Milky Way.*

Q: So the emu is the dark area in the Milky Way, is the camel also...?

*Well you can notice it. Stars in it, but a bit of darkness, so it has the shape of the Emu, and also the shape of the camel on the other side.*

Q: and so when you say the other side, do you mean...

*So you must look up in the Kimberley skies when there is no moon. Then you can see it very clear.*

Q: You have some of, literally, the best skies in the world here.

*Beautiful and clear at night and I really and truly appreciate that nature of the world.*

Q: Is there anything else you would like to comment about the painting?

*Well I hope people will really and truly enjoy this artwork that I did. Sorry I didn't put the camel in it, at the time that I drew it, there was another painting I did also, I don't know if it is here, or somebody bought it, and that has the camel in it. And that's also some time a figure, Aboriginal man, up on the sky, very faint, but you can see it. Yeh.*

Q: Do you know if there are other people in the community who have a good knowledge of the night sky?

*Well, we've got Maggie Long who is also an artist, not sure if they ever take notice to look up into the sky at night. So if she would have any stories, also about the night skies...*

Q: What about Kandimalal, Wolfe Creek Crater, do you have much connection to that area?

*No, because that's not in my area to talk about. Another man's country, and their Dreamings and all that. Sometimes the wrong people talk about another person's country, and something bad happens..., so we just leave it to the right people to talk about their country.*

Q: How do people know the right people to speak for country, is it just generally known amongst the community?

*Well as people are growing up and they know where the grandfathers and grandmothers come from, they know that part of the country is part of them also, so then, they can go back to their country, and learn the stories for the country, Yeh.*

Q: Thankyou very much Bonnie,

*It's a pleasure... ...Ah, it's alright, it's a pleasure doing something for somebody, passing on knowledge, so that the rest of the world can understand how we see the skies.*



### 13.2.3 Stan Brumby



Figure 120. Stan Brumby.  
(Photo: John Goldsmith)

Discussion with Stan Brumby, Halls Creek, 13 September 2000. The following are non-verbatim notes of the discussion, which was not video recorded.

*Star- he was man, fall down, proper man. He can kill you, that man in the star, that evening star, when it come out in the morning. Kandimulal, soak water, milky water from the crater, run out to Sturt Creek, milky water. Rainbow curled up in crater, holding the soak water. Murrungorru- Bush women sugar leaf in tree. Caranya. Murring- name of fly. Rainbow, kill fly, bushwoman, snake/rainbow. Kandimalal- Grandfather/mother country*

Interview with Stan Brumby, in Halls Creek, 15 August 2010.

Q: Can you tell us about yourself, Stan? Where were you born, where did you grow up?

*In bush, not in town, bush, I born in the ground, bush, in my country. You know, while I was thinking about from that bush, my life in the country, a good life, when I'm talking to... some white man, you know, come from big city, white man come from big city, he some of my friend, some of my friend, like a bloke like him, this one here, I got him my friend, I sell a lot of painting, I'm the artist. Wolfe Crater.*

*That's my mother's country. I do 'em, he wanted more, I can do it, this my friend, and the story, my story, for him. He giving them story from me, welcome, welcome, to him, my friend here. He was wondering this morning, he don't know where is (Stan Brumby) and someone tell him, next door, at Mardiwar Loop, at that house, he come down and find me. Have a good yarn, ... some people there, for painting story, sky, star, all small star, big star, story about that, well, in Wolfe Crater, that's my mother country, that's my family country, I can draw that, I'm the boss, for that country, my mother country, Wolfe Crater. Big star coming down, Morning star. ... like it. This friend, here, while I got him here now, he wantum more, I'll do it one more for him, a painting, a big painting, Wolfe Crater. He's my friend, and I told all my story, welcome, to him. You can go ahead, write all the book, what sort of book. I can't read, I'm the bushman, and he'll do it. He'll do it already with me today in Halls Creek. He's my good friend. He take my two paintings a long time.*

Q: So Stan, you talk about your mother's country, Kandimalal. When you say your mother's country, do you mean your mother, your grandmother?

*...My uncle, and my mother, my grandmother and my family come from there. I come from there. I been born top there, bush. Place called Garrin, blackfella name, Garrin, and whiteman name Sandshoe. ...stop from Ruby Plain, that Ruby Plain country, that's my country, that's my land, that's my country, waterhole, soakwater, hill, all them hill in Ruby Plains country, That's my country, that's my mother's country.*

Q: Can you tell us about your memories of Wolfe Creek Crater?

*All that memory, I got 'em here, Kandimalan, Wolfe Crater, I got em here.*

Q: Is there a particular story you would like to tell us about or share with us today, about the crater?

*Well my brother in law he passed away in Billiluna, he told me, before he passed away, you can take over Wolfe Crater. Another brother in law here, in ... frail age (care) he can't remember now, he can't talk to me now, he's lost his memory, I'm taking over that country. Ruby Plains. Wolfe Crater, I'm taking over. My family, people, and I still draw that Wolfe Crater in the painting.*

Q: So Stan, can you tell us about your paintings about the crater?

*When I want to paint that Wolfe Crater (Kandimalan), I paint sometime one, sometime...what I got they been painting again, country, I draw, my country, Ruby Plain, Karin, Sandshoe (whitefella name). I draw that, all that country mine in the middle. I can't draw Billiluna side because half Walmajarri, half Jaru. Mulan, Billiluna, Lake, Paraku Lake, that's my Walmajarri country, I can't draw that lake because he not my country. Paraku lake, big lake, in the desert. Danger, you can't ... you get drown,*

*big rainbow there, two bloke been go in there, they get drowned, boat and all. Very dangerous that lake. That's Walmajarri country, lake. That not my country, that's the Walmajarri country.*

Q: So you are talking about Lake Gregory, Lake Paraku?

*Yeh, people bin die, two Uncle of mine been die, three uncle been die, in that lake. Some family for my Uncle in Billiluna, all my cousin brother, all my cousin brother, Billiluna, I been telling them, I've got nothing to do with this, you boss for this area, from Billiluna, to Mulan, Lake, you boss. I'm boss for Ruby Plain top, right up to Wolfe Crater.*

Q: What does being boss of that country mean, what does that mean?

*That's the Jaru, the Jaru country. I, if I talk with the language... ..Mulan, Balgo, that Walmajarri country, I can't.. out there... Jaru country, Ruby Plains, come back this way from Wolfe Crater, I come back this way, come back this way, to Lambu, Kunji, Halls (?) Creek. I come back. So, when I draw anything, painting, I draw my country, Jaru country. I can't draw Walmajarri country, you might kill me. That not my country, painting, you draw 'em, Walmajarri country. Lake, I can't draw that lake. Good lake, that's you, you the boss for that lake. Paraku lake....*

Q: And Stan, the name of the crater?

*Crater... a little bit there, partnership, ...that's my mother country, Wolfe Crater, my granny country, crater, I draw em that one, that's all. I come back this way right up to Lamboo, Kunji, Halls Creek, I draw 'em country. You know 'em waterhole, soakwater, this way from Kurrin from up top, I been walk from there to.... that big hill on Ruby Plains, top... I been going there from Karrin to Kalcanga, and I sing him, that one, Wolfe Crater, that star, sing him, language. I ... singing stick, I can sing 'im now, without singing stick.*

*Warda wandinga*

*Warda wandinga morungai*

*Warda wandinga*

*Warda wandinga morungai*

*Warda wandinga*

*Warda wandinga*

*Warda wandinga morungai*

*Warda wandinga*

*Warda wandinga morungai*

*Warda wandinga*

*Warda wandinga*

*Warda wandinga morungai*

Warda wandinga  
Warda wandinga morungai  
Warda wandinga  
Warda wandinga morungai  
Warda wandinga  
Warda wandinga

*That's the warda, wandinga, morungai, on the ground, making biggest hole, like a bulldozer been make him, that the song I got him, for that... language, I sing him, warda, wandinga. Big star, from top, from sky, bin fall down leaving all the little stars from top from sky.*

Q: Stan, that story, the wada; the star that falls, how old is the story, where has that story come from?

*Story come from sky, from sky, that story come from sky, from sky, that story, I've been bring up that way, with memory and song, story. He bin fall down. Big star bin fall down from top from sky, leaving all the small star behind, and he been come himself, bigger one. Like a bulldozer been, make that (crater) himself. That story come from sky. When I sing 'em... language now, that star, big star, that's the story, from the sky.*

Q: Can you talk about the night sky, if you know about any star patterns in the night sky?

*This one, the Seven Sister, I was singing about, still there, I got to draw that, seven sister. He's still there behind, that big star been (leaving?) that seven sister. I got to draw that ... (little fellow?)... and seven sister in the sky, I got to draw him on the canvas. I was thinking about it last week, that seven sister.*

Q: Do you know if there are other stories to do with the night sky?

*One big star, not too big, come out from sunrise. He come out, at night, proper star. This star, bin fall down, that's the main star, we been use him for... droving cattle, that's the morning star, that's the main star. Well the drover lost that, we can't see him anymore. He's underground here, I don't know about it, down here. It's the main star for everybody, station, droving cattle, all the drovers, all the stockmen in the station. Can't see him anymore. That's the main star, .... loose him.*

Q: So that is the morning star, is that a bright star?

*Yeh, yeh, very bright, morning star, he come and take a break now, Sun, catch him up behind, this sun here catch him up behind, star in the front, that's the one. That's all I can tell you my friend. I give you permission to you, for story, my story, you my friend.*

Q: To acknowledge you as the owner of the stories, what is the best way to have your name there? What should I say, when I say to others that this is your story?

*Well you say, you say in other people, this is Stan Brumby tell me about the story about morning star, in his country, and this is a welcome to him, to you, welcome to you. I give you permission, I give you that word (permission), you can carry on tell your friend, tell your family in the book, story, they can read, from me, and the video, ... they can look me in the video, what I'm talking about you and me. I give you that word, permission, what you call it, from me, you my friend.*

Q: Stan, I remember there was a word that I heard about when the star falls down, the "Coolungmurru", what is that? Do you recognise that word?

*Coolungmurru? Coolungmurru, that's sound, that's only sound. Coolungmurru. You hear him sound. Hullo, Coolungmurru, fall down, Hullo, what's that Coolungmurru been fall down.... Coolungmurru, That's the star, Coolungmorru, he shake him, this country been shake, like a big bomb been come down, big bomb been fall down, shake him ground, big star, shake him, everything, tree, animals, like that shake him. This country been shake. Coolungmurru, big star been fall down.... Now, big star been fall down. ... Warda Wardinga ...language... Warda Wardinga Morungai. I been picking him up that way, that song, I got him, that story, why that star coming down, I been draw him*

Q: Is that word used only for shooting star?

*Yeh, shake the ground.*

Q: Or is it used for other things as well?

*No, only that star.*

Q: Have you heard that before?

*No, till that star been hit the ground and story. Every time we been look, big morning star coming out. That's all. I don't know how that even get (slack?), top. That morning star. That soakwater been there, right in the soakwater,... in Wolfe Crater. You know, big story, my uncle been walk from there to Wyndham, Jack Jugarie, race him ...American, and German bloke. And he win that race my Uncle. And that German bloke, (ate) caterpillar ... not proper beef, starving. My Uncle been killing goanna, kill 'em, in the road, cook 'em goanna,... that American bloke been shoot 'em kagadoo...he was shooting Kagadoo in the Wyndham road. That German bloke,... (ate) caterpillar, not proper beef, look 'em in the picture, that movie, that film, I been laugh.*

*That's all I can tell you friend, I give you welcome, my story to you. Story from me to you...*

*Thankyou too...*

Interview with Stan Brumby, in Halls Creek, 22 August 2010.

Q: Could you tell us about your experience with Wolfe Creek Crater?

*...Long time before the star been damage the place, come down, and I was camping there, station, one bloke been on the station there, cattle, and he told me, you got a work for me? Yeh. That's my place. My mother country. When him been finish, no more, one bloke (white bloke),... big star coming, damage the place, make a big hole. You can see everyone coming in, tourists, coming in, coming in, look at that star, crater. They was looking for that big star, looking down,... some sort of, some sort of camera, going down. Still going down. I don't know how far going down, that morning star. I'm very sorry for that morning star. That's the one, we been using when we droving cattle, ...to Wyndham, Queensland, down to Broome, we used that star, morning star, the biggest star, I don't know how, I don't know how, he been hit him, right place, that soak water in top, milky water. ...He's still milky water, where the star bin go in. I always wanted, how do you get that soak water? I thinking here, ah, look at the place, when I been looking at that place, like that, with my eye, in that camera, I mean canvas, drawing Wolfe Crater, big star coming, big star coming down, and I sing that, ... language, I sing that. That's my mother country. And what do you reckon that book, why you bring him, you got him finish here?... If you finish that book, what you reckon, and what everybody reckon, you can finish him (the book). I'm agree with the Wolfe Crater. That's my mother's country.*

Q: And Stan you have mentioned about the morning star, why is the morning star related to the crater, what is the connection there?

*Well, that's a morning star, we been using him as station, ... and when we been droving cattle. That's the main, main morning star, big star. Aboriginal looks at that (i.e. looks to the morning star to tell the time), whiteman looks at watch, yeh, in the morning. There's the morning star coming, look at the time. Whiteman look at the watch, not the blackfella. Whiteman said, the morning star coming, daybreak ... that star, big star coming up and the sun coming up, big sun, behind. Morning star, front, get up. ... This sun get up behind that morning star. And, we been happy, we lost that big star, that's the main one, just like a watch, just like a time watch. That's the watch, he's a morning star.*

Q: And the connection to the crater?

*Yeh, that's a one, with the ... crater, that morning star.*

Q: How would you like people in the future, to learn about the crater, for children in the future? How do you think people should learn about the crater and the stars?

*You got to teach them, down there... You, kid, family kid. You got to learn them, and your family, you family. Big people like you, like me. Down home. Down Perth, or Sydney, or overseas. You family, here. You look at me in the movie, look at me in movie, down there. This is the bloke, Stan Brumby. He's the traditional owner for Wolfe Crater. ...That's my mother country.*

Q: Do you think it's important for people to learn about the crater?

*White people,... you family, or other bloke, other family, when they look at you, coming out, look at the book, look at me, when I'm talking. This is the bloke, Stan Brumby, for Wolfe Crater, look at this star, left behind in the sky, Milky Way. Still there, and that one big star come, even come down and damaged the ground. And painting, it might be painting, look at that painting, couple of paintings been go overseas, to Perth, or Canberra. See, like that. If you want 'em more painting, I can do it. You know, I'm painting another country, bush tucker, country I draw, different... and these things today with you and me, when you got that book, and when I talk on there, really make sure, understand and you got that idea from me, to do that book, you know, star, and crater, that's good.*

Interview with Stan Brumby, after dusk, on the outskirts of Halls Creek, 6 August 2011.

Q: So our visit to the crater, I hope to be able to take star photos at the crater?

*Yeh, you can do that, when you go down in Wolfe Crater, take a photo, in the night, small stars, and this one, Milky Way, take a photo. That's my mother country.*

Q: Why do you think the morning star is connected to Wolfe Creek Crater? Why not some other star?

*That morning star, he was a man, that ground, that soakwater (in the centre of the crater), wild woman was there, Murrungoo. You can't see him. I can see him. Magic woman. My country, top, this side, from Wolfe Crater, this side,.. Sandshoe, whiteman call him Sandshoe. That's where I was born in the ground, Karin, Blackfella name, Karin, I born in the ground. That's what I been singing about from there. Wolfe Crater. My mother country.*

Q: So that crater area, the Murrungoo is woman, female?

*Even men, Murrungoo, but small like this. You can't win (by fighting) this way. No-one. They're hard fighter, they're clever fella. If you want to make a friend, you take it easy. Murrungoo. They're men, bush men, clever men. They give me... culture. Culture, they give me. ....I can,... they give me, I dream, look with a dream, when I get back to that bush, away from big mob. I lay down, I dream,*

*people coming in now, singing, singing, their regarding me, they regard me, regarding me, “ah you come back to your country, country” ... wohhhh, wi wi wid wid wid, wid wid wid, like a bird, but that not a bird, that's a Murrungoo, short man.*

Q: So you can hear this?

*Yeh I can hear him, I can dream him, When I sleep, I dream, they give me... culture. Song, everything. Song.*

Q: So you receive that, when you are asleep, dreaming?

*Yeh, I can dream. Like you got to come and dream and talk to me, “Hello, Stan Brumby”, “Hullo”, like that, I'm talking to you “Hullo”, dreaming, I dreaming you, and them Murrungoo, I'm dreaming like that, you talking to me, dreaming, they talk to me, they give that...culture, I sing that in the next morning, I sing him. In the night, in the morning. I sing him, this one, this one, this one, finish, you see. Same as that morning star. Murrungoo been giving me that song, with the language, right there, I've been camped right there, in the crater. Take a photo.... .... camp there, I've been dreaming at the same time. I've been looking at the place, from top, high, crater, make a dam, just like a dam, just like a bulldozer been cut him, right round, but big everything, wood, tree,... all in, him take 'im, right into soakwater, and that girl,... ... even if they killed that girl... Murrungoo woman, mischief, Murrungoo been see 'im. Finish, and sugar leaf, right round there, tree, sugar leaf, you can taken out that one, sugar leaf.*

#### **13.2.4 Keith Jugarie**



Figure 121. Keith Jugarie.  
(Photo: John Goldsmith)



Interview with Keith Jugarie, Halls Creek, 22 August 2010.

Q: Can you tell us about your connection to Wolfe Creek Crater?

*my connection to that area...well it goes back from my great grandfather, you know, that's my father's country, and not only my father, but there is quite a few, ...my sisters, cousins, and things like that. They are all involved with this sort of thing now. They live out at Balgo now.*

Q: Did Jack (Jugarie) talk much about the crater or the night sky with you?

*Like everybody knows, it must have happened years ago. Like a meteorite must have hit that place, and that's how the big hole is there, see.*

Q: We also mentioned about the soakwater in the centre of the crater, is there anything special about that area?

*That at the bottom at the centre you know, there's a hole that goes down, it runs, just like a river, you know, underneath and it sort of runs out, and whenever it rains, you know..., the crater, can get wet now, fill up with water, you know, run from outside, something like a tap, like a hose or whatever you like to call it. It fills it up,... like you will see, the bird life, kangaroo and whatever.*

Q: Is that in the wet season?

*In the wet season, yeh, you will see lots of wildlife, you know, kangaroo come down there to drink water, to have a feed, even birds, yeh.*

Q: Could you help me to understand about the stories of the snake in centre?

*Like in a tribal way, you have to be part of the family,... my father he is a Jaru man and like, old fella from that line, see, like my aunties, they all Jaru as well. As far as I know, my father, he's got, it was two elder brother, one down from... and from there, that was years ago, when they lived at Wave Hill they called him Big Ted, and he has a sister (my Dad) at Balgo, living with the Darkies family, you know. She got married with ...Darkie...old dad, so she's one of the mob as well you know, in the same line, and another one, a sister, who passed on, who's up in Wyndham, and the Martin family...and this other old fell he passed on again. He lives up at Wave Hill. I used to work in the Northern Territory. I never got around to ask about it, like if he has any sons or daughters, things like that.*

Q: I also got to meet Mary Darkie at Billiluna.

*That's my father's sister.... Yeh, like all them Darkies, my Auntie, she got married with a fella from up there, but... one of the Darkies, they wouldn't have stayed up there, after all those years, they raised a family. But before then they went to Balgo, they sort of lived around, worked around, aunty with his husband, ...these areas like Sturt Creek and Gordon Downs and all them places you know, that's all like the Jaru people as well.*

Q: And the crater itself, how would you describe it?

*The crater, well it goes back, really, like my old Great Grandfather, my Dad's father, he used to live around that place, he knows, he's from that area. My Great Grandfather, we use to move around a lot. But yeh, that was his place....If you ever do want to go to that (crater), for a drink of water or whatever, there is a hole, because I've never seen it. It goes down, you know, from on top of the earth, and when it goes down... like a seep, sacred site. You can't want to go down there,...like in a dreamtime way, you know, you can't go down there, because the snake lives there,... they only time... if you want to go there then you have to be like one of the family. You have to talk to that snake. You can talk from top (of crater), there's lots of little snakes, when it sort of comes out. Whenever you...down there, they all .... and it's listening at all time, you know, and if you want to have, try a talk with him, the snake, listen and he can get you, like a scent, if your are that right person, you know.*

Q: How do people talk to the snake?

*In the old lingo, you know, like being Jaru. You can't get another person from different tribes and go over there and talk. He doesn't understand what's that other person is talking about, but you go, and speak out from the top, and say, and explain... well, I'm here.... You come there, he's listening to every word you are saying, you know. Because my dad went down there, went down the hole, ...with a couple of those fellas, it's all right, he went down there, had a drink of water, inside. I've never been there, but that is what he has been telling me about. The last time, remember when he done the human race. Yeh.*

Q: Do you mean a dreamtime snake?

*Yeh,*

Q: And the name of the crater, Kandimalal?

*Like a lot of those places, you see like a blue lake, you know, it's not like... a open sea, or something like that, its, all, well, every blackfella, they know, you can't tread on another man's property. You can't go straight in.... specially in all those big lakes, (Lake Gregory, or Lake Paraku) because you'll be taken, you know.*

Q: What do you mean that people can be taken?

*Like the serpent, like the snake, you know, he gets the smell of your,... smell of your scent, you know... This is the right person here. You can be taken, drowned. You have to be really careful.*

Q: So, do you regard the crater as a special or sacred place? What does that mean to you?

*Yeh, it is. When you have the permission from us mob, who are around at the time, or like, see I've got my family, my Auntie out there,...but if you want to go to that place (the crater) you have to try and get in contact with them, you know.... It's OK to go....*

Q: So does that mean people like Harold Boomer at Billiluna?

*Yeh*

Q: And when we went to the crater with your dad, he spoke about a word, the "Coolungmurru" Do you recognise that word?

