

**OBSERVATIONS ON THE CHANGES IN STATUS AND MOVEMENTS OF
BIRDS AT THE MIDDLESEX FIELD STUDY CENTRE, MANJIMUP,
WESTERN AUSTRALIA, BASED ON TWENTY-FIVE YEARS OF DAILY
RECORDS**



R.J. Brown, M.N. Brown, M.J. Davis and S.J.J.F. Davies

**DEPARTMENT OF
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Abstract

This paper presents a preliminary analysis of data recorded by R and M Brown on the occurrence of birds at the Middlesex Field Study Centre, Manjimup, between July 1974 and June 1999. During this period of twenty-five years daily records were kept of the presence or absence of 116 species of birds that visited the 2 hectare Home Farm and Home Dam of the Centre. During this time the number of records of 15 species increased, 33 decreased, 12 remained stable, 21 fluctuated and 5 increased and then decreased. A number of factors appeared likely to be correlated with the changes in status of the birds. These included the increasing salinity of the streams, the increase in the number of irrigation dams in the area, the changes in agricultural practice in the area with an increase in the number of vineyards and vegetable crops leading to increased use of herbicides and insecticides, the planting of an arboreatum at the Centre, the provision of additional nest boxes for swallows, the impact of myxomycosis and calici virus on rabbit numbers, and the road maintenance activities of the local shire. Rainfall records were maintained at the Centre and some changes in status appear to correlate with years of low rainfall. The data set provide a useful base line for future studies of bird life in the area.

Introduction

The Middlesex Field Study Centre was established in 1972 when Dick and Molly Brown bought a five acre (about 2 ha) property in Middlesex, eight kilometres south of Manjimup, Western Australia. From 1974 to 1999 they kept a count of every bird of every species that they saw on this property. This paper presents a preliminary analysis of these data.

The Environs of the Middlesex Field Study Centre

The property included a stream, a few fruit trees and open pasture paddocks as well as an area around the wooden cottage that was suitable for the development of a garden. In the first two years the Browns established a garden, a poultry flock and a small orchard. They also bought a Jersey cow whose milking routine ensured that they remained on the property every day of the year. The property abutted a large agricultural dam, and with the permission of its owner, boardwalks were built to give access through the *Typha* fringe at its western end. Shelter trees were planted on the southern half of the property, and between 1979 and 1982 an arboretum of 227 native and exotic (to the area) trees was established covering about two acres of the northern half. The tree species were chosen to attract local birds and had, by the end of the study, grown into a substantial forest. In 1989 the stream was widened to a channel and later to a pool that attracted such waterbirds as Great Egrets and many ducks. Figure 1 presents sketch maps of the property in 1972 and 1989, showing the developments that were undertaken.

The Landuse of the District

The property lies close to the main forest reserves of south-western Australia, near the northern limit of the distribution of the karri *Eucalyptus diversicolor*. Originally the local creeks were lined with karri trees and these extended up the slopes for some distance before merging into jarrah *E. marginata* and marri *Corymbia callophylla* woodland. As the big timber was logged, the area was cleared for farming, initially for grazing by dairy cattle and sheep, with remnant bushland left for shelter, and later orchards were planted. During the period 1972 to 1989 there was much clearing of bush remnants, orchards decreased and vegetable crops, especially potatoes and cauliflowers, greatly increased. In the next decade vineyards were added to these vegetable crops. The change from grazing to horticulture was accompanied by the building of numerous dams on the streams so that water was available for irrigation. The impact of irrigation, coupled with the removal of the trees, led to a gradual increase in the salinity of the streams. The figures for a local stream are:

56-112 mSi/m

63-157 mSi/m

78-128mSi/m

168 mSi/m

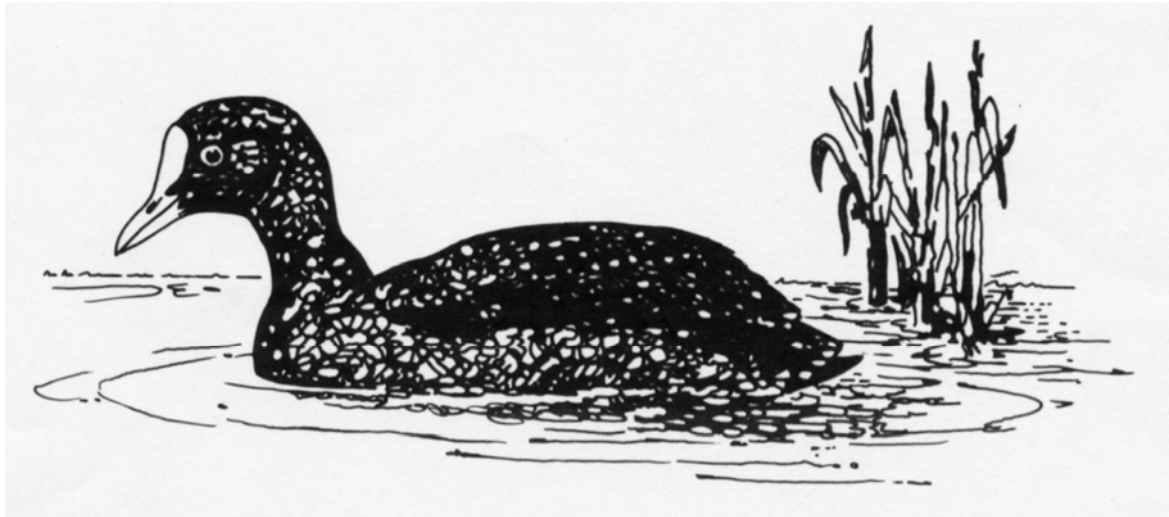


Figure 1. The Eurasian Coot has been the emblem of the Middlesex Field Study Centre since its establishment in 1974. This sketch is by Perry de Rebeira after the original by Owen Roberts.

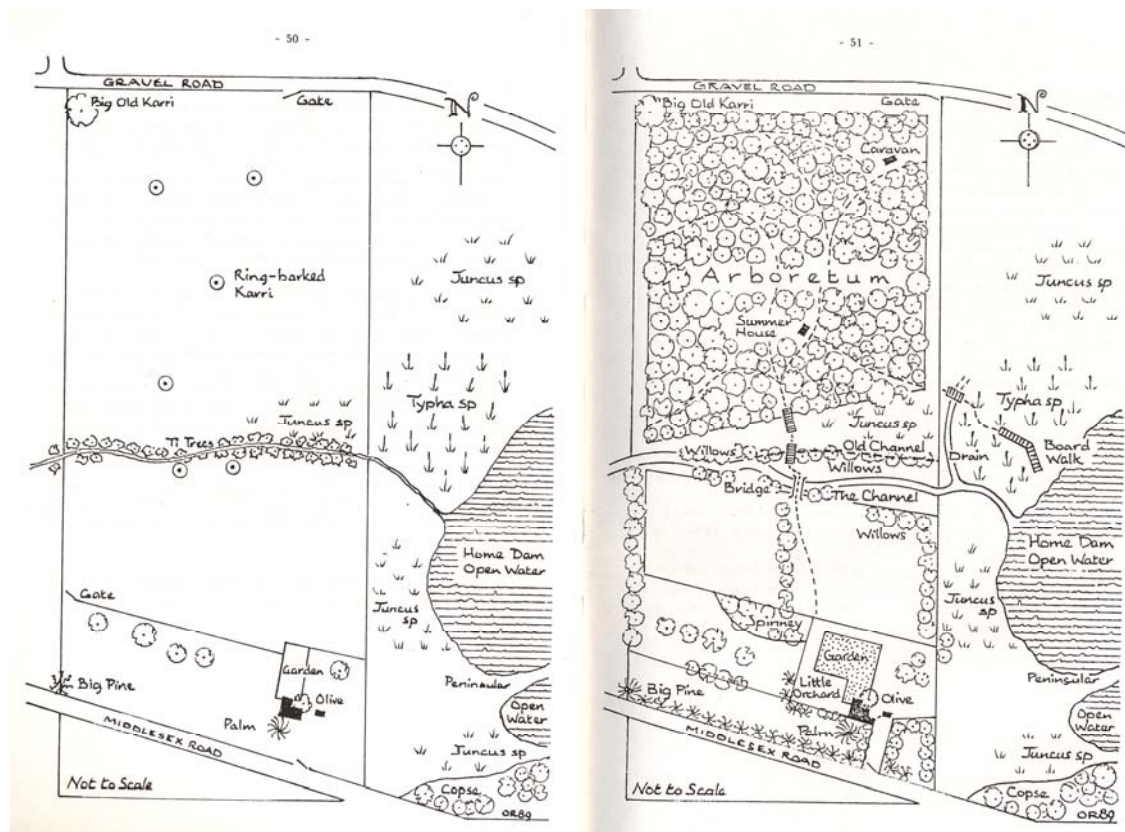


Figure 2. (left) Plan of the Middlesex Field Study Centre at the time of its establishment, 1972; (right) Plan of the Middlesex Field Study Centre in 1989, after development

Although there is obviously some variation, it is apparent that the trend is for increasing salinity in the local streams and dams.

In other ways the change in agricultural practice affected the birds. The change to horticulture and then viniculture meant that much more herbicide and insecticide was applied to the crops. Some crops were sprayed every day. With the substantial rainfall of the area, some of these chemicals and their residues would be washed down into the streams and dams, potentially killing the macroinvertebrates and aquatic plants on which many waterbirds depend. The impact of myxomycosis and calici virus on the rabbits of the area was substantial and reduced the amount of food available for some of the top order predatory birds. The reduction in grazing also reduced the amount of carrion in the area. Some cattle remained and in the course of the study dung beetles reached the area, attracting flocks of ibises.

One substantial remnant remained in the area, Smith's Brook Nature Reserve, and much of the work of the Centre on certain bird species was undertaken there. It is a block of karri forest of 72 hectares, containing some jarrah and marri and a good understorey. It lies east of the Middlesex Field Study Centre, on the same road, about 5 km away. The road verges, although sprayed every two years for the past ten years by the shire, were rich in bird life and many studies used them. The road followed the course of the local stream, so that the vegetation along it was rich and well watered, even though somewhat polluted by the farm chemicals.

The Climate of the District

Figures provided by the Commonwealth Bureau of Meteorology give the mean maximum temperature for Manjimup taken over 55 years as 20.2°C and the mean minimum as 9.6°C. The mean rainfall taken over 81 years is 1024.6 mm. Table 1 gives the monthly mean maximum, mean minimum temperatures, the mean annual rainfall and the mean day length for Manjimup. Table 2 give the annual rainfall figures for the Middlesex Field Study Centre for 1972 to 1991, cast in biological years, that is July to June, starting in July 1972. Comparing the mean rainfall per year at the Middlesex Field Study Centre over the 19 years shown in Table 2, 959 mm, with the annual mean for Manjimup in the same period, 1009.4 mm, suggests that the Middlesex Field Study Centre may receive slightly less rain than the weather station in Manjimup. There is no comparable temperature data for the Middlesex Field Study Centre.

Table 1. Climatic data for Manjimup, Western Australia. Temperatures in degrees Centigrade; rainfall rounded to the nearest millimetre; daylength in hours of sunshine.

Mean	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Maximum Temperature	14.2	14.9	16.4	18.7	21.7	24.7	27.1	26.9	24.5	20.9	17.4	15.2
Minimum Temperature	6.4	6.4	7.2	8.2	10.0	11.6	13.0	13.3	12.4	10.7	8.8	7.4
Annual Rainfall	180	149	109	79	47	24	20	20	31	60	135	171
Daylength	4.0	4.3	5.4	6.6	7.4	8.2	8.6	8.1	6.9	4.9	3.6	3.6

Table 2. Twelve monthly rainfall totals for the Middlesex Field Study Centre, 1972-1991, cast in biological years from July to June, starting in July 1972.

Twelve month period	Total rainfall	Twelve month period	Total rainfall
1972 - 1973	915 mm	1982 – 1983	771 mm
1973 – 1974	1099 mm	1983 – 1984	1040 mm
1974 – 1975	1084 mm	1984 – 1985	986 mm
1975 – 1976	974 mm	1985 – 1986	880 mm
1976 – 1977	873 mm	1986 – 1987	737 mm
1977 – 1978	1025 mm	1987 – 1988	980 mm
1978 – 1979	915 mm	1988 – 1989	893 mm
1979 – 1980	889 mm	1989 – 1990	964 mm
1980 – 1981	1050 mm	1990 – 1991	1060 mm
1981 – 1982	1097 mm		

The Operations of the Middlesex Field Study Centre

The Middlesex Field Study Centre was operated by Dick and Molly Brown. They maintained an active bird banding programme during the study years, working 22 sites, all within five kilometres of the study centre. Their locations are shown on Figure 2. Up to June 30, 1991, 43,473 birds were banded of 66 species. 12, 360 were recaptured at least once. In addition special efforts were made to observe nests and complete nest record cards for the RAOU Nest Record Scheme. Up to June 30, 1991, 4,826 nests had been recorded in this way. Special studies were made of a number of species (scientific names are given in the annotated list following) including the White-breasted Robin, Western Yellow Robin, Golden Whistler, Red-winged Fairy-wren, Yellow-rumped Thornbill, Willie Wagtail, Welcome Swallow, Silveryeye, Clamorous Reed Warbler, Purple Swamphen, Musk Duck, Eurasian Coot and cuckoos. Between 1974 and 1991 the centre issued annual reports, containing details of the centre's banding activities, nest recording and special studies. A number of publications resulted from this work and they are listed at the end of this paper.

Many ornithologists visited the Middlesex Field Study Centre during the period under review, some making lengthy stays and undertaking collaborative work. Lee Fontanini was involved in the centre's activities over many years, as were a number of local landowners who were generous in their encouragement of the Brown's activities on their land.

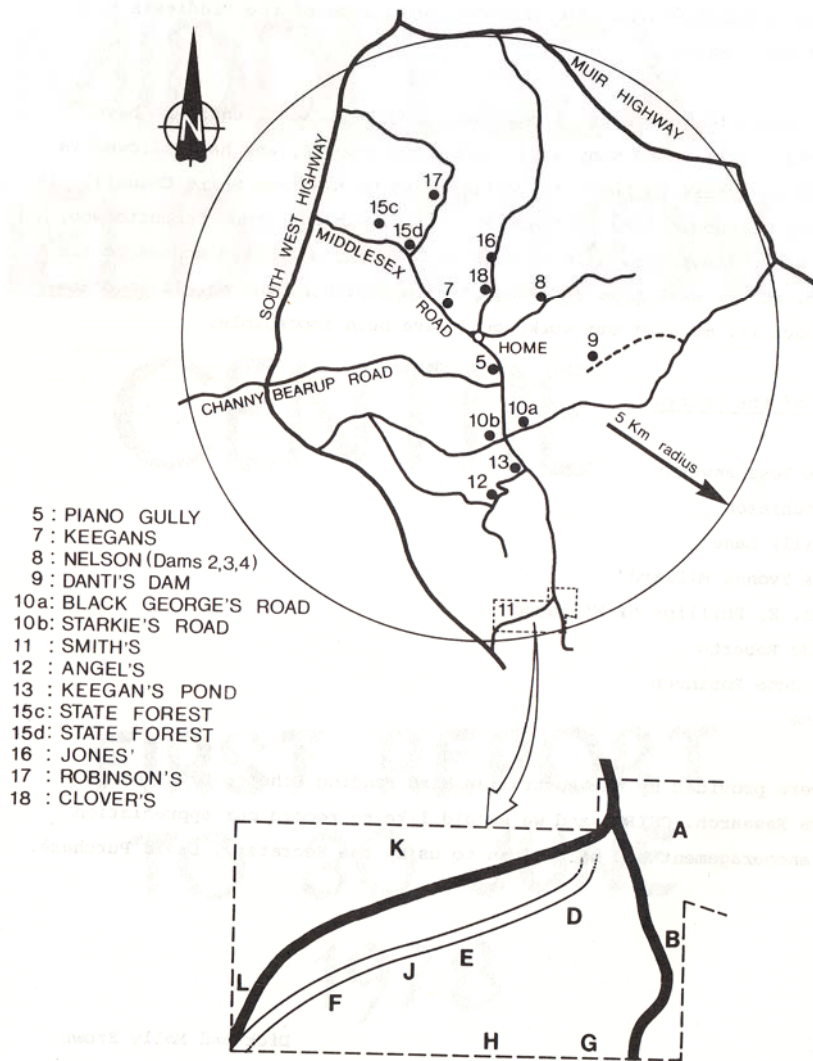


Figure 3. Banding sites used by the Middlesex Field Study Centre

Table 3. An example of the bird records kept at the Middlesex Field Study Centre, July 1974 to June 1999: White-naped Honeyeater. The heading "Num" is the RAOU number of the species. The heading "Code" is the abbreviated name of the species used in the analysis.

Year	Num	Code	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Total
74/75	578	WNHO	22	27	26	22	15	20	15	22	13	18	27	21	246
75/76	578	WNHO	26	26	25	26	28	16	14	7	5	10	23	23	229
76/77	578	WNHO	18	28	27	18	13	14	7	6	6	8	14	13	172
77/78	578	WNHO	10	12	11	9	12	11	11	8	16	15	19	19	153
78/79	578	WNHO	18	9	6	9	6	4	1	6	5	14	4	8	90
79/80	578	WNHO	11	10	17	8	1	2	7	6	8	12	15	5	102
80/81	578	WNHO	5	9	10	5	7	6	10	14	18	27	19	8	138
81/82	578	WNHO	8	4	6	4	6	10	6	17	12	14	17	11	115
82/83	578	WNHO	5	10	5	9	11	9	5	3	13	14	23	15	122
83/84	578	WNHO	12	8	9	4	10	13	6	7	19	18	19	19	144
84/85	578	WNHO	17	19	16	17	17	11	7	5	8	16	9	24	166
85/86	578	WNHO	24	19	8	9	4	2	3	7	15	6	14	8	119
86/87	578	WNHO	8	13	7	13	14	17	14	20	18	22	18	10	174
87/88	578	WNHO	12	8	21	25	12	12	14	8	13	24	22	16	187
88/89	578	WNHO	16	9	17	19	9	6	12	12	12	14	11	16	153
89/90	578	WNHO	16	14	16	16	13	16	12	15	18	27	25	22	210
90/91	578	WNHO	17	22	27	29	26	12	20	11	16	18	23	24	245
91/92	578	WNHO	18	18	10	13	15	18	12	14	19	20	20	12	189
92/93	578	WNHO	15	10	19	17	11	16	14	9	7	19	19	16	172
93/94	578	WNHO	22	18	22	16	15	21	14	7	9	17	10	22	193
94/95	578	WNHO	21	23	18	15	17	19	19	9	15	18	21	16	211
95/96	578	WNHO	11	19	9	12	13	16	20	10	20	15	21	22	188
96/97	578	WNHO	18	22	16	20	19	20	15	15	16	19	23	26	229
97/98	578	WNHO	27	17	16	15	17	15	10	8	4	12	17	9	167
98/99	578	WNHO	20	18	19	15	13	7	13	10	17	11	17	15	175
Total			397	392	383	365	324	313	281	256	322	408	450	400	4289

Methods

Recording

The records on which this paper is based were maintained both in hard copy and on computer files. Each evening the birds seen that day within the five acres – the Home Farm – were recorded, the banding records and nest records maintained and regularly submitted to the Australian Bird and Bat Banding Scheme and the RAOU Nest Record Scheme. The Middlesex Field Study Centre maintained a good ornithological library and the scientific names used in the reports followed successively the RAOU Checklist and the names published by Christidis and Boles (1994).

An example of the records kept for one species, the White-naped Honeyeater, summed for each month from July 1972 to June 1999 is given in Table 3. Copies of the full data are available from RMB 253, QMS, Manjimup, 6258, Western Australia; Lee Fontanini, Seven Day Road, Manjimup, 6258, Western Australia; S.J.J.F. Davies, Environmental Biology, Curtin University of Technology, G.P.O. Box 1987, Perth, 6001, Western Australia.

Analysis

In this paper the data are presented as a series of graphs, two for each species. One shows the totals of the number of days on which that species was recorded each biological year from July to June, numbered from 1 (1974-1975) to 25 (1998-1999) the other shows the total number of days on which records of it were made each month, numbered from 1 (July) to 12 (June) over the whole study period. The graphs are accompanied by a commentary that attempts to identify the factors that may have influenced changes in status of that species from time to time.

Results

Casuaridae

Single Emus *Dromaius novaehollandiae* were recorded six times between 1977 and 1982 and were rare vagrants to Middlesex.

Anatidae

The Blue-billed Duck *Oxyura australis* was a rare summer visitor to the Middlesex Field Study Centre, recorded in 1974, 1976, 1979, 1980, 1984, and 1991.

The Musk Duck *Bizura lobata* numbers varied over the years. Breeding was recorded in the area in most years. This is a species that feeds extensively on freshwater crayfish, gilgies or yabbies, and marron. These prey must have remained abundant throughout the study, because, unlike other waterbirds, Musk Duck numbers did not decline in the last years; indeed the number of recordings was particularly high between 1995 and 1999. The monthly totals show that the species was uncommon in July, August and September. At this time it congregates on lakes suitable for the post-breeding moult, when it is flightless, and does not spread out again until the spring. Such concentrations are bigger in Western Australia than in the eastern states (Serventy and Whittell 1976).

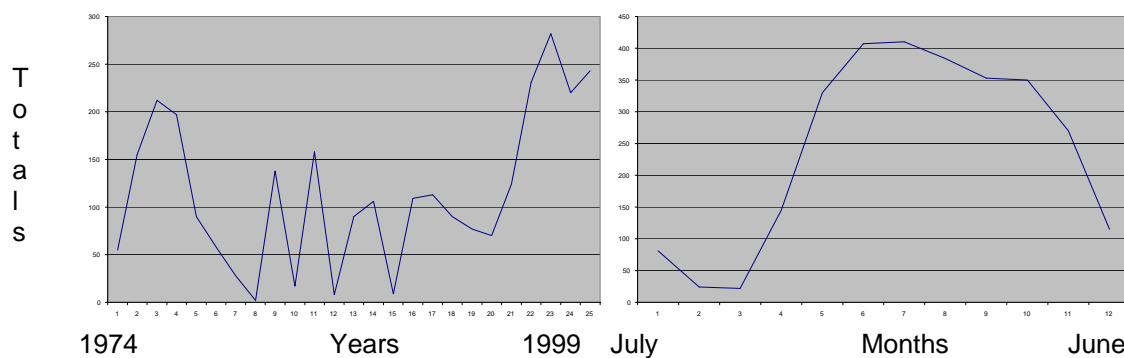


Figure 4: Trends in the numbers of Musk Duck *Bizura lobata* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Black Swan *Cygnus atratus* numbers fluctuated, with some periods when it was frequently reported and others when few were seen. Because it is a conspicuous bird, it would be reported if only one was present, so the large number of reports in some years may refer to a pair or family residing on the Home Dam and being seen every day. The monthly pattern shows that it behaved as did other waterfowl, frequenting the Middlesex area in the summer and autumn, with infrequent sightings at other times. Swans tend to breed in the south-west in spring and in the inland in autumn (Davies 1979). However a nest was recorded at Middlesex in 1982, on a dam on a nearby property, but the level dropped in the nesting dam and the family moved a kilometre to the Home Dam at the Middlesex Field Study Centre. Four cygnets fledged in January 1983. One nest was located in the area in each year 1983-1985, accounting for the peak in the number of records in those years, but swans did not nest thereafter.

