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Seasonal Data on Flying and Airborne Invertebrates Collected by Suction Trap near Jandakot, Western Australia

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SEASONAL DATA ON FLYING AND AIRBORNE INVERTEBRATES COLLECTED BY SUCTION TRAP NEAR JANDAKOT, WESTERN AUSTRALIA.

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ABSTRACT

Numbers of individual flying insects and airborne invertebrates in each of 56 broad taxonomic groups, captured weekly in 1972 in a suction trap, are tabulated to show frequency distributions through the year. Additional data are given on species and genera when known.

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INTRODUCTION

A suction trap was established in October, 1971 at the University of Western Australia's Zoology Department Marsupial Breeding Station near Jandakot, 25 km south of Perth (Fig. 1). It was to monitor flying and airborne invertebrate populations as part of a long-term study on the interaction between native and exotic species occurring as surrounding countryside changed (from semi-natural bushland, through market gardens to suburban housing). The trap is an effective means of monitoring arrival and establishment of populations of some aerial planktonic or weak-flying exotic and native species. The trap would be of no value in monitoring arrival of strong flying species, such as the European Wasp, *Vespula germanica*, which the Author first found in Perth during 1976. Comparisons between years could be expected to reflect the combined effects of weather, levels of water in lakes, fire, marsupial grazing etc., as well as the increasing influence of exotics on some native species.

The year 1972 was chosen for analysis to form a baseline comparison for study of seasonal occurrence and abundance of certain insect groups in later years.

METHODS

The Trap

This is based on the Johnson and Taylor (1955) 18 inch propeller trap. The 44 cm diameter trap mouth is 140 cm above the ground, and the fan is driven by a 900 rpm Woods Fan Motor 15 mk 1A. The brass gauze cone has 16 strands per centimetre and the holes have a diagonal measurement of 0.6 mm. The insects are caught in preserving fluid held in an exchangeable plastic container at the base of the cone, above the fan. Alcohol was tried initially as a preserving fluid, but problems with rain and evaporation made it necessary to replace it with a mixture of 5% glycerine and water with formalin and detergent added. Preservation appears to be adequate for most groups.

The Locality

The Marsupial Breeding Station (Grid Reference: 383023. See Fig. 1) located in the Shire of Wattleup, extends over 214 ha of semi-natural vegetation and has a perimeter fence to enclose terrestrial marsupials. It contains the 44 ha Banganup Lake. The area is situated mainly on the leached Bibra Sands, which have a vegetation dominated by open *Banksia*/Jarrah (*Eucalyptus marginata*) woodland, and a complex ground cover characterised by *Hibbertia hypericoides*. Some of the low lying areas develop swampy conditions and have species characteristic of a higher water table, including the trees *Melaleuca lanceolata*, *Banksia littoralis*, *B. ilicifolia* and *Eucalyptus rudis*. Bushes in these areas include *Astartea fascicularis*, *Boronia crenulata* and *Pultenaea reticulata*. Most of the central area of Banganup Lake is covered by a growth of *Baumea articulata* on peat.

The trap is located about 50 m from the laboratory in an area of open *Banksia*/Jarrah woodland, and is about 200 m east of Banganup Lake. There is another lake of 250 ha, Thompson Lake, 700 m north over Russell Road in the adjoining Flora and Fauna Reserve No. 15556. Both lakes vary according to annual rainfall and periodically dry out. A large proportion of insects caught have aquatic larvae and their numbers and species compositions reflect seasonal variations in the lakes.