(Keith Jugarie then asks John Goldsmith some questions)

Q: (Keith Jugarie) Is there any other meteorite from around the world?

(John Goldsmith) *Yes, and in fact other craters in Australia....*

Q: (Keith Jugarie) Is that the only one (i.e. crater, Wolfe Creek Crater) in Australia?

(John Goldsmith) *No there are others.*

Q: Do you know if there are any other stories about the night sky?

*Like when it comes to evening you know, and sleep outside and look up into the sky during the night sometimes I, but I never went and got around to talking to my old Dad,... but I think, you know, they way how I see it, you can't see some of these stars,... oh there's that Saucepan up there, they call it a saucepan, you know, something like this....like a saucepan, with a handle.*

Q: That's part of Orion, the saucepan, the three stars...

*You have a look at some other time, when you can see one star appear, there's three... down at the bottom and then there's another one up there, a couple gone straight up, just like a hand, you know. That's all, like a lot of people think about the night...*

Q: Do you like the night time?

*Yeh, it's alright...*

Q: Who would you recommend that I speak to about (Wolfe Creek) crater?

*Well,... last time I had a meeting with you and a yarn, there's an old fella there, he has a little property, 15 or 16 kms from Balgo. They call that little station Homestead, see. There's two brothers who work for that place. And remember this old fella here at the Butchers Shop (Halls Creek), Jamie Savage, the fella at the butchers shop. He was there, he was like a young Jackaroo, and then he got a job, they got him a job and try to put him in as a manager, run the place for a while, and them two men was there at that time. One fella, he's the oldest, ...Darkie,... and the other fella, Tiger Darkie, and sisters, Lucy, lives with the another fella by the name of Ronnie... They all work together, they look after that place. If you want to try to get in to that place, Caranya Station, Murring, you got to try and get around first, with, it's not Harold Boomer, he was there as a worker, looking after that place, but, there's that other one with full connection with that place is..., when he died,...that's his son, and that's the mother, there's that other fella where Tiger died, and all of them, easy, like sisters, you know, someone want to go through there, they'll make an argument about it..., did you get the permission to go to that place...*

Interview with Keith Jugarie, Halls Creek, 23 August 2010.

Q: We were talking about the crater, near the centre of the crater, and how people should approach the crater, and why that area is a special place...

*Right in the middle? Like my dad was telling me,... the river underneath, that runs from the crater to the outside, and if it does fill from the outside you know, like a river, and it goes underground and appears right at the centre, like a big rain...*

Q: That area has the sink-holes. You mentioned that that area (centre of the crater) is a special area?

*Well, my dad went down there once, when he came back and told me about it, he went down the hole. Like for him, he's OK, see, it's like, whatever you would like to call it, like the dreaming or whatever. You have to have permission to do something like that. He's OK, like the family who's with him, they like to go as well, but they have to do the same thing like what the old fella does, you can't do anything you feel like, you have to have, like, respect for it.*

Q: How can people show respect for that area?

*Well, you were up there when my dad was alive, and he took you up there,... there's a lot of things that you would like to pick, and, maybe tree or stone or what ever... Don't touch, don't touch from anything*

*around here, just leave it as it is. Very important place to them, you know, and on the other side, I think, he's been out there. I've seen that picture that they took with him (i.e. the Human Race film).*

Q: And we spoke about the snake there, which speaks Jaru?..

*He doesn't speak Jaru, he sort of knows and understands, what now, he's a serpent, the snake, you can have a look at any of them lakes, all different kind of culture and things like that. For this one, he has his own things, you know, he smell certain people, you know, you go out there and talk Jaru, and you say, well I'm here now,...he might say, that is my place..., well, you tell anyone, you come and tell him to see that hole now, what it means, then you sort of explain, so he understands what now, even though he is there, he listens to every word you say.*

Q: Is it partly to introduce yourself to the snake and ask permission?

*Ah that's OK, ...how you going to tell him..., If he wants to go down in that hole, certain things you have to do with him first, you know, to get down there, near that hole. You can't just go straight in and do whatever you like... if he does want to get the scent of you,... this fellow, not from around here, you have to talk. And a lot of these things,... and one thing that happened years ago, it was right there, right next to the Wolfe Creek Crater, there's a hole just right next to it, that's where the snake is.*

Q: Is that inside the crater or just outside?

*I think it's right in there (centre of crater). That's where my old dad went and drank a bit of water. He got me a bit worried (during the walking race). I was thinking that gee, it's been so long, but like in Aboriginal culture, it doesn't want to change, it's still the same way.*

Q: Are you referring to the walking race (Human Race film)?

*Yeh, it was at that time, you know, going down there. Like he wanted a drink of water, at that time, and he knew what it was like on the inside (of the crater), something like that, so he sort of spoke out, whatever was down there, the serpent, the snake, let him know, you know, and them things up there, they can get your scent from miles away, no matter who you are.*

Q: Sometime some people I've met when they are listening about the snake from the crater, they think it was a long time ago. Is that right, or is it from now?

*It's from the bygone era, you know, and it's been, well it just can't survive on its own, it's got to have family to, regard the snakes and things like that, they all get together, and they've got heaps of them, so... some sort of a thing to keep him going, like a ... probably the snake...*

Q: And the place “Red Rock”, and the crater, are they related? How do you understand what that connection is?

*Red rock, they're connected. Well, like my dad never really told me about that but he knows, they're not too far from one other, anybody will understand this. Like you tell me see that rock, you don't have to be afraid, you can go over there and drink. See this place, what you doing now, you tell him you,... speak in language, and then you go over there, see it's already been with them, like from here to there, it's been translated, you know, he understands from over there as well.*

Q: And for visitors who go to the crater who are not Jaru people?

*It's OK, like photographers, and whatever, from the outside, to go and sit on the outside, and take pictures and things like that, but sometimes it's pretty hard, unless when you go there, you have to have somebody who knows about that place, who can tell you about the past, about that place, and when he dies, you know, then you're OK, you don't have to worry about anything, somebody still there who knows about that place, and how to go about it.*

Q: What do you think about for younger people who would like to learn about the land and the sky? Should that be encouraged?

*It should have been taught years ago... You still can teach with the young people, about it, before it really gets lost. Like a lot of these kids now, they have got nothing to back them up. They start at school and finish school, and go on, but they don't know nothing about their culture. They got nothing to show for it. But some kids, they can want to go to school... and when they go home, they still got their tradition there, mum and dad.*

Q: So it is quite important for good teaching with the younger people about the culture?

*See, a lot of these people now, they do it...to tell the truth, they don't want the culture to die out, you know. See these people from Ringers Soak, Wave Hill, Balgo, Mulan, Billiluna, but not only there, Turkey Creek wherever...*

Interview with Keith Jugarie, in the centre of Wolfe Creek Crater, 8 August 2011.

*I remember years ago, my dad, he went down a hole up here somewhere, ... went down the hole, ... and underneath, running water underneath, down to the Sturt (creek).... What happened, all these... all these people at Billiluna... Is there anything up there (i.e. at the crater), we'd like to know.... They tell you quite a few stories. ... Surprise...when you go down here, they thinking about the serpent, you know... But I know, it is true. He's around somewhere. He's got to be around here somewhere... This area now.*

Q: What prompts you to think that Keith?

*Like a lot of these people, they know about it, at Billiluna. ...They came down here, ...I've got to say something to him. He said it. ....I need to tell him my tribal skin, is. On this side. This is my father country, you know. He been doing...Snake doing there, he's listening. What do you call it, Dreamtime story, you know, I know for a fact, it is real.*

Q: So where did you learn about the story of the snake and the crater?

*Well what now, it was from a long time. Even the old people from Billiluna, they know about this one. When they say about Murring, Murring, this place here. Murring, it's a like a Aboriginal way, they call it, Caranya, you know.*

Q: Is the name Murring different to Kandimalal?

*Murring,... Kandimalal?, what's that? That's the name here,...*

Q: So the other name is Murring?

*Murring, another way, it means its greedy, that's in Jaru, you know. You're murring (greedy).*

Q: How would that name get associated with this area, do you think?

*I had a quick read of the poster up here, you know, I want to try and go back and get some if I can, write it down... What I'm going to do and try to do... is to go back to all these people, explain to them, or ask them a question, you know. "What does it mean?","... It's already been done, we've been there.*

Q: Because your Dad called this place Murring, which surprised me, he didn't use the name Kandimalal.

*Murring, murring, you know....That's like what he was talking about, for this place now, that's an Aboriginal name for this place here, Murring. Like, a lot of them boys, talk about, you know; "Where are you going out now, are you going out to Murring, yeh I'm going out to Murring, we are going for a day out". That's this place here. That's an Aboriginal name, Murring*

Q: Is that a specific area (i.e. the crater) or is it like a general area?

*It belongs to this area here now, all this area, like if I want go over there.. and where are you fellas going out now?..Ah we are going out to Murring for a day.... I know straight out without a doubt, where he is going, talk about this place, he's going to this place, to Wolfe Creek Crater. And even that*

*Harold Boomer back there, in Billiluna, he knows Murring. That fella we was talking with. And he and his wife Sylvia, she knows it really well.*

Q: So I wonder why it is known as Kandimalal, and also known as Murring?

*...It's the name for this fella here, Caranya, so, really to me, I was just reading the name of the sign over there, there got to be some other place, but its linked to this one. People didn't want to explain to me, probably, you know now, it's name is Murring, and it's also got the other name, Kandimalal. But if I had of known about that one, well I would have explained to you as well, by Caranya, that's like a whiteman name.... He was a big fella. He went to Halls Creek and never came back, ....Yeh, and that's when the place was abandoned.*

Q: So Keith, you have heard about the snake story?

*They reckon that it belongs to this area, now, you know... I'm not quite sure which, see all these water hole, dried out. A lot of these, like all the other Blackfella they still believe,... they are still there....Things happen, I know, it has to be real, you know.*

Q: So when they talk about the snake, they're not meaning a living snake on the ground?

*No, it's a snake that lives in the, like this one, it's sort of dried up now, but like a permanent water, you know. It's there, and you go to have a swim. You have to wait for a while because it's a very dangerous water, you can get drowned, the water will swirl, just like someone stirring their tea up, and it will drown you.... A lot of these people up here in Billiluna, used to live here,... Mulan they all know about that, heh.*

Q: (Concerned about coming down the crater?)

*When I first came down from the top, I thought, Jee's, I was a bit worried, but ah, it's all right...*

Q: Was that about the steepness or something else?

*...the steepness when you were coming down, but it's not only that, it's what people tell you.*

Q: What have people told you about that?

*About the serpent, it is a snake,... in the Tribal Law, you know, if you lose someone, they go and get their clothes, you know, but they don't grab it with their hand, they grab it with a stick or something and put it in a bag, you know, and you might find out later on then, give em the bag, give it to someone else, and say ah, whose this from? Ah that fella who passed away, or that woman, you know, and they*



*give it to that fella, and he passed it on and he take it and he don't touch none of that one, see, no clothes from inside,... some other one, older people, with more experience.*

### 13.2.5 Doreen Green



Figure 122. Doreen Green.

(Photo: John Goldsmith)

Interview with Doreen Green, Halls Creek, 16 August 2010.

Q: (Introductions)

*My name is Doreen Green, I'm a Jaru woman from this part of the Kimberley. We grew up in Halls Creek, and my grandmother comes from the desert region which is the Djurabalan region out towards Sturt Creek, Ringers Soak way, kind of east of Halls Creek. And my dad was a drover, a cattle drover, a stockman and he drove cattle, like a lot of the Aboriginal men in the Kimberley, to the Wyndham meat works, and over to Queensland, and that was his lifestyle, his working lifestyle.*

Q: You've been a teacher here at Halls Creek District High School for some time now.

*I've been a teacher here... at Halls Creek District High School, for... 9 1/2 years, almost ten years, but I did a complete circle. I taught in Perth, the Goldfields, up in Arnhem land, up at Goringi Country out at Calcorinky, I spent 10 years there as a teacher, that was a place that I had some cultural connections too, 'cos my grandfather, Jack Skeen he's a Goringi man, the time spent out there was*

*really wonderful, and I also taught in Arnhem land, and in Darwin and I loved it. Meeting Aboriginal people who are different from us, but who shared the same love for their culture, for their language and I thoroughly enjoyed that as well.*

Q: Can you share with us your views about Indigenous sky knowledge within schools?

*I think the knowledge that Aboriginal people have on the galaxy, the stars and the moon, what happens up there, is a huge part of Aboriginal culture. As a small child I remember my Grandmother telling us stories about the stars, and the stories that came from the Milky Way, the moon, the Seven Sisters, so I come from that sort of background in my Aboriginal identity and when I became a teacher, that knowledge in the western culture just extended everything for me in when I'm teaching children in the classroom to have our own knowledge and putting it together with knowledge in the western world, and I think that becomes very powerful when you put the two together.*

Q: How do you think non-Indigenous people can also appreciate Indigenous sky knowledge?

*Well I think that it's very important for our children to know, our students to know, and particularly our teachers, in our schools, right across Western Australia, to have that knowledge and to combine the two together, because when you look at art, and this is right across Australia, when you look at art, there are tons of stories in art, which come from the galaxy, the skies and I've heard stories from my grandmother. Now if she was alive today, she would have been over 100. And I've heard stories from my grandmother where the stars, when they often used to wander around in the dessert, the stars would direct them to the locations that they were going to, so they wouldn't get lost, you know, the night sky, that was so important to those people who lived in the desert, but to Aboriginal people everywhere, just from my contact with people, you know. ...and one of the interesting things that I found with the Milky Way, our culture up here in the East Kimberley it shows an Emu in the sky, and you know we are very familiar with that. When I was working in the Arnhem land, and it was extraordinary information for me. The people over there saw a crocodile, in the sky, and when they tried to show me the shape of the crocodile, I could not see it, and I put it down to, maybe I don't belong to this country, and I, you know, don't see it, and to have that sort of phenomena. It just got to show how powerful and how deep our culture can be when it comes to the skies, the stories from the skies.*

Q: So you have mentioned the special role of the Emu, how is it generally described, as a star pattern, as a constellation?

*I think it's the star pattern as well as the Milky Way, you know, the dark spots in the sky, particularly when there is no moon around, you can see it very plainly then, and learnt that when I was a little girl, and I was taught that by my grandmother and we lived with that, and you know as an adult, this other story, about the crocodile, that was just something that people would not even believe it, but I do believe it because the Arnhem people saw it in the skies and I think that is very powerful.*

Q: Often that story is known across a wide area, but with variations of the story. Have you encountered that?

*Well I think so. Just from my moving around with different groups of Aboriginal people, you know. There's lots of stories there, about the Seven Sisters, about the Milky Way, about the Emu, the crocodile, and I think, it's all the same, but its... people see it... different cultures see it from a different angle, that's what I'm trying to say. When I was working in Nulenjara lands up around the Warburton Ranges which is up in the Goldfields, they told me about the Seven Sisters story, that's slightly different to the one that my mother told me which comes from here, the desert region of Western Australia, but there are some similarities as well. So the night sky is very very close to Aboriginal people, their culture, their heart, just the way they interpret things in the environment.*

Q: Why are these stories special or important. What's your view about that?

*I think stories are a big part of Aboriginal culture and it just tells, or talks about how people saw things from their point of view, and also it's that knowledge that they can pass down to the next generation and because storytelling, dances, art were a huge part of our culture, and these were the means of passing down that knowledge, that history, that story so that the next generation would take it on and then pass it on again and I am so happy that the new National Curriculum, has a, you know, the Aboriginal perspective as part of the national curriculum, that's going to go through schools right across Australia, has a deep deep aspect of Aboriginal culture, Aboriginal lifestyle, Aboriginal stories, and it's so important for teachers like myself and some of the non-indigenous teachers too, to get a handle, bringing it through in the curriculum, it can come through Maths, English, Science, Society and the Environment, Art, Dance, through every aspect of the curriculum, and I think, when people talk about reconciliation, I think this is the way that we are going to bring Australia together, it's celebrating our culture, and learning about it, the importance of it in our schools. You know, some of the old attitudes, from the kind of people of my era, you know, we accept that because they did not have what we've got now, and it's so important, get the kids to study it, to talk about it and discuss it, and you never know, in twenty to thirty years, we are going to move along way towards reconciliation, because our kids are learning, or should be learning about it now.*

Q: So it's very clear that you see a strong reconciliation approach with Indigenous sky knowledge.

*Yes I think it's important to all students to learn about some of these stories because they are so important to our culture. I had a Grandmother who was a very strong cultural woman. I had a mother who was a very strong cultural person. And these two woman played a big part in the lives of their children and grandchildren and when I think about it now, they played their role very very well, because you have to remember that, one hundred, fifty, years ago, forty years, thirty years ago, we lived under very very strict laws, in Western Australia, where they told us because mum and dad took out citizenship rights, and dad took citizenship rights so that he could move for employment purposes, taking cattle across the state and employing people and that was the purpose of them taking out*

*citizenship rights. But part of that citizenship rights it said Aboriginal people needed to relinquish their culture and language, and that was hard. But my grandmother and mother and grandmother found a way around it. A lot of Aboriginal people found a way around it. The teaching, the learning, the talking, the storytelling, the bush tucker walks, looking at different plants and trees, that still continued on. When there were non-Indigenous people around, OK it was not done. And I think we were very fortunate because my mum and dad, lived on cattle stations and we were free to learn about all of these aspects of our culture. Sadly a lot of other Aboriginal people who lived in towns and cities may not have had this opportunity just from my readings of Aboriginal history, but I think a lot of Aboriginal people who lived in the Kimberley's and lived on the station, they were able to carry out some of those teaching to their young children I am really grateful to my mum and my grandmother, because I'll tell you another really interesting thing. I did not know that my mother could speak Jaru language. She kept it in her heart for something like 50-60 years, and when the 1967 referendum came, she was the first one that started talking her language. She was the first one that started the language centre in my home town, with a lot of other people around her, and she started talking her language, and I was a young mother then, in my twenties. Thinking about it now, I do not how to describe it. Just a wonderful wonderful way of keeping your language strong because you had to live by these very restrictive laws, that took over Aboriginal peoples lives, and yet my mother was able to keep her language strong in her heart.*

Q: Can you describe your connection / experience with Wolfe Creek Crater?

*Actually the best person to speak to is Stan Brumby, because he knows the story. There's a lot of stories that are coming out about meteorites, the one in Alice Springs there was a dreaming story about it and when I read that I thought, wow, and old Stan Brumby, he's my Jabuji, which mean great grandfather, and that's his story, and I'd rather leave it to him because he owns that story. That's a very powerful story in itself.*

Q: That's a wonderful connection to Stan Brumby, I've had the opportunity to meet with Stan Brumby.

*It is. He's a man that is really strong. He's an artist as well. He's really strong in his language and culture, and he owns a lot of our stories, he own lot of things, to do with dance and culture and all of that. He's well respected here and I'm privileged to know him here.*

Q: The old man (i.e. Jack Jugarie) who did the walking race from the crater to Wyndham, do you know much about him?

*Yes I know him very well, because he's my Uncle and I've known him since I was a kid, a little girl, because he used to work for my grandfather and I think what he stood for is just absolutely wonderful. Did you know that walk, that he made, was a walk against alcohol as well. He's a man that was well respected in this town, everyone looked up to him, including myself and I've known him for a long long*

*time. Yeh, I just think that he wanted to demonstrate to the world that he was a very cultural man and a very strong man and he stood up for what he believed in. Every time you watch that video of it, you come away feeling really really strong about who you are, because of that old man. He's passed on now, and I can't say his name, but there is that deep respect there for a man like him, who happens just to be my Uncle.*

Q: Is there anything else you would like to talk about the night sky?

*Well I think when this new curriculum comes in, I hope there is a lot of help from the government to implement this so that we get it right in our schools in WA, and I'm really excited about it, I really am.. I feel like I want to get started on in straight away, because it goes back to 30-40 years now, a group of us, Noongar people, as well as Kimberley people, Pilbara people, Goldfields people, and the Yamaji people, we've always talked about a curriculum that took in our culture, that looked at, studied our way of life, and now it's happened, and that's why I'm so proud. I think I was only a young university student then when we started talking about it. I remember Rex Garlett, and Carol Garlett, and Bernie Rider and his wife.., ...These people that I've who I've known for quite a long time, Noongar people, Pilbara people, and we have always talked about bringing in the Aboriginal perspective into the curriculum, and finally it is done, and I'm so happy, and then we can bring in all aspects then of our culture, you know, there is so much to do, like the skies, the stories from the skies, the bushtucker, the country, the people... ...you don't always have to study just the full on Aboriginal lifestyle, Aboriginal history, I think people tend to get a bit overwhelmed, by thinking about it, specially by our new graduates. I think if you just take a little bit each time, it will come, it will work, and we owe it to our kids, you know. These kids are hungry for their culture and their language and their history. They are hungry to learn about how did our ancestors live, what did they eat, what sort of clothes did they wear, how did they travel. I know, because I've been a teacher now for 26 years and I've always brought in the Aboriginal perspective, when I'm in the classroom, and like I said, we owe it to our children. Because they are hungry for it and we need to keep feeding them with good, healthy, wholesome, things on our culture, language, the whole thing, their identity, it's so important, and not forgetting reconciliation for the whole of Australia, and this is the way we are going to do it, through our schools, and we need to do it right, so that we get it right, and our kids will benefit, our young people will benefit. And that's all we want, we want strong men and women, productive men and women, growing up in our communities, our towns and cities. That's all we want from our children.*

Q: Doreen, thankyou very much for your time, and your generosity to share your knowledge, thank you.

*Well that's something very close to my heart, and when someone talked to me about these sorts of things, it comes straight from the heart, because you have been at it now for a long time because it's been passed down, if my grandmother was alive she'd be over 100. I owe it to my grandmother and mother, who's been faithful, they taught their children well, grandchildren as well. Thank you.*

### 13.2.6 Tanbar Banks



Figure 123. Tanbar Banks.  
(Photo: John Goldsmith)

Interview with Tanbar Banks, Halls Creek, 13 September 2000. Tanbar Banks describes the various features of her drawing of the cosmos, as shown in Figure 40. She refers to the Large and Small Magellanic Cloud in her drawing as “Fred”, which I queried during the interview.