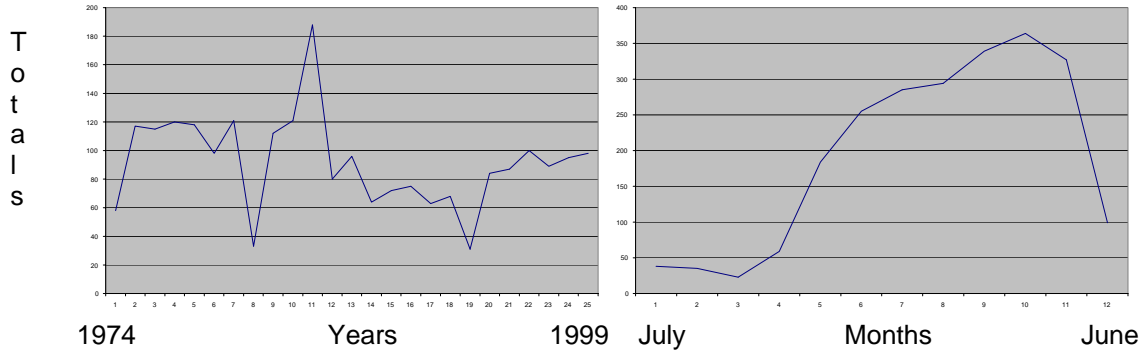


Figure 5: Trends in the numbers of Black Swan *Cygnus atratus* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Australian Sheldduck *Tadorna tadornoides* was rare until 1984, but thereafter became common in spring, summer and autumn. Like the Musk Duck it has a moult migration in winter, retreating to large lakes and estuaries where it sheds all its flight feathers together and becomes flightless for about three weeks. It is not clear why it arrived so abruptly in 1984. The species has increased greatly in the south-west since the land was cleared for farming and it may be that by 1984 the expanding population had reached Manjimup. It remained common, probably because some grazing was still available despite many areas becoming vineyards or market gardens, whereas many waterfowl decreased in the 1990s.

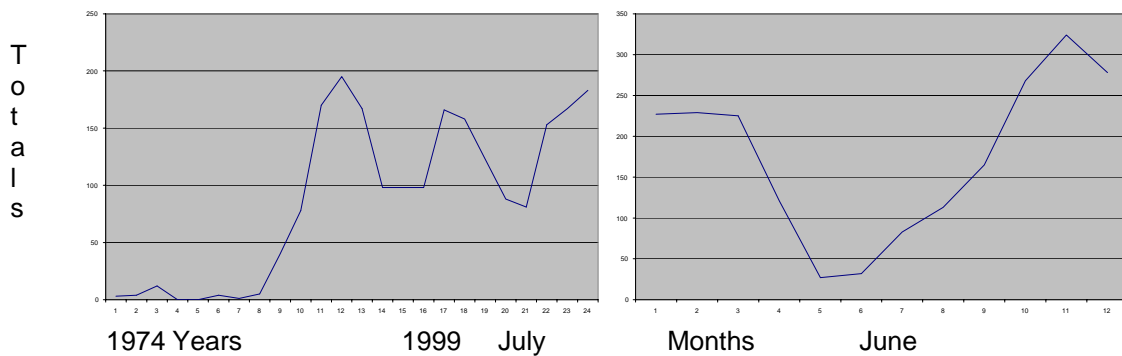


Figure 6: Trends in the numbers of Australian Sheldduck *Tadorna tadornoides* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

For most of the study period the Australian Wood Duck *Chenonetta jubata* was abundant, but there was a marked decline in the number of recordings after 1992. This probably reflects the changes in agricultural practice, from grass pasture to various horticultural crops. The Australian Wood Duck is a grazing bird, favouring grassland, especially those that remain green in the summer. Once these diminished in the Middlesex area, so did the numbers of duck.

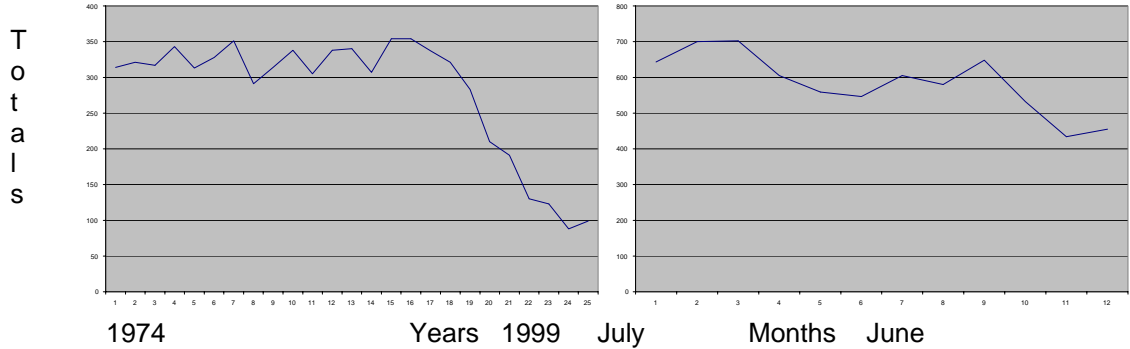


Figure 7: Trends in the numbers of Australian Wood Duck *Chenonetta jubata* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Pacific Black Duck *Anas superciliosa* was always abundant. The dip in the monthly totals in February is more an effect of the month having only 28 days, whereas the other months have 30 or more. Over 25 years this accumulates and appears significant, but is not. The duck must be very well adapted to the scattering of small, shallow dams characteristic of the area.

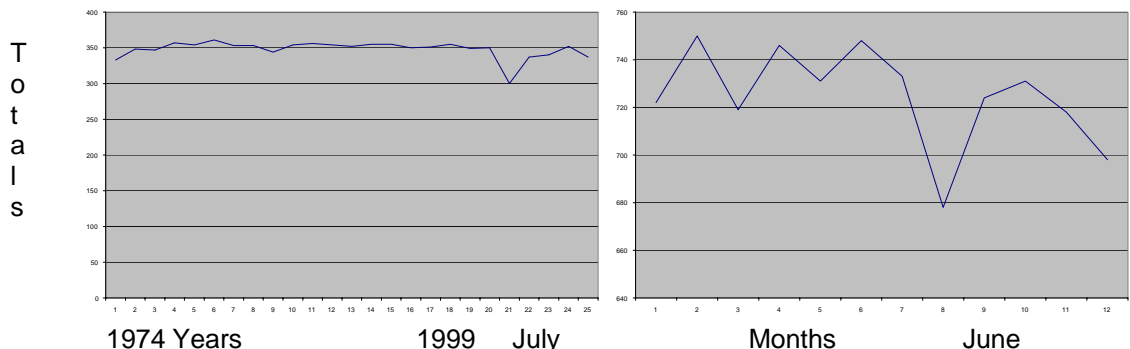


Figure 8: Trends in the numbers of Pacific Black Duck *Anas superciliosa* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Australian Shoveler *Anas rhynchos* was a regular visitor in autumn between 1975 and 1988, with maximum number of recordings in 1977. As with many waterbirds it was hardly seen after 1988. It is essentially a filter-feeder and would be discouraged if numbers of aquatic invertebrates declined because pesticides from the horticultural enterprises were draining into the dams.

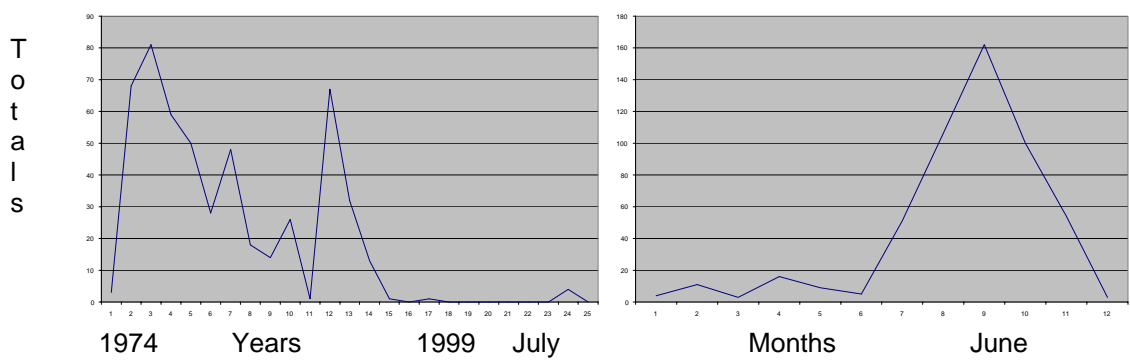


Figure 9: Trends in the numbers of Australian Shoveler *Anas rhynchos* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Grey Teal *Anas gracilis* was abundant throughout the year until 1990 when it declined rapidly and remained in very low numbers for the rest of the study. Grey Teals are dabbling ducks, feeding in shallow water on seeds and invertebrates. The pesticides and insecticides draining from the horticultural enterprises in the last years may have destroyed this food supply. In addition the dams were often drained to provide irrigation water, and these fluctuations may have discouraged the birds.

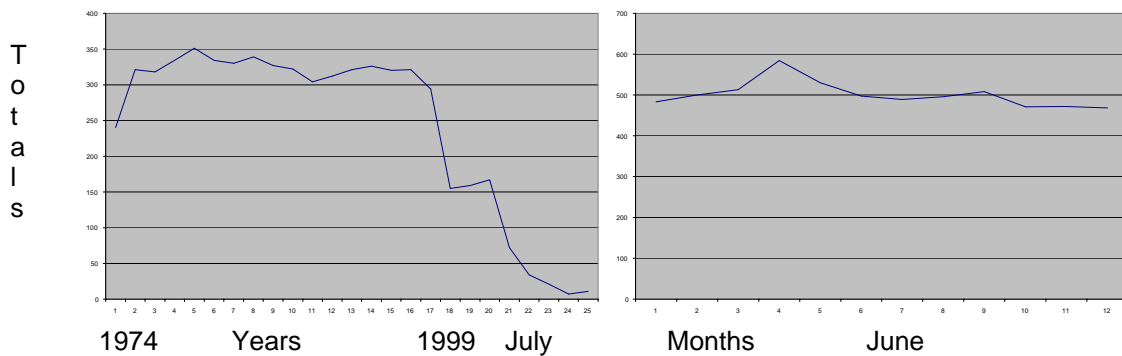


Figure 10: Trends in the numbers of Grey Teal *Anas gracilis* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Very few Chestnut Teal *Anas castanea* visited Middlesex, then only in the winter; it was absent after 1980.

Records of the Hardhead *Aythya australis* at Middlesex were very variable. In some years it was regularly seen and in others there were few records. The years, 1985/86, 1991/94, in which it was most frequently recorded were not those in which it was found nesting; they were 1979/80 and 1984/85. Possibly the years when it was frequently seen were ones in which the local dams were favourable for it and remained full during the spring.

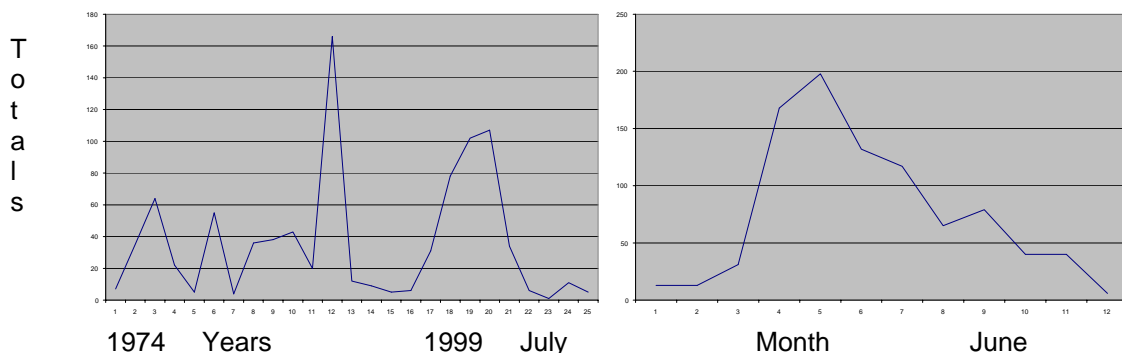


Figure 11: Trends in the numbers of Hardhead *Aythya australis* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Podicipidae

Australasian Grebes *Tachybaptus novaehollandiae* were regular visitors to Middlesex until 1994 when there was a sharp decline in the number of sightings. This appears to correlate with the management of the dam, because after 1994 the dam was fully drained each summer. The graph of monthly totals shows the grebe to be mostly a summer visitor, staying into the autumn. This behaviour is consistent with that of other waterbirds that spread out through the state once the winter rains cause ephemeral floods elsewhere. As these ephemeral waters dry up, waterbirds begin to concentrate on the wetlands of the south-west. The Australasian Grebe was also absent in the last eight years of the study.

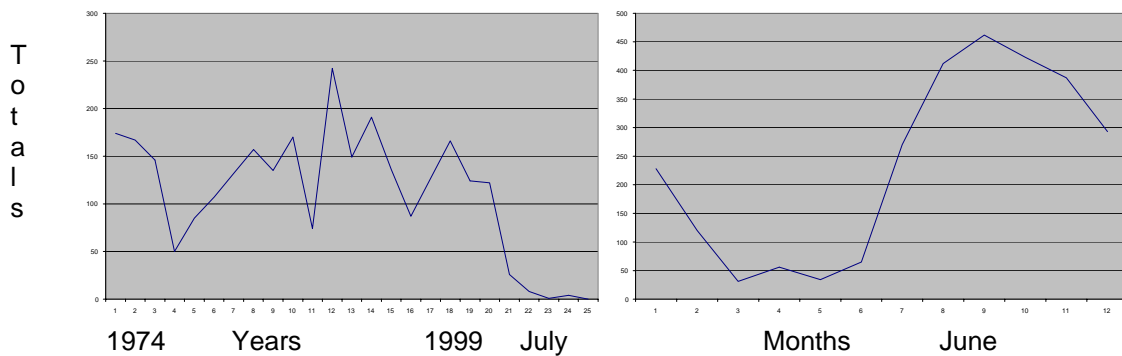


Figure 12: Trends in the numbers of Australasian Grebe *Tachybaptus novaehollandiae* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Hoary-headed Grebe *Poiliocephalus poiliocephalus* visited the dam at Middlesex in the autumns of 1976 and 1977 but thereafter was rarely recorded. It tends to be an inland bird and its abundance and distribution may be controlled by factors outside the area.

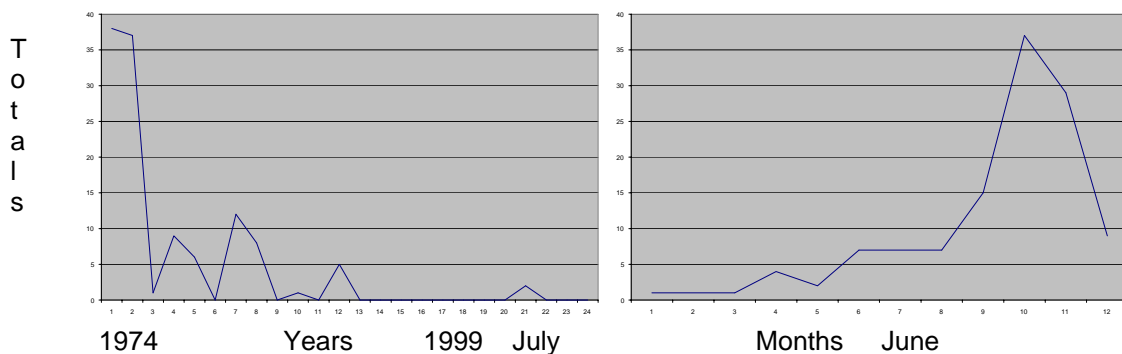


Figure 13: Trends in the numbers of Hoary-headed Grebe *Poiliocephalus poiliocephalus* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Anhingidae

The Darter *Anhinga melanogaster* was a visitor to the dams at Middlesex in summer and autumn, but the number of records varied from year to year, and toward the end of the study, declined. It is not possible to interpret the variation without knowing where the birds came from and the success of the immediately preceding breeding seasons. The decline after 1994 may be due to the increasing pollution of the dams, but in the last year, 1998/1999, the numbers were up again, and the apparent decline may be within the normal range of variation.

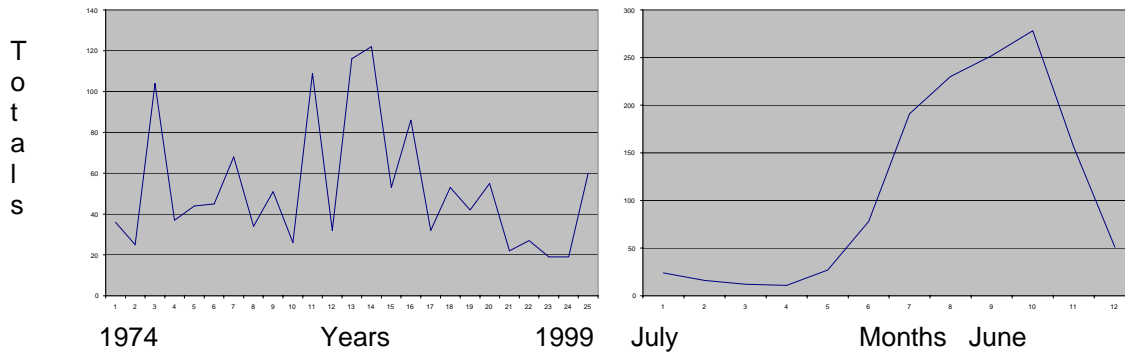


Figure 14: Trends in the numbers of Darter *Anhinga melanogaster* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Phalacrocoracidae

Apart from a reduction in the number of records in the spring, when the breeding birds were absent, the number of records of the Little Pied Cormorant *Phalacrocorax melanoleucos* remained high. It did not show a decline towards the end of the study and appeared to be able to withstand the level of pollution suffered by the dams as the agricultural practices changed.

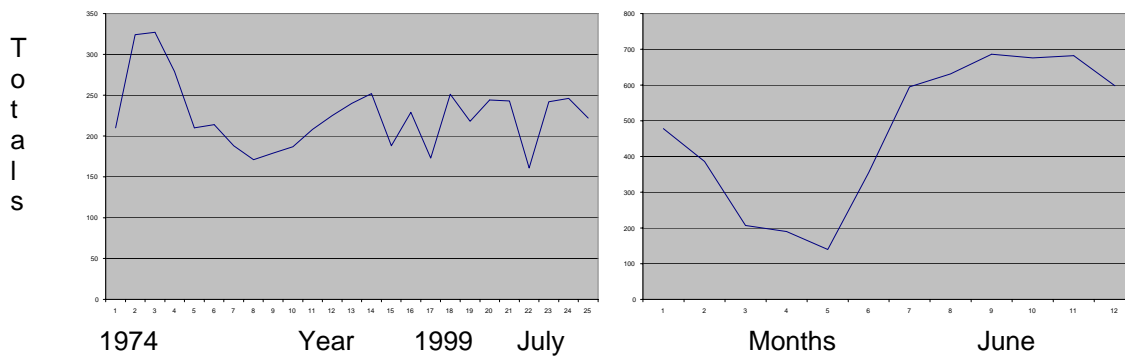


Figure 15: Trends in the numbers of Little Pied Cormorant *Phalacrocorax melanoleucos* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The number of records of the Little Black Cormorant *Phalacrocorax sulcirostris* differed from the Little Pied Cormorant not only in that they were low in autumn and winter, rising in spring to a maximum in summer, but also because there was a steep decline after 1992 to the end of the study. The data suggest that the Little Black Cormorant may have been more affected by the increasing pollution of the dams than the Little Pied Cormorant. It is unlikely to have been affected by the increasing salt levels, because it is common in estuaries and the sea, but may also have found the frequent draining of the dams, and their consequent shallow depth, unattractive.

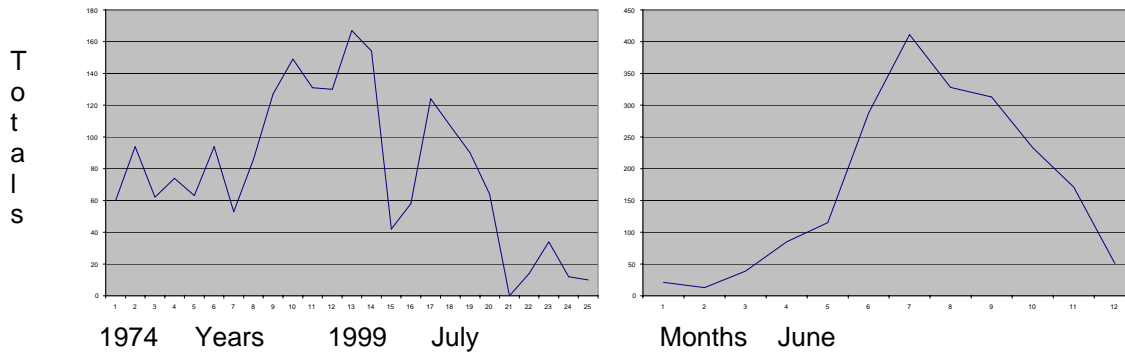


Figure 16: Trends in the numbers of Little Black Cormorant *Phalacrocorax sulcirostris* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The number of records of the Great Cormorant *Phalacrocorax carbo* was high only in the summer of 1980/1981, with some records in the summers of 1976 and 1977. It is likely that few birds were involved and that the species should be regarded as a vagrant to Middlesex.

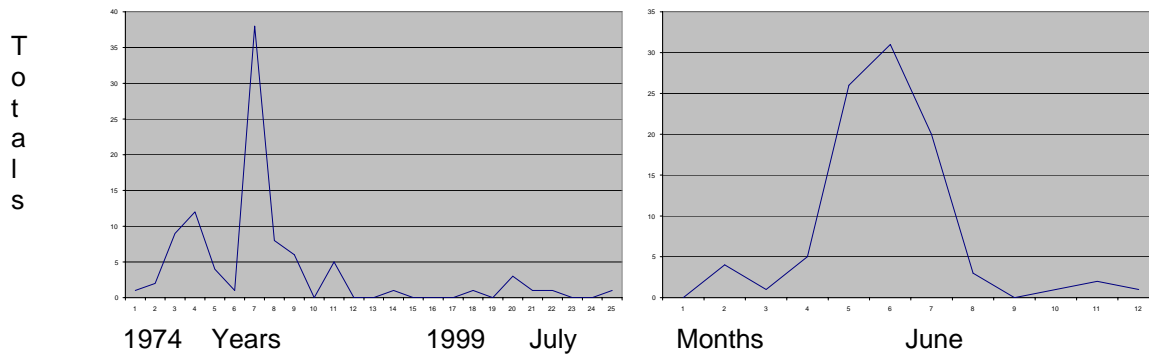


Figure 17: Trends in the numbers of Great Cormorant *Phalacrocorax carbo* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Pelecanidae

An Australian Pelican *Pelecanus conspicillatus* was only recorded at Middlesex in the winter of 1985 and the winter and spring of 1992. It was a vagrant to the area.

Ardeidae

The White-fronted Heron *Egretta novaehollandiae* was abundant throughout the year, although number of reports were slightly higher in summer than in the wet months of autumn and winter, when many ephemeral wetlands were flooded. A small decline in reporting was evident after 1991, with a particularly low number of reports in 1995. This decline probably reflects the increased use of the water in the dams for irrigation in these years.

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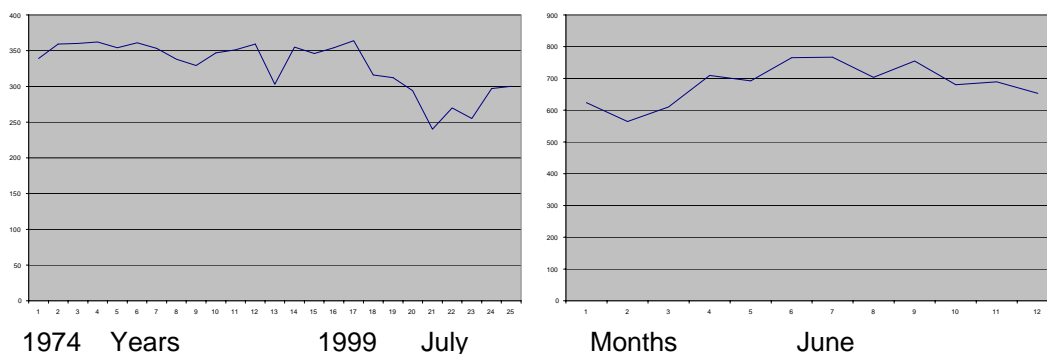


Figure 18: Trends in the numbers of White-fronted Heron *Egretta novaehollandiae* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The White-necked Heron *Ardea pacifica* was a summer visitor to Middlesex, the large numbers recorded in 1976, 1978-9 and 1986 probably reflecting the exodus of birds from the inland at the end of a good breeding season, once dry spells eliminated the inland wetlands. In a few years many records were made in May, just as the first rain fell. These years, 1976, 1978 and 1990, were not all years in which the bird was frequently recorded in the previous summer. It seems likely that the May records were of birds, prompted to move by the rain, that were passing through from other summer refuges to breed in the inland. The White-necked Heron was less often recorded after 1992 than it had been before, probably reflecting the declining attractiveness of the dams as a result of pollution and increasing salinity.