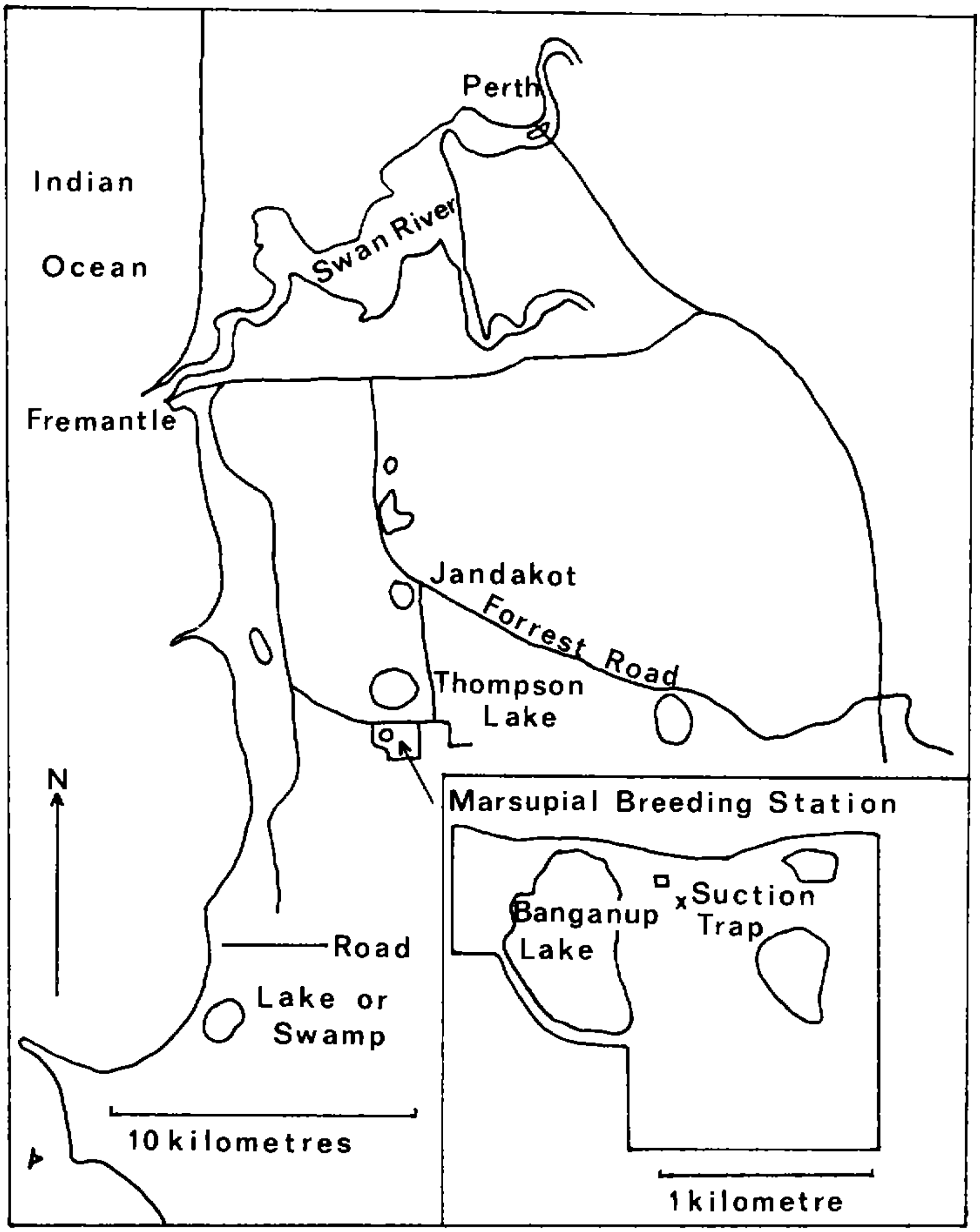

FIGURE 1

LOCATION OF THE MARSUPIAL BREEDING STATION AND THE NEAREST WEATHER STATION (FREMANTLE) RECORDING IN 1972. INSET SHOWS THE LOCATION OF THE SUCTION TRAP IN RELATION TO BANGANUP LAKE.

Climate

The climate of the area is Mediterranean in character with nearly all rainfall occurring during the warm winter months. The summer is hot and dry. Details of weather, from the nearest weather station which was recording in 1972 (Fremantle), are given in Figure 2. Rainfall for the year was below average throughout and the temperatures in May, November and December were unusually high.