*This is the evening star, you know, Sun, do you know this one? Sun, ... Big star coming coming up, sun get up, you know? Star here...like a jangala. Emu and the Fred, you know, milky way. Two Fred, six star front of him, and Emu. This is the sun, coming out. This is the one coming before sun, and big star coming. Big star, this thing, you know. That big star coming up, this one the first one.*

Q: Is that the evening star?

*No. When the sun coming up, you know, from Milky Way, Milky Way coming down, finish, but this the one coming out, out, when sun come out. (i.e. the “morning star”).*

Q: Which one is the moon?

*This go down, big star go down, lake and moon go down. You know, when he night, this one coming down, this Milky Way coming down, you know? This one.*

Q: Do any of the stars have skin names?

*Skin name? Kangaring, Sun coming up, Kangaring, there's marril, marril coming up, before sun come... This one,... Kangaring, that's the Sun. And this one, that's the big star coming up you know, before the sun coming, you know.*

Q: Is that the morning star?

*Yeh, Morning Star, Morning star. This is the one he come out, but Sun coming out now, see?*

Q: And so, in the Milky Way?

*In the Milky way, there's the emu. You can look at the emu in the milky way... And this one, "Fred", these two (pointing to the drawing of the two Magellanic Clouds).*

Q: Can you tell me those names again?

*"Fred".... "Fred" you know, We talk like jaru. We talk about what this, you know, what is this one and this one. This Milky Way and this one. "Toogalla", Toogalla staying here, look. Warraloo, Warraloo.*

Q: For Milky Way?

*Yes, this one Warraloo, and emu*

Q: And what's the name of this one (pointing to the Large and Small Magellanic clouds in the drawing)

*Fred, (somehow related to a part of the body near the chest).... ...and this coming... And moon go down, and this one, this one, this one, they go down,... with the moon, see?*

Q: And this one (pointing to the evening star in the drawing)?

*Evening star, big star, two ...second one.... They go down, and moon go down and he get a big one, and the sun get up.*

Q: and the Emu?

*Emu...*

Q: Does the Emu pattern have an Aboriginal name?

*Well, I can tell you, but um...I tell you, Waardi... You know, this God been make him... God been made him. When somebody die, you could know. This one and this one (Large and Small Magellanic Cloud) and this one (moon). You can understand. This one you can understand... When you die. Somebody lost, says Fred.*

Q: The spirit when someone dies?

*Someone like...*

Q: What do you mean when someone dies?

*“Goongar” they're Goongar, old country man, Goongar, ...die...*

Q: Why are the stars spoken about when someone dies?

*We understand it. We understand this one (moon), and ah, this one (Morning Star) and these two (Large and Small Magellanic Clouds), we understand. These two “Fred”. (wispered). When they light, somebody passed away.*

Q: Is there a story with this pattern of stars?

*Well, he come in front, that's another star coming,... sun coming up, you know, for sun, all that, sun coming up.*

Q: But that's the morning star?

*Yeh, morning star.*

Q: But what about this pattern?

*That a one he is in the front, we call him, I don't know what now. We call him,... I don't know, what now. I forget his name... We call him this one. He come first, but we look,...coming up. Sun coming up, like this, cungring, marril, saddle, like a saddle, like 'im riding a saddle.*

Q: Is this one (Figure 39, item 1, section 4.2.7.8) anything to do with a lizard?

*Not like a lizard. You can see, you can look this way, when you get up, You can look now. When sun coming up. Now you look this face, and this sun... What is, star coming. You got to look later, sun coming up. Later this, see?*



Q: And what is that (centre of Milky Way)?

*This Milky Way, that the one, same as this one (referring to Large and Small Magellanic Clouds), he white too (bright), and this one you can look like that Milky Way. You can look at it. There's the Emu, Emu. We call it the emu, emu.*

Q: (Describing the meteor in the drawing)

*Come down and he finish there, yeh.*

Q: and that a shooting star?

*Yeh,*

Q: and its name (shooting star), Marril?

*Marril wandingan, wandingan...Marril, maybe, somebody coongah.*

Q: What was that last word?

*somebody coongah, somebody die ! you know... ...when big star fallen down, we said, maybe somebody coongah..., finish. Like, that. We said like that you know. Maybe somebody die....*

Interview with Tanbar Banks, Halls Creek, 23 August 2010.

Q: Can you tell us about the Bungle Bungles story about the sky, you just spoke about?

*Well, when we were camping in the Flora River, we see them big...he falling down, big thing, you know, falling down while we are looking at, and we reckon, what that?, too big, big star.*

Q: An you used a particular name for the falling star?

*Marril, falling down, Maril.*

Q: and the story ?

*Well, we were camping at my place, Flora River, we looking at, we see big star falling down. We reckon, must someone, passed away, somewhere. You know I was thinking, falling down, they die somewhere.*

### 13.2.7 Jack Lannigan



Figure 124. Jack Lannigan.

Image: John Goldsmith

Interview with Jack Lannigan, Halls Creek, 12 September 2000. Discussion is in relation to Figure 44.

*Red rock, that's red rock.... What's that place...*

Q: Is that like Wolfe Creek?

*No, Sturt River. Sturt River this one. Sturt River. Well that thing, water from here now. He's a rock,... right up here inside, water here.... This is the one now, all the trees here now, all the trees. ....*

Q: Because at the crater there are some quite big trees there, so those ones you are drawing are the trees?

*Yeh, trees, up top,... outside, on top, outside, and this is the middle now, middle,... lovely lawn (?) ...  
...Walk around, right here, walk around,...he might... muddy, water there. Sturt River, Sturt River.*

Q: Is that one Sturt Creek?

*Yeh, Sturt River, this one.*

Q: Not Wolfe Creek?

*No, Wolfe Creek here, (pointing to Wolfe Creek in the drawing) this side, this one... this one from Ruby plains, yeh.*

Q: (referring to the "underground tunnel" to the crater) So the underground water goes... ?

*Inside, that away... (through the) hill (to the crater) water he goes that away (to the crater),*

Q: So it goes that way (to the crater), I thought it went from the crater?

*Inside underground, you know, from here underground, you can't see him,... but inside.*

Q: So is this area here, is that called Red Rock?

*Red rock, Red Rock, this one.*

Q: If you visit Red Rock, can you see that rock?

*Yeh, you can see him, when you go there, you see him,... outside, this one, water, from (Bangaloo?) creek, here's a creek now, Bangaloo Creek inside... You understand now?*

Q: I understand now, I thought the underground tunnel was to Wolfe Creek, but I was wrong.

*Journey goes up here to the crater from Ruby Plain, another creek... You go right up lake, big lake,*

Q: Lake Gregory?

*Yeh,*

Q: So you need to go to Billiluna and further.

*...Billiluna....*

Interview with Jack Lannigan, Halls Creek, 27 August 1999. The discussion is about the Milky Way, and the Large and Small Magellanic Clouds, and Lannigan's description and story relating to them.

*Two men in the sky, come down. Make him numb (they won't fight back). You have to kill him. He can't kill him. Missionary been teaching, you can't do it this way.*

Q: Why kill him?

*Because he steal your wife, wrong type of marriage. Mulli (in laws) would straighten him out.*

Lannigan continues:

*Two men come out of the Milky Way, Two men, he take your spirit away. He keeps you in the Milky Way till you die. That's finish.*

Q. What do the two men look like?

*Power all round, like a light, like a Superman, he can look all over the land. Both men can make...? Only need one to make you numb. Suck him blood and blow in sky. Two men sit. Power like electricity. Short one, short fat. Long one, long skinny. All finish now, all gone now.*

Q: Why is it all gone now?

*Because its daytime, you can't see him now, you see him at night. You can see it because it is bright shiny. He'll always be there, come down, make him numb, kill him. All old people told him a long time. This new people know nothing.... Blackfella, they don't know this law, so they don't know this story. We don't talk about law, unless you ask the question...*

### **13.2.8 Boxer Milner and Speiler Sturt**

The following discussion took place at Billiluna, 22 July 2003, with several community members present, including Boxer Milner, Speiler Sturt and Hanson Pye. Extracts are provided below:

Q: How was the crater (i.e. Wolfe Creek Crater, Kandimalal) made?

*Well something big star been fall down from top, star,... he bin fall down, he make him, knock him down... Make him big hole. Soak water in the middle. Fall down right there. Long time.*

*...Kandimalal, you see him,... that side, from top there, star bin fall down,... knock him that thing now... star... right there, make him go round,... we see him,... side along top, that thing go down there now, star, Kiki, Kiki. We call them Kiki (star).*

Q: Why did that star fall down?

*...Star fall down himself, like he been travelling from that side, from Walpiri side,... well, two stars been go down there now, knock 'em.. that soakwater in the middle,... to make him big hole, from bottom from right round. Red rock, naygima naygima...*

Speiler Sturt: *From Kandimalal now, he been go, he been knock em, and that hole right through, to naygima naygima, (red rock) in that way.*

### **13.2.9 Frank Clancy**

The following are notes, not a verbatim record, from a discussion with Aboriginal artist Frank Clancy, conducted in Halls Creek, in August 1999, in relation to his painting of Wolfe Creek Crater (which features in Figure 91). The interview was not video recorded.

*Underground tunnel (from Wolfe Creek Crater), to red rock. Man from red rock, he had a small dingo, like a puppy, (for food). Long time living along the underground tunnel (walking). Dingo, man killed dingo in the tunnel. Blood. Big snake, water snake, rainbow snake. The tunnel fell in on him and the man is still there in the tunnel. Dead in the tunnel. Finish. He never get out- the dingo is still there as well. This story can be told to anyone, man, woman and child. Dreamtime story.*

Note: Red Rock is located on the Sturt Creek, near the junction with Wolfe Creek, and is also called “Naygima Naygima”.

## Part III. South West Western Australia

### 13.3.1 Toogarr Morrison



Figure 125. Toogarr Morrison.

(Photo: John Goldsmith)

Interview in the foyer of Horizon Planetarium, with Toogarr Morrison, held on 19 September 2011.

Q: Could you tell us about your background? about yourself?

*Well I was brought out in the bush, Dad was out in the bush all the time, and life just revolved around being on a reserve, ah, never went to any of the missions, except Rowlands, when I got a bit bigger, but I see most of the people just getting pushed from pillar to post, so to speak, and being taken away from their parents from the reserves, get put in the missions, no-one knew what was going on, no-one gave permission, no-one done anything, so I grew up in the world where you were bossed and you were told what to do, and to me, that was just full of crap, when I grew up, we came to Perth, and that's probably why I didn't do high school, because I didn't want teachers telling me what to do. So really in a sense it bugged my education up. When I got about 30, I went back to TAFE, and then from there tried to learn where to put a comma, and a question mark and a full stop, and then from there went to UWA for a while, trying to be academic, but I couldn't get into that, so I went to Curtin University and started an art course, and I was so confused in there, with what people were trying to tell you to do, as*

*an artist, that it was damaging to your imagination, and I read one time, where one bloke said that if you don't have imagination, well then you're not really worth anything, and that was Einstein, you know, and look what he done, so I used my own imagination to do art at Curtin, but then the Aboriginal enclave came over, and told me that I wasn't allowed to paint what I was painting, because they were the big people, and they were the same age, and I know that no-one went through any Aboriginal law in the south west from my time, so I do not know who they were trying to bullshit as guardians of this so called Curtin University enclave, and ah, when they came and told me, my own people, that disgusted the hell out of me, so I just grabbed all my gear from Curtin, and I only had a month to go before I would've got my BA, so I grabbed everything and told them to stick Curtin up their backside, and I went over to Edith Cowan and Mount Lawley, and they said, well you do another year and we'll give you your BA, so I done another year, then they said well stop here, so I stopped there, and I got my (BA) from there. It was just that the lecturers there, not telling me what to do, but trying to understand what I was doing because all my ideas was coming from the point of view, that they didn't even had a clue, and they didn't really know, I think, how to judge what I was painting, because they didn't know too much about Aboriginal culture. So we came to an agreement, so when I rit my Masters essay, nobody knew what I was writing about, so they failed me. But then, the bloke who I was with, he was the police man, it comes back to me now, and lucky we talked about it for a couple of years, and he had a pretty good understanding of where I was coming from, so he said, well you have passed. So you know, you just keep battling along until you come to an understanding, of where other people who are the officials, so that you could get what they'd give you, but you have already got what you know from an Aboriginal perspective, so you've already got that, but then you are really educating yourself, to try and educate the white person, to try to get them understand where you are coming from, of what you see, because they have never seen it before, and it's a crazy little world, you know, it was like a tumble weed, going along in the wind, you know. You cop it from both black side and white side. But then if you keep going and like I said, you have your own imagination, you know you're winning, and once you know you are winning, you have already got to a place that can tell the story. So that's basically my education, there is nothing big about it. Only that maybe I was just strong headed, that I didn't like people telling me what to do. I wanted to do what I wanted to do. Some things you can't change because there's a law, and with that law, it is a white law, and the black law, it is there, and you are supposed to adhere to that, but you know that if you use that law, you will have to face the white law, so you are still in that world, of not being accepted, of your full potential as a human being, an Indigenous human being.*

*So basically, that's it, and if people want to hear what I've got to say, well they know that I'm a Bibbulmun Aboriginal first in the South West here, and I'm a Noongar, as a biological male. A lot of people in the South West call themselves Noongars, even the women Noongars, even the kids, they call them Noongars. I can't get over how unthoughtful, and provocative that is and mentally unaware that these people without any imagination calling themselves all men, when they know that a female is a Yorgah, and a child is a Coolungah, and there's Aboriginal people sit around the table in the South West, and then the man will say, I'm the boss, I'm a Noongar, I'm going to talk, I'm the male. Then the*

woman will say, I'm a Noongar, I'm the male, I'm going to talk. Then the kid, will say I'm a Noongar, so I'll talk. Where's the things that have been passed on that have been passed on around camp fires out in the bush, long time ago, nothing at all, sweet bugger all. Its only just,...of where's there supposed to be a hierarchy but there is nothing in the Aboriginal content of our society now in the South West here, because no-one in the South West has gone through the traditional law, to become elders, yet you look at people, they will argue everyone is an elder by the white people. Elders are being made by local governments, by primary schools, everyone is an elder by white people. Where is the tradition?, where is the culture? I mean to say you could use your imagination. You might go mad by using it, but, you know, that's the whole process...

Q: Toogarr, you have had a remarkable career with using your artwork, to help people learn about Aboriginal culture. Could you tell me a little bit about that aspect of your work, the use of art to help to educate and inform people, who previously, may not have been very aware about some of these topics?

Well it's just the same issues, you've got the bad, you've got the good, you've got the hierarchy of Aboriginal people in the South West here, who are not artists, but they think they seem to know everything about art, everyone... It just drives you up the wall, you know, and, but then, like I said, I just go and do my own thing, I was the first person, when Percent for Art came out, that's Public Art, I was the first Aboriginal to get a public art commission. I did it down in Narrogin, down there, Narrogin, I written my first, in the project book, I wrote my first trial, I suppose you could say, of this cosmology story that were are talking about. But back in those days, I didn't know the names, because I was still researching, and when you are researching and you don't go to the library and get a white persons book, that's already tells you, and then you talk from a white persons perspective, so I was going out in the bush, and just hopefully doing the right thing, by picking up words with my imagination, of, saying to myself, this is what my old people are telling me. Because they're there. Because in our culture, in our religion, we don't go to heaven or hell. We just stay here on our ground. We just come up and have a yarn with people when they want us too. Instead of frightening the hell out of them, Boo! I just go out there and listen to all sounds, at each different place I try and go to, and with those sounds, I try to compare them with what I heard, and how it was spelt, I don't have a clue how they were spelt. I just write down, and I'll go to another place, and I'll write down that and I'll say well that's nearly the same as this sound, and it was nearly the same question, so if I now say that word in English, that will be the word for that certain entity, and this is how I placed them all down, and I came up with the story of the southern stars constellations, you know, of the Bibbulmun nation, and I had to believe myself through my own culture, that what I was, because there is no one down here to learn you. Like I said, no-one was going through the law, no-one was doing anything, everyone was just going to the Local Government, and they were saying sign here, you're the Elder, sign as an Elder. So it was a hard work and you really had to try to get yourself to believe what you was hearing and what you were trying to do, was a part of the traditional culture that has gone, which is a bloody hard thing to do. And, but I compared a lot of words, and writ them all down, and put them down here, there and everywhere, then next minute, I just got all the stars, and then there were a couple of stories



*about babies being stolen, and, in the first project book I wrote in Narrogin, there was, I wrote it there, but I didn't know the name of the women with the long white hair, and all these stars which were her children. So a Charnock was a devil thing, and so I just called it Charnock woman, while I was lingering on the right name to call it, and then I found out, ...that if that woman was a Charnock woman, she wasn't a Charnock woman, she was literally related step sister to Bibbullmun and that's the mother of our land. And the Grandmother, which was a Gorbinda, what they call, what I put down to as gravity, because my Mum said that a chitti chitti was in the tree and it always sang about falling off and Gorbinda always put her back, so, but Gorbinda also made her fall out too, so I think, what was between that nest and the ground and Gorbinda had to be gravity... Crazy... So with all our culture lost, I just wrote that down, as that's our Great Great Grandmother, and Bibbullmun is our mother, because that was pretty easy to find out, because, a lot of the old people, and the first recorded history of the word Bibbullmen comes from 1820, down at the Murray River, where the person probably got sick and tired of Aboriginals spearing his sheep, so he made friends with him, and he said, Who are you? so they seen him pointing and they said Bibbullmun, and he wrote that down how he thought it sounded, whether it was a true pronunciation, or not, who knows, but, Bibbullmun, and a lot of people said no, well he's a Buddhist. I said no, bugger Buddhism. It's Bibbullmun. That's our mother, that's dirt. Because they try to put the context of our religion, into worldwide religions, of all the religions that they see around the place, when it just really different. It's just based on the dirt and the water, and all the other elements that make it up, and then you look at them all, and then get put off by all the Aboriginal people, in the South West, saying, who are Christians, saying no don't do dot painting because that's devil worship, and that really puts you off of looking at a your culture when it's your own, and when you are growing up as a vulnerable teenager, you are trying to understand, so you know, I just kept delving into it. ... No matter where you look, it's all made up of dots, they're called atoms. And when they get put together, in our dimension of the 3D dimension, we can make what all those dots are all about. So the thing is, when these people, old people used to go into another dimension, in a spirit form, and then come back into our dimensions, now, they put it together in dots, and then we could look at the painting and see what they've seen in the other dimensions and scientists are trying to do that now with microscopes and all other sorts of things, so maybe we didn't need microscopes a long time ago, we just jumped into that other dimension, and now they reckon they went down past that atom, quantum theory and string theory, you know, so they are imagining all these things, that maybe, the Aboriginal person who was still practicing traditional culture, are simply going into those dimensions. They reckon there is about 12 dimensions out there in quantum theory and these big scientists with all the machinery and that, these other people are jumping into those dimensions, and when they come back,... ah yeh, Jesus Christ was walking up there with all them men, so you know, and it's true, he was a man, he got followers, and all them people are still following him. Probably Buddhist, all sitting under the tree, pulling his ears, and old Aboriginal people, they still sitting around to. But then, there are other entities that are different, so you just got to be, and that makes up our law, where you have to have respect, no matter where it is. And that respect then goes a long way. And if you don't there is other entities, that can infiltrate back into the (seers?) and you know, I mean to say, it's all made of atoms, even all our organs, like right down to our DNA, RNA, that*

*other entity can come in and just take one little atom from there, and mislead that whole construction and you might die. And this is how people can do things without even having a microscope or probe, or anything else, and this is the wonder of our culture, if you have respect and go through the law in the proper way, and what you can do. But when people tell bullshit, it's all based on what the white person has written down, and what they can prove and dis-approve. So you know, its, you could win, but then you can't win, when Parliament changes the law, to say, no well we won't allow that, with a clause. So they'll get to understand how you could tell lies about the culture, and then they can change it. So you are fighting not with the traditional law, you know, and it is such a waste of time, so the best thing is have your imagination, and just do art.*

Q: Toogarr that's very helpful to begin to appreciate your thinking about this subject, because the work that you have done here, for Horizon Planetarium (the artwork behind you right now), it is incredibly rich, there is an enormous amount of story within the painting. For people who are not familiar with the parts of the painting, the story, what do you see as some of the key parts of the story that you have painted here, for Horizon Planetarium painting?