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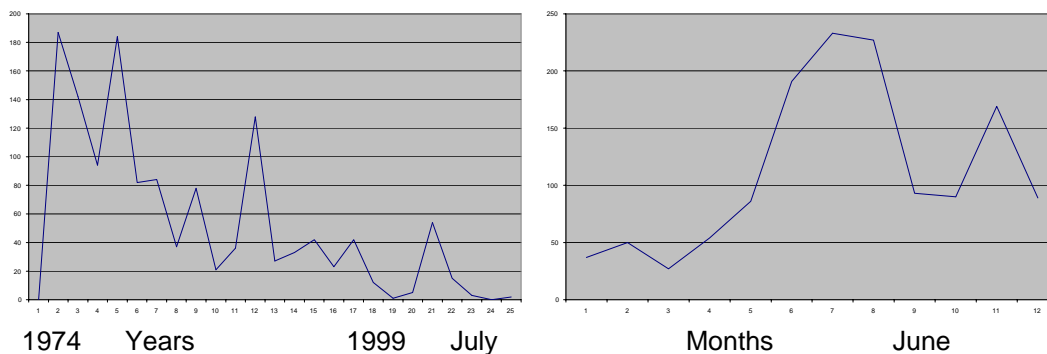


Figure 19: Trends in the numbers of White-necked Heron *Ardea pacifica* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Unlike the two other common herons the Great Egret *Ardea alba* remained undiminished in number of records until the end of the study, although there were fluctuations. It was an autumn and winter visitor, when rain was frequent and the dams were continually being recharged with fresh water, so that salinity was less of a problem than in summer. At the same time the rain stimulated the surviving frogs to breed and the tadpoles would provide a useful food source for the egret. Egrets breed in colonies but hunt singly. There was no breeding colony at Middlesex, so that, although the egret was recorded often, the species was usually represented by a single bird.

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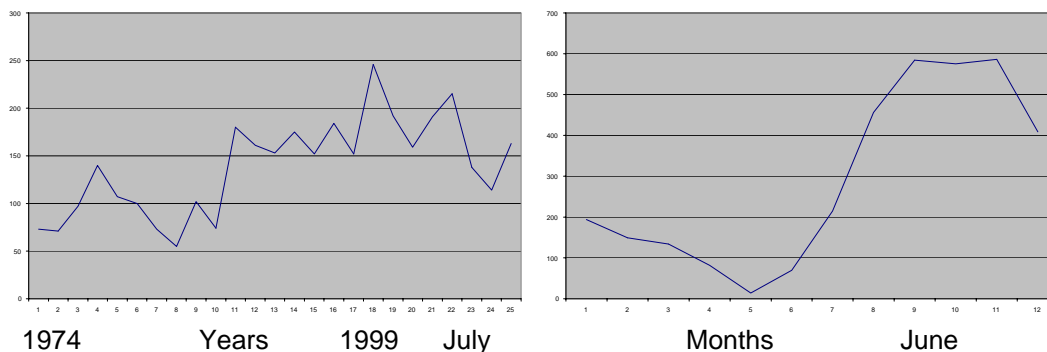


Figure 20: Trends in the numbers of Great Egret *Ardea alba* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Nankeen Night Heron *Nycticorax caledonicus* was a rare vagrant to Middlesex, recorded only in May and September 1986 and February and March 1997.

The Little Bittern *Ixobrychus minutus* was recorded only once in January 1984.

The Australian Bittern *Botaurus pliciloptilus* was recorded only once in January 1976

Threskiornithidae

The Australian White Ibis *Threskiornis molucca* did not arrive at Middlesex in any numbers until 1984. Thereafter an increasing number of records were made each year until 1996, when the number of records fell slightly and fluctuated at about 10% below the maximum of 1994. Most birds visited Middlesex after the breeding season, spending autumn, winter and spring in the area. The increase during the early years was probably a reflection of the irruption of the species southward from the Kimberleys, where it was always common. It first appeared in the south-west of Western Australia in 1952 and it first bred near Capel in 1979 (Blakers *et al.* 1984). Since then it has spread through the south-west. The environmental change that favoured it was the clearing of woodland and forest and the development of irrigated pasture where it feeds.

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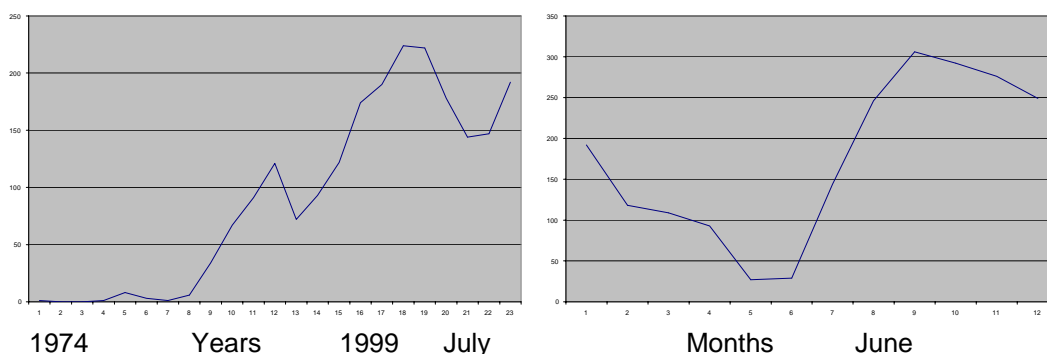


Figure 21: Trends in the numbers of Australian White Ibis *Threskiornis molucca* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Unlike the Australian White Ibis, the number of reports of the Straw-necked Ibis *Threskiornis spinicollis* fluctuated without evidence of a trend to increase or decline. It was first reported in south-western Australia in 1892 (Blakers *et al.* 1984) and did not breed until

after 1950. It was most abundant in summer and autumn, and absent during the spring breeding season. It, too, favours flooded meadows for feeding and has benefitted from agricultural development.

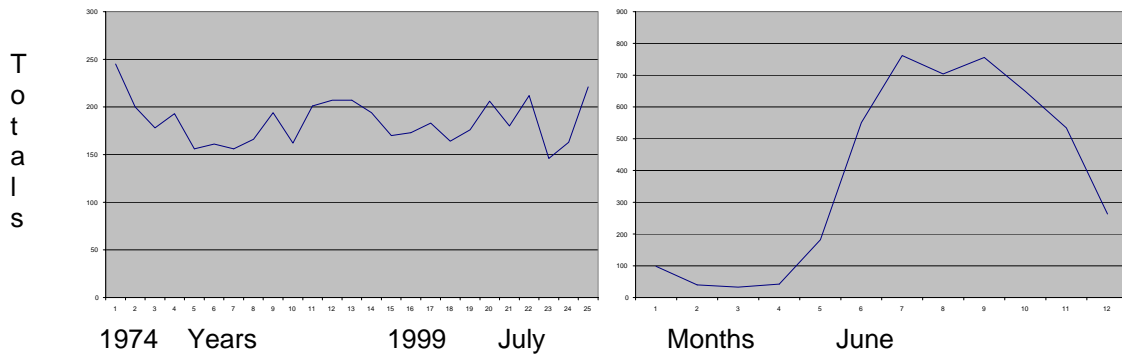


Figure 22: Trends in the numbers of Straw-necked Ibis *Threskiornis spinicollis* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

As with the Australian White Ibis, the Yellow-billed Spoonbill *Platalea flavipes* was rare in the early years, the number of reports increasing rapidly from 1987. Thereafter it remained common, with no evidence of a decline in the final years of the study. It visited Middlesex mainly in the autumn and winter, when the dams were full and it could easily filter its invertebrate prey from them. It was first reported in south-western Australia in 1900, but was slow to breed, although nests were found at Moora in 1921 (Blakers *et al.* 1984). The increasing number of reports at Middlesex from 1987 reflects its slow spread through the south-west where it is now well established. It is interesting that it seems to be unaffected by increasing pollution and salinity in the dams, but as it uses them at the time when rainfall is highest, these effects are probably diluted when it is in the area.

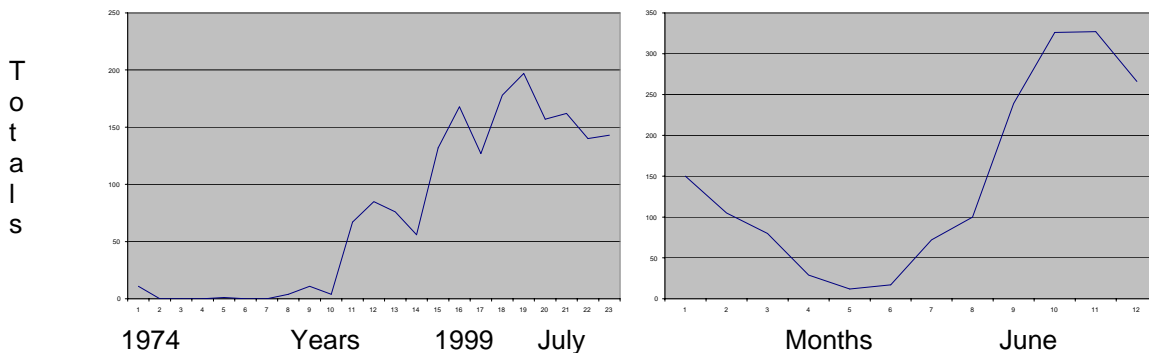


Figure 23: Trends in the numbers of Yellow-billed Spoonbill *Platalea flavipes* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Accipitridae

The Black-shouldered Kite *Elanus axillaris* was at Middlesex in autumn, winter and early spring, but few were recorded in summer. In the winters of 1981 and 1986 (years in which it nested nearby [Brown and Brown 1991]) it was very frequently recorded and up until 1989 was a regular visitor. Thereafter the number of records declined. It feeds mainly on mice, grasshoppers and large insects (Brown and Brown 1991, Marchant and Higgins 1993), so that it may have been affected by the changing agricultural regimes and the increasing use of

insecticides. It is a bird that favours open country and, although it does hunt over horticultural crops, a lack of insects would make them unattractive to it.

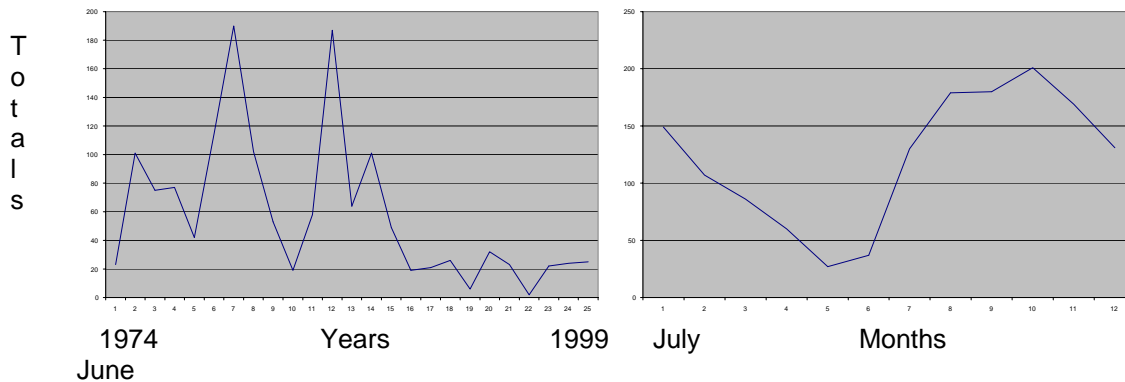


Figure 24: Trends in the numbers of Black-shouldered Kite *Elanus axillaris* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Records of the Whistling Kite *Haliastur sphenurus* although abundant at the start of the study, when it nested in a nearby tree (Brown and Brown 1991) declined after 1978 and remained low thereafter. Although it fed locally on the young of waterfowl during their breeding season, it was presumably also affected by the change from pasture, where carcasses are not uncommon, to cropping, as well by the reduction in rabbits, and therefore road kills, following the spread of myxomycosis and later colici virus. It was still seen throughout the year, but on few days.

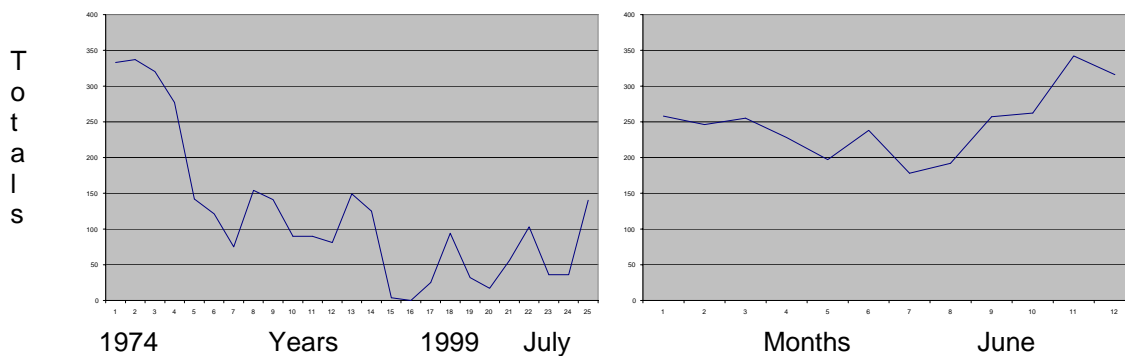


Figure 25: Trends in the numbers of Whistling Kite *Haliastur sphenurus* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Swamp Harrier *Circus approximans* visited Middlesex in the spring and summer, when the rush beds were growing well. Unlike many other birds the number of records seemed to increase gradually over the years. It feeds on young waterfowl, domestic poultry and also on introduced rats that may have benefited from the changing agricultural practice. For whatever reason the number of records of the Swamp Harrier has gone against the trend shown by many other species.

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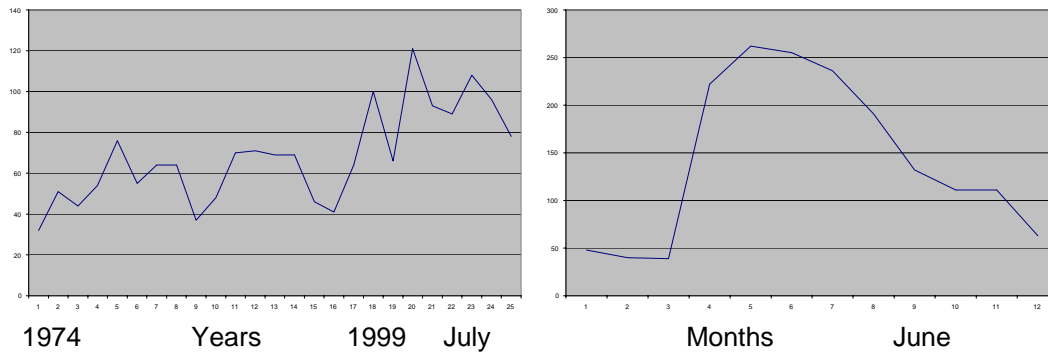


Figure 26: Trends in the numbers of Swamp Harrier *Circus approximans* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Brown Goshawk *Accipiter fasciatus* was seen occasionally, 31 times over the 25 years. There were up to seven records a year in the early part of the study, but after 1978 was rarely recorded.

Like the Brown Goshawk, the Collared Sparrowhawk *Accipiter cirrhocephalus* was scarce, with only 13 records in the year when it was most frequently seen, and 82 records over the 25 years. There was only one record after 1994. It showed no seasonal pattern.

In the early years the Wedge-tailed Eagle *Aquila audax* was seen commonly in the spring and summer, but after 1977 it was rare. Probably the decline of the rabbit population affected it.

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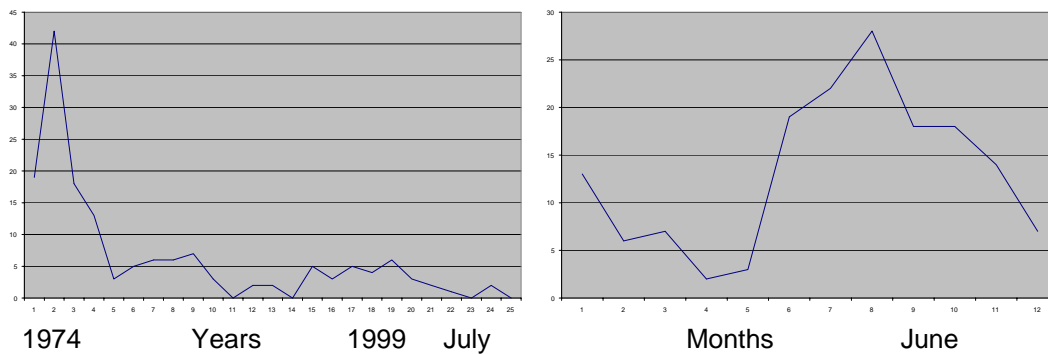


Figure 27: Trends in the numbers of Wedge-tailed Eagle *Aquila audax* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Like the Wedge-tailed Eagle the Little Eagle *Hieraaetus morphoides* was seen commonly in the spring and summer in the early years, but after 1978 it was rare. Probably the decline of the rabbit population affected it also.

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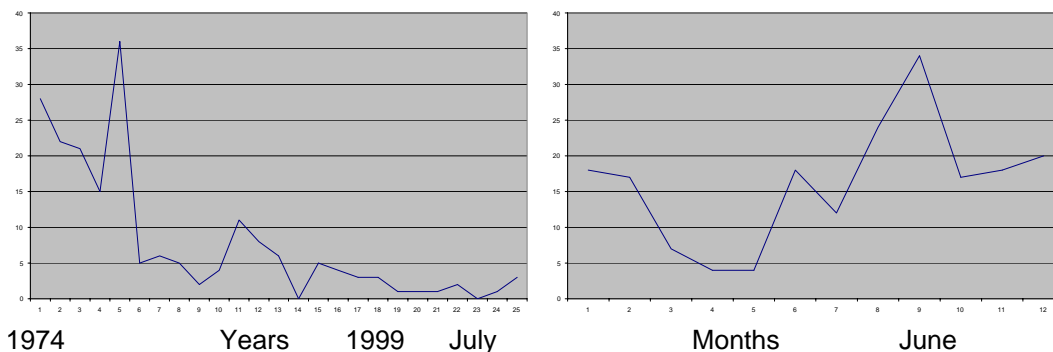


Figure 28: Trends in the numbers of Little Eagle *Hieraaetus morphmoides* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Falconidae

Although the Brown Falcon *Falco berigora* was recorded throughout the year, it was more rarely seen in summer than at other seasons. It was commonly recorded in the early years and rarely seen after 1995. It is an opportunist when feeding (Marchant and Higgins 1993) and the erratic trend to decline shown in the number of recordings of this species may indicate a general decline in small prey organisms, such as birds, reptiles and large insects. At the same time it is regarded as a “chicken hawk” and the growing settlement of the area may have led to its increasing destruction as a pest.

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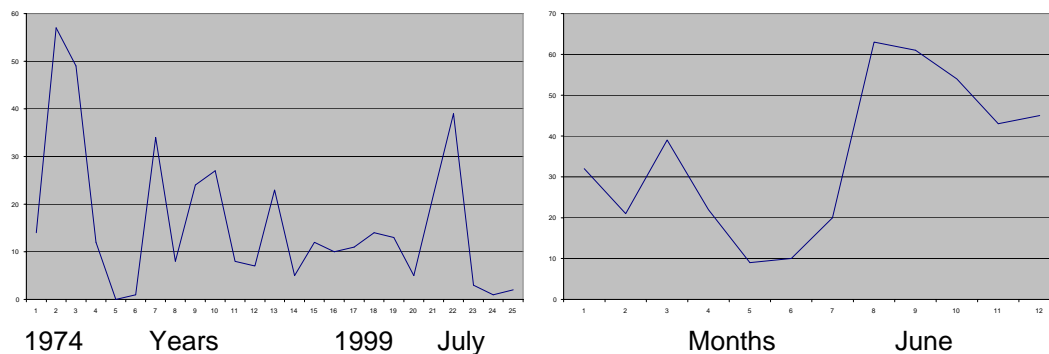


Figure 29: Trends in the numbers of Brown Falcon *Falco berigora* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Australian Hobby *Falco longipennis* visited Middlesex most frequently in the late summer and early autumn, when many young passerines were just out of the nest and learning to fly. The Australian Hobby’s food of small birds (Marchant and Higgins 1993) would therefore be easy to catch, and the declining number of passerines recorded in the later years of the study correlates with a decline in the number of records of the Australian Hobby.

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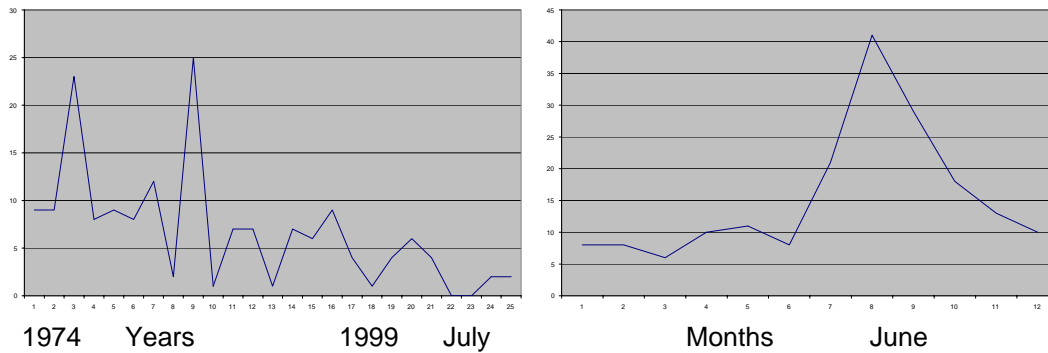


Figure 30: Trends in the numbers of Australian Hobby *Falco longipennis* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The number of records of the Peregrine Falcon *Falco peregrinus* was always low, and it showed no declining trend during the study. When it was recorded it was usually seen in summer and autumn, but in some years was not seen at all.

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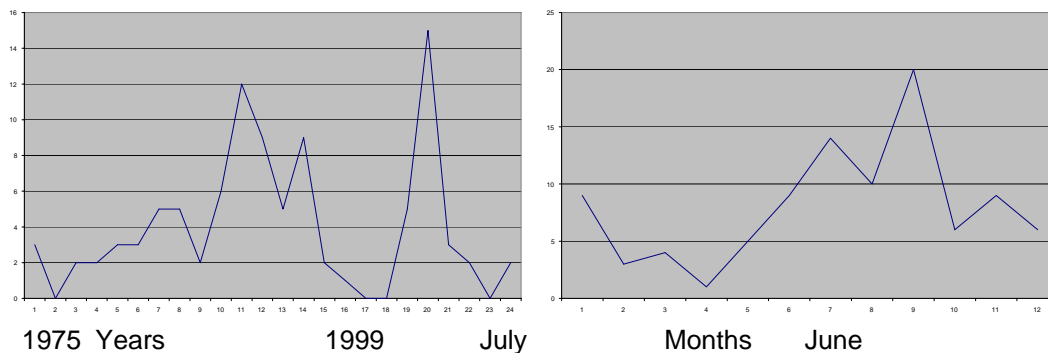


Figure 31: Trends in the numbers of Peregrine Falcon *Falco peregrinus* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right). None were seen in 1974.

The Australian Kestrel *Falco cenchríodes* was common in the first years of the study, when it bred nearby (Brown and Brown 1991), but the number of records declined steeply after 1976, although the bird was occasionally recorded during all subsequent years except 1994. The peaks in the graph of records by years were the results of large numbers of records in the February's of 1975, 1978, 1980 and 1985. The young birds are known to migrate north from south-eastern Australia, and Marchant and Higgins (1993), quoting Baker-Gabb (1987), suggest that birds from the south-west may also move north for the winter. The influxes in late summer to Manjimup support this suggestion. The general decline of the species in the area probably reflects the change in agricultural practice from pasture to horticulture, because the bird favours open country for hunting.

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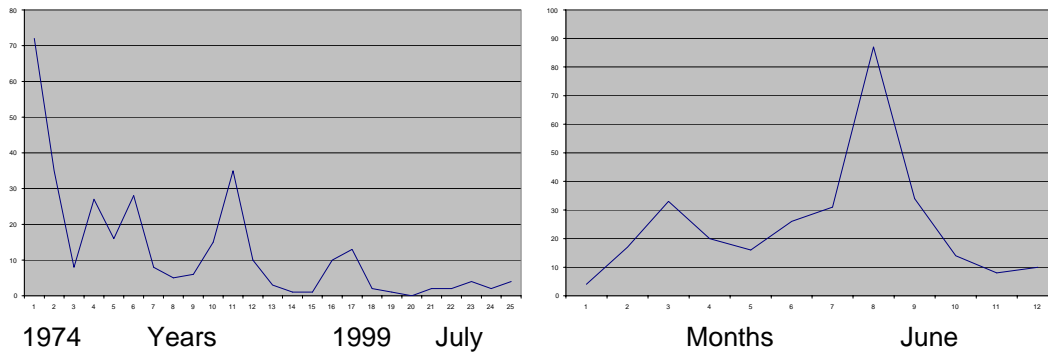


Figure 32: Trends in the numbers of Australian Kestrel *Falco cenchriones* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Rallidae

Baillon's Crake *Porzana pusilla* was a rare summer visitor to Middlesex in 1975-1976 and 1980-1987, with only 32 records in all.

The Australian Crake *Porzana fluminea* was a rare summer visitor to Middlesex in 1974-1975 and 1980-1983, with only 17 records in all.

The Dusky Moorhen *Gallinula tenebrosa* was most frequently recorded at Middlesex in summer and autumn. It was abundant in the early years, but very scarce after 1980, a change in status that Brown and Brown (1985b) attributed to increasing salinity. However, a number of records of the Dusky Moorhen were made in the summer of 1993 and the autumn of 1997 and 1998 when salinity was still high. It is hard to interpret this pattern.

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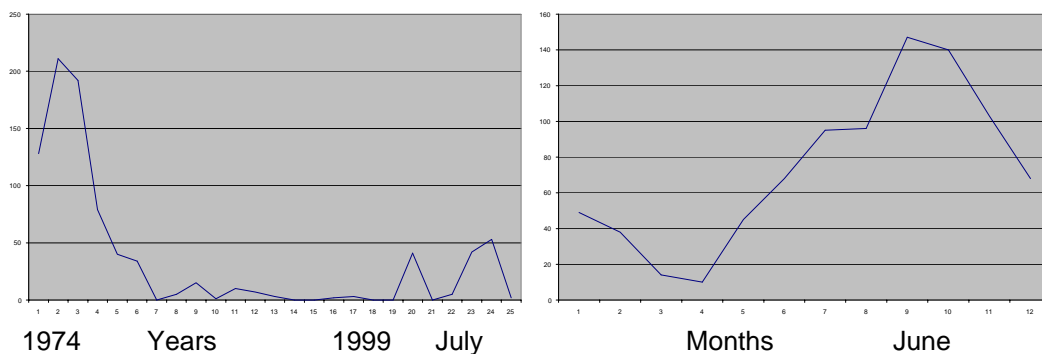


Figure 33: Trends in the numbers of Dusky Moorhen *Gallinula tenebrosa* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Spotless Crake *Porzana tabuensis* was an unusual summer visitor to Middlesex between 1980 and 1990. There were also two records in each of 1997 and 1998.

The Purple Swamphen *Porphyrio porphyrio* was one of the most commonly recorded birds at Middlesex. Apart from the springs of 1979, 1980 and 1989, when it was rarely recorded, it was seen almost every day. It was the subject of a special study (Brown and Brown 1977; 1981) on the Home Farm. The small dams with their fringing *Typha* beds favoured the birds.

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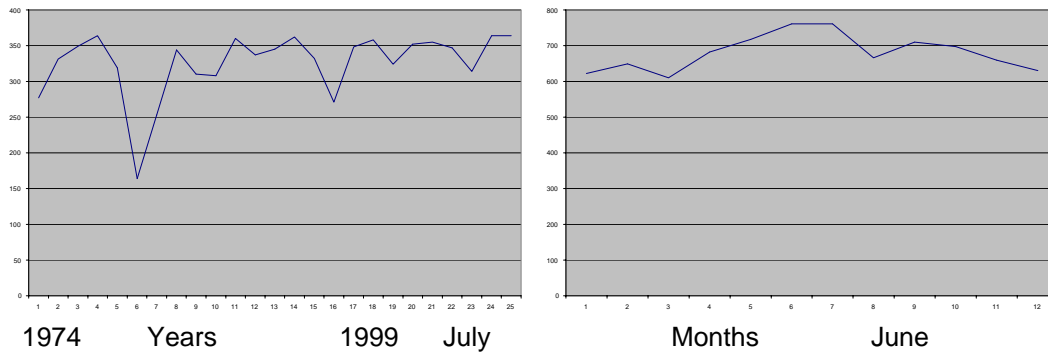


Figure 34: Trends in the numbers of Purple Swamphen *Porphyrio porphyrio* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Like the Purple Swamphen, the Eurasian Coot *Fulica atra* was one of the most commonly recorded birds at Middlesex until 1990, and its breeding was the subject of special study (Brown and Brown 1980a; 1989). Thereafter the number of records declined steadily, probably because the change in agricultural practice and the increasing run off of pesticides as well as the rising salt levels in the dams, made the dams less productive. Coots feed on aquatic vegetation and this is notoriously sensitive to pollution and salinisation, so the decline in number of records is understandable.

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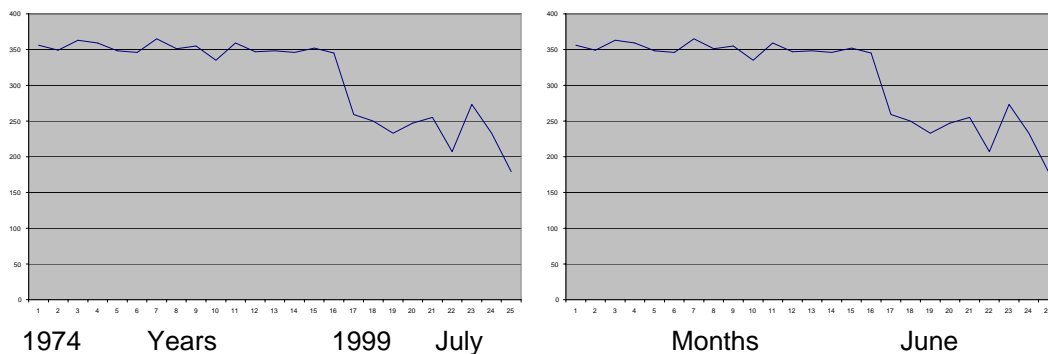


Figure 35: Trends in the numbers of Eurasian Coot *Fulica atra* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Scolopacidae

The Common Greenshank *Tringa nebularia* was seen on the dams at Middlesex in the years up to 1985, as an uncommon autumn visitor. In all only 25 records were made.

Charadriidae

In the early years of the study the Black-fronted Dotterel *Elseyaornis melanops* was a frequent summer visitor at Middlesex, with some birds seen throughout the year. After 1980 it was seen almost exclusively in summer, and the number of recordings nearly halved. Between 1996 and 1998 it was rare, but the number of recordings in 1998/99 was at the level prior to 1996. The species feeds on small insects at the edge of dams and its decline probably correlates with the increasing impact of insecticides on its food supply. In addition 1997 was a year of low rainfall with a consequent decrease in the length of shoreline of the dams.

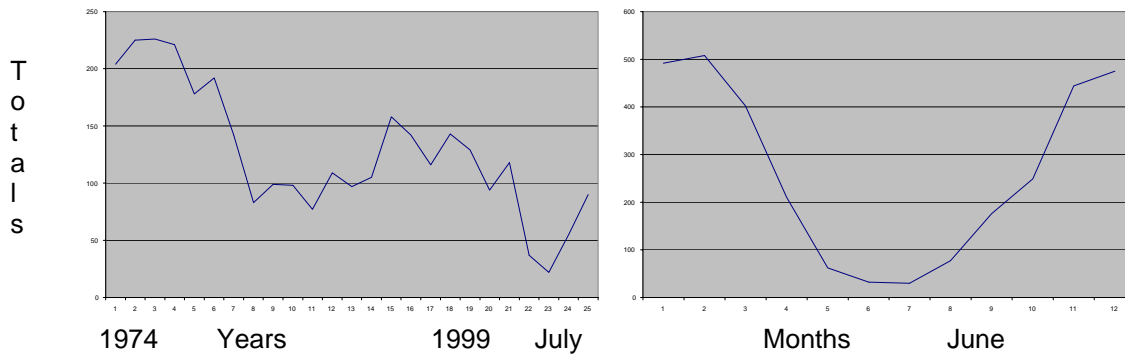


Figure 36: Trends in the numbers of Black-fronted Dotterel *Elseyornis melanops* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Banded Lapwing *Vanellus tricolor* resembled waterbirds in that it was a summer visitor. Even then it was only regular up to 1992, with the greatest abundance of sightings in 1986/87. It is a bird that favours short grass pastures and the gradual change from grazing to cropping that has taken place in the district will have restricted areas it can use. The increasing use of insecticides has also impacted on the numbers of this species, poisoning many of them.

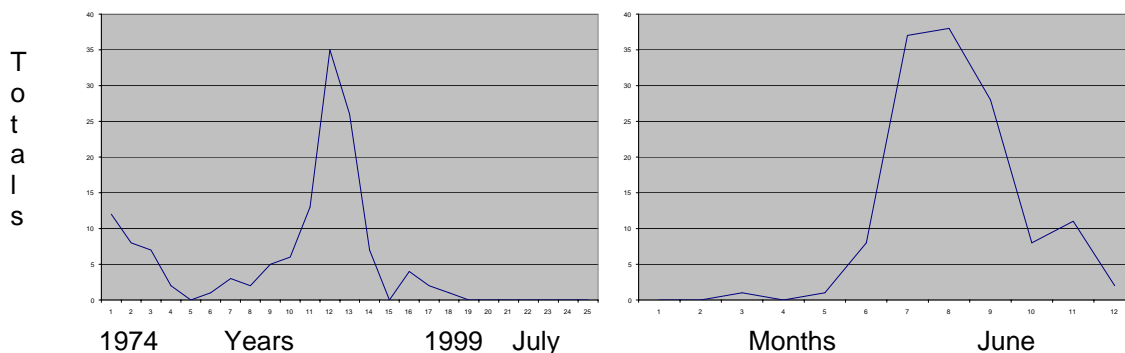


Figure 37: Trends in the numbers of Banded Lapwing *Vanellus tricolor* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Laridae

A Whiskered Tern *Chidonias hybridus* was seen in April 1987 and March 1988 hunting over the Home Dam.

Columbidae

The Common Bronzewing *Phaps chalcoptera* was always recorded at Middlesex but the number of recordings built up gradually to a maximum in 1994 and then declined slightly. The increase may have correlated with the growth of the trees in the arboreatum, but the decline is difficult to explain. Bronzewings are subject to predation by goshawks and falcons, but all these declined at the same time, a decline that may in fact have been a consequence of the decline of the pigeon. Possibly food became harder to find as the poultry activities of the Middlesex farmyard declined in the last years.

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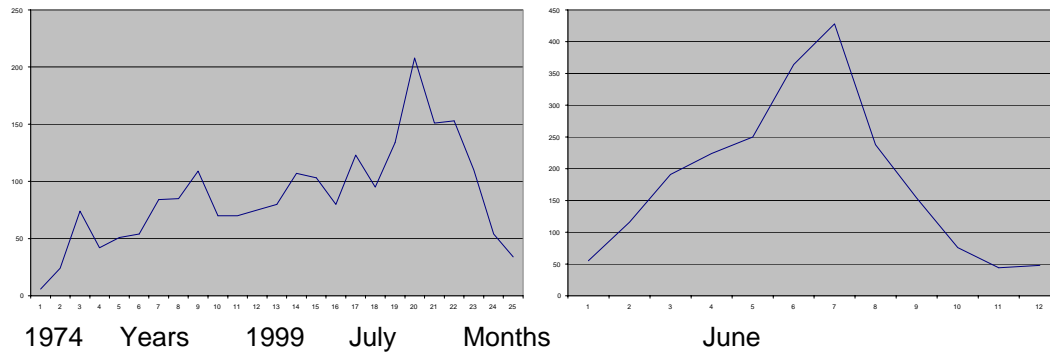


Figure 38: Trends in the numbers of Common Bronzewing *Phaps chalcoptera* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Crested Pigeon *Ocyphaps lophotes* was recorded only once, February 1997.

Cacatuidae

The Red-tailed Black-Cockatoo *Calyptorhynchus banksii* was recorded at Middlesex frequently in the summer and autumn and less commonly at other times. The number of records varied from year to year, but showed a trend to increase as the study went on, perhaps in correlation with the growth of the arboreatum.

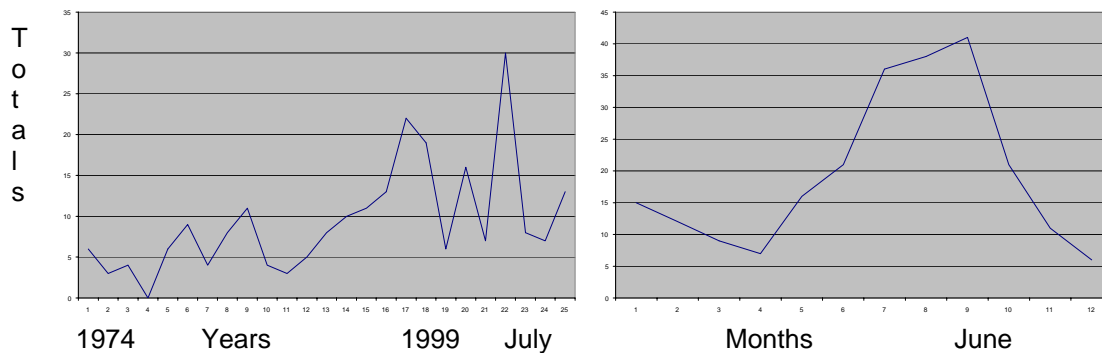


Figure 39: Trends in the numbers of Red-tailed Black-Cockatoo *Calyptorhynchus banksii* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The two species of White-tailed Black-Cockatoo *Calyptorhynchus latirostris* and *C. baudinii* were not separated in this study, but on the basis of distribution most would have been *C. baudinii*. Most records were made in spring and, to a lesser extent, in autumn, suggesting that some movement was taking place. *C. baudinii* is known to breed mostly in the karri forest, of which Middlesex is on the northern border, and no nests were found in the area. The number of records varied from year to year, and although there appears to be a trend for fewer to be made in the second half of the study, the number of records in the first and last years, 77 and 92 respectively, are almost the same, and the evidence for a decline as opposed to annual variation is unconvincing.

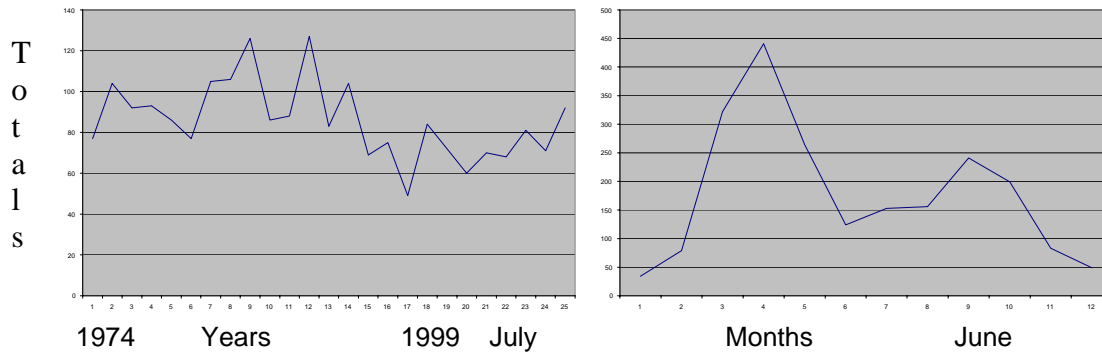


Figure 40: Trends in the numbers of White-tailed Black-Cockatoo *Calyptorhynchus latirostris* and *C. baudinii* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Little Corellas *Cacatua sanguinea* were recorded only 84 times, 55 in the autumn of 1987, 24 in the summer of 1990/1991 and 5 in the summer of 1980. It is difficult to correlate these irruptions of an invasive species with any local factor.

Psittacidae

The number of records of the Purple-crowned Lorikeet *Glossopsitta porphyrocephala*, although low in the early years increased as the arboreatum matured, but remained very variable from year to year. This was true of both spring and autumn visitations and presumably correlated with the abundance of nectar-producing flowers.

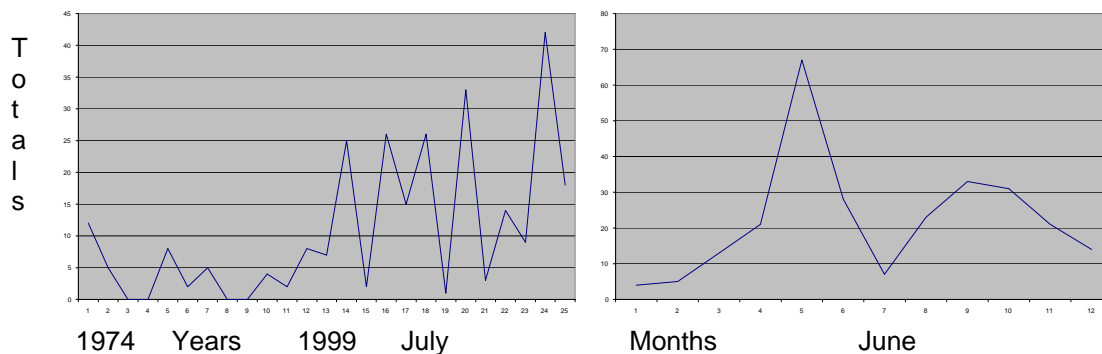


Figure 41: Trends in the numbers of Purple-crowned Lorikeet *Glossopsitta porphyrocephala* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The number of records of the Western Rosella *Platycercus icterotis* was high throughout the study but there were fewer in the summer than at other times and there was some indication of a decline in number towards the end of the twenty-five years. Particularly over the last ten years the numbers of Australian Ringnecks were increasing and it is possible that competition for food and nesting hollows was impacting on the Western Rosellas as the agricultural practice in the district changed and the number of the aggressive Australian Ringnecks increased.

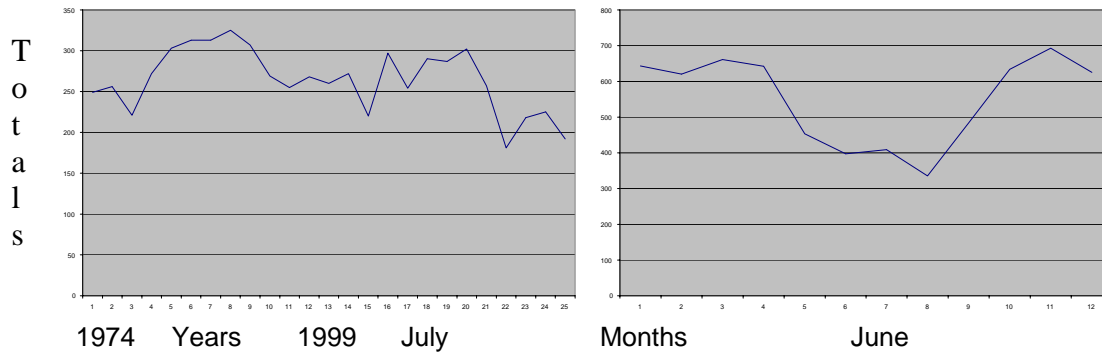


Figure 42: Trends in the numbers of Western Rosella *Platycercus icterotis* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The number of records of the Australian Ringneck *Barnardius zonarius* increased steadily throughout the study, a trend that was apparent over the whole of the agricultural area of Western Australia. It may have been facilitated during this period by the change from bag handling of grain to bulk handling, leading to greatly increased spillage of grain along the roads and the exposure of abundant grain at the storage bins. The parrots were thus provided with an inexhaustible food supply that would have been particularly helpful to young birds just reaching independence and learning to forage. The increase in number of birds inland probably led to the emigration of birds from the wheatbelt to the Manjimup area.

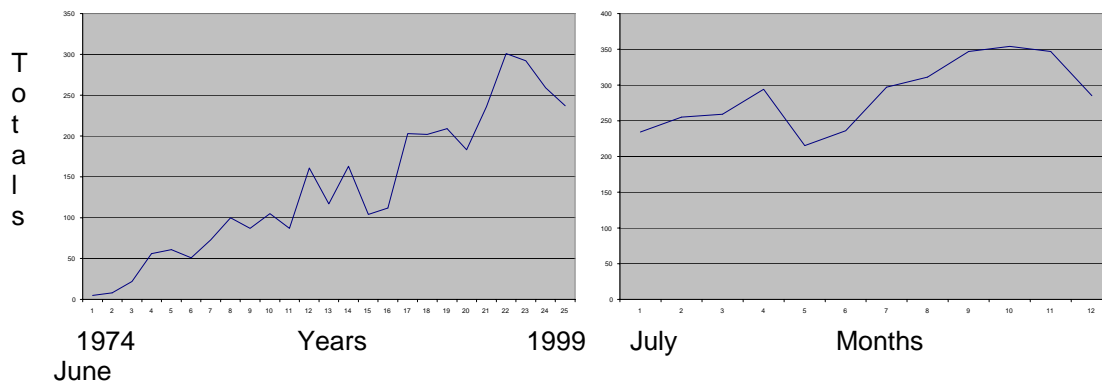


Figure 43: Trends in the numbers of Australian Ringneck *Barnardius zonarius* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Red-capped Parrot *Purpureicephalus spurius* specialises on extracting seeds from the nuts of the marri. As a consequence it moves around to harvest the best crops of marri. When these were in the vicinity of Middlesex, the number of records was high, when there were few marri nuts, the number of records was low. The nuts ripen in spring and summer, and these were the seasons when most records were made. There was no evidence that the bird's status at Middlesex had changed over the study; the Australian Ringneck would not compete for its food.

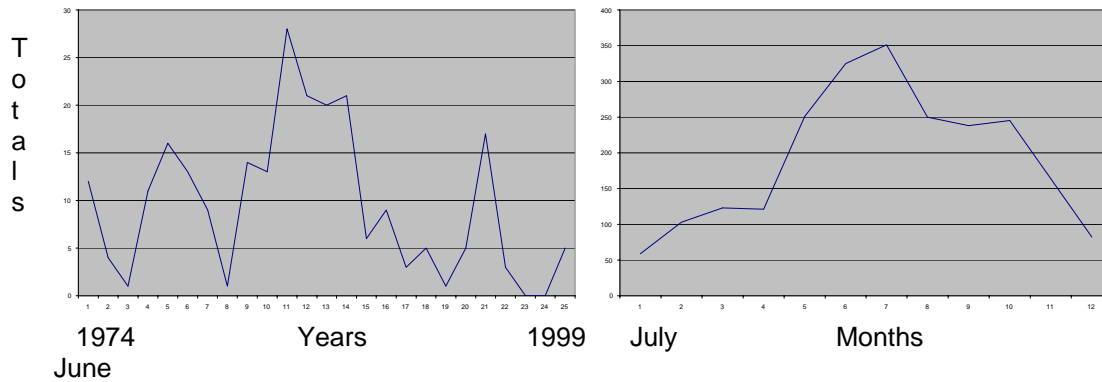


Figure 44: Trends in the numbers of Red-capped Parrot *Purpureicephalus spurius* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The number of records of the Elegant Parrot *Neophema elegans* was high between 1984 and 1987 but then declined, steeply after 1991. However the number of records in the early years of the study was also low and the fluctuations may be within the normal range of the species for this locality. It is a bird that favours open pasture, and as this was reduced with the change in agricultural practice conditions may have become unfavourable for it, whereas the initial clearing of the forest favoured it.