*Well maybe the key parts aren't painted because if I tell that story, like ah... we got a word that's called Beway Coolongar, that's means that's a rock where little spirit babies sits, and a Yorgah, a female, before she becomes a mother, a Nanjun, she will get pregnant by the spirit, before conception with the man takes place, so she's already pregnant from that rock and I think up that Wolfe Crater, they looked at some elements within them, and found the first building blocks of a human being, amino acid or something like that, and ah...so, could...long time ago when that first spirit roamed the land, because you know, what came first the egg or the chicken? Well the spirit came first, and we were all walking around us in spirits and that's probably why the dinosaurs never ate us, because they couldn't see us, you know, about 70 millions years or so, you know.. and...You got all beliefs how humans came, but ah. Within that, that element got out and what I think happened is that it was caught with water in some form, maybe something that we can't even see with a microscope, and then within that microscopic element of water, and the elements, because everything was fighting, and these elements were fighting too, and they got mixed up in that little blob of water. And then, somehow these two elements scraped together, which formed maybe 2 million elements, a hundred elements, I don't know, but when they came together, they were two different strands, that were still fighting each other, and still trying to duplicate each other, and then one must have, in somehow I don't know the brain formed, but one must have said, it has to stop this fighting, so it entwined them together to make the first DNA. But then, when that happened, whatever formed from it, who knows. Maybe there was a big lot of elements that formed into different sort of spiritual entity shapes. But then, with the form of the skin, which I think the skin formed from the water, and the other elements inside. From all this fighting. And the biggest fight was between the male and the female, where one then turned into a male and one turned into the female, but that didn't stop the fighting. Now that they are humans they are still bloody fighting, you know. So it hasn't changed. Maybe somewhere within our subconscious, somewhere, there is still that element. Or did the old people know a long time ago that we did come from that rock*

*and that entity still came from there because there is another element with your spirit, and that's the totum, and that totum is related to that. But then it was still based on the animals then, of what you couldn't and what you could eat. So, somewhere along the line that had changed, but they still recognised the Beway Coolongar, but they just call it where the little babies sit, waiting to come out. Now with that, that means, maybe the painting hasn't got everything down because if they're still there, and there's that two young people they threw up there for breaking the law, that means the law hasn't been based, and maybe it has been based, but now in the south west here, its morally unstable. So that means it's got to go from there and come back down here to earth again. So that means that those little children who have jumped up there, have to come back and the rocks have to form again on the land. See, it may have formed before and that's why the cloud of rocks around the earthly planets, and the Oort cloud is way out there, so maybe it's a process which duplicates itself, over and over and over, so because they're out there waiting to come. So what's our time here for? So that puts a (Philosophical ?) statement then of who you are as a person here. And as a person, the Aboriginal people from the South West always believed and I think elsewhere, that they weren't allowed to touch their mother (Earth), that means they weren't allowed to dig up no precious stones, like gold, diamonds, or anything else, because they knew that they were not born from the mother, but given to her from out other side of Gorbinda, that may have brought them here, the Great Grandmother and other people, or stars, or relations through the stars, or whatever, would have thrown them all here, so they to stay here, because they had a different contribution to how the earth, the mother, will react to different situations. So everything has a place and this is what you as a human being had to really stick to within your mother country. You know, so that's why, this here, just looks at, the painting just looks at what you see in the night sky through different phases, and that of how our mother is turning and all that. But ah, there is still another story that doesn't answer all the questions. And I know that people are trying to, white people, you know, they are trying to find out about how the big bang occurred, you know, but who's going to worry about that, when you know that you have to look after your part of the earth, to make a chance for them other Beway Coolongars, when they come back, to run around and roam around. So your role here isn't to ... but to look after it, for them fellas to come and that's why that walk is still going on, to get 'em back. But now we are using spaceships and that to go up there, so they might come back quicker, who knows...*

Q: One of the things that I'm hearing, this is a lot of knowledge that you are sharing here, the act of creation, that creative part, I'm hearing from your story, is quite an important part in various ways, and in fact even the creation of an artwork itself is an act of creation. I'm very intrigued to hear about this.

*Yeh I'm mean to say it's, I mean to say, it goes back to every time, I look at, people who say "use your imagination" you know, and all you got to do is have a belief in yourself, that your belief is doing what the old people would have wanted you to. You know, because like that old fellow, that was talking on your video, old Jack Jugarie you know, he was the first person to come down to get a badge for the police, long time ago, I was about 18 maybe then or something and I met him in Port Hedland there, he pulled up and asked where we were going now, all we had was a bit of damper, and he said come here*

*and have a feed, me and this other old bloke, and he said where are you going now, he said I'm going through to Halls Creek, so we (asked) can we get a ride, yeh, so from Port Hedland, we got a ride to Derby, and my sister was there, so we had a camp and a place there, so from there we went up to Halls Creek, and where the swimming pool is now in Halls Creek, that was his camp, that was a reserve there, and his camp was the first camp, and all them other places... So I camped there with him. See, all of that tradition has nearly gone from people now. 'Cos a long time ago, down in the south, used to have the same tradition, where if you were a stranger and you do something good, they'll pay you back, you know, in that sense, and I was camping there at his camp, and every time, in the morning, whenever I was there, his wife would always give me a feed first before the kids would have a feed. Now we say give the kids a feed first. But, you know, you as a stranger, you got your billy of tea, and when you was full, everyone else was allowed... and even Roebourne there, when I went there a long time ago, they all got out of the house and I got... and I'm thinking this isn't right you know, but it was respect, and you find out all those things and you learn allot about culture and that's why, that old bloke, you know, he learnt me so much, just by showing respect, you know, and that's why I never forgot him, and in all those places, I went looking, 'cos there you could, when you lay in the bush, you can look at all the stars, and then you just wondered, what was that and why I was up here..., and that there....you know. Then later on you learn, you know,... Earth going around, you know. So all them things just came, you know, and white people only told their stories up there, and other people told their stories down there, so when I got back down here no matter where you went on the reserves, reserves were only just closing then, and people were only now and again were going into houses. So, every kid I talked to, and nearly every young person, they didn't know nothing about culture because the people wouldn't talk about it. Most of them had only just come out of the missions, and they were all Christians. And everything was "don't believe in that". Yet they wouldn't walk out at night time, that means they still believed in the spirit, of the Aboriginal. I used to say to them, your white God, and...let him talk to the Black spirit, I said, then you'll find a place in between, where he knows better too, you know, because everyone was a human, before they become the spirit, they were a spirit first, a long time ago, they were the Beway Coolungar, before they became that. So we got something in common, you know. So, nobody knew anything, so that's why I started putting all the things together, down here. What we could see and why, and then I came up with like I said, first public art. The first time I ever wrote a report about the project, so I had to put something in the front, I didn't want to do it because I knew that if I did it, it's out there, but you got to have trust, and sometime I wish I never...and I put it down there, and yeh, the person who stole it from there, he used to work for... (deleted)...and he's going around telling everyone that his Uncle told him, and I just said to him, alright then, you're telling the story word for word, and Charnak woman, you know, and I said, that's what I put because I didn't know her name. And he went word for word, and I just said, so if your uncle told him word for word, that means that means I must have know his Uncle, to write it down word for word, and I don't even know his uncle, so how can that happen, and it never happened between no interaction with spirit, you know, so that means, and it just cements my feeling towards people, that what they do now is to use the white law to protect themselves and have no respect, and they haven't got that respect for Aboriginal culture, because it's clearly copyright theft, and this is what allot of Aboriginal artists, in*

*the South West are doing now. I said, but if you are going to do it, go into it and tell the whole complete story. I said don't tell what you've given me, what I've written. Because every book, like Minim Cove, ah,... all the public art, down in East Perth, you know, all public art I've done, that was doing it by the same criteria of going down and talking and writing things down and getting a clear picture about it, and, they're all written in the project book in the different Councils, and everyone can go and access them, so people go there and get them and look at the Aboriginal history of that place. But then they will take the story, but take it as their own, and say that their Uncle and Auntie... (told them) so I must be everyone's Uncle and Auntie. And people, Aboriginal people sit down and look me right in the eye, and say this is what my uncle told me, and this, this, this... and yet, I was down in Fremantle, how I got the Fremantle story, like I was doing the wetlands story in North Fremantle. What can we tell here? I didn't know anything, I went and asked some of the old fellas, they didn't know anything. ....they didn't know a bloody thing, even old Fred Collard, when he was alive, he didn't know a bloody thing, and so I went and got the history books, and I always wondered why the boats were all pulling up, because I thought the boats were right at the river, big masts, and pulled right outside, East Perth,... Swan River there. But there was a bar across, so Ken Colbung told a story, about a whale, a shark and a crocodile coming down, and then I thought, well, where's the crocodile, there is no crocodile down here, so what happened to him? So I done the same thing camping along the banks. And someone said that the Wagul got angry, because this was a longtime ago, ...15-20,000 years ago, the waters rose, but the Wagul knew that, so he had a fight with the crocodile, and he bit off the crocodile's tail and stuck it across. This is the idea that came to me sitting of the banks of the river there, and my imagination, so I said...What would keep the tail down?,... what would keep the tail there, so I said oh well, seeing that he pulled off his toenails, and stuck 'em in ... that's a good explanation. Then crocodile starting walking up this way, because I read in a book that in Yanchep, there was a lake there, that was used, the mud used for people's backs. So by the time the crocodile got there, all the marrow run out of his back, and that was marrow made of the mud for healing people's back. But then there is a lot of turkeys along there, before the white people all shot them out. And so they got sorry for that crocodile walking on his back legs. So they give him a coat of feathers, and he turned into an emu. And seeing that he was a male emu, that ran away a long time ago, from the crocodile, he had to look after the eggs all the time,... to learn him, that sort of story sounds good, so I wrote that down. And I told 'em, the historians, when I'm writing, are given to me from the bush, no-one else is given them to me I said. From the history books that I wrote about (i.e. read) Stirling, Fremantle, and... some Dutch fella... They parked their boats out, and pulled their boats over this limestone (at the mouth of the Swan River), and then I'm thinking it was all blocked, so there is freshwater and salt water. Then, just up around the river, North Fremantle there, you're not allowed to eat red meat there, red meat, and they were eating things there, so I was thinking I wonder why they weren't allowed to eat red meat, So, ah, when I went to Minim cove, there, I put the two, I forget her name now, but... I liked the way she drew this woman there. So, I said, because women were allowed there, that must of been where they stopped the process of when the young fella's walked over. Because down this way, you only stick a bone through your nose, you don't do no cutting, and so that was the process after three or four years, and they came back and went back to different places, and*

*that's why there are 24 states within our Bibbulmun Nation, and each one is divided into four skin groups...Crow people and Cockatoo people... and why they went around was they learnt respect, and the young fellas camped with their skin people, that way no unwanted pregnancies occurred. And all this was thought out by people, and I'm thinking aren't these people marvellous, they had all these things, what you look out now in society,... they've got all these things... and everything was based on, on that, so it was just amazing to really get a picture from my imagination, of what was happening, but now, I don't mind, 'cos, I did it for the kids, 'cos they could grow up and tell something about their country. But it wasn't the kids that grabbed hold of it, it was the big people, and then started stating "I'm and Elder" and don't you ask me about things, which put a different turn to what the whole thing was about, really, and I still hear it today, and I know every single one of the Aboriginal people in Perth, and down East Perth I was there, I seen nearly every late night pub where they used to go and drink, and everyone used to get kicked out of one pub and the go to another pub, and not one person I ever heard talk about a crocodile, a wagul, snake, or anything, or even a bar across the river. But now because of economics, they will tell lies and state, their people told them. So I've got a lot of people,... it drives you mad, but then you've got to have a bit of sanity about you, and just keep away and do your own thing, and that's why I'm still going. Maybe I'll write a book about everything, the whole shebang, it's just like a big cycle, and I'm trying to have a look of where that cycle might end, but the further you go out there, the further you see these rocks lining up, and there are billions of them, just in our universe,... just within our Milky Way, so you think, you know, you are trying not to get away from your mother (i.e. Planet Earth), but then you can't help wandering so far, because if the Small Magellan Cloud and the Large Magellan Cloud were the two people who will come back, and these people, at Orion's belt there, are going up to... where the woman is around the campfire there, so these people are still there, even the Seven Sisters,...down to the Wagul, straight down.*

*So you just got to ask yourself whether you believe in it or still your imagination. And this is what I really would have liked, young people to get hold of, and question it themselves, amongst themselves, and in this way, it would learn them more about the whole universe, than just the little local town there, which puts constraints upon their mind, you know, and... but,... their being made Elders by other people, and that then puts a constraint on these young people's mind, instead of letting them have the freedom to say no, well this here... you know, and the old people saying, well I'll learn that too, instead of saying ah no, well that was told to me by (old people) and they don't know nothing on how to expand upon it. So, its... It's a funny world, not to many of us left down here in the South West.*

Q: There are certain places that feature prominently in the stories relating to the night sky, for example, Wave Rock, is that part of your background that particular area, as far as your sky knowledge is concerned?

*Well I really I don't know, like I said at the beginning. Dad was clearing just land all over the place, and like, after the war, they done' like Ongerup, and all those places, when they did returned soldiers. My brother returned and they wouldn't give him no land, because he was Aboriginal, so they gave it all to his mates, so he went working for his mates. Like you know, right down other side of Ravensthorpe,*

*and then right up past all them places, way up other side of Hyden and all that where they were clearing land, where there was a lot of mallee root picking and sucker bashing, you know, all sorts of land clearing. Dad just used to get out there and pitch a tent, for all the family in the bush and whoever could go to school went to school, but there was hardly none because everyone just stayed and helped pitched in for all the thing and that. So it was just everywhere you went, you know, and I had the utter most faith, because you hear all the stories: Don't go there, don't go there, don't go there, you know. I seemed to be the person, who just used to walk and had a drink, I was only about this high, and I used to say, now I wonder what's here, and whether things were following me around I don't know, but I had the utter most faith and respect in Mum and Dad of them being the bosses, you know, and they never sort of over reacted about where they may have knew a sacred site or something was. They never over reacted, they just came down and, notice, let's just walk over this way now and never shouted or anything like that. So that made me think more of places, you know. And when dad had to move out to these places he always knew these places. They were the last people in the south west to have gone through the law, as far as my knowledge of the Morrison family is. And, ah like... now, they got the dates from the last people to have ancestors in the South West. So the last person they could trace was dad's mother, and so that puts us in the running for the Native Title holders of that area. It's just a big political game now, I don't want nothing to do with that. But it only just proves that our history can go back as far as the white history, but then we can go back further, because of the little caves, that are still down there, you know, along the river, where Dad said well don't go to that, because that's where old fellas used to take young men a long time ago, and this and that, around Ongerup and Jerremungup and all those places right through, that way. And other places, well, he just knew what the other old people recognised, and he just told them well don't come to my place, where I am camping, I'm camping in a place that's nothing to do with any of the sacred sites, so there was good conversation, but there was still culture being discussed, and if, now and again, you weren't allowed to hear what the men were talking about, but sometime you made the tennis ball or something run under that way, and you hear a couple of things. A couple of things used to stay in my mind, because secrecy, was, I spose... In those days, why they were being secret, but they didn't want secrecy to be a part of the family, was because if you went to say something in the main street of a town, and an Aboriginal Affairs person walked passed and heard you say an Aboriginal word, you've then got taken away and got put in a mission, because Aboriginal people weren't allowed to teach their children any Aboriginal. So, they had that, now I think back, your mother and father, had this enormous responsibility that was controlled by that fear, but they still let their freedom out of culture in the land they were actually destroying, but it was for economics, you know. So you look back on it, and know how to comprehend it, but it's just a whole lot of thought process, that was a lot of hog wash, on the white person's part. They were just racist idiots, in their thought pattern. Instead of having any, and yet they put it down that we have freedom, we let anyone do anything, all this and that, but the poor black fella, even in his own country, they wouldn't let him have no freedom. And I think some of that sort of, emotion comes up into my art, sometimes, and ah, sometimes I think that it makes it look a bit dark, that I don't want to explain about that, and I think I shouldn't do it. So there is a whole turmoil this and that still going on with respect of my community, and mum and dad, and the disrespect for white culture, you know. But*

*there is no animosity, its, I think that, someone has to put something there through an honest process, where, then when it gets into the holistic part of our culture, of respect, that honest part will come out better than these other bullshitting people that are around the place, and that's just my belief. So I'm getting old now, I spose, you getting, you know, a bit... so I guess you .. you know. But the main thing is I just don't like the way the process of politics is leading our kids. Sure there is a lot more within universities now, but, you won't hear a person, see, those that are teaching in there now, are people who have been through the University, and every bit of their knowledge has come from written books, from all the white person has writ. Yet they will swear to you black and blue that their mother and grandmother and all this has told them, and even when a person does an opening, you listen about them, and they will say, our people have come from over there, and ... and you know that they have come from Kellerberrin, or somewhere way up in the bush. So you think how can that one person escape that massacre, then run those hundreds of miles, to Kellerberrin, have a child there, then that child will go on and marry a white person, and have that child. You know, where's the history coming back. You can't trace it, that means they'll get away with that, and they expect us all to believe it. And this is what the kids are listening and hearing now, and when they get to about 18,19, 20, they realise that it is a lot of bullshit, and they'll start doing it. So we are passing on a line of bullshitters. Not honest people with respect, where you go to a camp, and you are given a meal, first. We're loosing it. We've lost it. Yeh, and we know that, whoever goes to university and all this and that, knows the books of what is being written, where and when and by whom, and if you study that, and when someone tells about it, you'll say, but you can't do that, your mother wasn't around, your mother was over that way, and your father was there, so you can't have nothing to do with that, so you got that out of the book, or your mother, and told your mother to say that, when she opens up the thing, and that gives her then an identity to that part of the land which she is talking about,...and it's not honest. But we are the only people who have to deal with it, through our kids, and yet, you still see those jails getting fuller and fuller with blackfellas, you know, and they're coming through the juvenile system. So, you know, it's an attitude that you try and get it across but, see it's based mainly on that Bibbullmun, see. Like all they old people, a couple of them, they will still remember that everyone was called Bibbullmun. But the young people who have been through the missions, and been on a reserve, everyone was said you are to call yourselves Noongar, and then in..., after we became citizens, after (19)67, and people started to get Aboriginal centres, and legal aid, everyone in Perth, they were all the men, Ken Colbung (etc) they called it Noongar, because they were Noongars, they were men, and the same people, then everything became Noongar Legal Aid, Noongar Medical... So the young person, the first word they are learning now, they are getting brainwashed from their own people, is Noongar. The first word that comes out of their head, is Noongar. They won't stop and think, what is a Noongar?, that's me, and if you say anything I'm going to punch you, you know, and that's the argument and they will defend that without no reason why they are defending that. And this is how I see how the Aboriginal people, in the South West, in that arena there, you know. And the kids, they're learning to tell, should I call it a white lie, because it's from white people? But you know, instead of using your imagination, you get out of your little spot, and take your own trip, you don't need a rocket ship, and what you don't know, go to the shop, and get a book, and read it. And if you don't know anything of it, in the first place, put it to one*



*side, and go and get a little children's book, and read that, and then go back to the other one, and then use your imagination to put things in your own context, and then put it back to the old Blackfellas, and their maparn, their (law). And then you say, well, they must have done this without microscopes. And, this is the full intensity of human experience of Indigenous proportions, that these young people can gain going through, so what they are doing is then saying well we are theorising about it, we are not telling lies. And they will grow up to be more honest, in getting instead of waiting till the next person do that, and saying well I'll get that and put it here. You know, and they will grow up in a much more honest way. And there's nothing stopping them from doing that, except, most of the Aboriginal people, you hear them, when they are not with white people, saying, who the hell do they think they are, just telling bullshit. So what is that doing. And these are some of the big, so called elders in Perth, who are Christian saying that. Why should they swear if they are Christian, why can't they be truthful to their own white god they're following. So you see a big lot of contradictions, and then, when you have been through it, you start saying, I'm doing something myself, and maybe if I go over here and sit on my own, and I talk to my old people, maybe they will tell me. A lot of them told me to go somewhere, but you know, you just gotta have respect. It's a whole new world that opens up, that, and not only me, a lot of other people, believe in. So that means I'm not a person who went and got this for that sake, but just for enlightening young people's minds, so that they can hopefully take that trip, and get out there, and be themselves. Instead of looking for some drugs down on the corner and going on that one little trip.*

*Because it's, there is so much that those people now are taking young fellas through still out in the country you know, that can open up all these different worlds. ...It's just not being played out right, because the white people are controlling the whole situation, except when they are out in the bush on their own, and there is a freedom, because sometimes you look at a young person, soon as they get their head band, they're sitting around a pub, drunk. That makes them a man. You know, but if they keep that process up, I reckon open up the whole process of traditional law again, initiation, and with the school, get the Aboriginal people, to put it within the school curriculum, and say, right o, you are not a man or woman until you go to year 12, and the only way to do that, is to have the process of the law in between, every year, before you do year 12, and then from there, just give them a little broader image of letting them see if they go to Uni or something. But then, by that time, they should have their other entity that our mother gives us, where all these other worlds can open up. You know, I mean you go out in the bush sometimes, you see an old fella sitting down, he might 'en be sitting, he might be gone somewhere, way out past them stars, talking to someone who is travelling. And then, gaining something that is given back, maybe these things are different elements that are not made up of only the 30 or so elements, that live in this environment... Because look up there, at, about 3 or 4 years ago, at Kings Park. The bloke took all the elements of smoke apart, and then found another element that generates it. Now if there's an element in there that generates, Aboriginal way, there's an element in there that can kill people. You know, so what is that element, we haven't seen it yet. But the Aboriginal person has. But then, they will sing a song to generate that element that can vibrate into your body. And everyone uses smoke to takes things away, even Blackfellas, you know, they will walk*

*through your house with the smoke and sing the song. So it's a song that can activate that element. Why is that song so important. Why is that element...Where is that element, you can't see the thing. So you know, the whole process of everything. Just to sit in the bush and to look up into the stars, you're thinking isn't this easy, you know, isn't this easy, there's those stars there that I ... and they are there for you to see, and they are not hidden. But these other things, you know are hidden, but then, there is nothing to stop you from using your imagination and unhide them, I was lucky I suppose, that some people still talk to me, 'cos I done this (the Horizon Planetarium foyer painting) with the kids, you have to do that with the kids, so that was no worries...*

### 13.3.2 Josie Boyle



Figure 126. Josie Boyle.  
(Photo: John Goldsmith)

An interview with Wongai elder Josie Boyle, at the Kidago Gallery, Fremantle, 21 Dec 2011.

Q: Can you give us a brief introduction about yourself and your artwork?