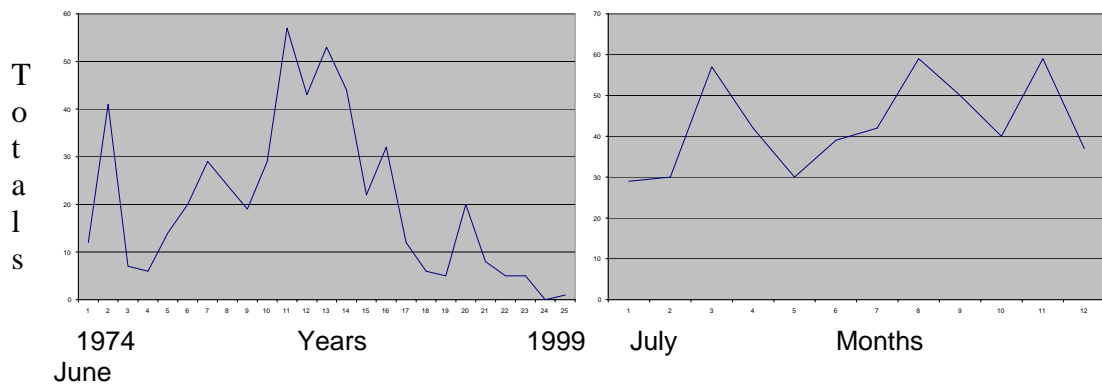


Figure 45: Trends in the numbers of Red-capped Parrot *Purpureicephalus spurius* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Cuculidae

The number of recordings of the Pallid Cuckoo *Cuculus pallidus* was high early in the study, declined and then showed two subsequent maxima, but at lower levels than the first. These fluctuations may relate to the availability of host species for this parasitic bird. It is hard to justify the suggestion that the bird was affected by increasing levels of pollution, although the decline after 1997 may have been influenced by this factor. Pallid Cuckoos feed on caterpillars, among other things, and these would be less available under a regime of heavy insecticide use. The bird is a seasonal visitor to the area (Brown and Brown 1987), abundant during the spring and summer, but absent during the autumn and winter

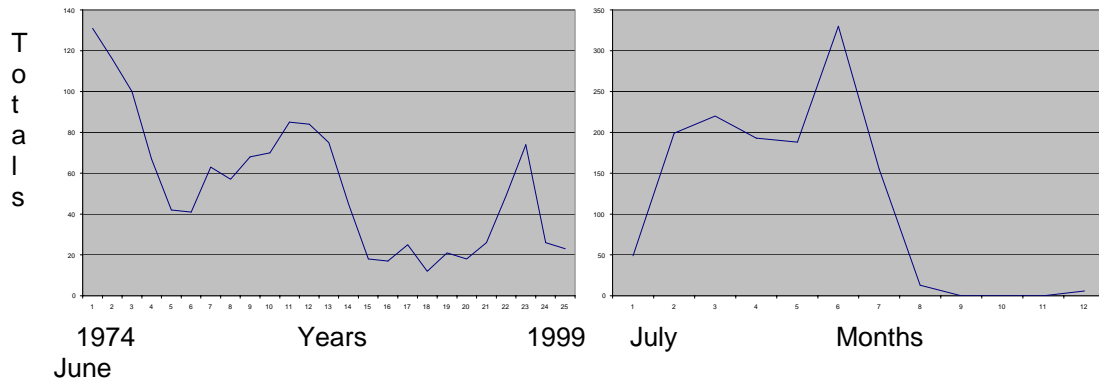


Figure 46: Trends in the numbers of Pallid Cuckoo *Cuculus pallidus* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Fan-tailed Cuckoo *Cacomantis flabelliformis* showed great fluctuations in the number of recordings from year to year. It was also a less strictly seasonal visitor than the Pallid Cuckoo, but did have a minimum of recordings in summer (Brown and Brown 1987). These differences may relate to the availability of hosts but in any case do not appear to correlate with any changes in agricultural practice in the area, because, when other species declined towards the end of the study, the number of recordings of Fan-tailed Cuckoos increased.

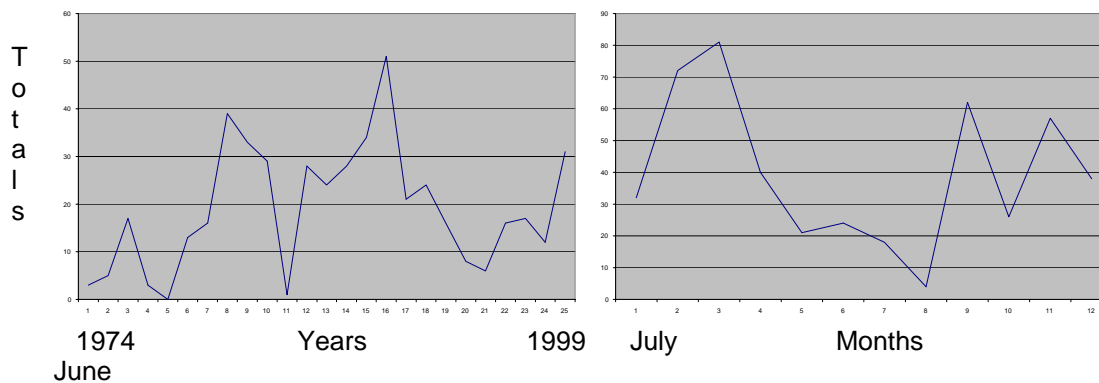


Figure 47: Trends in the numbers of Fan-tailed Cuckoo *Cacomantis flabelliformis* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The numbers of Horsfield's Bronze-Cuckoo *Chrysococcyx basalix* were low at the start of the study, rose to a maximum in 1985/1986, and then declined and fluctuated, rather in the way the numbers had before 1985. It is hard to correlate these trends with any local or environmental variable. The bird is a migrant, visiting Middlesex in the spring and early summer and then moving away (Brown and Brown 1987). Its presence is made conspicuous by its call and calling is intense if many nests of hosts are locally available. The usual hosts are fairy-wrens (54%) and thornbills (24%) (Higgins 1999). The Middlesex annual reports (Brown and Brown 1985b;1987) indicate that Yellow-rumped Thornbill *Acanthiza chrysorrhoa* numbers built up in 1984/1985 and three cuckoos were raised in 1985/1986 in the home garden at Middlesex. The intense calling of the cuckoos, reflected in the high number of records, presumably therefore correlates with the attention they were giving to the local thornbills. In comparison, 1986/1987 was not a poor year for Yellow-rumped Thornbills, and the number of cuckoo records declined.

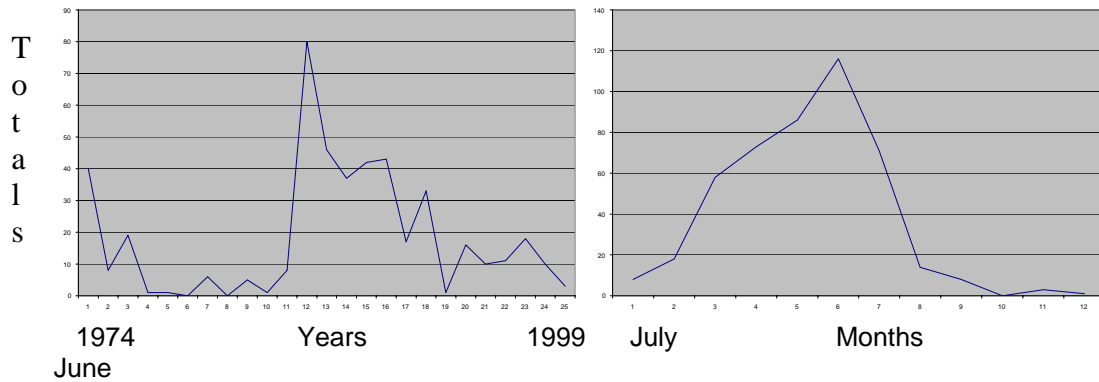


Figure 48: Trends in the numbers of Horsfield's Bronze-Cuckoo *Chrysococcyx basalis* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Like the Horsfield's Bronze-cuckoo the Shining Bronze-Cuckoo *Chrysococcyx lucidus* is a spring and summer visitor to Middlesex (Brown and Brown 1987). Its main hosts are thornbills (64%), but it showed great fluctuations in number of records at Middlesex, although thornbills were common in most years. These fluctuations may have had more to do with its movements than its hosts. Whereas most Horsfield's Bronze-cuckoos winter in western Indonesia and only a few in geographical New Guinea, most Shining Bronze-cuckoos winter in eastern Indonesia, New Guinea and Melanesia, the same subspecies visiting south-west and south-east Australia (Higgins 1999). It is possible that the years in which few Shining Bronze-Cuckoos came to Middlesex were years in which weather conditions were more favourable to travel south-east than south-west. Because the same subspecies is involved, some mixing of the populations must occur on breeding grounds. Notwithstanding these fluctuations, the species was more frequently recorded in the second half of the study than the first, and appears still to be a regular visitor to the area.

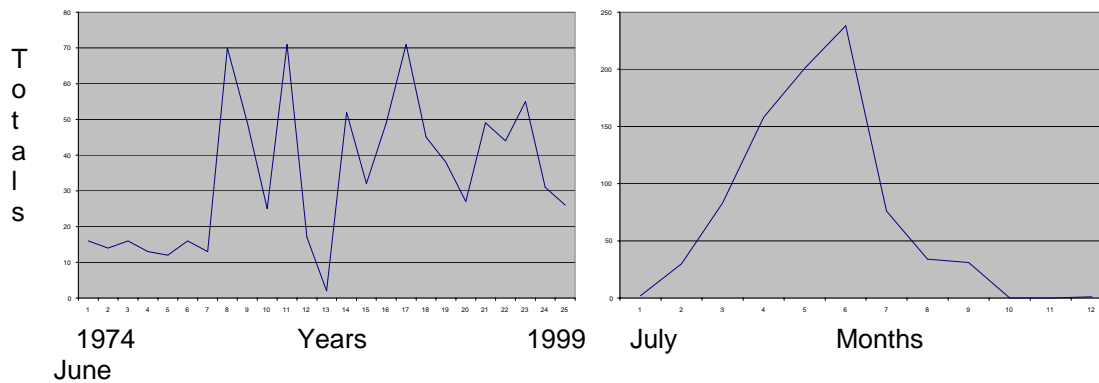


Figure 49: Trends in the numbers of Shining Bronze-Cuckoo *Chrysococcyx lucidus* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Strigidae

The Southern Boobook *Ninox novaeseelandiae* was recorded erratically at Middlesex throughout the study. It is most conspicuous when it is proclaiming territory in the autumn and that was when most records were made. There was no evidence of a change in status of the species over the study.

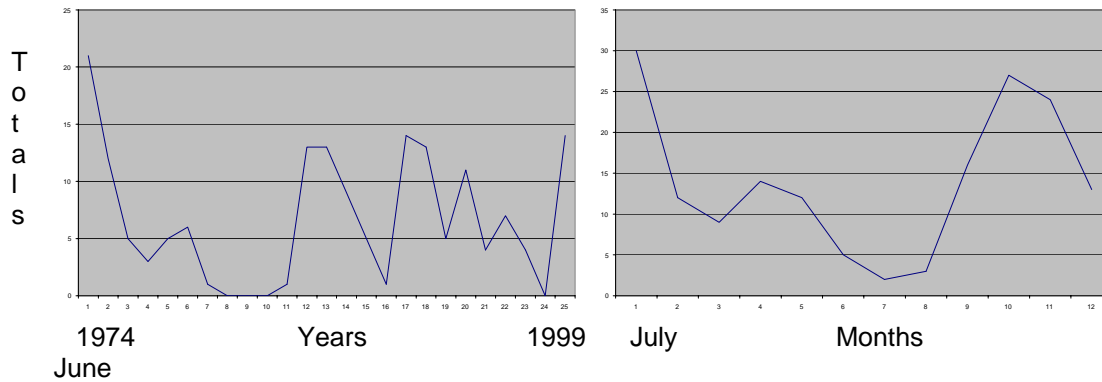


Figure 50: Trends in the numbers of The Southern Boobook *Ninox novaeseelandiae* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Tytonidae

The Barn Owl *Tyto alba*, a nomadic species that builds up during plagues of mice, was recorded only ten times at Middlesex, eight times in 1976 and once in each of 1995 and 1998.

Podargidae

The Tawny Frogmouth *Podargus strigoides* is a common bird and it is surprising that there were only five records at Middlesex, all in the spring of 1993.

Halcyonidae

The Laughing Kookaburra *Dacelo novaeguineae* was introduced to Western Australia in 1912 and has since spread through the south-west where it is now common. It was recorded throughout the year at Middlesex – the decrease in February is an artifact of the shortness of the month – and breeds in the area. The most interesting feature of the data is the decline in number of reports towards the end of the study. A number of species show this decline and it is most likely attributable to the increasing use of pesticides as the grazing systems changed to horticultural and vinicultural practice. The use of insecticides in particular would affect the food supply of the kookaburra, which lives on reptiles and large invertebrates, as well as nestling birds.

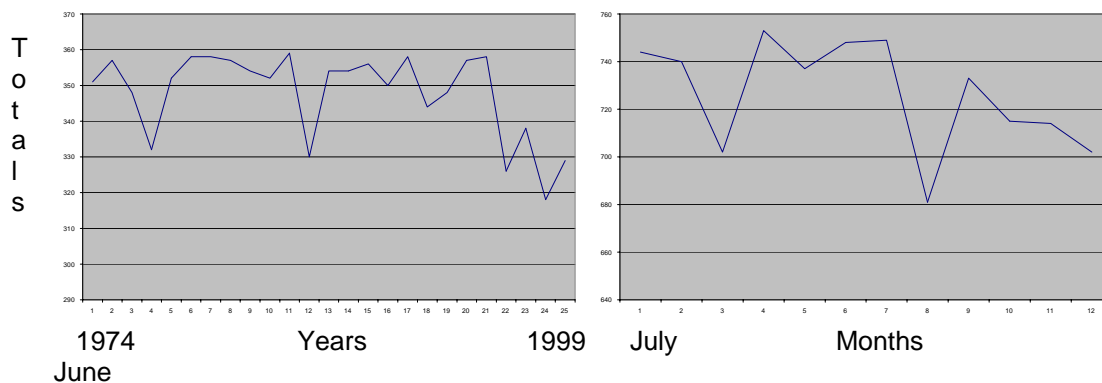


Figure 51: Trends in the numbers of the Laughing Kookaburra *Dacelo novaeguineae* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Sacred Kingfisher *Todiramphus sanctus* is a summer visitor to Middlesex, although the monthly records show, that while the adults left after breeding, some young and immature birds stay over the winter. The number of records of the species fluctuates, it being often

recorded in some years and less often in others. There is no indication of a trend for decline in the last years of the study and it appears that this migrant is little affected by the changing environmental conditions of the area. The development of the water body on the Home Farm will have benefited the bird, as will the growth and increasing density of the arboreatum, where it can find the large invertebrates on which it feeds.

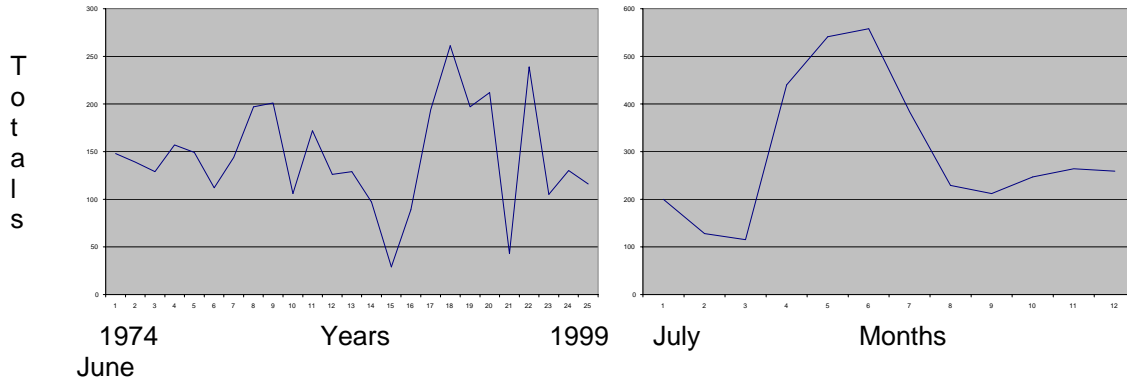


Figure 52: Trends in the numbers of Sacred Kingfisher *Todi ramphus sanctus* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Climacteridae

The Rufous Treecreeper *Climacteris rufa* was recorded only once, in November 1991.

Maluridae

The Splendid Fairy-wren *Malurus splendens* inhabited the orchard, garden and arboreatum at Middlesex, as well as many other sites. Other than an unexplained decline in number of records from 1980 to 1983, the number of records rose throughout the study. Brown and Brown (1989) attribute this to the habitat enhancement of their 2 hectare property that they started in 1972. The wrens benefited greatly from the plantings and cultivation, as well as being protected in the Home Farm from the rising pesticide load elsewhere in the area.

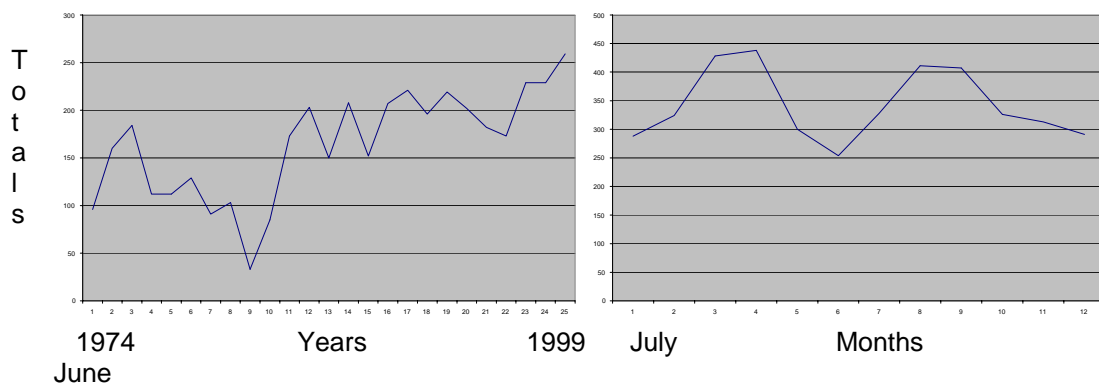


Figure 53: Trends in the numbers of Splendid Fairy-wren *Malurus splendens* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Red-winged Fairy-wren *Malurus elegans* is a successful member of the local avifauna, and highly productive for a woodland bird with a hatching success at Middlesex of 79% and a fledging success of 52% (Rowley *et al.* 1988). The low number of records in 1982-1983 and 1992-1993 correlated with years of low rainfall, 771 mm and 898 mm respectively, compared with an average of 959 mm. The species is resident in the area.

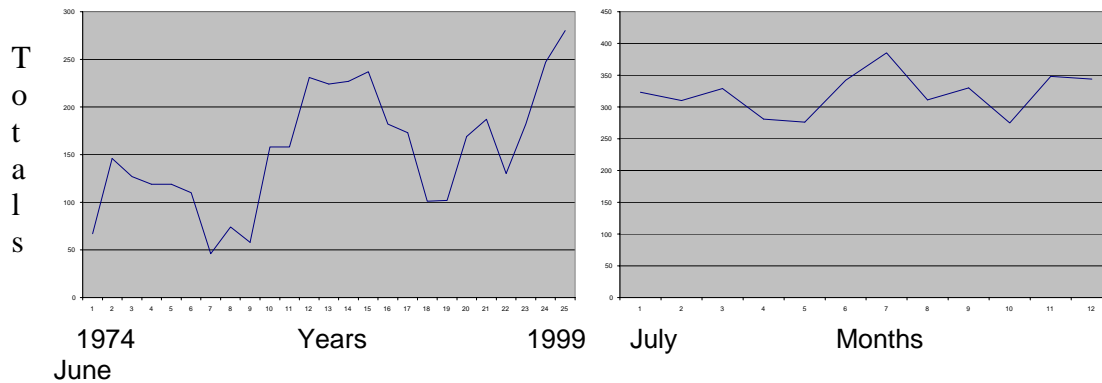


Figure 54: Trends in the numbers of Red-winged Fairy-wren *Malurus elegans* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Pardalotidae

There were only 12 records of the Spotted Pardalote *Pardalotus punctatus* at Middlesex, nine of them in the spring and early summer. There were no records after 1994

The Striated Pardalote *Pardalotus striatus* was a spring and summer migrant to Middlesex. It was frequently reported in those seasons until 1979, but thereafter the number of reports declined. It is possible that factors away from Middlesex contributed to this change because, unlike some other passerines, a substantial number of records were made in 1997, during the second last year of the study, when the number of records of other species had fallen.

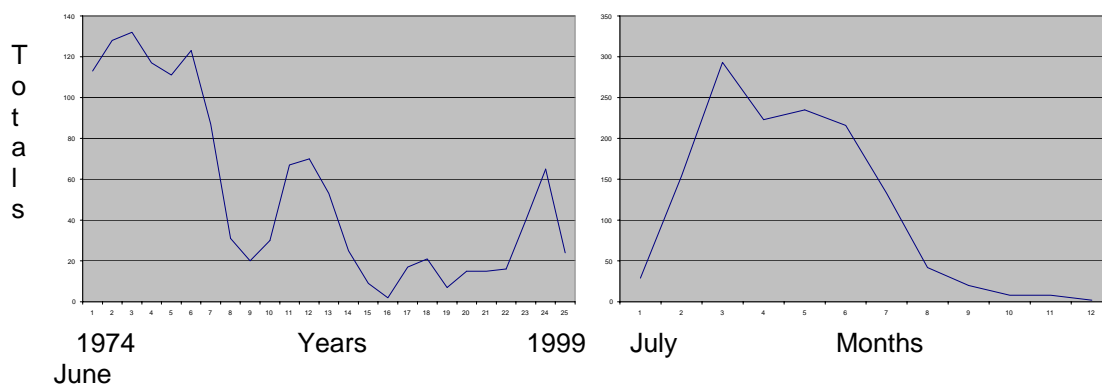


Figure 55: Trends in the numbers of Striated Pardalote *Pardalotus striatus* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The White-browed Scrubwren *Sericornis frontalis* began to be regularly reported as the arboreatum on the Home farm grew and woodland conditions were created that were suitable for it. As with many organisms invading a new environment, the number of records rose to a maximum and then fell away, but remained at a steady level after 1993.

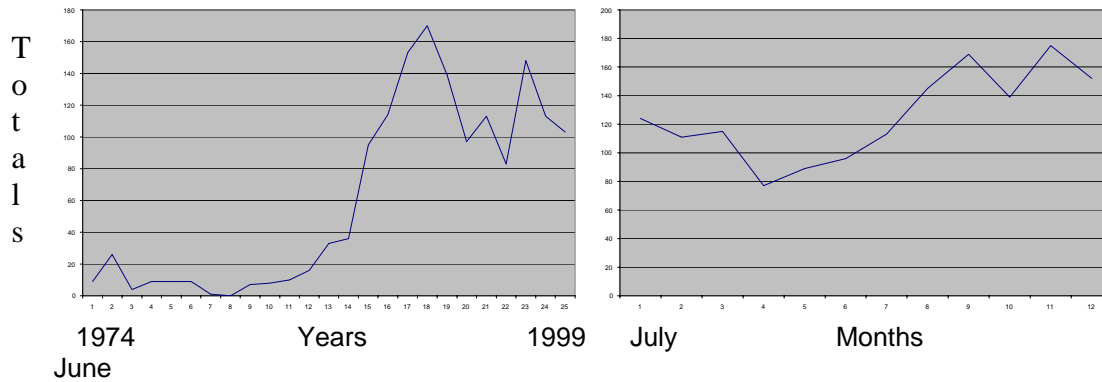


Figure 56: Trends in the numbers of White-browed Scrubwren *Sericornis frontalis* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The number of records of the Western Gerygone *Gerygone fusca* fluctuated throughout the study, but tended to increase overall, probably in response to the growth of the arboreatum on the Home Farm. More records were made in the spring when it was calling actively than after the breeding season when it was moulting and not calling so much, but the fall off in number of records in winter may reflect a partial migration. Some birds are known to migrate north in the winter to the wheatbelt, and it may be that some Middlesex birds joined this migration.

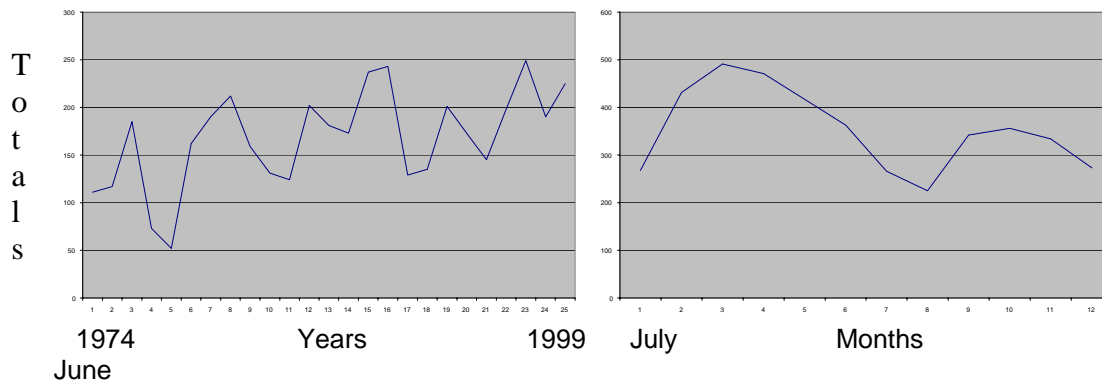


Figure 57: Trends in the numbers of Western Gerygone *Gerygone fusca* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Inland Thornbill *Acanthiza apicalis* showed two cycles of increasing number of reports followed by a decline. It is not easy to correlate these changes with any environmental change, but it is likely to be related to factors in the area because the species is sedentary. It was reported most often in winter and spring, when it calls frequently as it searches for food near the ground. It would have benefitted from the growth of the arboreatum and nested often in the study area.

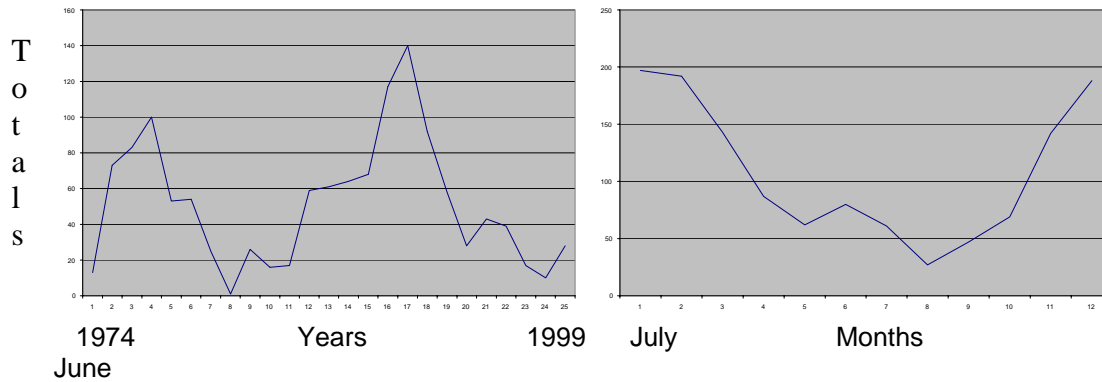


Figure 58: Trends in the numbers of Inland Thornbill *Acanthiza apicalis* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Western Thornbill *Acanthiza inornata* was reported only once at Middlesex, in 1999.

The Yellow-rumped Thornbill *Acanthiza chrysorrhoa* was a common breeding resident of Middlesex, most conspicuous when it was breeding (Brown and Brown 1982; 1986). The number of records showed a trend of slow decline after 1982 that may be related to the increasing use of pesticides in the district.

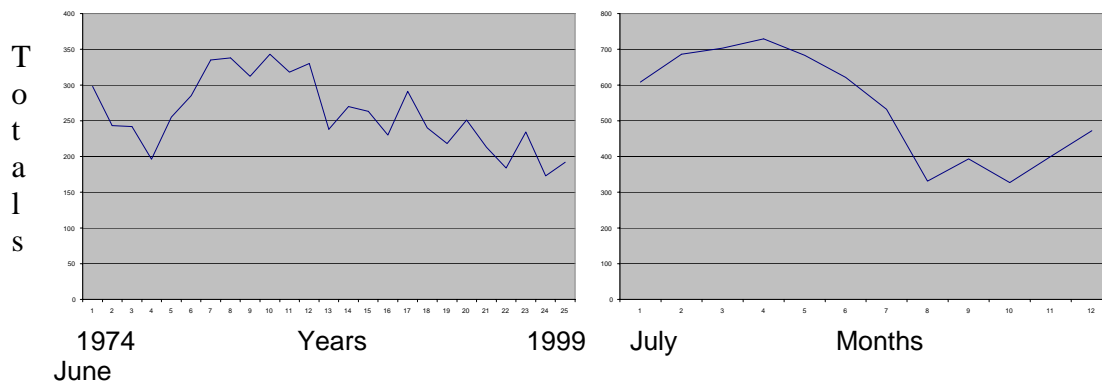


Figure 59: Trends in the numbers of Yellow-rumped Thornbill *Acanthiza chrysorrhoa* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Meliphagidae

The Red Wattlebird *Anthochaera carunculata* was abundant at Middlesex throughout the study. The decline in number of records observed in January, February and March can be attributed to two factors. In February numbers declined because the month is short and the cumulative total is therefore lower than other months, even if the birds are seen equally often. The number of records may also have been low throughout this time because some birds moved away to take advantage of the marri *Corymbia (Eucalyptus) callophylla* blossom in other areas.

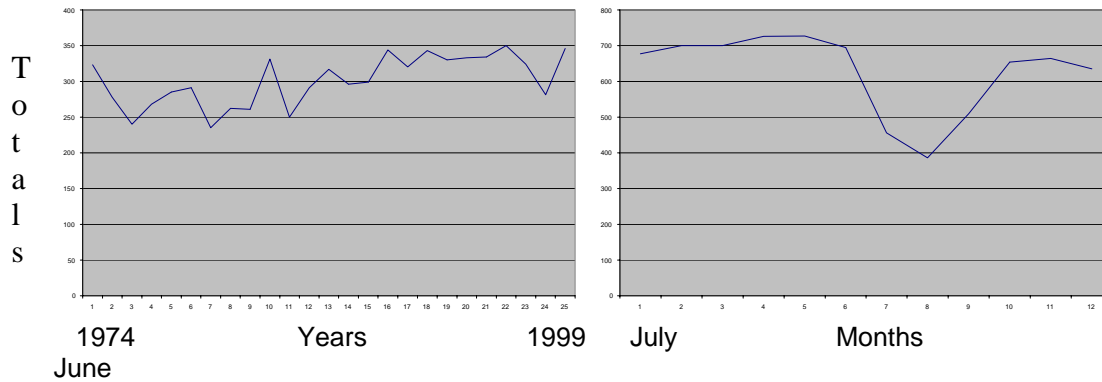


Figure 60: Trends in the numbers of Red Wattlebird *Anthochaera carunculata* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Western Wattlebird *Anthochaera lunulata* appeared only occasionally at Middlesex, with the highest number of records in spring of 1988. Sometimes, for example in 1982, these irruptions correlated with the flowering of both marri and karri *Eucalyptus diversicolor* (Brown and Brown 1983), but this was not always so.

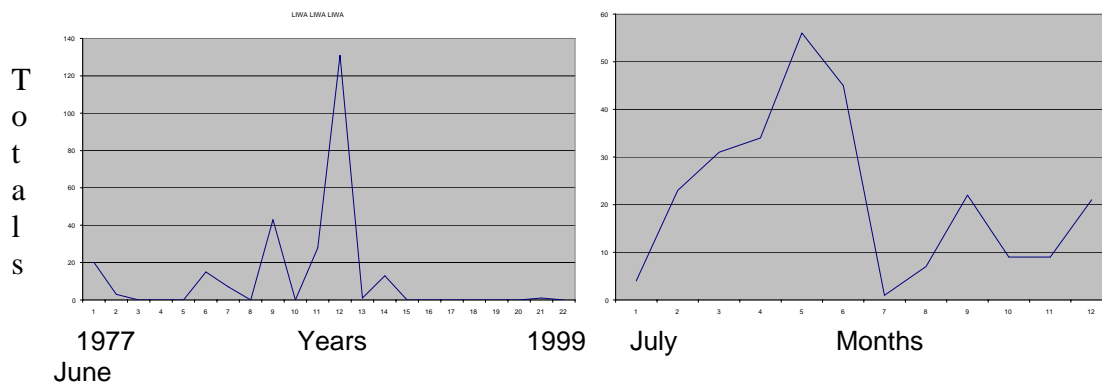


Figure 61: Trends in the numbers of Western Wattlebird *Anthochaera lunulata* observed each year between 1977 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right). None were seen in 1974, 1975 and 1976.

The Singing Honeyeater *Lichenostomus virescens* was recorded only 29 times at Middlesex, mainly in the early years. It was a vagrant to the area.

After declining in the first few years, the number of records of the White-naped Honeyeater *Meliphreptus lunatus* gradually increased, with some fluctuations, for the rest of the study. As with several other honeyeaters the number of records declined in the summer, a time when the birds were moulting and tended to be silent and less active.

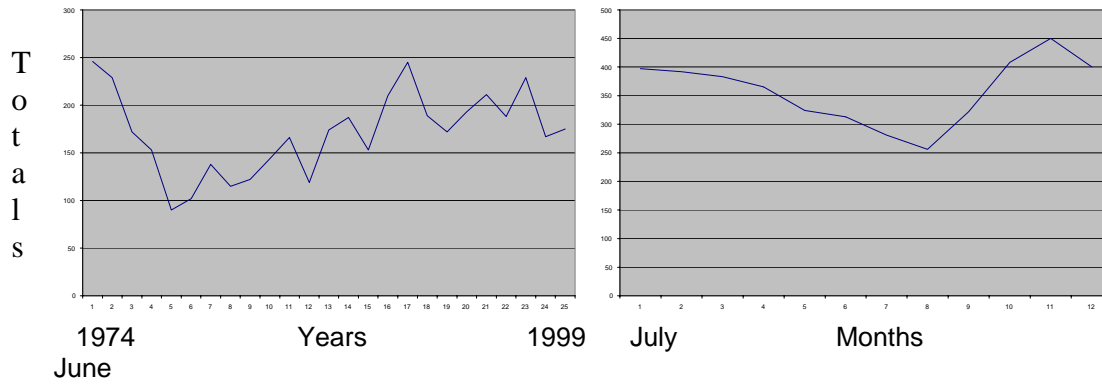


Figure 62: Trends in the numbers of White-naped Honeyeater *Melithreptus lunatus* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Numbers of the Brown Honeyeater *Lichmera indistincta* that visited Middlesex varied erratically, but some were always present and the number of records gradually increased over time. The number of records was always low in summer, when some birds may have moved elsewhere.

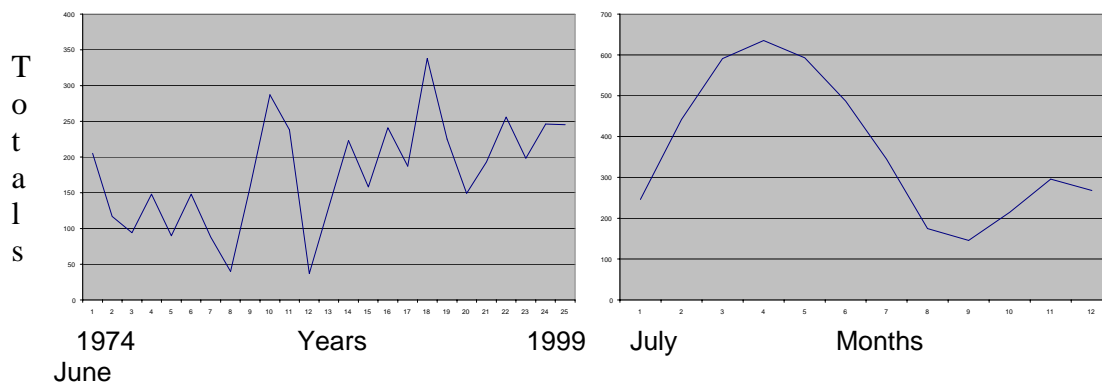


Figure 63: Trends in the numbers of Brown Honeyeater *Lichmera indistincta* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The number of records of the New Holland Honeyeater *Phylidonyris novaehollandiae* remained stable throughout the study. Some fluctuations occurred from year to year but there was no evidence of birds moving away from the area.

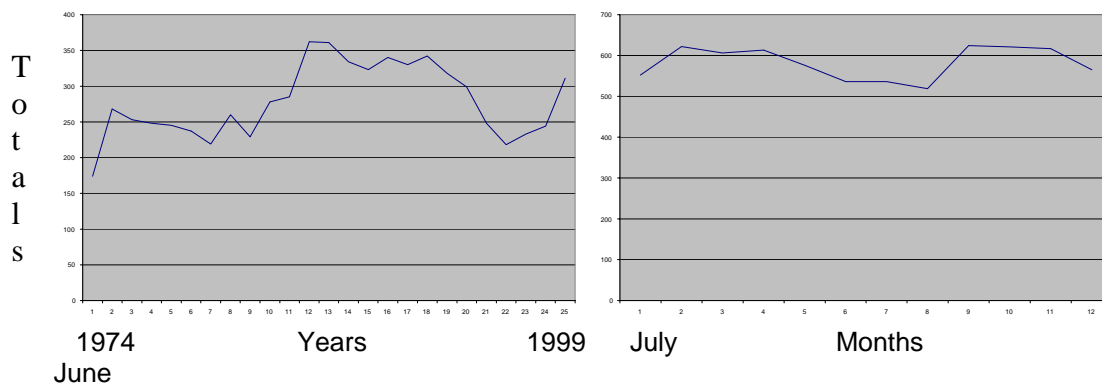


Figure 64: Trends in the numbers of New Holland Honeyeater *Phylidonyris novaehollandiae* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The White-cheeked Honeyeater *Phylidonyris nigra* was recorded only 11 times, 9 of them in the summer of 1977/1978. It is a vagrant to the area.

A few Western Spinebills *Acanthorhynchus tenuirostris* visited Middlesex each summer and autumn, but occasionally large irruptions were observed, as in 1988 and 1998. These irruptions did not correlate well with the flowering of the eucalypts and they were in years of average rainfall. Presumably they were the result of factors outside the Middlesex area.

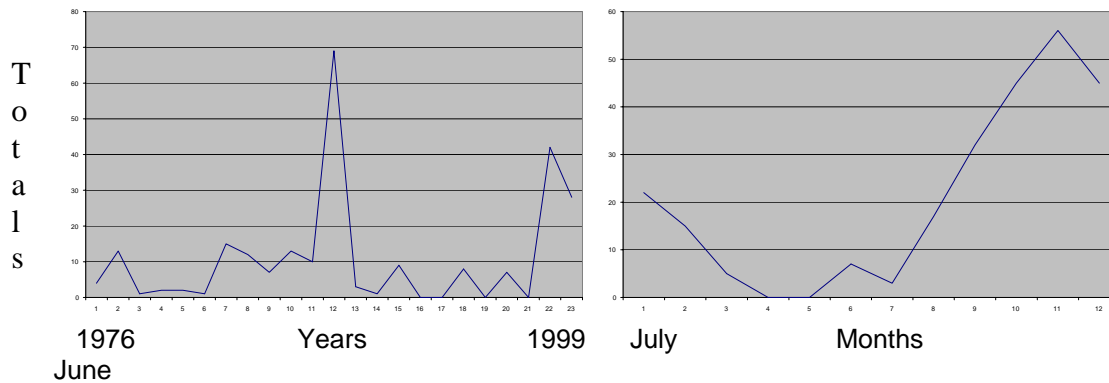


Figure 64: Trends in the numbers of Western Spinebills *Acanthorhynchus tenuirostris* observed each year between 1976 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right). None were seen in 1974 and 1975.

The White-fronted Chat *Epthianura albifrons* was recorded only five times at Middlesex, in 1974, 1986, 1987 and twice in 1989. It is a vagrant to the area in spring and summer.

Petroicidae

In some years the Scarlet Robin *Petroica multicolor* was frequently recorded, whereas in other years there were few records. The trend in number of records over the length of the study was downwards, with very low numbers after 1997. This may reflect the increasing use of pesticides on the horticultural crops in the district, leading to a reduced number of insects available as food for the birds. The number of records in summer was low, suggesting that the birds may move away from the area at that time.

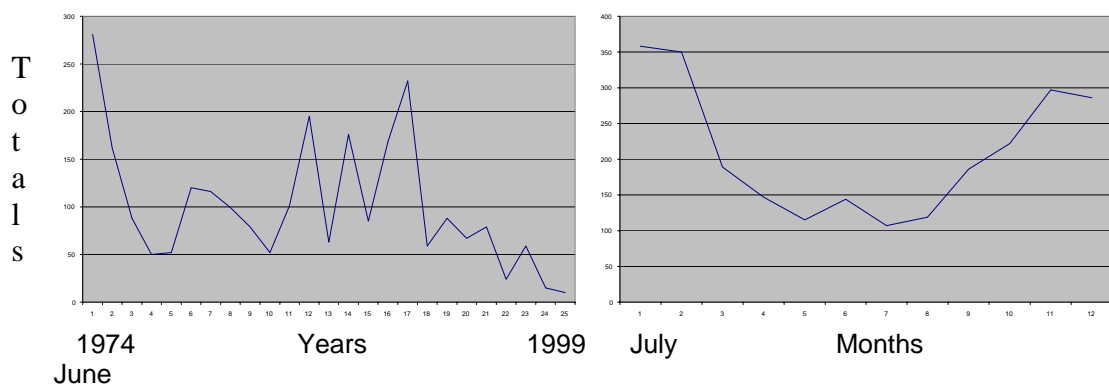


Figure 65: Trends in the numbers of Scarlet Robin *Petroica multicolor* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Red-capped Robin *Petroica goodenovii* was rarely recorded at Middlesex. Only in the winter of 1986, one of the driest winters in the course of the study, was it frequently seen. It was a vagrant to Middlesex.

Only three records of the Hooded Robin *Melanodryas cucullata* were made at Middlesex, where the bird is a rare vagrant. The records were in March 1982, October 1984 and June 1991.

The Western Yellow Robin *Eopsaltria griseogularis* was seen only twice, once in March 1975 and once in January 1994, at Middlesex, although it is resident and breeds in the district, notably at Smith's Brook Reserve (Brown and Brown 1980b).

The White-breasted Robin *Eopsaltria georgiana* was the subject of a special study at Middlesex (Brown and Brown 1978, 1980b). It was resident in the area and the gradual increase in the number of records up to 1993 correlated with the growth of the arboreatum. Its subsequent decline may have been the result of the increasing use of pesticides on the horticultural crops that had become common in the area.

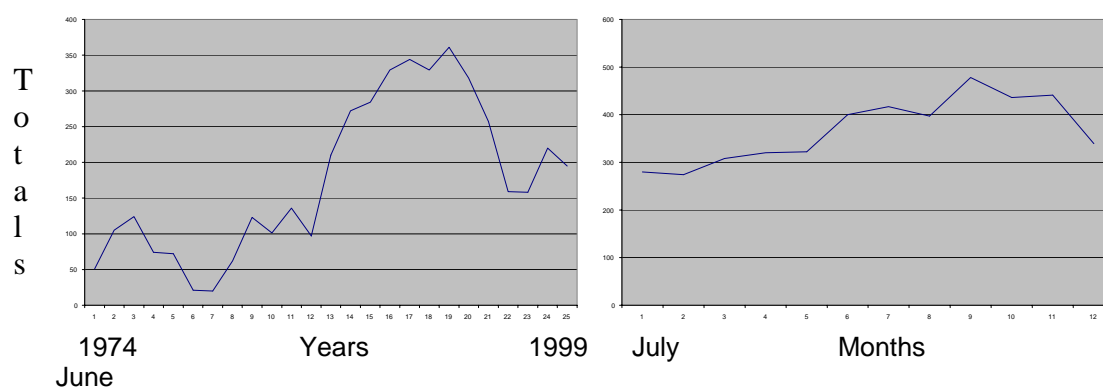


Figure 66: Trends in the numbers of White-breasted Robin *Eopsaltria georgiana* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Pomatostomidae

The White-browed Babbler *Pomatostomus superciliosus* was rarely seen at Middlesex. It was only in the spring and early summer of 1994 that a group was in the area frequently and the species can be considered a vagrant.

Pachycephalidae

The Crested Shrike-tit *Falcunculus frontatus* was a rare vagrant to Middlesex. It was mainly seen in winter, 20 of the 39 records were in May, June and July, and 31 of the records between 1982 and 1991.

The Golden Whistler *Pachycephala pectoralis* was recorded frequently throughout the study, with an increase in the number of records after 1987 in correlation with the growth of the arboreatum. There was a slight decline in the number of records in the last three years, and also in January and February each year when the birds were quiet during their moult after the breeding season.

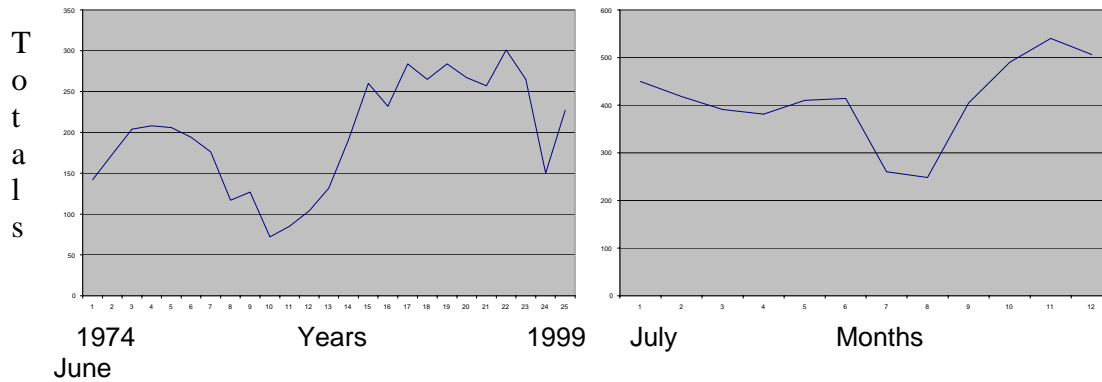


Figure 67: Trends in the numbers of the Golden Whistler *Pachycephala pectoralis* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Rufous Whistler *Pachycephala rufiventris* was recorded mostly in the winter and spring, perhaps because it is most vocal at these times. The number of records was high between 1983 and 1990 when the arboreatum was full of young trees, at heights favoured by Rufous Whistlers, but thereafter fell back to a level slightly above that of the years immediately before 1983. There was no significant decline towards the end of the study.

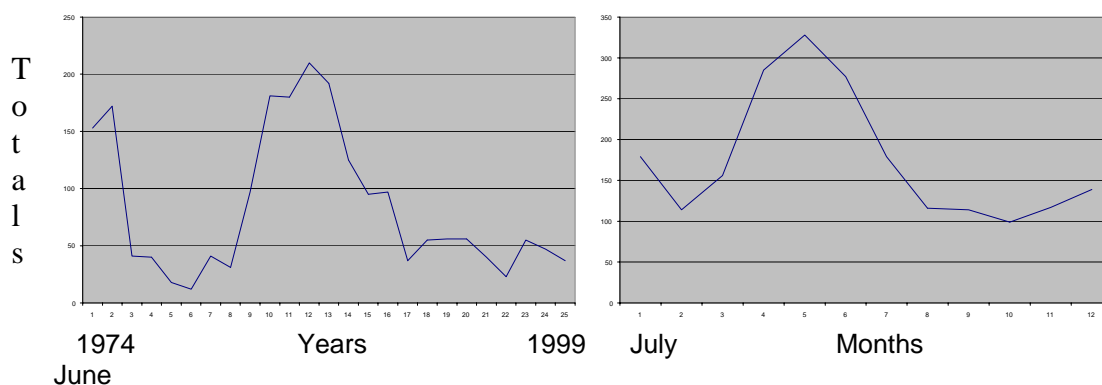
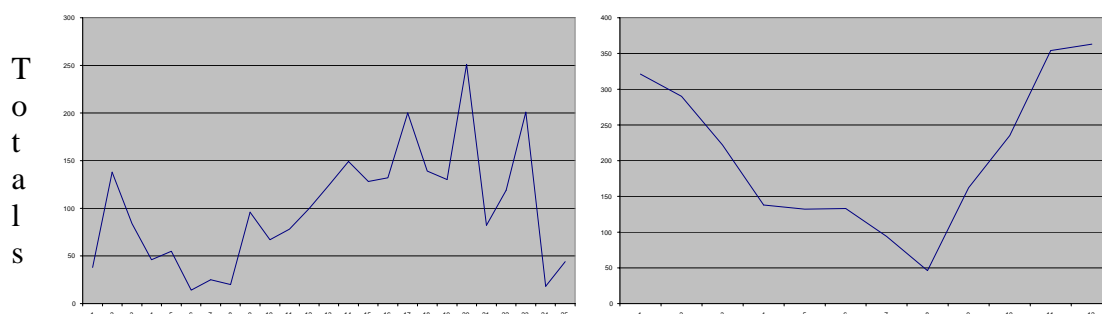


Figure 68: Trends in the numbers of the Rufous Whistler *Pachycephala rufiventris* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The number of records of the Grey Shrike-thrush *Colluricincla harmonica* were numerous at first, declined and then showed a gradual increase as the trees in the arboreatum grew. Towards the end of the study the number of records fluctuated but gradually declined, perhaps in correlation with the increasing use of insecticides that may have impacted on the bird's insect prey. The number of records was highest in autumn and winter when the bird was most vocal and lowest in the summer when it was molting after the breeding season.