*...Probably my Aboriginal heritage brings me into the art way too, you know, people doing lots of art around you all the time, and talking about stories through art. Because we have lots of stories through dance, art and stories and dancing, and all sorts of things, so I've watched as a child growing up a lot of people doing those things, 'cos my tribe was very traditional. They were the Wongai people. And I grew up watching the wongai people always being involved in a lot of dancing and a lot of artwork that they did in all different forms. They were doing with the stick work, burning with sticks, in the old*

traditional way, and long wires, ...they got big long wires, patterns, and they had all these patterns, and we often wondered what the patterns meant and why they put patterns on animals and I used to sit and watch them do that, and later on I didn't know why they were doing that, but later on, I asked my mum. Why were they doing that. And she said because they wanted to feel closer to the creator and by drawing on animals or carving animals, that gave them a closeness. That's why I can see, a long time ago, why the people sat round the fire. They wanted to be close, like the animals, higher to the creator, because the animals are, and that's why I got interested in art, later on, and it came naturally to me after, when I started to think that way and all that stuff that I learnt as a child, and when the tribes and the clans... everyday...in our growing up days. All that came back easier for me, because it was something that I'd learnt as a child, and knew and was there, and it came easier for me, and of course my mother was a star girl. We called her a star girl. But she always believed she was one of the Seven Sisters left behind. We had to watch her every day, and become that star sister. And she said that star sister, Seven Sisters, left behind, and she was in that story. It was her story and she was in that story. So we couldn't go past that story every day. She was that sister telling us that story every day, see. Everybody got in that story, and she was a good artists too. And my mother, because she didn't have to prop up photos and copy from, it was all in here (Mind) like Albert Namatjira. He knew the land, so he could paint it easily, he didn't have anything to follow, it was all photogenic stuff for her, and she had that same vision. She could do this brilliant art, and when she sat down and drew the universe, and saying the songs and the maps, and we used to think, how on earth did she have a map song of the universe. But sadly I didn't keep some of those songs, that she was singing about the universe, the ... songs. And Yindibarndi was a big word..meant the universe. And she believed she was the sister in and out of the story. How could we not know the story when you had her dancing the story every morning.

Q: So it sounds like that the Seven Sisters story is a really close family story?

*It was easy for us to listen to all that and for me now to follow that pattern. I always believe in patterns. And patterns are very important in the land, you know, you see all the pattern of the land. We believed, well she believed in light and shade. How can we not learn from her today and keep upping it. Everything was light and shade every the morning. We didn't use to understand it all at the time, when she used to sit around the fire, and how she followed the light and shade, and that was from the Seven Sisters story of how the light and shade got over the land. And even now when we go digging for bushtucker, my mother always used to say, dig on the shade side, because, that's where the coolest tubers are, you know. And that is how the pattern of light and shade came every morning, and that's where they sat and where did their work, feeling close to the creator or whoever they had as their... the seven sisters in their case....*

Q: For those people not familiar about where Wonga people live, can you tell us about your country, out near Kalgoorlie?

*Well we're really called the Lake people, because Aboriginal people live in a lot of country out there where we come from, most beautiful, we call it the stick and mulga country, and it's just beautiful, little sort of, you got to go out a see it, it's called honey ant dreaming country. What's those little birds that we have out there, mallee hen country. And that's how the country is made up of all these animals, and where they live, they describe the country where they like to be, and she always was in that country, in the lakes country, because they follow the lakes when they travel, that's was their road, and the lakes, so that's what we call that today...*

Q: So for those who are not familiar where Wongai people live?...

*You go 1000km north east of Perth. So you got to go north east all the time going out into our lands. And then we have lots and lots of lakes that nobody goes to much today, travelling country that the people travelled long time ago. Lots and lots of stories, through there still, that we are still trying to collect, and you know, and our sites, or a lot of sites out there, that we have, sites relating to the seven sisters. Beautiful sites. I was only sitting down with my son of law who grew up out there, and he lives here in Perth and I was talking to him about the distances between sites, because we have a wonderful intact site at Jindowie, which is a beautiful name, Jindowie, and at Jindowie, we have this beautiful limestone rock, where it breaks away, it's called a breakaway. Some were damaged by the mining people. But the ones that are still intact are beautiful sites, and we've often wondered what they mean. We have never had anyone explain it to us, what these sites are there. There are about six that are out there still. I was asking him the other day, how much distance is between Gindowee, and Niagra Falls, and Boorley Well, and another site out there, and there are six out there, and why are they are zig-zagged, and he said, well, he looked at it that there were six out there specially because they were aligned to the stars, and that's where they had their ceremonies, so that's why these people along time ago came together, my people, the Wongai people and the Warburton people, they all came together, what was that big word that we had the other day, Grungada. Grungada was that big thing that they were all meant to do it, and it was like a big dance, wasn't it, and it was ceremonies that they all came in for, big Gurandgora, like a big dance, where everyone was involved in that big dance. It was also for singing, alignment to the stars, and everybody before, well I was there, long long time ago, the people, actually, you know a long time ago, probably before my mum, everyone... told these stories, brought these rock, from east and west of the land, and the walls are still there, you know, like Stonehenges in England, and they have these walls there still in the bush. And they are all still there, all these sites like I was telling you... these big trenches for dust storm sites, where people sheltered from the dust storms and there was all like all these stones came out and hit you pelted you for three days sometime, you just couldn't see in front of you, so the people had to shelter. So the ... ..Still, you know, still out there, these sites, so, beautiful time to go one day and see all these sites and learn of early history of our people. It's something similar to the Jerusalem people, the pilgrimage of the Jerusalem story or the Christian story, and this is a beautiful pilgrimage yet, that nobody knows about. And the sites are beautiful because they are all identical, and they are all caves around, lake in the middle, waterhole. Always the waterhole there for drinking, beautiful sweet water still there. And these*

*beautiful intact sites, limestone breakaway, that we call breakaway country, and all zigzagged and pointing to the stars, and the songs were all days singing, days and days of singing, of songs alignment to the stars. They all had to line up to the stars.*

Q: So these particular places are very special...

*I go quite often to them. It's like people go back to the Christian pilgrimage and pay their respects. I go to the one in Coolgardie, because that's easier going past there, don't we, and I take Bronwyn there, and we stand on this hill and we look out at, because its damaged anyway, there's only a little bit left of it, but we still stayed there and pay our respect that it deserves, because it's a dancing site, see? so everything has a different story of the sites of what happened, when the seven sisters were here on earth, see, and that was a dancing site and it was like the celebration site of the end of the journey on the earth. And that was where the boundary line came for the Noongar people, and the Noongar people came from Coolgardie, back to Perth, see, so it was all danced the Seven Sisters, and they made the boundaries as they went over the land, wonderful story really, and as I was saying, we have this wonderful story, of how they have simple ways of the land, we have four words, we use Gailey for north of Australia. You don't have little towns in between like we do, in a white way, (e.g.) Where's Moore river? Ah, it's this way and this way... Gailey, one way, that's north. Don't ask any more silly questions. This is gailey north of Australia, so Yagardo, don't ask any silly questions, that's south. Ubardi, west, Gagada, east. So you don't ask, who's in that line or where the towns are, you know it's all in the east of the land, west of the land. Yagardo, .. gailey, see, wonderful ways, simple ways the people had of lovely ways of describing the land, you know. Sunup and sundown. Now where do you live, you know, today? ...Sun down country, see, the sun sets here and the other mob, up there, Sun up, but I was really born in sun up country. It's a wonderful way of linking everybody in the world, sun up and sun down, see, and I love the way the universe, my mother taught me, is equal, it's equal to everybody, you know, you all share these stars and we all have 24 hours of brand new hours every day, everybody gets 24 hours of free time, and she'd use to say,... this wonderful free time everyday... it's it's up to you what you do with those 24 hours. Because it's a sharing thing, see, because we are all sharing the stars, and we share a time. Time is divided to everybody. Time is a wonderful thing, that she always taught us, time, you know. Because time was like ...well, the essences of life. She taught us time. More so than anything else. And when you look at it, it is really timeness, it means a lot, doesn't it. When we give free time of ourselves, or what we give of our time in our life, we get it back 10 times in all ways. If we don't give time, we don't get anything back. And that's just even just to listen to a little story. And that's Aboriginal culture, really, is giving time, I think, you know, and it's a wonderful thing to give, and you get blessed for it.*

Q: So Josie, turning our attention to the exhibition here at Kidago Gallery (Fremantle), can you give us a brief introduction about the artworks here that you have been involved in.

*Joanne the lady who runs this place (Kidago Art Gallery), she had this amazing idea of getting us as mentors with the Artist who work here (or that come here), artists, and to go on a journey together. My journey was with an Italian lady called Alexandra. She and I went on this wonderful journey of me telling her the seven sisters story. She chose that, because I had a few other stories that I told her and then she chose the seven sisters one because she liked that, and then I left her who to paint perceived the story. I didn't tell her, how to do it. I just said this is the story. She listened to us, listened to Brony,... Brony's version of the Seven Sisters the Greek legend, and then I told her the Wongai version of the seven sisters, and she listened and then she came up with the drawings, like this... her way. And I had to go on that journey because when I paint in Aboriginal style of the seven sisters I tend to fill it all up, and she uses a lot of space. So I had to learn, there was a lot of space, which I grew to love the space today, and I've got a painting of hers in my room, as I said, and I love it because it has all this lovely space. And really, we Aboriginal people were in space a long time ago and sometimes my mother was in space to, because she was in space, because she was in a timewarp. So probably that's why I connected better to space when I saw her teaching there. Because everyday, my mother couldn't read or write, so she had to tell the time by the birds, or the sun or the way everything was out in the land. So when she painted like that, it was wonderful because it connected me to her too and she connected in her way to me too... and we had a wonderful four weeks, of learning this wonderful journey and bringing the exhibition together, and me bringing the sand painting in and actually getting her to do it. I sort of stood and showed her how to do it and she loved it. Because she learnt how to do a sand drawing as well. Between us we had a wonderful learning time and she really wanted to come to Kalgoorlie with us and I was sad I couldn't take her because we had three other women with me at the time, white women, who I was taking up, and we didn't really have the room. But she really wanted to come up, see, so I was telling Bronwyn, why is it that all these people, even though we have lots of problems in our culture today, a lot of people still want to come out and come back with this wonderful, what do we say.... ...this wonderful, they're vibrant, regeneration of everything, even though there are all these dysfunctional things going on around us. They still come back, for this wonderful...what is it that they come back that we give them, is it the same way around that, you know, I don't know that. More people would want to come I think, but they just don't know how to you know. I think a lot of people would like to come, more, because it's like a journey, we can learn together, you know.*

Q: What sort of benefits have you seen of this working together, because what you are describing sounds really interesting, people from different cultural backgrounds coming together, working on a project?

*I would say to Bronwyn, coming on, Bronwyn got very excited, for this project that I'd like to do next year, or the year after, probably next year, if we can all come together, and go on a journey of the star journey, and all these people like you, astronomers and us and Bronwyn, and I personally can paint the painting every day. We can sit in the bush for two weeks. We can sit at those sites, and we can tell those stories together and have this amazing star journey together, and document it and I said it would be a wonderful thing and my daughter is a very good artist. She could paint all these beautiful places that we go and tell the stories. We can take people from Kalgoorlie with us on this journey we know a*

*few people who are interested in the journey, we can sing the songs of the star songs and the stories that they know too and all have this wonderful time together on the journey, and I'd like that to happen one day if we can arrange that. So Bronwyn was excited, and she said that she would love to go. You'd love to go. If we can get a few people who would love to come. A lot of people have journeys on TV today of all sorts of things. We went on a journey for four weeks together. We could have documented that. That star journey would be wonderful, because I work as a ... a story teller. The kids today don't really know much about the universe and I think a documentary would be beautiful, and they could have it in each, every library in every school all they could all go to get the documentary from the library, and watch it and learn. They would really love those stories, but they don't get enough of it, sadly because people don't come in enough to hear them.*

Q: Well this sounds like a great idea, and ICRAR's experience with working with Elders, artists and scientists coming together, out on country as well....

*We could get anybody doing the art, beautiful art. People could sit and do and especially new things that people haven't seen before. Even those lovely limestone country, where the breakaways are, you know, there's a lot of breakaways out there. Beautiful looking beautiful country, you know. That still there, people haven't even seen today, and a lovely star journey would be beautiful. Capture some lovely shots. I think it would be a wonderful time to sit around the fire at night time, tell stories of the, you know, land and sea and sky stories, earth and sky.*

Q: You referred to one of the artworks, could you tell us a bit more about what it is represented and how it was created. A brief introduction to this artwork?

*But there again, all those sites have the best sand going, all those lovely seven sisters sites. You go into those caves, that the seven sisters caves, where they all have, you see the amazing sand. This isn't all from those caves, but I do intend to go one day and get that lovely stuff. Pure white. Beautiful white paint there, there's beautiful ochre, yellows, different colours of yellows, different colours of red earth. You even get that really maroon red earth as well as this red earth and you just make this beautiful colours all happen together, and you can make ripples in the red earth and fill in the sand stories you know, like the stories in the sand that the sand holds for you. You know, it holds layers and layers of stories and you can paint them in the sand. See, unfortunately you can't keep them because it's not on canvas. So you really have to take the photo, of them, each one you draw and you use all these beautiful stories using the sand. It's a wonderful way of doing art, so because I work with sand a lot in the schools. But I only use one colour because by the time you use all the other colours you can't use it again. So I only use the one red earth. But when you do paintings, it's much more nicer because you can see all these amazing stories in the sand, and the sand is the holder of the stories. See, it keeps it and stores it, holds...*

Q: The history or origin of this kind of artwork, can you tell us about that?

*Milbardi Milbardi means stories. We used a lot when we were in the mission because all the kids brought their milbardi stories with them into the mission. Everybody had all their little wires, because we were all converted to white ways by the time we were in the missions. We had little wires, and everybody drew their milbardi stories. Everybody sat together and they still held those stories in the mission, so the stories were a way of keeping everybody together and it was like that, you were in with the environment. It was like the environment helped you out, looked after you while you were there even though it was sad times, you could go out into in the environment and tell Milbardi stories, see. And it was all what they brought with them see, and we brought that to Perth when we came, when you came to Perth, we brought our Milbardi stories with us, so we still got together and did our Milbardi stories in the big park in town, What do you call that big park on the corner, in Perth, where they have the courts, you know where the courts goes in there, where's that big park, I can't remember, (Supreme Court Gardens) that big park in St Georges Terrace. Even though we were all little lost kids living in Perth, 16 year old, 17 year old, we still met there, with something to do, Milbardi stories in that park and we all met there and it kept us all together, this story form that we'd all brought to Perth with us, even though we were lost here in the new world. This held us together, ... even though we were telling it on new soil, it still kept it, and we taught other people here how to keep their stories to in story form, you know, you can keep it just by doing it in... ...without writing.*

Q: One thing that I've encountered, for people learning about sky knowledge from other cultures, is that some people take the view that if it's not science, then it's not valued. What you have just described is a very practical example of why this kind of knowledge can be of benefit and valued today.

*And that's how my mum told us the story. She used to tell us the story of this... ...what that...?...she would say ...My mother told me a long time ago... and she'd draw it ...this big thing with a tail on it ...it went across the land it was just fiery and ...shooting and fire, you know...and what's that...and she'd tell us. They must have been talking about a comet or something, way back. What's a comet they would have been talking along long time ago that somebody saw and passed to the tribe down over the things that comes to my mother's time and she always talked about this big fiery thing that went over and I said where did it go, and she said, I don't know it just landed, it just went down somewhere, and she said probably in the sea, but it had a tail on it and it was fiery and shooting fire as it went over. Everybody saw it all around the world. So she always talked about that and she drew that, you know, it always had a tail on it and that was the stories that they brought with them from when they walked across. She came from (Ooliar?), see, and they did lots of journeys across the Nullarbor, straight across the Nullarbor where the railway line is today, engineers they made a railway there now. That was the walking path of those people, my people, that walked from (Ombi?), long time ago, for ceremonies for star stories and star aligning stories, they all came across to these sites, where the sites were, see, that's why they had to travel to those journeys and they did a lot of journeys across there. That's how we got walking paths, from the engineers, put roads today see, from their little trips across, where they were going to their ceremonies, for the Guarnadagas and the singing songs of the alignment of everything, see, of the earth and the sky. Wonderful times they must have had, I wish I*



*was there to join in at that time with them, it must have been fantastic. Everybody coming together all singing the songs of the earth and sky songs, you know, dancing the Gurandura, and that's what she talked about all the time see, and see she drew these things in the sand. So this is an important way of storytelling for us, and not many people have done it in painting form. I've tried it and I really intend to go more of this way and take photos of it next year and put it onto canvas. I think it would be wonderful images you would have specially the, holding the stories one, you know, with all the layers of the sand, minding the stories for us.*

Q: So the story itself of the Seven Sisters, I've heard different versions of that story. What can you share about that with us today?

*Well I think it's what they've left for us today. I think it's a wonderful way of what they've left for us today. And you can virtually pick what you want from what they've left, you know. I've chosen the celebration of life, the story of the seven sisters, that was a celebration of wonderful life that we can have today, and I think we can all have this wonderful celebration every day. I really chose the path of joyfulness. I always try to walk on that path, that the seven sisters had. They had a lot of attributes when they danced over the land, you know. They left all these wonderful things like what we eat today, when we go into the bush, and how do we have the knowledge of eating witchetty grubs? How do we have the knowledge of eating bush tucker? Who told us we could eat all this? See, this was what I was asking my mum. Who made this law? She said it's all in the song book. And we sing the songs and, ah yes that's alright to eat. And they sing these wonderful songs, in this... book, how the seven sisters went around and they seeded the earth and they danced the cycles of life on earth. And how they went and stored the harvest in those caves in those sites today. And when you go there you know the story you can really appreciate that story, and you can see the beauty of how everything is today, and how you can fit in there and the free time, everyday, 24 hours of free time, and everything is fair, you know, given out to everyone. It's all fair. Everything's fair. The time, the sharing of the stars, the sharing of the sky, the sharing of the land, you know...and how wonderful the story is, and how important. And that can benefit each and every one of us today. Well, it is a religion, see. And it's the more you link to it, it's a religion for me today. It was a religion for my mum. She danced the sun up every morning. She used to get up at daybreak. Daybreak was an important time for them. They'll all happy by 8 o'clock in the morning. They'd already been up and watched the sun come up out of the egg at special times of the year. We were working out what time, we saw that vision, the footage of it. Brony saw it too of the sun coming out of the egg exploding, wasn't it. Beautiful, it must have been daybreak and dark, because to see that big light, beautiful footage we had, and all the flying ants coming out of the ground, it just like instant snow, you know, and all this beautiful stuff, and it makes you feel like you're a gift here. Instead of saying why am I here, and why, life's not good to me, and all that. This sort of footage you see, and all this lovely wonderful celebration, it makes you feel, Wow, I'm special to be here and I think that's the message we need to tell children today and the kids. And that's what I teach the kids today, all this beauty of where we live today, and what we have and how we are special here. It's a wonderful journey for them, so teaching kids today at schools, to go and celebrating themselves*

*and celebrating things around us and who we are, and what we have in the sky, and what we have on the land. It helps you out, like it helped us out with our sand stories and the environment. And the Seven sisters story is a wonderful story to learn. It really is. Does lots of things for me every day, you know. Just talking about the seven sisters story, I get happy, and I want to be like my mum. Happy by 8 o'clock every morning. You know, and being up and danced it in, and saw it coming, not that I get up at that time, it's going to get me into getting up to see it now more, you know, it will be part of early morning blessings, you know, blessing times. Everyone has with that themselves. It's a good religion for everyone, you know, in any faith that people have. Having that can help you with other people with their journeys with their own faith.*

Q: Because what I'm hearing is a lot to do with appreciation, healing, a positive motivation. I suspect what you are describing could have a wide application.

*Well the storyteller man loved it. Didn't he. He didn't think of it 24 hours of free time, you know. We told him, he's a well known story teller, and he loved it, didn't he. ...A lot of people loved it, that saying when you tell them it makes you think. It's true, and you know, it's a shared thing, you know, which we can share together. ...I love the star sharing, you know, of the stars, you know, you can all watch it. You can see that it's a unified story. Everyone around the world can see the same thing that we're seeing, probably from different angles, or whatever. We are all together, and it makes us all special. Special people to be here to see it, isn't it, and to see the comets, and all that come in special time, like my mum telling, carrying that story, about what somebody saw way back, that went over like a big fiery thing, and she talked about it all the time. That impacted on her, whoever told her that story way back she carried that story all through her life and she talked about it.*

Q: Its fascinating having a chat like this....

*Well the seven sisters story is nice isn't it. It's a beautiful story and even the Greek story, see, similar and... ...we really got together in that story together, because Bronwyn tells the Greek story, and it's similar to ours, isn't it. And I'd say in, oh yeh, in that story of ours we do that to and say that too... And so Bronwyn was saying wow... She's got the same stories, as what I know, of the Greek Pleiades of how they... My mother used to come up with the same sayings, you know, don't be greedy, it will take your eyes. That was in the Pleiades story, Orion, Merope ?... And everybody, from the Italian lady, she's probably got a similar Italian story, if she asked her old people, as the Greek legend...and the Canadians and the Indians. The Indians, apparently, did you know they lived by the seven sisters on one little island. ...There was a story on TV once and we were watching it and it said that they were all living by the Seven Sisters rule today and they didn't even let any men own any property. All the men weren't allowed... Women were the rulers and then we heard lots of stories, but they were after the male seed, remember, when the lady told us the story, when the Queen chased this man, and he ran for his life, they were after his seed, you know. So we have all these ancient stories, you know that really all fits in, you know, comes back to the seven sisters, doesn't it.*

Q: For non Aboriginal people who are trying to learn about Aboriginal people, because some of the challenges of being together, what's your views about this, about how people from different backgrounds can come together well?

*Well in my country, I believe that Morapoi is the place that you could go to because, we went to Applecross High School the other day and the kids got interested. They are actually going on a journey there next year, to Morapoi. They want to be out under the stars. They want to learn about the stars. They want to learn about how to get bush tucker. 'Cos Wesley College goes so many times a year to Morapoi. Morapoi Station is quite close to Lake Ballard, it's close to Jimboudy, it's close to Niagara Falls, and the people there they welcome people in there, they actually take you out on these journeys with them. You work from there where everybody's willing... ..We want to go on a star journey, would you like to be a part of it, they will come with you and we can all join together with people from Morapoi Station because they are actually doing it now. Taking people to Lake Ballard. The other night had a big mining, 25 mining men there, at Morapoi, staying there overnight, doing cultural workshops for three days. They were going out looking at sites around there, looking at sites, all there happening. So it is easier to go now, because people are doing, taking you out there, there's no asking about why we should be there and that, because it's all covered... at Morapoi. That's a good place to start, I think...*

Q: That's very helpful to get some of your views about that.