1974 Years 1999 July Months
 June

Figure 69: Trends in the numbers of the Grey Shrike-thrush *Colluricincla harmonica* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Dicruridae

The Restless Flycatcher *Myiagra inquieta* is a common autumn and winter visitor to Middlesex. Only three nests were recorded in the area, none after 1988, yet in 1992, the year when the highest number of recording was made, the bird was seen 188 times, that is almost every day for seven months, so that at times it was very common. As with other passerines it declined after 1995, probably as a consequence of the increasing rate of herbicide and insecticide application in the area.

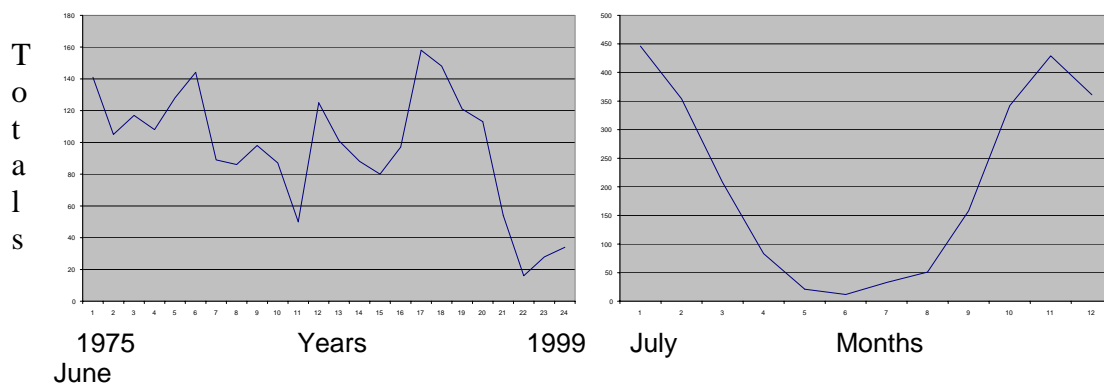


Figure 70: Trends in the numbers of the Restless Flycatcher *Myiagra inquieta* observed each year between 1975 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right). None were recorded in 1974.

Although the Australian Magpie Lark *Grallina cyanoleuca* was abundant, at Middlesex, it showed two small trends. First the number of recordings was not as consistently high late in the study, as it was before 1991, possibly because of the deterioration in environmental conditions. Secondly it was most frequently recorded in spring and less frequently in the autumn, probably in response to falling water levels at that time of year.

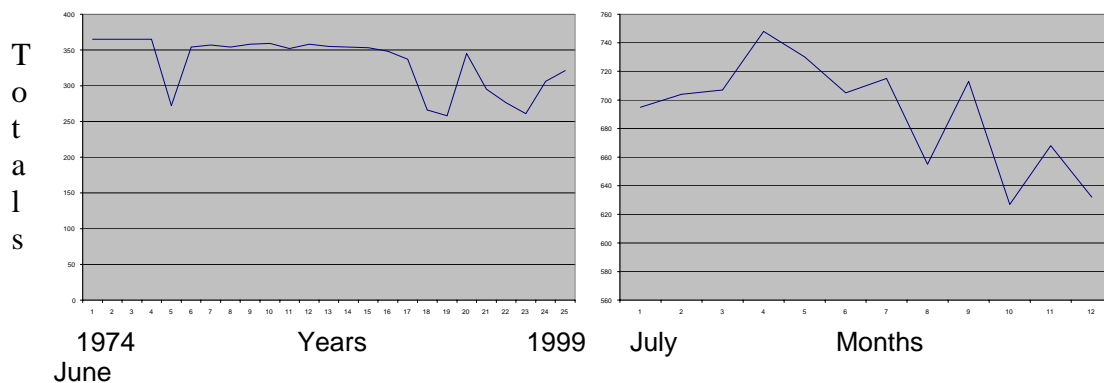


Figure 71: Trends in the numbers of the Australian Magpie Lark *Grallina cyanoleuca* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Grey Fantail *Rhipidura fuliginosa* was an abundant bird at Middlesex, although the data show two minor trends. First the number of records tends to increase slowly, after an initial decline. The birds occupied territories and nested in the arboreatum, so that as this grew the environment improved for them, and this may have been enough to generate the increase in records. Secondly there is a tendency for the birds to be less often recorded in summer than in winter. Blakers *et al* (1984) noted that this species tended to move out of the south-west in winter, the reverse of the trend seen here. Brown and Brown (1991) on the other hand observed that the breeding pairs remained in their territories all year, although the young dispersed. It may be that the drop in number of records in summer is a result of the birds calling less than at other times and therefore being less conspicuous. In any case there is no doubt that the Middlesex pairs, three on 2 hectares, were resident.

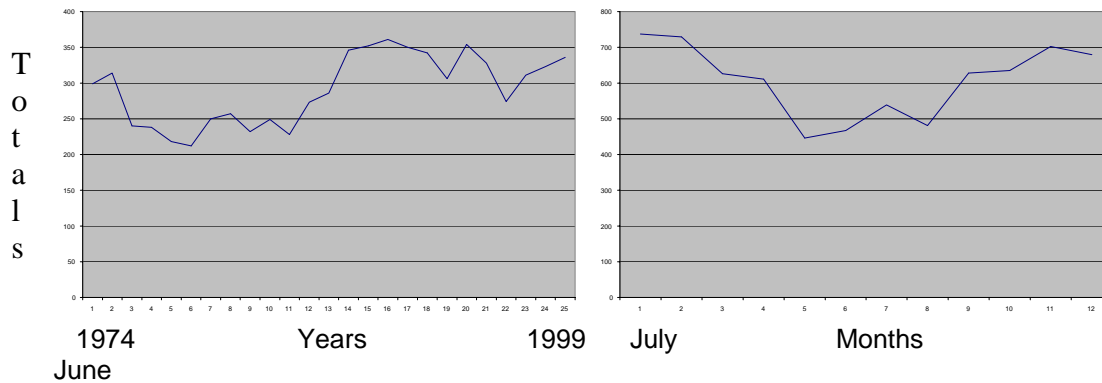


Figure 72: Trends in the numbers of the Grey Fantail *Rhipidura fuliginosa* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Nineteen territories of the Willie Wagtail *Rhipidura leucophrys* were known within 2 km of the Middlesex Field Study Centre (Brown and Brown 1987). The fluctuation on the yearly graph is more apparent than real, exaggerated by the truncation of the vertical scale. There was no evidence of movement. The number of records certainly did not decline towards the end of the study, 362 in 1997/1998 and 355 in 1998/1999.

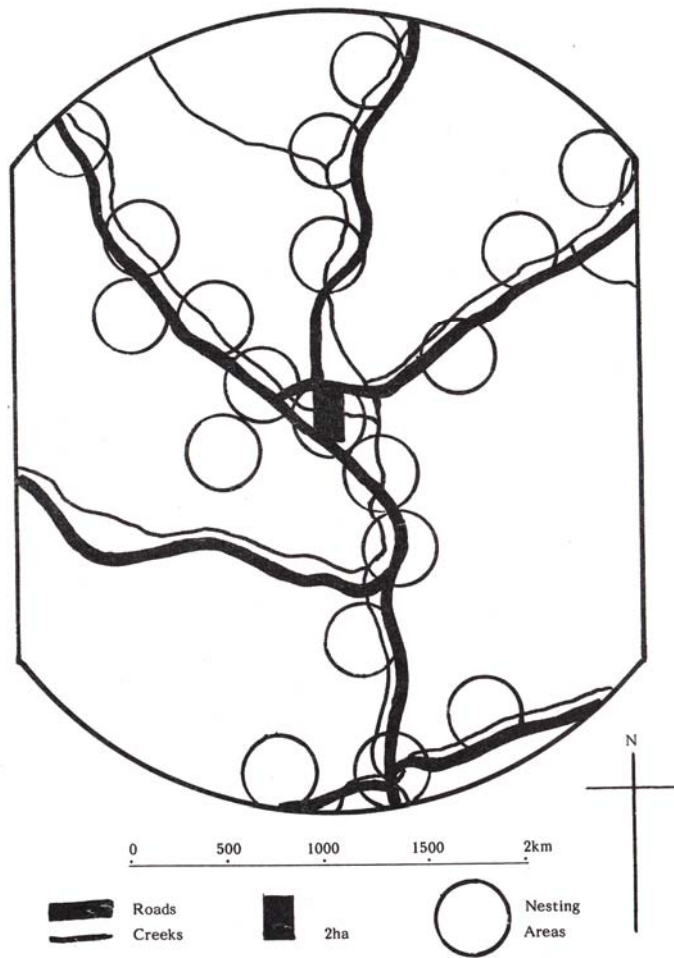


Figure 73. Territories of the Willie Wagtail within 5 km of the Middlesex Field Study Centre between 1974 and 1986

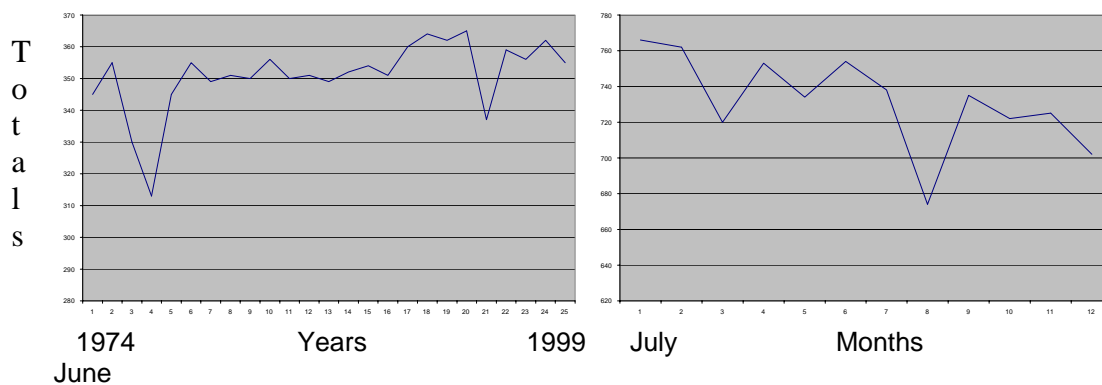


Figure 74: Trends in the numbers of the Willie Wagtail *Rhipidura leucophrys* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Campephagidae

The Black-faced Cuckoo-shrike *Coracina novaehollandiae* was common throughout the study period, although the number of recordings fell away in the last years. This decline does not exceed the decline in 1991 by more than a few days, from which a recovery was made. The species appears to have remained unaffected by changing conditions in the district. The

monthly graph shows some changes in number of recordings, but these may reflect times when the birds were less conspicuous because they were calling less than at other times. On the other hand the bird does appear in flocks in the wheatbelt in autumn and winter (Davies 1992) and the low number of recordings in winter may reflect partial migration from the district.

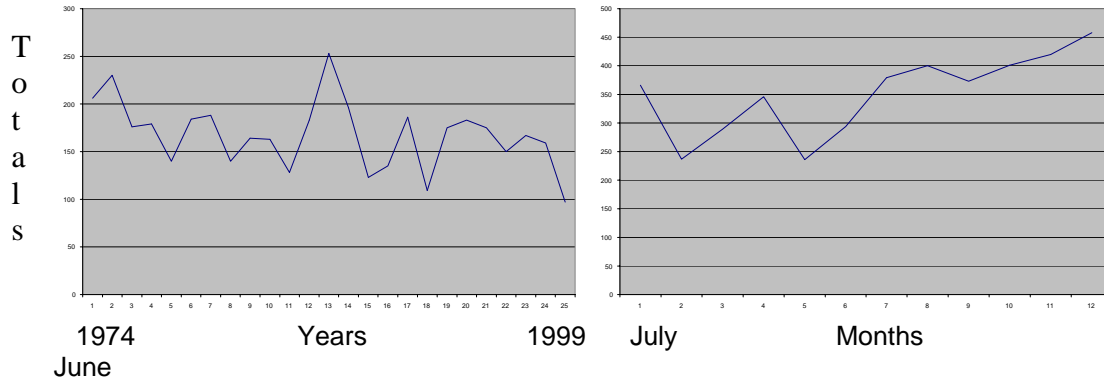


Figure 75: Trends in the numbers of the Black-faced Cuckoo-shrike *Coracina novaehollandiae* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The White-winged Triller *Lalage sueurii* was uncommon at Middlesex and shows a variable pattern of occurrence. In some years it was seen much more frequently than others. The White-winged Trillers often bred in association with the Dusky Woodswallows, arriving after the Dusky Woodswallows had established their nest sites, and then selecting their own nearby. The graph of records by months demonstrates that it is a migrant, visiting in spring and autumn. In some years therefore few birds passed through Middlesex, and in other years several were seen. This variation may have related to conditions in other parts of the migration route, rather than to conditions in the Middlesex area. However, as with many species, few birds were seen after 1991, suggesting that local conditions may have had some effect on whether or not the birds stayed in the area.

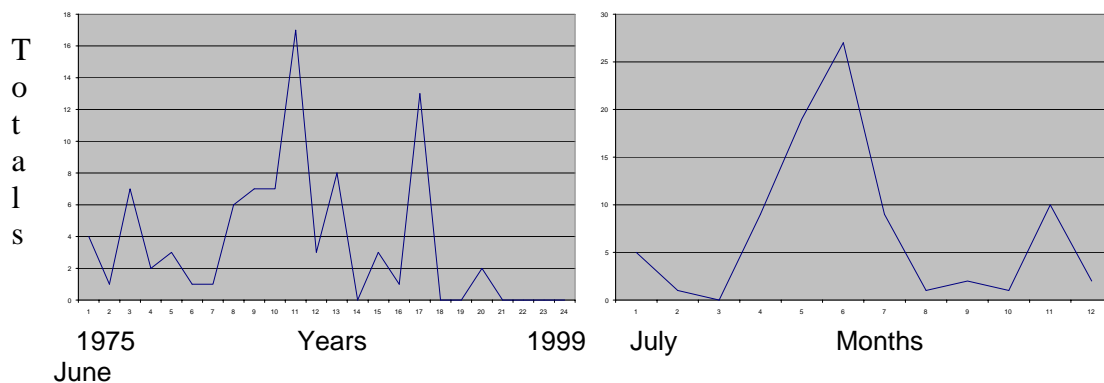


Figure 76: Trends in the numbers of the White-winged Triller *Lalage sueurii* observed each year between 1975 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right). None were seen in 1974.

Artamidae

The Dusky Woodswallow *Artamus cyanopterus* was a resident breeding species at Middlesex, although the numbers recorded did vary, both over the years and month by month. It was most conspicuous in the autumn and winter and most frequently recorded between 1991 and 1995. It may be that these fluctuations reflected in part the state of the dams. When the dams were in a condition that would produce many flying insects, as they would be when

the levels were declining during irrigation in autumn, the Dusky Woodswallows had a good food supply. The decline of Dusky Woodswallows after 1995 probably reflects the impact of insecticides on the aquatic life in the dams.

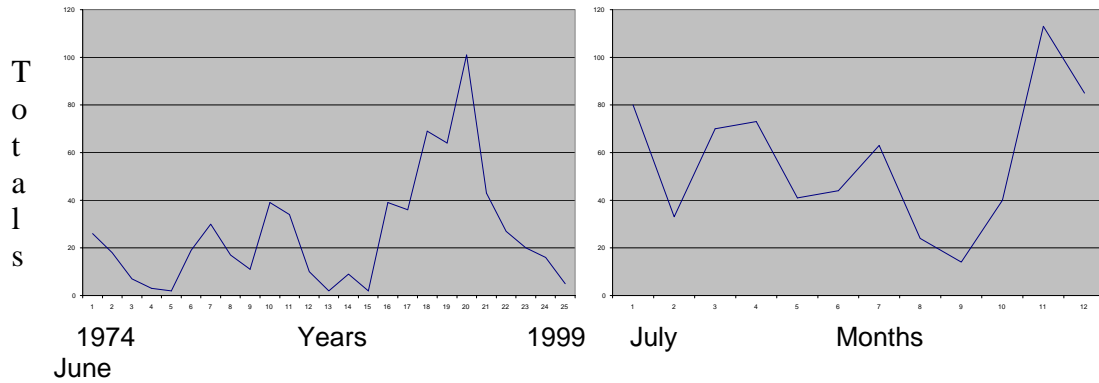


Figure 77: Trends in the numbers of the Dusky Woodswallow *Artamus cyanopterus* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Australian Magpie *Gymnorhina tibicen* was an abundant resident at Middlesex, apparently unaffected by changing conditions and agricultural developments in the district. Even the low count in February is an artefact due to February being the shortest month.

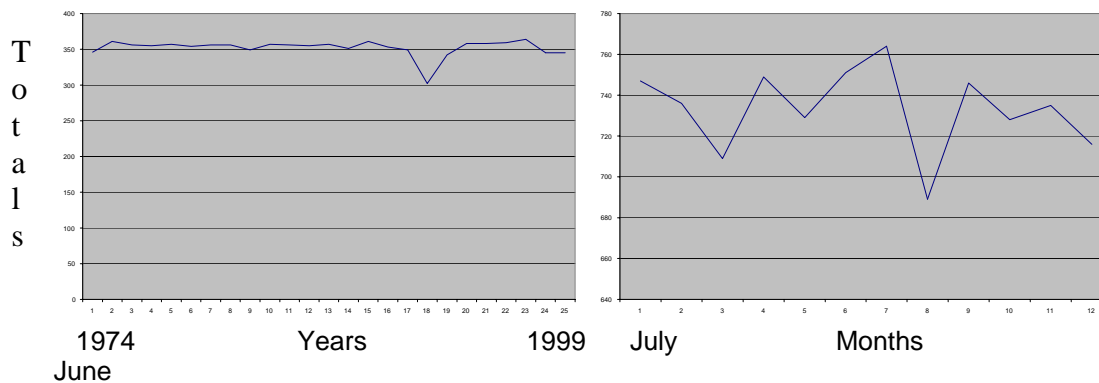


Figure 78: Trends in the numbers of the Australian Magpie *Gymnorhina tibicen* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Grey Currawong *Strepera versicolor* was seen only once, in July 1980.

Corvidae

Like the Australian Magpie, the Australian Raven *Corvus coronoides* was abundant and apparently unaffected by the changing conditions at Middlesex. The trend of increasing numbers reported towards the end of the study period scarcely exceeded the fluctuations seen in 1984-1986, and is probably not significant.

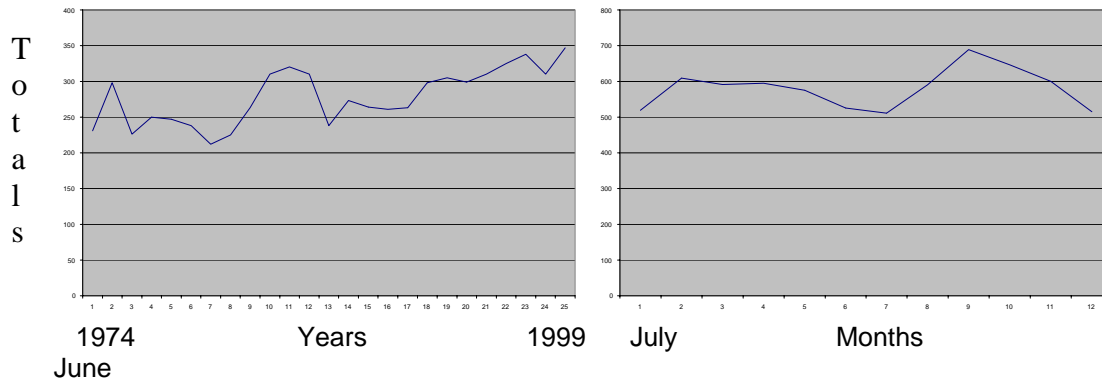


Figure 79: Trends in the numbers of the Australian Raven *Corvus coronoides* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Motacillidae

Richard's Pipit *Anthus novaeseelandiae* is a bird of open country and pasture. It was always uncommon at Middlesex. As agricultural practice changed from grazing to horticulture the number of records of this species declined. At first, when the fields were ploughed up and the crops small and thin, conditions favoured Richard's Pipit, but once vineyards and orchards became established it disappeared. There is some suggestion that Richard's Pipits may be partial migrants. Their absence in the autumn may be the result of partial migration, but they are also a cryptic species, conspicuous only when proclaiming their territories in the winter-spring breeding season, and at other times hard to detect. The data do not distinguish between these possibilities.

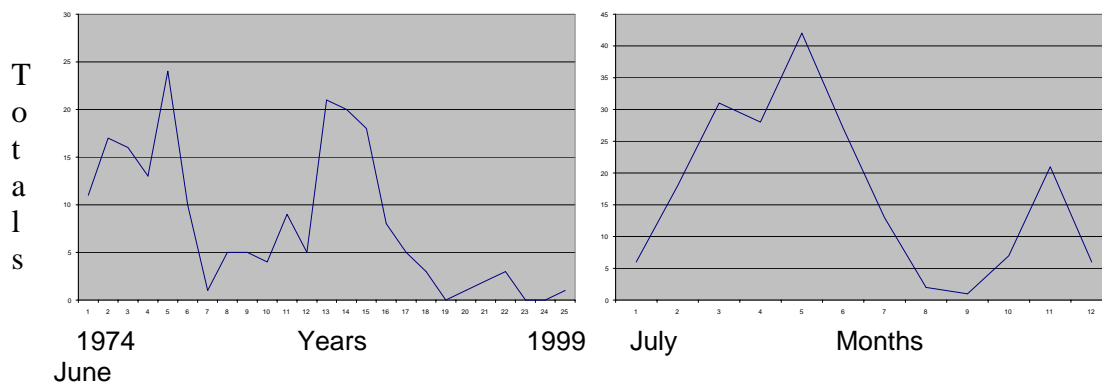


Figure 80: Trends in the numbers of Richard's Pipit *Anthus novaeseelandiae* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Passeridae

The Red-eared Firetail *Stagonopleura oculata* although a resident species, showed two periods when the number of records was exceptionally high, 1985-1987 and 1993-

1994. Both these periods followed two successive years of above average rainfall, although the rainfall in the periods themselves was below average. Possibly these conditions contributed to the birds having good breeding seasons. Each year few records were made in October and November when the birds are breeding and are extremely secretive. Their success in concealing their breeding activities is attested by the few nests found. From 1974 to 1991 only 2 nests were recorded (Brown and Brown 1991).

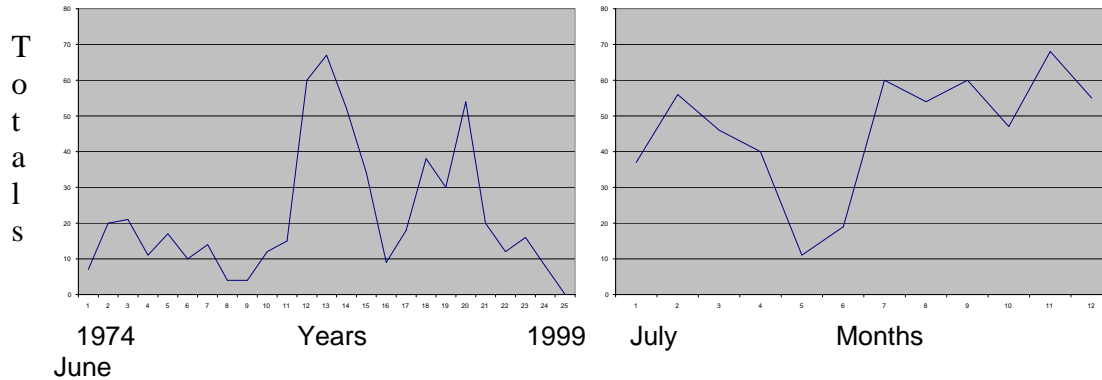


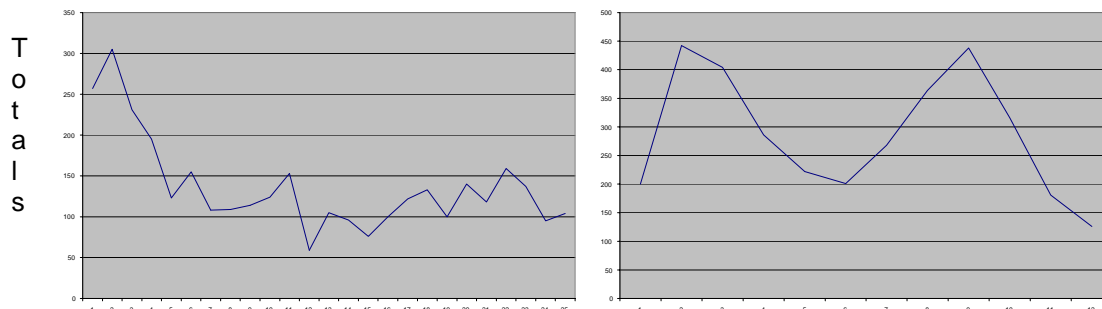
Figure 81: Trends in the numbers of the Red-eared Firetail *Stagonopleura oculata* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Dicaeidae

There were only nine records of the Mistletoebird *Dicaeum hirundinaceum* at Middlesex, all in the summer and none after 1994. It was a vagrant to the area.

Hirundinidae

Although recorded throughout the year at Middlesex, large numbers of records of Tree Martin *Hirundo nigricans* were made in spring and autumn, suggesting that migrants were passing through the area at these times. Large flocks of migrating Tree Martins have been reported at Eyre Bird Observatory and Eucla moving east in August (Congreve and Congreve 1985), correlating well in time with a movement through Middlesex, where August had the maximum number of spring records. The recovery of a Tree Martin banded at Eyre from Shark Bay on the west coast suggests that the birds may follow a coastal route on migration, north and south on the west coast and east and west across the Great Australian Bight. Apart from the migrants it is apparent that, as with many species, the number of records of Tree Martins declined during the study, with a steep fall after 1977. It is not possible to correlate this decline of an aerial insectivore directly with changing environmental conditions at Middlesex.



1974 Years 1999 July Months
 June

Figure 82: Trends in the numbers of the Tree Martin *Hirundo nigrica* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Welcome Swallow *Hirundo neoxena* was subject to a special study at Middlesex. In its course artificial nest boxes were erected in several of the local dams and the breeding activities of the swallows monitored. As a result more records of this species may have been made than of others that were less intensively studied, but it was clear from the study that, while some may move away, many of the birds were resident in the area (Brown and Brown 1983, 1991). In the eastern states the bird is considered a partial migrant (Blakers *et al.* 1984), and the drop in number of records in autumn at Middlesex supports the suggestion that some local birds may move away, even if the breeding pairs do not. Brown and Brown (1991) point out that agricultural activities, especially the creation of many small dams that provide breeding grounds for insects, have favoured the swallows. The birds hunt ceaselessly over the dams and the maintenance of a high level of records over the study indicates that the environment is favourable for them. Nonetheless some seasons were better for breeding than others, and the high number of records in the mid 1980's reflects a period of high productivity of young swallows (Brown and Brown 1991). This period was followed by a slow decline in number of records of swallows that may correlate with the increasing pollution of the dams by herbicides and insecticides, leading to a reduction in the numbers of insects that hatch from them and therefore a reduced food supply for the Welcome Swallows.

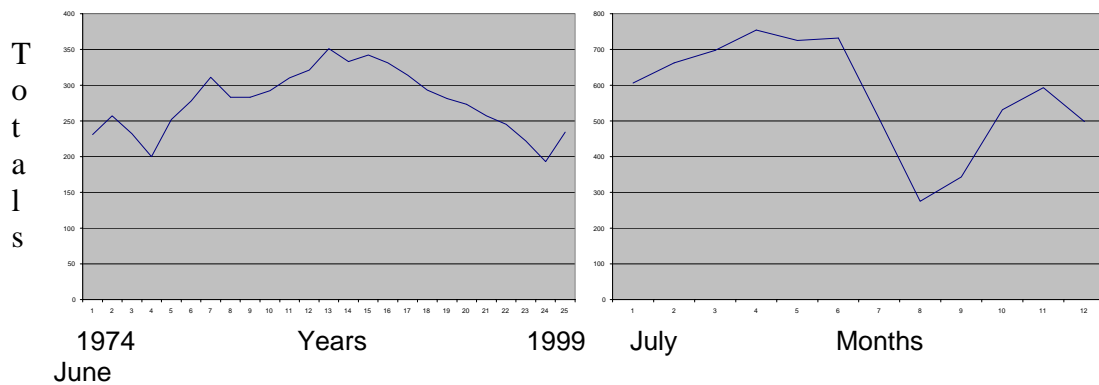


Figure 83: Trends in the numbers of the Welcome Swallow *Hirundo neoxena* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Sylviidae

The Clamorous Reed-Warbler *Acrocephalus stentoreus* was a spring and summer migrant to Middlesex, the males arriving before the females. It was the subject of special studies in the area (Brown and Brown 1981, 1983, 1985b, Brown *et al* 1990) . Unlike many of the small passerines at Middlesex it is not parasitised by cuckoos. The number of records of Clamorous Reed-Warblers remained at high levels throughout the twenty-five years. The increase in number of records between 1984 and 1991 correlated with a period when some birds stayed longer in autumn than was usual. The species showed no evidence of a decline towards the end of the study, as was observed in some other birds. Much of the food brought to nestlings was dragonflies and leeches, species that may have avoided the direct effects of the increased use of pesticides on the horticultural crops. This diet may have protected the reed warblers from pollution.

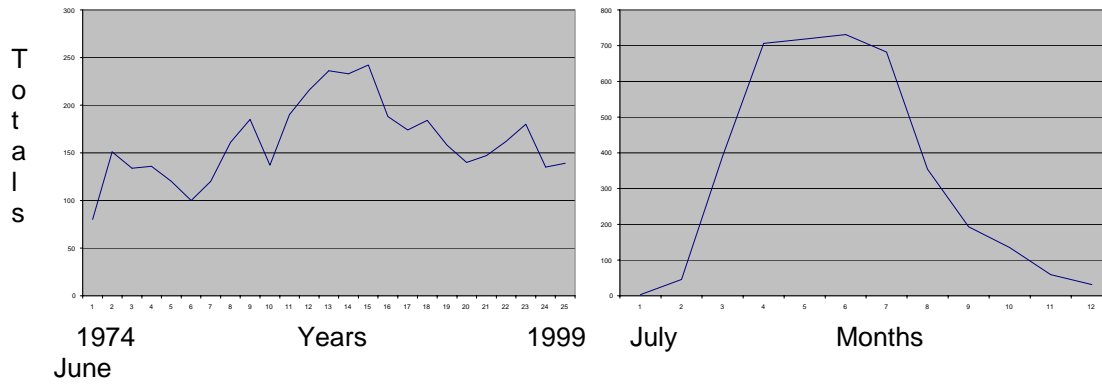


Figure 84: Trends in the numbers of the Clamorous Reed-Warbler *Acrocephalus stentoreus* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The number of records of the Little Grassbird *Megalurus gramineus* showed a pattern different from that of the Clamorous Reed Warbler, although both live in the reed beds. Most records of Little Grassbird were in winter and spring, with a sharp decline in summer and autumn. Over the twenty-five years the species showed three declines and two increases in the number of records, with very low numbers towards the end of the study, perhaps correlating with the effects of changing agricultural practice and the increasing use of pesticides. The contrast with the Clamorous Reed Warbler is marked.

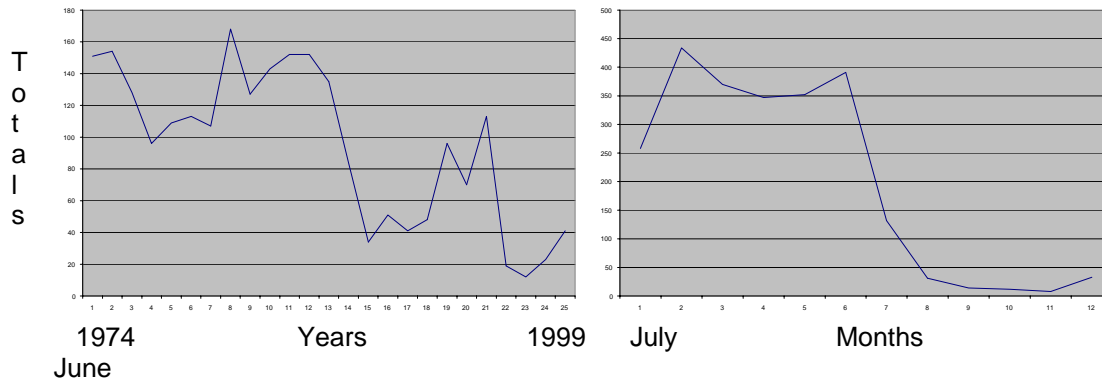


Figure 85: Trends in the numbers of the Little Grassbird *Megalurus gramineus* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

The Rufous Songlark *Cincloramphus mathewsi* showed an interesting irruptive pattern, being common for two periods, 1984-1987 and 1991-1997, and almost totally absent at other times. Furthermore, when it did come it was present only for a sharply defined time in late spring and early summer, October to January. These movements are likely to correlate with conditions outside the study area.

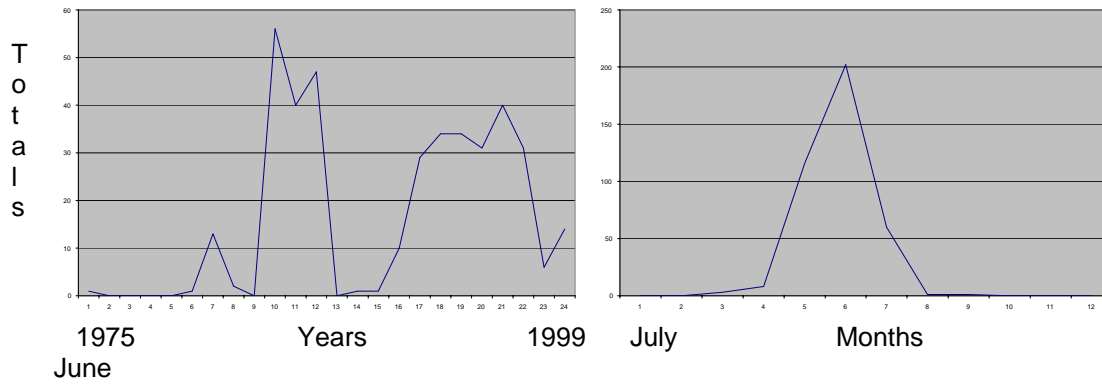


Figure 86: Trends in the numbers of the Rufous Songlark *Cincloramphus mathewsi* observed each year between 1975 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Zosteropidae

The Silvereeye *Zosterops lateralis* was the most abundant bird recorded at Middlesex, perhaps because the Home Farm had such an excellent garden and orchard. Up to 1991 22,368 had been banded. The species had both resident and nomadic populations. Banding showed that some individuals remained in the area throughout their life, whereas others were seen only once. The nomads arrived to take the fruit in Decemebr and stayed until June, some moving as far afield as Mundaring (267 km) and Darkan (114 km). The scale of the influxes correlated well with the flowering of the marri. If there was little marri flower many came to Middlesex and *vice versa* (Brown and Brown 1981).

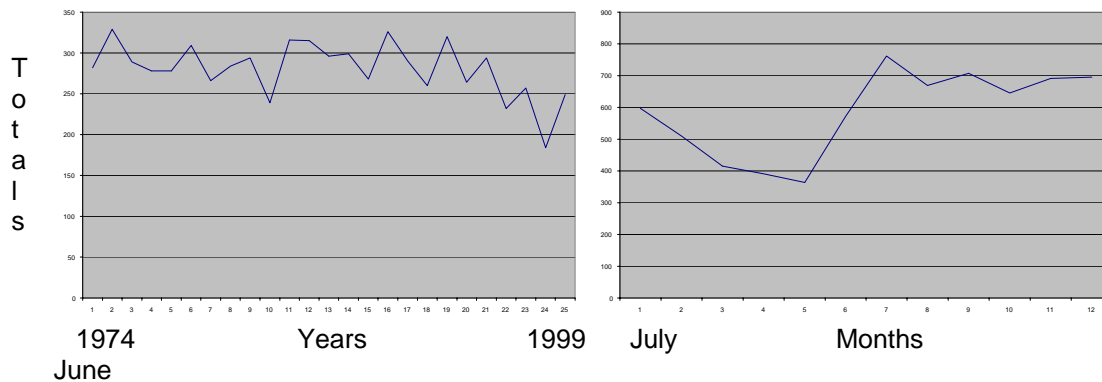


Figure 87: Trends in the numbers of the Silvereeye *Zosterops lateralis* observed each year between 1974 and 1999 at the Middlesex Field Study Centre (left), and the total number observed each month over the twenty-five years (right).

Discussion

The number of reports each month for some of the 86 species for which there are more than 100 records, had increased during the study, others had decreased, while others had remained stable or fluctuated. A few had increased and then decreased. These changes appear to correlate with the effects of a number of different factors.

Of the species for which the number of reports increased between 1974 and 1999, (Table 4) many benefited from the planting and growth of the arboreatum, others are species that were known to be expanding their range during that period, while the Musk Duck, Swamp Harrier and Australian Raven appeared to be responding to other environmental changes, notable the increasing number of dams used for irrigation.

Table 4. Species in which the number of reports had increased between 1974 and 1999 (15)

Musk Duck
Australian Shelduck
Australian White Ibis
Yellow-billed Spoonbill
Swamp Harrier
Australian Ringneck
Splendid Fairy-wren
Red-winged Fairy-wren
White-browed Scrubwren
Western Gerygone
White-naped Honeyeater
Brown Honeyeater
Australian Raven

Of the species in which the number of records had decreased from 1974 to 1999, (Table 5) most appeared to be affected by the changes in agricultural practice in the district, notably by increasing salinity and the increasing use of herbicides and pesticides. Some of the species appeared to be responding to secondary effects of these changes, for example the cuckoo to the reduction in host species and the raptors to the reduction in prey. The Western Rosella may have been responding to the increasing numbers of Australian Ringnecks, an aggressive competitor for nest sites.

Table 5 Species in which the number of reports had decreased between 1974 and 1999 (33)

Australian Wood Duck
 Australian Shoveler
 Grey Teal
 Australasian Grebe
 Hoary-headed Grebe
 Little Black Cormorant
 White-faced Heron
 White-necked Heron
 Black-shouldered Kite
 Whistling Kite
 Brown Goshawk
 Collared Sparrowhawk
 Wedge-tailed Eagle
 Nankeen Kestrel
 Dusky Moorhen
 Eurasian Coot
 Black-fronted Dotterel

Banded Lapwing
 White-tailed Black-Cockatoo
 Western Rosella
 Elegant Parrot
 Pallid Cuckoo
 Laughing Kookaburra
 Striated Pardalote
 Yellow-rumped Thornbill
 Scarlet Robin
 Restless Flycatcher
 Willie Wagtail
 White-winged Triller
 Richard's Pipit
 Tree Martin
 Little Grassbird
 Silvereve

Most of the species for which the number of records remained stable between 1974 and 1999 (Table 6) were species that have usually survived the changes brought about by settlement well, and remain common throughout the south-west. They are adaptable and able to use a range of resources. For example the Clamorous Reed-Warbler frequently feeds on land surrounding the dam in whose *Typha* bed it nests. Perhaps the most surprising of this group is the Grey Fantail, a specialist in catching flying insects, but widespread and common across Australia. It is able to hunt in thick undergrowth, whereas other aerial hunters of insects, the swift flying swallow and martin, are not.

Table 6. Species in which the number of reports had remained stable between 1974 and 1999 (12)

Black Swan
 Pacific Black Duck
 Little Pied Cormorant
 Straw-necked Ibis
 Purple Swamphen
 Red Wattlebird

New Holland Honeyeater
 Rufous Whistler
 Australian Magpie Lark
 Grey Fantail
 Australian Magpie
 Clamorous Reed-Warbler

Many different factors appear to have influenced those species in which the number of records fluctuated between 1974 and 1999 (Table 7). For some, such as the Purple-crowned Lorikeet, it was apparently the erratic availability of food, for others, such as the migrant cuckoos and kingfisher, it may have been the effect of factors operating remotely from Middlesex. In any case it cannot be established that these species were affected by the environmental changes that took place at Middlesex, although these changes may have had some effect on them.

Table 7. Species in which the number of reports fluctuated between 1974 and 1999 (21)

Hardhead
 Darter
 Great Cormorant
 White-necked Heron
 Great Egret
 Brown Falcon
 Australian Hobby
 Peregrine Falcon
 Red-tailed Black-Cockatoo

Purple-crowned Lorikeet
 Red-capped Parrot
 Fan-tailed Cuckoo
 Horsfield's Bronze-Cuckoo
 Shining Bronze-Cuckoo
 Southern Boobook
 Sacred Kingfisher
 Inland Thornbill
 Western Wattlebird

Western Spinebill
Black-faced Cuckoo-shrike

Red-eared Firetail

The species in which the number of records increased and then decreased between 1974 and 1999 (Table 8) are in some ways the most revealing. It is likely that they benefited from the developments that were undertaken at Middlesex, but were then affected by the changing environmental conditions of the surrounding landscape. Apart from the pigeon, all are insectivores and may have received doses of insecticides from their prey that could have reduced fertility as well as the direct effect of these chemicals on the numbers of prey. The case of the pigeon would be different. It would have benefited from the seeds of weeds available while the trees in the arboreatum were young, but once the canopy closed, these would have vanished and reduced the amount of food available for the pigeon locally.

Table 8. Species in which the number of reports had increased and then decreased between 1974 and 1999 (5)

Common Bronzewing

White-breasted Robin
Golden Whistler
Dusky Woodswallow
Welcome Swallow

The data collected at Middlesex over the twenty five years give a clear picture of the dynamic state of bird populations in times when great, but subtle, changes were taking place in the agricultural practice of the area. They will provide a useful baseline against which future studies of the birds in the area can be compared.

Acknowledgements

A great many people over the years have contributed to the operations of the Middlesex Field Study Centre, and we thank them all, but we should like to mention especially Stephen Davies, Lee Fontanini, Bill Lane, Bruno and Bruce Pessotto, Owen Roberts, Ian and Eleanor Rowley.

References

Baker-Gabb, D. (1987). BOP Watch Update No. 4. *RAOU Newsletter* No. 74:4-5.

Blakers, M., S.J.J.F. Davies and P.N. Reilly. (1984). *Atlas of Australian Birds*. Melbourne, Melbourne University Press. 738pp.

Brown, R.J. and M.N. Brown. (1977). Observations on Swampheens breeding near Manjimup, W.A. *Corella* 1:82-83.

Brown, R.J. and M.N. Brown. (1978). Observations on White-breasted Robins breeding near Manjimup. W.A. *Corella* 2:59.

Brown, R.J. and M.N. Brown. (1980a). Eurasian Coots breeding on irrigation dams near Manjimup, W.A. *Corella* 4:33-36.

Brown, R.J. and M.N. Brown. (1980b). Co-operative breeding in robins of the genus *Eopsaltria*. *Emu* 80:89.

Brown, R.J. and M.N. Brown. (1981). Reports of the Middlesex Field Study Centre, I to IV, 1976-1981. *RAOU Report* No. 4.

- Brown, R.J. and M.N. Brown. (1982). Learning behaviour at the nest of co-operatively breeding Yellow-rumped Thornbills *Acanthiza chrysorrhoa*. *Emu* 82:111-112.
- Brown, R.J. and M.N. Brown. (1983). Reports of the Middlesex Field Study Centre, V to VI, 1981-1983. *RAOU Report* No. 5.
- Brown, R.J. and M.N. Brown. (1985a). Banding Silvereyes in Western Australian. *Safring News* 14:3-6.
- Brown, R.J. and M.N. Brown. (1985b). Reports of the Middlesex Field Study Centre, 7 and 8, 1983-1985. *RAOU Report* No. 23.
- Brown, R.J. and M.N. Brown. (1986). Nest-building behaviour of the Yellow-rumped Thornbill *Acanthiza chrysorrhoa*. *Australian Bird Watcher* 11:218-223.
- Brown, R.J. and M.N. Brown. (1987). Reports of the Middlesex Field Study Centre, 9 and 10, 1985-1987. *RAOU Report* No. 29.
- Brown, R.J. and M.N. Brown. (1989). Reports of the Middlesex Field Study Centre, 11 and 12, 1987-1989. *RAOU Report* No. 45.
- Brown, R.J. and M.N. Brown. (1991). Reports of the Middlesex Field Study Centre, 13 and 14, 1989-1991. *RAOU Report* No. 77.
- Brown, R.J., M.N. Brown, M. de L. Brooke and N.B. Davies. (1990). Reaction of parasitized and unparasitized populations of *Acrocephalus warblersto* model cuckoo eggs. *Ibis*. 132:109-111.
- Brown, R.J., M.N. Brown and B. Pessotto. (1986). Birds killed on some secondary roads in Western Australia. *Corella* 10:118-122.
- Brown, R.J., M.N. Brown and B. Pessotto. (1990). Sedentary Welcome Swallows *Hirundo neoxena* in the southwest of Western Australia. *Corella* 14:86-87.
- Brown, R.J., M.N. Brown and E.M. Russell. (1990). Survival of four species of passerines in karri forest in south Western Australia. *Corella* 14:69-78.
- Christidis, L. and W.E. Boles. (1994). The taxonomy and species of birds of Australia and its territories. *RAOU Monograph* No.2.
- Davies, S.J.J.F. (1979). The breeding seasons of birds in south-western Australia. *J. Roy. Soc. W.A.* 62:53-64.
- Davies, S. (1992). Report on the birds, kangaroos and feral animals of the Inering Project Area, Carnamah Shire, 1991. in Read, V. (Ed.) *Inering 'Save the Bush' Project: Bush Management Strategy*. Unpublished Report.
- Higgins, P.J. (Ed.) (1999). *Handbook of Australian, New Zealand and Antarctic Birds*. Vol. 4. Oxford University Press, Melbourne.
- Marchant, S. and P.J. Higgins. (Eds.) (1993). *Handbook of Australian, New Zealand and Antarctic Birds*. Vol. 2. Oxford University Press, Melbourne.
- Rowley, I., E. Russell, R. Brown and M. Brown. (1988). Ecology and breeding biology of the Red-winged Fairy-wren *Malurus elegans*. *Emu* 88:161-176.

Russell, E. M., R.J. Brown and M.N. Brown. (2004). Life history of the white-breasted robin *Eopsaltria georgiana* (Petroicidae), in south-western Australia. *Aust. J. Zoology* 52:111-145.

Russell, E., I. Rowley, R. Brown and M. Brown. (1991). Acquisition of nuptial plumage in the Red-winged Fairy-wren *Malurus elegans*. *Corella* 15:125-133.

Serventy, D.L. and H. M. Whittell. (1976). *Birds of Western Ausdtralia*. University of Western Australia Press, Perth.