*I think that is a good starting point because they are doing that now so you can come there. Then wait for them to invite us all out to sites around there, you know, and then I come with my story of that site and someone else can come with their story of that site, see, and it's like a journey together, you know and then Garry's, can tell us... Garry's got lovely stories of the sites too, that I haven't got. And Laura got different stories of the sites. I love her story of one particular place that she knows which is a beautiful story and this story is a rock, a special rock that's sitting out in this desert country, and the story is that its shaped like a big damper and its white and it's got all the bubbles on it exactly like a damper and the legend on that place is that a long time ago, everybody went out there to plant (Broome?) seeds, see and one year they came and there was nothing growing on the men's side, and the men got really wild and they hit the rock in anger because they all got no seeds and all the women had all the seeds, and then they hit this rock, and then when they came back nothing ever grew on the men's side. Today, the women's side is flourishing and the men's side nothing happening...see... ..so these wonderful... Kids love those stories and the teachers love those stories, when I tell them in the schools. And so they all have got these lovely stories. Laura shares that stories doesn't she... and somebody else has got a lovely story. So you bring these wonderful women together on this journey and you invite them as a film, I think you will get everything you want, about everything, because everyone will bring these stories together, has to happen. That journey has to happen, that star journey. Because there's a lot of cooks going on journeys today. The TV is full of cooking programs. A man and a camper van and he just gets out of the camper van, and cooks from his campervan. So*

*you have all these people doing these stories, and you are learning another way of life and culture even by the cooking of the food. I've learnt that much about other people's culture watching those shows. See, and it's all about the food, and yet I've learnt all about the people, and who eats the food, and I thought why can't we have a star journey and we all go and we can learn together and people bring their, like those people, cooking stuff together. And they are all on this wonderful cooking journey. We can a wonderful time with the people, you know, we can have all sorts of people come, ... a good journey about the stars. So we all just have to all get busy and do whatever's needed to do, I sponse, ...look for the grants for it to happen, write it out and do it, and try and get it happening. I'll come.*

Q: We could have a chat about that later...

*...She's a Noongar, but comes from Yamaji country and her story was that, wasn't it...the seven sisters dropped all these lovely crystals down, in some parts of Geraldton, and they've got these...in the back of Geraldton, have you been up there, where that road goes, into that lovely valleys and things, you go over that hill. You see all these beautiful formations of hills and things. Well along there, there is a lovely story of how they dropped the crystals through there.*

Q: That's in the Geraldton area,...

*...More of that story, of her story, but she just told us that briefly when we went to that day, remember, and she invited me to her house, and we never got there yet, but she invited us. Remember she said come for lunch, but she said that beautiful story, crystal story through those hills. I can't remember, when you get to Geraldton, there's a roundabout there before you go to Carnarvon, and you turn right into the hills, beautiful through there. Then you go over those hills... Lovely formations, and plateau's, plateau shaped hills... They must have lots of stories through there of the seven sisters landing on the plateaus... But it's a wonderful thing to all come on this journey and all talking from different areas, you know, it would be a wonderful, wonderful thing together.*

Q: Do you think this type of journey happened before?

*No, hasn't happened. This is the first, here... Isn't it... It's a learning journey, see, everyone's has had a learning journey together. Working with Aboriginal and white people artists together, see, so it can go on into a nice... Universe story, of whatever... Seven Sisters, wonderful... Star stories I mean...I've got lots of stories of people who tell me different stories, too, you know. We just carry the ones our mum told us and the ones that my mum danced to in the morning, and that she taught us about the sun, and the light and shade of the land and how she was doing the blessing stuff in the morning, and she was the seven sisters in the story, and those sorts of stories... and other people have different stories, so it's a wonderful time to come on that journey of learning more...*

Q: Now Josie, is there anything else you would like to share about this exhibition?

*Because my mum was into this story more than anyone else. She was the one who was the seven sisters left behind. She was the one who danced every morning. Everybody knew her as talking about the Seven Sisters, it was her religion. She danced it and there was a similar story floating around about the ice-cream kid, and this little ice-cream kid came from a tribe who came with the seven sisters story and he tried to teach people the seven sisters story. And he couldn't understand why are people not listening to my story, they are pushing other things on me, and I want to tell them all about what I know and what my religion. And he got that angry with everyone that he stole an ice-cream. And then from then on, his life of crime began. An then everyone dubbed him the ice-cream kid. But it all started from him getting angry that no-one wanted to hear his story about the Sevens Sisters, see because that was what he was trying to teach them. When he went to jail, he was still trying to tell them, why you people can't listen, ...You're here now, you do this our way. And he couldn't understand why anyone didn't want to know about the story he had... religion, see. So, that was her everyday doing this wonderful dancing, singing, storytelling... Being that story, in that story.... ...Funny thing the women, that were carrying the egg, were strong tall women in the story, ... like they carried the Earth, and that's what she painted here. I can love these, you know, ... She's done it very much like the story we told her. And she put them in the painting. And she even painted the women, the way the desert women were, so even in my day, the desert women, Beth's mother was a big strong tall women that could have carried the earth. They had this wonderful postures. They were tall strong women. And they walked across the sand hills, in Indian file, and they sang and they were telling the stories of how the ground was hard, and we were battling here now, and we were all struggling, you know, and when they all floated, they all had lights on, they were all singing the floating song, you know, so they were all telling you stories... and we were all sitting and laughing because to us it was all strange and silly, but now I look at it, and it was a wonderful way of describing the earth, wasn't it. where you walked, this hard, where you walked you float, and it's a wonderful journey to, you know, how the land holds you, isn't it, and if you lose your friendship with water you will perish. And these were the sort of things, you want to make sure that water's your friends because if water is not your friend, if you're not be a friend to it. That's all the saying we have today. That's like um, she was very much into all that teaching, see. And that's a wonderful way of, this girl, portraying that in her painting, she listened to us, and then she got that look of her fading, see, that's the seven sisters fading, losing her shine, only the shiny bit... as she is fading, and the eyes, how she has put them, and then she has Orion with the stars, painting him big and the Milky Way, you know, the Milky Way up there, she's made them special. And Orbor the star girl story, and they are in the heavenly embrace,... universal embrace or whatever, you know, that is a beautiful embrace. Isn't it. You could not have that embrace anywhere, it kind of suits that story, doesn't it. How "orbor" was the little star girl, "Orbor" means "kiss" on our language, and Orbor was the little star girl who wanted very much to be in love. But her home in the universe was a lot stronger, she wanted to go back to her home, see, so today they look at each other, you know, he's probably in the reflection in the water still, and she's probably the reflection in the water still,... image of each other still, you know, the star girl who once came to earth. Beautiful story isn't it.*

Q: (Bonwyn), Do you want to talk about the men?

*Well, the men, the Wadigudara, the two Wadigudaras men, the law men. When I used to sit with my mother, nobody really had the stories like I did. Nobody sort of ask why and how and what, and those sort of stuff, because my mother used to stay with me, and I sat with my mother every day, who made all these laws? who did this?, who said that? I used to say that to her and she would have to answer me because I was asking her: ...Who made the skin groups?, Who told us how to live like this? And she said: "Wadigudara, the two men". Some people say there was only one but... my brother said there were two, because he obviously heard my mother's stories. Him and me says there's two, and Frank tells stories, of Wadigudara, which is one man, but the two men that I have in my story and my brothers story, is that they were the ones who sat and made the skin groups, they sat with the tribes, and they said this is how you must live,....so it was governance, of how everyone had to live. All the rules of how you had to live, the two wadigudora made that, and they were on the earth the same time with the seven sisters and they were doing their law, making the shapes of the lakes with the right hand boomerang, and the other one had a left hand boomerang. And they said, right you carve now, and I'll carve now. And they complimented each other as they carved the land up. See it was carving more than creating, they were carving more, funny isn't it how they got the boomerang today and how they were carving, and that's how you must complement each other today, so all the laws of complimenting each other, and not be jealous, and not be...it's a wonderful law there for us today, of how you compliment as you went. See, so all my people live of the right hand side, and all my people live of the left had side. So we have left and right handers. So I'm on the right hand side. Laura says we are the important side, Laura says we are the important mob. Bronwyn your our skin we are all ... women, we are higher than the left handers. So 'cos I used to say what on earth is this right hand and left hand. I thought they were talking about Christianity, God on the right hand side of the throne, and the devil on the other side, and I thought that was what they were talking about, growing up listening to these stories. She said, "No, right hand, the Wadigudara made the carving, and that's the way we are going to live, light and shade", and when you came, you walked on the light shade of the land or the right side of the land, see wonderful, and that's how they came together and that's how they came together, right hand and left hand of the shade and the light. So we are the light side. And anyway, when they came together, they all got in the skin groupings and the Wadigudara, were these important men, who control the living side of how you should live. They knew what was going to happen. They could foresee that you will always know who your mum is you would not know who your dad is...All structured specially in the skin groups, so you that you married rightly and didn't run of in the wrong, and have incest. And all the wonderful patterns of life that they put together. They did all that. And then I said to my mother, we heard from a Wadigudara today, the Seven Sisters are up there, they all went back to the stars, ... they are the two clouds, outside the Milky Way (Magellanic Clouds)....*

Q: There are some topics relating to the night sky that can be sensitive, some of knowledge is said to be restricted, but I don't understand why that is...

*I can follow that up briefly, I always have this belief, I mean, I can't really understand other people not telling the story, myself. Because my mother showed me these sites. Now if there was anything to hide, why would she show them to me? Why did she tell me? Why did she take me and show me them? That's how I think if she didn't want me to know even Mary took me to show me some out at Coolgardie. There was a couple of things she didn't show me because she thought they were men's things, which was fair enough, and I didn't ask but when they do show you or tell you, I think that's quite OK. I think some of the times, the people. If you know something, it's nice to share it, but if you say sometimes, "I don't want you to know about it" sometimes I find that could be because they don't understand it themselves, so they shut the shutter down and that's an easier way to put you off, because they don't know how to tell you, they haven't been in that story themselves, to know it. See, if you've been in that story you know it, you don't find it frightening or threatening, or to me you just tell it because, other cultures tell it because there's no people in other cultures saying you shouldn't know that, you shouldn't do that. Why aren't they saying it if it's all out there, hiding things. To me, that's the way I look at it... If people really hide a lot, I find sometimes, they don't really understand it themselves. That's how I... A lot of white people, say a lot of people put the shutters down when they ask questions,...ah we won't talk about that... they don't really understand it all themselves. If you understand it, you share it and you let the person work it out for themselves, of what they think.*

Q: This is very helpful, so I take it that everything we have discussed today is quite open.... Several cultures have an idea of concealed or restricted knowledge. ... knowledge is open to everyone via learning.

*That's why I never understand Curtin (University / Centre for Aboriginal Studies) because Curtin promotes learning and then you go in there and then they don't teach any other culture other than Noongar culture. They are not allowed to talk about another culture, but hang on, you got a learning place here, you're supposed to be able learn about everybody, so I can't understand that either, learning is learning and schools, you all go to learn, you promote it... ..It's a pity, because when you go and be a storyteller like me, you want to be able to tell other stories. Why should I not tell a Noongar story in my class, I think it's lovely to be able to grab a little frog story from Noongar country, and read it.*

Q: Is there a connection between the Emu story and the cosmic egg story?

*To me it's a different story. Although the Emu features a lot in the universe, doesn't it, the Emu story, it features a lot. The only version I've heard of the emu story is when I was a child. I never really heard about the eggs story of the emu. I mean, now I have, it's there for regeneration of new chicks, of new life, you know, when eggs come and the emu is there as a silhouette to tell you the time, May, June, July, when you see the emu in the sky. But the version that I've heard is when I've been at a campsite in the mission, as a kid, singing Christian songs and the man saying Jesus is coming tomorrow, and the Aboriginal men looked up the Milky Way and said, not yet. I like that version, see, because they didn't see the sign up there in the Milky Way and to them, the Emu was still up, and he was still standing up,*

*Southern Cross or whatever, and he hadn't fallen over yet, and that to them was the Big Bang coming when he collapsed, and he's still strong. That was they're version. I'll always love that version of the story, see, of the emu.*

Q: A comment about Wolfe Creek Crater, I've come across the influence of some of the early preachers with some Aboriginal people...

*Witch doctor to the Wolfe Crater, he was a witch doctor, he a big man, Barragu, and he told us the story of the two snakes in there (in the crater), and he told you that story too didn't they... ..Barrago, George Wallaby. But his aboriginal name was Barrago, and he was the witch doctor and he took me thorough that crater, and he said there's two big snakes in them, don't go in them,... what's that place near Balgo... (Billiluna). That's where he told me the crater is in... there is a big crater there too, but it's covered with water. I was always interested in other peoples cultures, and always went around with the people, and when I lived in... and I learnt all of that them there,... I've been around all those places and every time I went to a new place I always sat with the people and learned their culture. ...Love other cultures, you know, we learn their songs and we learn their dances and we learn everything about other cultures, and we always... I used to go with the people ... saw the...two little albinos, there's two albinos, Monica and Murphy, two little white albino's. They sit inside all the time with sun glasses because they can't come out, they live up at (Bells River ?)...way up in the thing. Anyway, there's all these lovely stories, we know about how the nuts fell off the tree, that's the time we can go and get the turtle eggs and all these beautiful stories of how it all works in the land, you know, when the hot wind blows the Barramundi's fat... Yellow fat comes in the trees, that's all the fat off the animals tummy. You can go my girl and eat as much as what you want, the yellow colour is there. All this wonderful way of learning the land, you know and they had these wonderful stories, so, to me I used to go with Barragu. Barragu used to tell me all about the Halls Creek where the craters were. We used to go digging the amethyst up and they showed me where the amethyst was and it's all jagged in the hills. We used to go there. John used to come with a backhoe and lift it out because it was too hard to dig and there we had these big slabs of red amethyst... and I was only talking to Rodney Rivers the other day, Rodney live here, and he's a Kimberley man, he lives in Perth, Rodney Rivers, we were talking about the amethyst. He knew where it was and I also know and I come from another part of the country but because we all learnt together, we learnt about the land together. See, learning the land together is a wonderful way of learning.*

Q: That old man from Billiluna?

*He's dead now. Finished, he's gone long time. But everybody knows of him. His name is not spoken about, because he was the witch doctor and you worked with Jugarie people, the Jugarie sons, Jack Jugarie is their father, I know them all well. And that's why I wrote that little song...“One hundred miles from Halls Creek from the eastern Kimberley”... about the snake song, we were all listening to that the other day and we were laughing our heads off, a lot of people like that song because it's funny,*



*and they way he told it, don't go in there because the snakes might get you, you know, and that's the same story that they told you, didn't they. Barragu told me that years ago.... ....and my mother saying I took my mother there, and I said you've got to come and see this place, and I can't understand how it landed in the flattest country of all its flat, flat, flat for miles. How it didn't go anywhere other than that flat, it's flat for miles and anyway when I took my mother there she went, ... and I said why... "It's a big tap"... ....and we all started laughing because her version of that crater is a big tap and I said what do you mean a big tap?, and she said its turned off, it's kept the sea away, you need all those rocks to keep the sea at bay. So Ayres Rock is the place that's specially put there to keep the sea back, Crater, Wave Rock, Hanging Rock and Augustus. All these rocks are there specially. They're not there for nothing, she said, they're there to keep.... Wonderful way the way they looked at it, didn't they. To us it didn't make sense at the time, but then you look back and think there is some meaning there that could be right and she said, if it wasn't for those rocks, you'd have the sea over the land. And Booree Well, one place where we must go, they reckon, the rock there, some mining people were going through that rock and they couldn't go through it. It was just so much they couldn't work out how they couldn't go through this special rock, keeping the sea back.*

Q: Breakaways associated with the Seven Sisters?

*When you look at all the sites, there's about six in my place. There's a lot in Geraldton, so they have crystal stories through there. Beautiful, when I drive through there, I just look at those beautiful formations of the hills you know, and the breakaways up there, right through there, Meekatharra has got a lot of breakaways, too. They must have a lot of stories there. Because where breakaways are, that's the Seven Sisters story, see. Where there are no breakaways, I can't see where they would have been, because we got no breakaways here, have we?*

### 13.3.3 David Wroth



Figure 127. David Wroth.

(Photo: John Goldsmith)

Interview with David Wroth at Japingka Gallery, Fremantle, 15 September 2011.

Q: (Introduction, David Wroth's role at Japingka Gallery)

*...well, principally putting together exhibitions for the gallery, so we would run 12 to 14 exhibitions a year, across the two galleries upstairs. So my role is looking at the paintings and the artists, see what's currently happening. Selecting shows for the gallery, a year in advance perhaps. Curating the paintings that go in, and preparing the exhibitions. So it's an exhibition curatorial role, I suppose...*

Q: Can you tell us about your background and experience, you have had a very substantial history in this field?

*I've been working with Aboriginal artists, for um .. do the sums.. 28 years or something now, I think. I began as a young student when I was studying print making at Curtin University and I took a job within Fremantle Prison as a tutor and that's when I began meeting some of the Aboriginal people from remote communities that were in Fremantle, for extended times and so we had some very interesting art classes in those early days, it was a bit of a revelation. I had studied anthropology, so I had some background into Aboriginal culture and I'd also studied fine arts, so the two together was a*

*compelling mix, for me. So consequently with partners we set up a company called Desert Designs and that focussed on working with Aboriginal artists and creating textiles and a whole lot of everyday products that had Aboriginal designs on and as part of that we would market limited edition prints and paintings, and one thing led to another, and now we manage a gallery that is entirely focussed on Aboriginal Art.*

Q: And so part of the history here is relating to Broome, Pat Lowe and Jimmy Pike (Kimberley Aboriginal Artist).

*Yes, that's correct. This gallery really started probably with a focus on Jimmy Pike's artwork and Kimberley artists. We already had a very close association with Pat and Jimmy through licensing Jimmy Pike's designs into Desert Design, as well as running exhibitions and fine art prints and etchings and silk screen prints, etc, so yes, there's always been a very close tie with Jimmy's group, particularly the Walmajarri people of the Kimberley and so in the last decade of his life Jimmy lived in Broome, and Pat and he were an eye onto the cultural and lifestyle realities of Aboriginal people in that part of the world.*

Q: By way of background, it was 2003 when I went out to Wolfe Creek Crater with Pat Lowe.

*...fantastic, and ...Wolfe Creek Crater, is, for somebody who comes outside the world of astronomy, to visit that site is very sensational. I remember I went there in the (19)70's, and was blown away just by the monumental scale of it and an appreciation of the kind of forces that are at work and some of those issues, but it is a great site and Jimmy Pike painted some works early on which were based on the subject of Wolfe Creek Crater and therefore it was of intrinsic interest and he used to talk about the star story that related to this part of the world, yes.*

Q: Many of the Japingka exhibitions often represent the ground, from an aerial perspective, but in the last few years there has also been the exhibitions that have turned their attention to the sky. I'd be interested in your comments about this body of work?

*I think we first saw the star stories, from areas Walpirii artist from around Yuendumu, and maybe going back a decade or so, but it's been recently that stories from Yuendumu have been strongly represented particularly by Alma Nungarrayi Granites. It captured our imagination because, yes, most of the paintings we represent are terrestrial maps, and what Aboriginal people bring in particular to that is a kind of closely observed map of country, that gives them the sort of information that's important to them. Whether it is a kind of creational story or whether it's got to do with everyday issues of hunting and food gathering and so on. So these maps can represent either small areas of space (so they could be a few square metres), or they could represent vast tracts of land. So the scale issue was always a fascinating issue, when Aboriginal people were painting these terrestrial maps....*

*So we are used to seeing works of art from Aboriginal artists that are based on terrestrial images, so it's got to do with hunting and tracking aspects of Aboriginal life, and the big creation stories of Aboriginal life, so many of these paintings can deal with long time spans if they are creation stories that still exist in evidence in the landscape, or they can be very immediate issue like food gathering and bush hunting. So when we saw the first images of the night sky it was a revelation because the issues of time and creation stories that Aboriginal tell about the landscape were also told about the night sky and the scale of some of those images, obviously whether that's the Seven Sisters, or the Milky Way or other significant constellations for Aboriginal people, they are very vast in terms of both the time over which the creation story is depicted and obviously the scale of a sky is a immense sort of subject. We first seeing works coming out of, I think it was Yuelamu near Yuendumu more than ten years ago, and they were very interesting stories mostly based on the Seven Sisters creation story and more recently we have seen an fabulous body of work by Alma Nungarrayi Granites, which has looked at the night sky in a maybe, a combined way it has elements that we recognise as observational and naturalistic, it has elements that relate to the significant stories that Aboriginal people tell about the constellations, and Alma also inherits that particular dreaming story down through her father's line who also has stories of star dreaming and creation stories relating to the constellations. So it's a very significant connection through Alma. It's quite a fascinating step forward in terms of the artwork that she is producing. I think given the long story telling history of constellations of our own culture, to the Greeks and beyond, to all maritime cultures that much more familiar with perhaps constellations than most modern people are, Indigenous people living out of doors have a profound sense of season and night sky, so it is great to see an artist make these compelling images and just showing us from an indigenous point of view, a very powerful look of the night skies.*

### 13.3.4 Ian Plunkett



Figure 128. Ian Plunkett.  
(Photo: John Goldsmith)

Interview with Ian Plunkett at Japingka Gallery, Fremantle, 2 August 2011.

Q: (Introductions and background of Japingka Gallery)

*My name is Ian Plunkett, I'm a co-director of Japingka Gallery, in Fremantle. Japingka gallery came out of a long standing interest in Indigenous art and culture. The company originally started in the early 1980's with a collaboration with a major Indigenous artist called Jimmy Pike. The company was then called Desert Designs, and it was licensing Jimmy's paintings and designs to go on different things such as fabrics, and also limited edition prints, exhibition.*

*Out of that grew a gallery that was aiming to be at the top end of the market dealing with leading Indigenous, and finding emerging artists, as well and promoting them to a wider audience. It had been our goal to get Indigenous art into every home in Australia, whether that's achievable or not, but that's the goal, because when you get the art, you also get the story behind, and it's an introduction to Indigenous culture.*

Q: Can you tell us about your background to Japingka, and Aboriginal art and culture?

*I first became involved with Desert Designs back in the mid 1980's. At the time I was living in Europe and I lived in Europe for about 18 years. But I was starting to hear a bit about Indigenous culture and the art especially, and I came back to Australia and I came across Desert Designs which was an*

*ethical, already well developed company, that was not only taking the art to a wider audience but also the designs and the background stories. So I became a director, European Director of Desert Designs, I went back to Europe, and organised exhibitions in Paris, and London, and also started to promote the culture alongside that, introduced a lot of Europeans to Indigenous culture for the first time. So that is how it started, and when I came back to Australia to live in about 1993, we set up the Japingka Gallery then it was really about getting the best Indigenous art and to promote it to as widest an audience as possible.*

Q: Can you provide an introduction to the Alma Granites solo exhibition?

*Alma is a daughter of two very famous artists from Yuendumu which is to the west of Alice Springs. Her parents, Paddy and Bessie Simms were founding artist of the Warlukurlangu Arts Centre there, which is an Indigenous owned and run arts centre, and the second Indigenous art centre to be formed after Papunya Tula. So it has a very pivotal role in Indigenous art, and has been one of the first to be out there promoting art to a wider audience. The ...Alma as a daughter, hasn't had any formal training whatsoever, but she's had the traditional training where her parent and Aunties have brought her up, told her the stories. She's fully initiated and this is one of her dreaming stories what we have here. So she's been taught the traditional way to paint, and as the custodian of this dreaming story, she's entitled to interpret it as she sees fit, and so she's taken this particular dreaming story to another level, as far as the art is concerned.*

Q: What are the main themes of the exhibition?

*It's a very unusual perspective. Most Indigenous artists paint from an aerial perspective looking down on the land. Whereas, Alma's one of the few, probably one of three or four, who paint looking up into the heavens. So, for a start that's quite unusual, but in some ways you wonder why it is unusual, because if you have ever been out to the desert, the one thing at night, that really strikes you is the clear skies and the stunning views of the Milky Way and all the different star clusters. So that is one of the first things that really hits you. But the other unusual aspect of it is it's one of only two dreaming stories that I know of that is national, goes right across Australia. Most dreaming stories are very regional, such as the Wanjina spirits, they are only in one little area, and different emu stories with different interpretations, but, along with the rainbow serpent, it's the only one I know that is national dreaming story, that's recognised right across Australia by all the different groups. So that's really unique. But it's also a very very ancient story, which is telling. For a culture that had no written language, one of the main ways of passing on knowledge was through art, and oral tradition, and sometimes dance as well, this particular seven sisters dreaming story has a very long tradition and if it's done full ceremony it goes on for several days. There are different dances that tell the whole story and re-enactments. But what Alma has done here is to put it onto canvas, and to distil the essence of the story, using her innate sense of colour, to tell the story in her own way.*

Q: and Almas' style?

*Well she (Alma) has a freedom, and an unfettered imagination, and her paintings are probably less formal than some of the traditional paintings, to do with say, the emu dreaming, or the wallaby dreaming... very fine controlled dot work and built around symbols. Whereas Alma's actually depicted the actual skies themselves and the stars, and she's painted them in a really remarkable way in that she's captured elements of the Pleiades star cluster which you can just sort of discern with the naked eye, but really stuff that she has got in this painting, you really need a telescope to see. So it is quite remarkable, the level of detail, the dust around the stars, she's managed to pick up, which is unusual and I can't really explain how that is, but it's part of, she's obviously had this passed onto her, this knowledge, but how they knew about this level of detail, I'm not really in a position to say. But it's there in front of us, there it is.*

Q: Which brings us to the way in which people interpret paintings, the meaning different viewers of artwork experience. What's your take on how to understand meaning from a particular painting?

*Look, art's always very subjective, and what one person gets from a painting can be completely different to what someone else sees, and it could be something as simple as the colour, composition, where a particular symbol is placed, can affect someone's view of the painting. But with Indigenous paintings we are very fortunate, in that the artist wants you to know the story behind it. So, when you buy an Indigenous artwork, you also get the story as told by the artist, and as I mentioned earlier, this is one of the oldest dreaming stories known to Indigenous culture. There are parallels in Europe and all around the world, about the Seven Sisters, though they have different names. And even though this is a national dreaming story, it does vary in its elements from place to place, it's basically the story of... in one version anyway, of unrequited passionate love, where this Japiljari man, depending upon where you hear the story, it's either one of the stars of Orion, or it's Venus has fallen in love, with one of these seven sisters, but it's a forbidden love because he is of the wrong skin group, so it's definitely forbidden. But he pursues her anyway. So her sisters take her, and they flee to get away from this man, and he chases them right across from the east coast of Australia right over here to Perth in Western Australia, where it ends right on the banks of the Swan River and the Indian Ocean, where they can go no further, and the Japiljari man is coming right up to them, where the powerful local spirit takes pity on the sisters and turns them into stars in the heavens, but the Japiljari Man is a powerful medicine man himself and coming to the Indian ocean, he realises what has happened. He turns himself into a star and pursues them across the heavens, and... he is forever pursuing them, but never catching them and it really just documents what you can see in the sky as they move across the heavens every night, its replayed, the same story.*

Q: This actually touches on a major theme in astronomy,... that the stars are for everyone, across the nation, and in fact, across the globe. So this connection with the night sky is a really important one.

*It is, and I think what this exhibition,... we've been lobbying the Warlukurlangu Arts Centre for several years now, to get a solo show, because we think she's is a major artist, with some of her own story to tell, and in a very distinctive way, and that's been bourne out in the sales of this exhibition. It's a sell-out exhibition and this is in a very flat art market, in fact retail market generally. So for her to have a sell out show in this environment I think not only speaks to her talent but to the universality of the subject matter, and I think people right across Australia are fascinated with astronomy and the stars and I think it goes to something within our souls, our very being, where we have always looked up at the heavens, and wondered what are they, and where are they going and what does it all mean if you like, and Indigenous people are no different. They've documented these and they've made sense of them, by bringing stories into them, trying to explain the existence of them.*

Q: What is it about Aboriginal art, and this subject in particular (Aboriginal star dreaming), why do people value it, why do they find it interesting? What's your take?

*...Art itself is very subjective, and yet, this particular subject matter of... this exhibition is called the night sky, even though it just focuses on one or two constellations. It appeals so widely, we've had sales to Museum in Switzerland, major arts collectors around the world, have clamoured to be buying these paintings. It's because, but I can't speak, but certainly for me, it's about the wonder and the mystery of the universe, the complexity and the fact that it is inherently beautiful to look at and what Alma's done here is brought this down to earth, if you like, for all of us to see and enjoy, even those people who don't have dark skies, and they just look up and see it, here it is on, brought down to earth, for everyone to, you can own a piece of the heavens really, you can buy one of these paintings, hang it on your wall, and enjoy it, marvel and wonder at the complexity and exactly what's behind it. I think that's what it is, it speaks, it's hit a cord with a very wide range of people, people who probably have very different tastes in art, and come from very different cultures. It still speaks to them, and I think that's the thing about astronomy, is that everyone can enjoy it, everyone just has to look up and see it, and since time immemorial, we've wondered about what these things are, people have always attributed to being different spirits or gods, or, we now know, stars are just like our sun and we know a lot more about them, but it still doesn't diminish the awe and the wonder, part of astronomy, and the world which surrounds us.*



## Part IV International interviews: South Africa

### 13.4.1 Dr Thebe Medupe



Figure 129. Dr Thebe Medupe.

Photo: John Goldsmith

Interview with Dr Thebe Medupe, at the South African Astronomical Observatory, Cape Town, 25 March 2010.

Q: (in response to an overview of the Cosmos, Culture and Landscape research project).

*I think this is a worthy project, because you know, this kind of information is related to stories of the land, sky, related to folk lore, star lores. It's very important. It tells you something of the history of the people as well. And also presenting that kind of information for future generations in South Africa we've been using this information to try to make astronomy and science attractive to young South Africans. So I, absolutely, I support this kind of study.*

Q: How has this approach been used to encourage younger people with their interest in science and astronomy?

*It has mostly been done by an isolated group of people. It has not really formally reached the schools. We are like in South Africa,...our Department of Science and Technology has the Indigenous Knowledge System division to it and those are the kind of people who are really trying to push for this kind of thing, studies to be done and for the information obtained there to be written in the form of high school books which can be used in addition to the other learning material, about science in schools.*

*To that effect I've been approached by Cambridge University Press, the one based in Cape Town and I've written at least one or two books, one book about African night sky which is a small little book for children maybe 7 or 8 year olds, and then I'm writing one book based on the history of astronomy in Africa, but slightly different because there we are looking at the written records because in West Africa, people have been writing since about a thousand years ago, so there are a lot of ancient books, that were written in Arabic and using Arabic script, to add local languages, so its slowly getting there, but it's not as good as we hoped it to be. Ideally we would like this kind of information to be included in the curriculum. Especially at lower levels at school, even at the higher levels to, to just add a different dimension to the teaching of science and then the message is that, if our ancestors were so much in touch with the surroundings with astronomy and even tried to understand what was happening, although, I mean, it was a kind of science, it's not science in the modern sense of the word but it was that kind of understanding of their environment, so if that was so much part of their culture, why can't we make science part of our culture today. That's the message really, we are trying to carry with it.*

Q: What was the idea behind the film Cosmic Africa?

*The idea came from, there was a film maker and a research, all based on a field researcher. Two people who wanted to make a documentary about astronomy in Africa how people in the rural villages in Africa related to stars and what their beliefs were, and things like that. And so they approached me because I am an astronomer, and I was interested in those kinds of things, and eventually, we managed to get good funding from Cosmos Studios in the US and the idea of the film just became big and so we decided to visit several African countries, Namibia to study the bushmen people. These are Africa's very old Indigenous people, they were here thousands of years ago, already, and we spent one week there, and we got them to tell us about their knowledge and the stories of the night sky, but also we went there at the time of the solar eclipse in 2001, and it was very interesting because we were asking them about eclipses a few days before the eclipse took place, and according to their way of thinking, an eclipse cannot be predicted. It's an un-natural event which happens, you cannot predict it. So they were very very shocked when we appeared to know beforehand that an eclipse was going to happen. And also they associate an eclipse with the lion which is like enemy number one, they live in the (veldt?) where lions are the big enemy, lions everywhere, so they link an eclipse with a lion wrapping its tail around the sun and so, the eclipse is an evil thing, according to them and they were very worried, that I somehow ... knew how, had somehow, could control these things and therefore I'm a magician. So we had to go back to them and explain to them that according to our science, our modern way of understanding things, an eclipse happens because the earth is a round ball and the Sun is a big round ball, and the moon is also a ball and if the moon comes in between then you can have an eclipse, and it was interesting because I think some of the elders internalised that kind of knowledge, because a couple of days afterwards, when we were going down the mountain with one of the elders, we asked him what he thinks causes an eclipse, and he told us back the information that we gave to him which, I don't know if that is good or bad. We didn't go out there to try to teach them science. We just*

wanted to learn from them, and so I felt that we interfered with their knowledge system. I don't know. It's an interesting question anyway, to deal with.

So from there we went to Mali which is in West Africa, and there we studied the Dogon people, they live on the cliffs, very beautiful houses, architecture, very isolated community and so we spent three weeks with them, and we wanted to know again about their knowledge of the stars, and it's just beautiful everything is graphical, you can see, how in that temples, you know, the painting, every year they paint that temple, and in the painting there is a lot of symbolism to do with astronomy and also we were curious about they apparently knew that Sirius, the star Sirius, has a companion going around it, and how can they know that when they didn't have telescopes back then, and so the film directors were very excited, they really wanted to push that line, I was very reluctant, because I would have to explain scientifically how these people would have knowledge about the companion of Sirius when they didn't have a telescope, but fortunately for me, and unfortunately for the directors, nobody in the villages we went to seemed to know about this, I felt very relieved...

Q: So you didn't come across people who could talk about the companion star (of Sirius), because that's been very contentious...

... Null result... Well I think it's interesting... ...So we were talking, yeh,... about other possibilities of the story, some people think that it is possible that maybe about one hundred or more years ago, some missionaries came and visited the Dogon's and told them about this Sirius thing, and maybe they internalised this knowledge, and made it part of their knowledge system, because after all knowledge is not static, you know, its dynamic, and so some people suggest that maybe this knowledge came from missionaries and talked to the Dogon's and some of the elders...internalised this information, although then, apparently the, celebrations or ceremonies linked with the apparent period of rotation of this companion star to Sirius, and if the tradition is very old, then it's a very interesting question indeed, of how they would have known, how they would have come up with ceremonies of that sort, if the information about Sirius came from outside, so really it's an unsolved issue, which really needs people, scientists, and anthropology to attack it, not just a scientist alone, and not just a sociologist alone, because you know often some of the old studies of cultural astronomy suffer from the fact that the people who did these kinds of studies were astronomers only or anthropologist or sociologists, alone, which really, ideally you want the two groups working together.

Q: Have you used the Lloyd Bleek Archive?

I've often used other peoples reviews of the study of the (Lloyd Bleek) archive, so really I've not studied extensively, but it would be an interesting thing to do, to see, although the Bleek archive was a study done on people of this area, and the bushmen, people that we are studying, went from Namibia, the north of Namibia, so I wonder if the two cultural groups have a lot in common, that you can

*extrapolate or use the information from the Southern Cape, to describe things that were happening in the northern part of Southern Africa, Namibia and places like that.*

Q: Can you tell us about the naming of suburbs in Cape Town, based on astronomical names?

*...Oh that's right, the sun Langa...Langa... the one that comes to my mind is Langa, which is the sun, I think, but not only the Western Cape for example, one of our provinces is (Pumalanga?) which means the setting sun, and the other one, the Eastern Cape, you have Tralalunga, which means the rising sun, one of the two, I stand to be corrected, to be honest, you caught me there by surprise. ...There are astronomical places named after astronomical objects, that is true, but.. you also find it even in the ordinary language, for example the... month in one of the South African languages, is the same as the moon. The same word for the month and the moon, which has to do with the fact that the calendar system that they used was based on the different phases of the moon, so that's as far as I can say about that, and I'll still stand to be corrected about Pumalanga, and Tralalunga, I'm not sure..., I'll check that for you, because that is not my language, it's a different language...*

Q: How can people share or help to appreciate about this type of knowledge (Indigenous astronomy knowledge)?

*Almost immediately after the release of Cosmic Africa, I was invited to write a series of articles every month for a travel magazine on African knowledge of astronomy so that was quite fun, and that is one way that was done, and also every year, for the whole country of South Africa, we have what we call the Science Week, and during the science week, in many places we have many exhibitions and big posters where people can come and find information about this kind of knowledge, another way again, there was an initiative by a company in Johannesburg to try and include this kind of knowledge as part of the tourism experience. So one way of doing it is you train game rangers in game parks about African indigenous stories to do with the stars and also about, just the different constellations, and the African equivalent and in that way people will come and visit our game parks to see the animals, at night when you are looking for the animals, and there are times when you can't see the animals, then the game rangers can tell them about the night sky and it's very beautiful because it brings together the African concept of the surrounding you know, when we were in Mali with the Dogons, the old man there, told us that... He gave a very powerful statement, he said "The Earth and the Sky are like men and women, you cannot talk about one without the other". So according to them the whole knowledge is completely integrated. For them, a Zebra is as much a part of nature as Betelgeuse which is beautiful I think. So this idea of combining tourism, mostly is to do with watching animals and watching beautiful trees and the surrounding, and linking it with the sky, and I think, it's a very nice way of making people aware that you know, after all we are part of this whole universe, part of the whole surround, environment, which is quite nice. And also there has been a lot of TV and radio interest in this kind of information. But I think really we should try and make this part of this, the school curriculum, as well, you see, when I was studying as a young person, during the high school, the*

*junior years at school, we used to learn about Inca astronomy, the Chinese, European astronomy, but there was nothing on African astronomy. So we need to rewrite our introductory books on astronomy and on science to include African (and Aboriginal) astronomy as well. It will just integrate everything together, and also that's another way of integrating the society as well, to show, you know, that there are other people out there who study things in a slightly different way to what we are used to and it's nice I think, it's interesting I think, I think that's how we can share this information, and books of course....*

### 13.4.2 Sivuyile Manxoyi



Figure 130. Sivuyile Manxoyi .

(Photo: John Goldsmith)

Interview with Sivuyile Manxoyi, held on 19 March 2010, at the Communicating Astronomy with the Public conference, Cape Town, South Africa.

Q: (Introductions)

*My name is Sivuyile Manxoyi, and I work for the South African Astronomical Observatory as an education officer, so I'm responsible for public outreach and education in general, so I run workshops for educators and learners and I organise public events to communicate astronomy.*

Q: Does that include work with the (Cape Town) Planetarium?

*We work jointly with the planetarium. In fact in terms of the South African structure, our organisation, the South African Astronomical Observatory is part of the Department of Science and Technology, while the planetarium is part of the Department of Arts and Culture, but because... .. we share the area of astronomy, so we work together, yeh, I work together with the Cape Town planetarium, as well as the Johannesburg planetarium, those two planetariums.*

Q: At this conference (CAP2010) we have heard a lot about Indigenous astronomy, can you tell us about that subject?

*I think I'll start with just Cape Town, because Cape Town is one of the astronomical cities in the world. Because if you look at the (geographical) areas of Cape Town... and you look...Indigenous townships, you will notice that most of them are called, have astronomical names. I'll give an example. There's one that called "Lana", "Lana" means "the sun". There's another one called "Nanga" the Moon. "Naga" means the moon. The third one is called "Quezilumbo". It's even nice this one because all the streets are astronomical. "Quezilumbo" means Venus, so that's why I said Cape Town is really astronomical and when you look at the indigenous people of South Africa, you've got the Xhosa speaking people, got Sutu speaking group, OK, I'll say that, there's two broad groups, there is the moon group, the moon group, they speak...languages. So you have Xhosa, Zulu speaking people and Suate, and... they are all, all the languages are related, they share their common origin. And then you got Sutu, Swana, and Bedi, OK? All the languages are related, how they do their traditions, and modes of behaviour.*

*Now if you look at the Mooni People, even their clans, some of the clans are astronomical. They relate to the stars. Even the traditions, in fact. The people have a long tradition, long old relationship with the stars. Most of the ceremonies that they perform are regulated by the stars. I'll make one example which is crucial in our community. The one of manhood. There is a group of stars, in English they'd call the Pleiades, But Xhosa speaking people call "Isimahl"...*

*If you look at the Vela people, they call it them "Chilmella", you know, and when you look, even at the Shona people and the ... people, it's the same. I'm quite interested as to why the name is more or less the same. I'm interested in that. But the stars are used to regulate the years of manhood, because the appearance of the stars indicate the time when boys have to go to circumcision. Because in our culture, the difference between a boy and the men, and now there is a period of transition, when you spend time in the bush, to become a man. So the stars are very very important. In fact, the month of June, is also called the "Isimahl" and the month of May, is called Canopus... It heralds the beginning of winter and this is the time when boys enjoy their last moments of boyhood. Before the transition to manhood. So, for me as an educator, I've found cultural astronomy very important and I've noticed, that most of our people because of the history of decolonisation, as well as colonisation, as well as westernization, development also, people have lost touch with their tradition and their culture and now, when you introduce science and particularly astronomy, they think it is something that comes from*

*outside of them. But now when you relate to their culture, then they discover, that no, we have always had this relationship, and suddenly they gain confidence. So that's why I think the emphasis on cultural astronomy can serve as a bridge to understand modern astronomy. So we use it a lot when we talk to elderly people, and the kids, so they identify easily with astronomy.*

Q: So this is a way why this kind of knowledge is so important?

*Because of our history. What has happened here is that...most of the..., I don't know whether, OK, if the people know about this, ...History of Apartheid. Apartheid was about separating the people, and they created even definitions, some people were called coloured, and they had some funny divisions. Now even people like the Nguni speaking people, Xhosa speaker, if you remember, just before 1994 when democracy came. There was a lot of tribal fights between Xhosa speaking and Zulu speaking people. But now when you talk about this, you relate to the stories, because all the people share the same story in Southern Africa and now the people can see that they are one. So it can serve as a way of unifying and dissolving those artificial bridges between the tribes. So when you talk "Isimahl" even when talking to Zulu speaking people, they can see they are from one root, they are all one, so apart from stimulating the interest in astronomy. It helps to unify our people, I think it's very important. Yeh.*

Q. What would you say to other cultures who would like to learn about their own culture; astronomical knowledge, is that something that you would encourage?

*I would definitely encourage that. In fact I've learnt also about other cultures now. I see sometimes we share the same stories, some stories are common and I think, number 1, it helps to instil a sense of pride and number 2, it shows that astronomy is close to everyone, the skies are accessible to everyone because it doesn't matter where you are in Russia, or in South Africa, or in Australia, or in Europe. When you look up you see the stars and ancient people developed calendars, you know. When to plant, their ceremonies, were all regulated using the stars. So I think it's very important for, apart from just installing the pride but to show that, you know that,... science belongs to everyone..yeh, that's what I want to say, science is for everyone,...They think it's something that comes from somewhere, but the stars are there for everyone. So I think cultural astronomy also helps us, to actually claim that astronomy is ours too, because of the history.*

Q. Is it OK to use this interview to share with others?

*Definitely, and even more, if people want to exchange ideas and share their stories, the legends and how our people...the other thing, there are the stories, for example, we had the stories about the moon. How the moon came about and what people see in the moon. People say they see a woman who's got a child on her back...but the Sutu tribes say, they say they see a rabbit in the moon. These are the legends. But we also need to look at how practically our people use the stars, 'cos in their daily lives*

*they use them and we can see there is a scientific basis, because maybe with myth we can dismiss. But they use them for direction, they use them for different things, like they use the sun to determine the time, looking at the shadows. So we have to differentiate between the legends and the practical because it's still relevant even today. We know about Canopus, we know it's going to be winter...So some of the.... The point I want to make, we have to differentiate between the myth and the legends what the people tell the story. What happened, like they say... How the Milky Way came about. They say there was a child playing with the sand, and then she threw the sand up, and then there was the Milky Way... There are other things that are practical, like people use the stars for direction...to determine when they must go for circumcision, they go to circumcision.. during winter, when they see Venus, for different activities, so these are practical things that people can still use even today. The stories maybe.... ...when we tell our kids. One of the stories, they say...there is day and night because there is a big crocodile that swallows the sun in the evening and then in the early morning, then it releases the sun. But we know why now, we can explain... But I think ...those legends are important, because they make the children aware. Once you start talking about the day and sun, they will start asking questions...about...they will start asking questions, tell them the stories, because in our tradition, before we sleep we gather as a family around the fire and then the father will tell stories. But now we are living in townships, but we still gather around you know, sitting in the lounge, altogether, and the father he has to tell... like I have to tell my kids stories, you know before we go to bed. So I think the point about the practicality of Indigenous knowledge and the legends I think that point is very important and also that I feel strongly that, people emphasise, OK, I've heard it even from John, that different types of knowledge and how people know, but I still feel that, you know like, but if you look at any concept, like if you look at gravity and how Einstein understood it and how maybe Newton and them understood. You will see there is a shift. There's always that shift. So my view is that Indigenous knowledge is also science... ...there is some observation that people did before and therefore it's a continuum maybe now we know more than, and better instruments today than in the past, even Galileo... I read that when Galileo, when he looked at Saturn, when he drew the picture of Saturn, he said it's a planet with ears because his telescope was limited but today we've got better telescopes we can see, we can understand better, so I see Indigenous knowledge is an ancient form of how we understood stars but now we have more, now it's a continuum for me. It's not like this or the other one, yeh, OK...*

Q: We hope to share this video (interview) with Aboriginal people in Western Australia, thank you.

*I would love to make a link with them too. Because I was in Australia last year. I was in Canberra. I went to the National Museum. There was a lot of stories in the newspaper, the debates about how the Indigenous knowledge is being accommodated in the museum. I read the newspaper... but I think they are trying to put stuff there and I feel strong that we should make links between all the Indigenous people in the different parts of the world, and start sharing our stories, so we are also willing also to work with them.*



## Appendix 14 Transcript for the *Ilgarijiri* Exhibition video

The video opens with Kevin Merritt.

Kevin Merritt: *I find it quite interesting. The stars are interesting to all races of people of the world. We will always be searching amongst the stars for whatever reason we like to search the stars. When we come out at night, it fascinates myself anyway the brilliance and the enormity of our own little solar system, compared to what's out there, further out.*

Christine Collard: *We'd just like to say, hello from all the Yamatji (means Aboriginal), Naru (means Women) which are us, of Mullewa. We'd like to welcome and acknowledge all the past and present elders in Alison's country. We hope you all enjoy the exhibition that we are now going to produce to you. Thank you.*

Barbara Merritt: *The Hunter that's chasing the girl and the seven sisters the one that is the fading star, can't see in our story, there is a man chasing that girl and in our ancestors stories it probably goes back to where, when they did law. It fits in to the things they did at law time. Romances kind of a story, when they do law. They are able to choose out of the group's (the girl), Ohh... the elders choose the girl for the boys when they go through the law. Very interesting to me to know about that story, the seven sisters.*

Christine Collard: *Most of my artwork relates to the seven sisters, which I call the seven jijas. I did one with the seven sisters reflecting over Yamatji Country onto the Greenough River and that was a big lift for me once I sold it and now it's actually, you know, they are using it as a logo on the government vehicles over in Adelaide and the station area. Not only myself but all the women. Our artwork goes overseas, it goes all over Australia. So, I think the sky ones has really lifted and more noticed now, and more requests on the sky ones.*

Charmaine Green: *I work as the arts administrator in Yamaji Arts Centre and my involvement ranged from getting the artist ready, like talking the project up, helping Kathryn with getting materials ready, doing the media. I was sort of pushed to the front to be the spokesperson, when Kevin wasn't available, or when one of the older artists wasn't available, through to organising the bush trip out to Boolardy and basically being an artist as well right through the whole range of stuff for the project really interesting...*

Margaret Whitehurst: *...and they were doing all the artwork in there, and we went in there they tried to give us some sound from the sky, but I don't know if they were telling us the truth or not. I don't know if that was true or not but they have us a little sound, I don't know if that was true. I think some of the people believed it. Yeh, it was quite good. I really enjoyed that and that night when we went back to the station sat around a big campfire and we told stories, and we even pointed out the sky, the saw the*

*emu in the sky that night we pointed out up in the sky and the non-Indigenous people ...They got so excited when they saw the emu in the sky. Yeh, they really... they couldn't believe it... We'll show you the emu in the sky when it gets dark and we showed it to them...they just couldn't believe it because we saw it plain as thing out there at Boolardy....*

Susan Merry: *Every year we look forward to emu eggs. So, we take the kids out emu egg hunting, so when we look into the sky. We see that shape in the sky, we know that that is when they are laying.*

Christine Collard: *So its inspired us all. We're really driven, it's driven us, we're just emerging now, so a lot of our art we paint with passion, and it comes from our heart and we all practically grew up here in Mullewa. So there are stories that we have and connection that we paint and from the sky. Like myself personally I was told by an Elder, that my grandmother which I didn't meet, her totum was the emu in the sky. So a lot of us do have connection and we do have stories. We paint those stories and like I said, it's from our heart.*

Babara Merritt: *It made a big impression all right because just the name alone, the jewellery box, jewellery box, a star called the jewellery box. As women, like, these are the things that we talk about, and do. Well I do beading and things in my spare time and jewellery is in our lives, every day and to see the jewellery box, ahh... That's just amazing thing sparkling pretty colours, so that's the first painting that I drew, and that got sold very quickly.*

Christine Collard: *Summer time is the best time. We all sit around the campfire, like Sue said, have a yarn, you tell you kids the stories, all what's up there in the sky, they get very interested in it to. Yes, so. We love that, love sitting outside, we're outside people. There is therapy within yourself but for others too. You don't realise that, but it is good therapy, sitting around the campfire, yarning. Everything comes into that place, like bonding and all that.*

Margaret Whitehurst: *Because, a lot of people coming up to us and saying we saw this in the paper we saw what you've been doing with this story. It's a good thing because it's going to be going out to the people because nearly every second week we were in the paper about that and all the non-indigenous people coming up to me, and saying, that's a great thing you're doing because everybody is going to see this.*

Charmaine Green: *Everyone was quite anxious on how we were going to interact and how we were going to connect with the astronomers but the good thing was people like talking about the sky people liked talking about the sky in particular. So the connection there was when the sun came down, people had lots to talk about. When we went out to the actual site at Boolardy and spoke to the scientist and talked about how they were going to capture sound waves to get images from what's happening in space. People were thinking, ohh... This is really something mind boggling. It's just really quite easier*

*to think of our stories and our perspective on what happens with the sky, all this other stuff, maybe that could stay over there. That was what we were thinking.*

Barbara Merritt: *That was really a big eye opener to, you know, see the stars that close and through the telescope and the colours, and the, yes... I'd think I'd look at them every day if I had the telescope, and night.*

Margaret Whitehurst: *The older people now a days; because the older people, nowadays, because we live in towns, we can't get story's from our older people now, and a lot of our older people are dying, and there's no one left to tell the stories. Like in my family I only got my Uncle and Auntie Olive. They are the oldest people in my family my mother and father have gone just hard to get stories from elder no more, we got to pick it up ourselves, we can't go out to special places no more. It's hard to go out to special places, where we can get those sort of stories. It's just all gone.*

Olive Boddington: *When you first see the emu, you don't see the whole of him you see the neck and the head part and as the months go by it shapes more into the emu, and then .. ...it's sort of lying and when it does that that's when the emu's laying eggs and everyone seem so hunt for them then...*

Charmaine Green: *We've had other projects in town, working on one with public art, still in its infancy stage, working though that. One of Barbara's paintings on the seven sisters was made into textiles and went into a fashion show with a fashion label in Perth and that was on the catwalk in London and Paris and Melbourne.*

*We still want people to paint, maybe leap from the sky to the ground, or to the land. Talk more about the stories practices and beliefs, that come with linking the two together and people are starting to see now and starting to think about that a lot more and starting to say, yeh, we have a right to tell our story, and yes this is important, people do want to see our cultural perspective on stuff. There is still a lot to go and I think we could move the project further into the future and that's what we are hoping to do from Yamaji Art, anyway...*

Christine Collard: *For the America exhibition, in America, I'm very pleased to know that we are going international again. America, you hear a lot about America, didn't think your heart would ever make it there, is another thing, I'm just so happy and thankful to Auntie Charmaine, she's our big inspiration. She just inspired us all and the support she has given us all... ...We are just so happy and overwhelmed.*

## Appendix 15 Script for De Laeter Scholarship exhibition video

*INTRODUCTION* Three hundred thousand years ago, a giant meteorite hit our planet, creating an impact crater almost one kilometre in diameter. This crater still exists today, and is located in the East Kimberley region of Western Australia on the edge of the Great Sandy Desert.

The crater, which is protected by the Wolfe Creek Crater National Park, is a place of great scientific importance. Scientist and astronomers from around the world have investigated and researched the crater, to find out how it was formed, its age, and to discover fragments of meteorites.

*INDIGENOUS CULTURE* Local Indigenous communities call the crater “Kandimalal”, and they have known about the crater for a very long time.

For over 40,000 years, Aboriginal people in Australia have developed a detailed knowledge and awareness of their environment, including the landscape and the night sky. Some well known Indigenous stories about the night sky include, and the “Emu” star pattern, and the Seven Sisters. The “Emu” is formed by the dark parts of the Milky Way.

Indigenous people today maintain their connections to the crater landscape, and some express their sense of belonging, through art. Aboriginal artists have painted their stories about the crater, and their stories of the country.

Elders of the Jaru Aboriginal people refer to several stories about the crater. One well-known story deals with the passage of two rainbow snakes, which formed the nearby Wolfe Creek and Sturt Creek as they crossed the desert. In the Dreaming, one snake emerged from the ground, forming the crater.

(Interview / voice over with Indigenous Elder Jack Jugarie at Wolfe Creek Crater)

*...in the early days, the first Mob, they never saw any white people, they reckon, star... second star from the big one, you know, be fall. We call him wada that star. Wada it fall in this ground. It makes big noise and shakes this country and made a round rim right round, and in the centre, down there, it's a hole, no water stay in there. Doesn't matter how much rain the water don't stay, it goes in the hole. Sink holes, right in the middle.*

(Interview with Indigenous Elder Stan Brumby, featuring “Wada, the star song”)

*I sing him, that star, language, singing stick, I can sing 'im now, (Wada song, sung by Stan Brumby). That's im song, Warda, Big star, bin fall down, from top from sky.*

The crater remained unknown to Europeans until 1947, when it was first sighted from the air, during an aerial survey of the Canning basin. The crater got its name “Wolfe Creek Meteorite Crater”, from the nearby Wolfe Creek.

*CRATERS ON THE MOON AND EARTH* When we look at the moon through a telescope, we see thousands of impact craters. The craters on the moon are impacts from solar system debris, more than 3900 million years ago.

However, on Earth, we see far fewer impact craters. There are less than 200 known meteorite craters identified around the world. The process of erosion has wiped out much of the evidence of meteorite impacts on Earth.

Meteorite impacts on the scale of Wolfe Creek Crater are rare. Scientists estimate that an impact as big as Wolfe Creek Crater, may occur once in 5,000 years.

Our planet is constantly being hit by meteoroid particles from space. Usually, these meteoroid particles are small (the size of a grain of sand), but some are much larger.

Meteoroids hit the Earth atmosphere at high speed, often at several kilometres per second. Friction through the atmosphere causes meteoroids to vaporise in a flash of light, and that’s when we see a meteor, also commonly called, a “shooting star”.

If the meteor is large enough, it can survive its passage through the atmosphere, to hit the surface of our planet. Then it is called a meteorite. Not all meteorites form craters, but large meteors do. There is evidence for some massive impact sites on earth, more than 100 km in diameter.

Wolfe Creek Meteorite Crater is about 860 metres in diameter, and about 40 metres deep (20 metres deeper than the surrounding plain).

**SCIENTIFIC RESEARCH.** Scientists study meteorite craters to learn more about how such sites were formed, their age, and their role in the development of our planet.

Discoveries continue to be made, and there are new areas of research to be done. In 2007, scientists announced the discovery of a 200+ metre crater in Western Australia, after noticing it on Google satellite maps.

A current project is the searching for new meteorites, on the Nullarbor plain, using a very special automated camera network. The project has already successfully photographed a meteorite fall, which was then recovered.

Experiments can be conducted at the Gravity Discovery Centre Leaning Tower, to experiment with free-falling objects.

At the Zadko telescope located next to the Gravity Discovery Centre, the 1 metre telescope is involved in a research program, to monitor asteroids.

**CONCLUSION** For scientists and researchers, Wolfe Creek Meteorite Crater is a place of great scientific importance. For Indigenous communities, “Kandimalal” is a part of their rich cultural heritage, and bond with the land. For Western Australian’s, the crater is a remarkable landscape. Kandimalal, Wolfe Creek Meteorite Crater.

## Appendix 16 Listing of presentations by John Goldsmith 2009-2012

A summary of presentations, talks, briefings and conference posters given by John Goldsmith, 2009-2012.

### 2012

- 7 December 2012      “*Cosmos, Culture and Landscape: Aboriginal Astronomy Virtual Tour*” Oz Viz Conference, Perth, Western Australia. [www.ozviz2012.org](http://www.ozviz2012.org).
- 31 August 2012      “*Exploring the Cultural Cosmos*” Presentation to delegates of the Australian Council of Professional Historians Associations AGM, (at the National Trust headquarters, Perth, WA)
- August 2012      “*A virtual tour exploring Wolfe Creek Meteorite Crater’s geoheritage, cultural and educational values*”. Conference Poster Collaboration with Margaret Brocx, International Geological Congress, Brisbane. August 2012.
- 7 August 2012      “*Australian Indigenous Perspectives*” Guest lecturer at UWA (Our Solar System unit), 7 August 2012.
- 1 August 2012      “*The Cosmos and Human Culture*” Guest lecturer at UWA (Our Solar System unit), 1 August 2012.
- 31 July 2012      “*Mystery and meaning in the visible universe*” Guest lecturer at UWA, “Our Solar System” lecture 31 July 2012.
- 23 May 2012      “*Astrophotography, An Introductory Guide*”. ICRAR photography club.
- 21 May 2012      “*Indigenous sky knowledge: Cosmos, Culture and Landscape PhD key research findings*”. ICRAR Student Day talks 21 May 2012
- 6 March 2012      “*The Sky and the Land, Indigenous Sky Knowledge*”. Guest lecturer at UWA, “Our Solar System”.
- 29 February 2012      “*The Sky and the Land, Indigenous Sky Knowledge*”. Guest lecturer at UWA, “Our Solar System”
- 3 January 2012      “*Comet Lovejoy 2011, Astrophotography and timelapse preview*”. Astronomy Group of Western Australia (AGWA).

## 2011

- 5 December 2011 “Scientific and Indigenous Perspectives of Wolfe Creek Meteorite Crater, 1. De Laeter Science Engagement Scholarship video exhibit, 2. Extreme Imaging Research Competition (Canon Australia)”. ICRAR Journal Club.
- 29 November 2011 “*Aboriginal Sky Knowledge, Insights from western Australia*” Space Sciences Day, Curtin University.
- 7 September 2011 “Kandimalal, Wolfe Creek Meteorite Crater, Learning and Sharing Indigenous sky knowledge”. The Kimberley Society, Western Australia.
- 17 August 2011 (*Informal discussion*) Science Café (UWA / Curtin).
- July 2011 (*Exhibition Opening Speech*) Japingka Gallery Star Dreaming exhibition opening.
- 22 June 2011 “Aboriginal Sky Knowledge, Cosmos, Culture and Landscape”. Questacon video link.
- May 2011 “Cosmos, Culture and Landscape, Indigenous Sky Knowledge from Western Australia” Scifest Africa, Grahamstown, South Africa.
- 11 April 2011 “Visualisation in the Cosmos, Culture and Landscape PhD Project”. 3D Visualisations Forum, Curtin University.
- 6 April 2011 “Indigenous Sky Knowledge: Introduction to field work and survey results from the Cosmos, Culture and Landscape research project”. ICRAR Student Day.
- 21 March 2011 “An Overview of Australian Ethno-astronomy” ICRAR Journal Club, ICRAR.
- 11 March 2011 Astrofest, Curtin University.
- 8 March 2011 “*Cosmos, Culture and Landscape, Learning and Sharing Indigenous Sky Knowledge*”. Department of Environment and Conservation (Indigenous Heritage), Western Australia.
- 20 January 2011 “Western Australia at Night. An introduction to astronomical timelapse photography in Western Australia”. Gingin Observatory, Western Australia.



January 2011      *“Building bridges between cultures, Communicating and Sharing Australian Indigenous Sky Knowledge”*. Conference poster presented at the ninth “Oxford” International Symposium on Archaeoastronomy, Lima, Peru, January 2011.

## **2010**

27 October 2010      “Cosmos Culture and Landscape, Aboriginal Sky Knowledge. Recent field work results from Kandimalal, Wolfe Creek Meteorite Crater and the Murchison Region”. Curtin University (Physics Department) .

11 October 2010      “Cosmos Culture and Landscape, Aboriginal Sky Knowledge. Recent field work results from Kandimalal, Wolfe Creek Meteorite Crater and the Murchison Region”. Astronomical Society of WA.

July 2010      *“Sharing and communicating Indigenous astronomical and sky knowledge”*. Conference poster, presented at Astronomical Society of Australia, Hobart July 2010.

1 April 2010      “Documenting natural and cultural places with spherical 360° images, panoramic and time-lapse digital photography”. UWA Seminar Series.

16 March 2010      *“Cosmos, Culture and Landscape, Learning and Sharing Indigenous sky knowledge”*. Conference Presentation, Communicating Astronomy with the Public, March 2010, Cape Town.

16 February 2010      *“Cosmos, Culture and Landscape, Learning and Sharing Indigenous Sky Knowledge”*. Centre for Aboriginal Studies, Curtin University, Western Australia.

## **2009**

28 November 2009      *“Starlight, Celestial Visions on Second Life”*. Astrofest 2009, Curtin University.

November 2009      *“Cosmos Culture and Landscape, Recent Examples of Art, Science and Culture Working Together, Inspired by the Celestial”*. Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS) Indigenous Astronomy Symposium, November 2009. “Indigenous Astronomical Knowledge”.

November 2009      “The World At Night, A New International Year of Astronomy Project”. Theosophical Society, Perth, WA.

17-18 October 2009      “Innovative digital photography and “fulldome” 360° panoramic images, for documentation of natural, cultural and heritage places of significance”. Conference

Presentation, (October 2009) AURA Inter-Congress Symposium Broken Hill, October 2009.

12 October 2009 “The World At Night, A New International Year of Astronomy Project”. ICRAR Journal Club, 12 October 2012.

14 August 2009 “*Cosmos, Culture and Landscape in Bali, Indonesia*”. Science Communication seminar. The University of Western Australia, 14 August 2009.

7 July 2009 “*Astronomy and Landscape, A Cultural Journey*”. Astronomy Group of Western Australia.

18 May 2009 “*Astronomy and Landscape, A Cultural Journey*”. Royal Society of Western Australia.

22 March 2009 “*Cosmos, Culture and Landscape. An Illustrated Presentation*” at Hovea Ashram, Perth, Western Australia.

20 January 2009 “Unity Through Diversity in a vast and awe-inspiring universe- The Cosmology Gallery”. IAU Symposium 260, UNESCO Paris, France.

## **Appendix 17 Videos and Virtual Tour (DVD disk version, for playback via computer)**

Note: Content is supplied on DVD disk for playback on a compatible computer. Video files are in .WMV format, and the virtual tour is exported as a .SWF file, which is viewable via most web browsers. To view the virtual tour from the DVD disk, users may need to OK the prompt, to allow blocked content.

Contents include:

1. De Laeter Scholarship Video exhibit "*Kandimalal*" (2011).
2. "*Ilgarijiri*" exhibition video for 2012 European exhibition tour.
3. "Timelapse video, Kandimalal, Wolfe Creek Meteorite Crater".
4. Virtual tour, "Cosmos Culture and Landscape: Aboriginal astronomy tour".

## Appendix 18 Acronyms

AGN	Active Galactic Nuclei
AIATSIS	Australian Institute of Aboriginal and Torres Strait Islander Studies
ANKAAA	Association of Northern, Kimberley and Arnhem Aboriginal Artists
ASKAP	Australian Square Kilometre Array Pathfinder
ATNF	Australian Telescope National Facility
CAP	Communicating Astronomy with the Public (journal)
CDEP	Community Development Employment Projects
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DVD	Digital Video Disk
GDC	Gravity Discovery Centre
IAU	International Astronomical Union
ICRAR	International Centre for Radio Astronomy Research
ILUA	Indigenous Land Use Agreement
IYA (2009)	International Year of Astronomy (2009)
JPEG	Joint Photographic Expert Group
MRO	Murchison Radio-astronomy Observatory
MWA	Murchison Widefield Array
PUS	Public Understanding of Science
SKA	Square Kilometre Array
TO	Traditional Owner
TWAN	The World At Night
UNESCO	United Nations Educational, Scientific and Cultural Organisation
VLBI	Very Long Baseline Interferometry
WIPO	World Intellectual Property Organisation