Sample Analysis

The samples, which contained up to 15,000 insects per week, were removed and transferred to jars containing alcohol. Some insect groups had been counted and removed for further study prior to the present work; these included the Culicidae, Psocoptera, Neuroptera, Trichoptera, Isoptera, Apoidea,

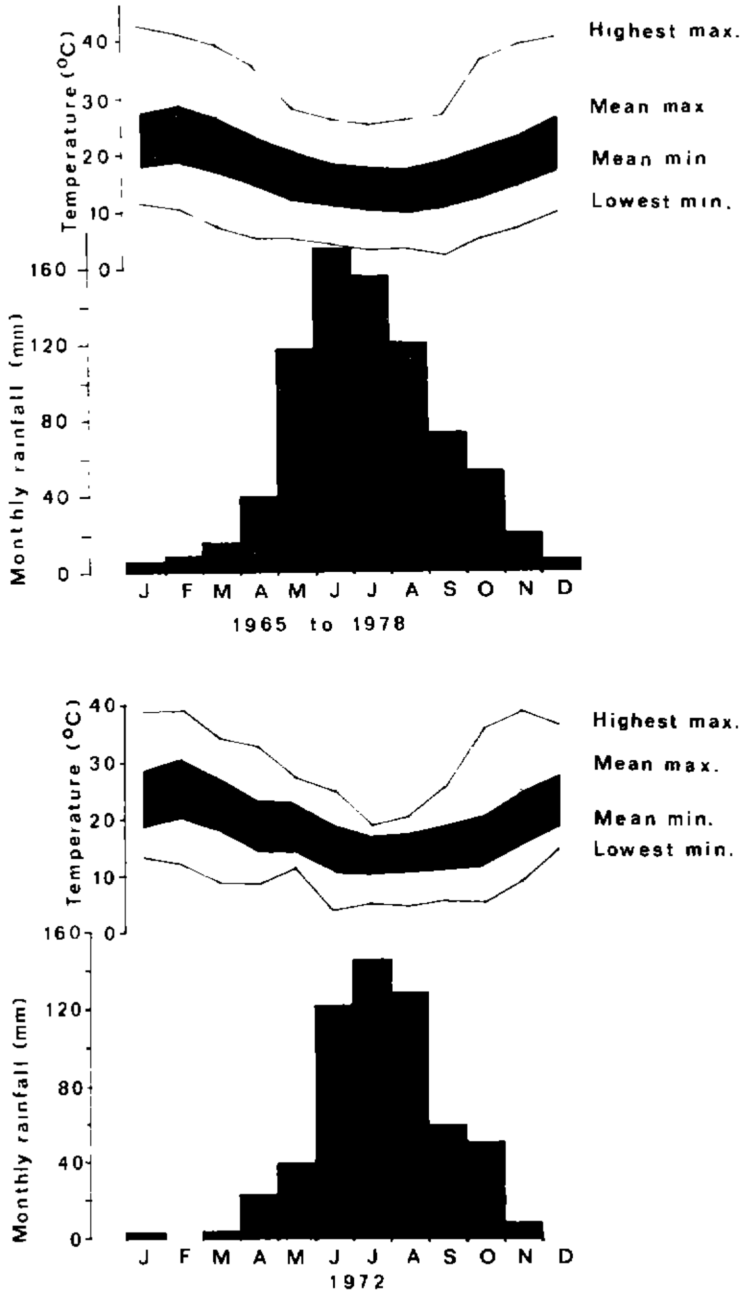

FIGURE 2

UPPER GRAPHS SHOW MEAN MONTHLY RAINFALL (HISTOGRAM), MAXIMUM AND MINIMUM, HIGHEST MAXIMUM AND LOWEST MINIMUM TEMPERATURES FOR FREMANTLE (1965 TO 1978).

LOWER GRAPHS SHOW MONTHLY RAINFALL FOR THE DURATION OF 1972 AND MEAN MAXIMUM AND MINIMUM, HIGHEST MAXIMUM AND LOWEST MINIMUM TEMPERATURES FOR FREMANTLE (1972).

Aphodius (dung beetles) and Aphidoidea. The insects remaining in each of the jars for the year 1972 were counted or estimated by the methods outlined below. These were considered adequate for the purposes of providing comparative numbers as a guide to seasonal abundance. The complexity of the samples precluded more detailed analysis.

For each collection, the contents were placed in a petri-dish and all larger insects and other easily recognisable groups, such as chrysid wasps, were removed and counted. Estimates were used for the following groups: Acarina, Araneae, Collembola, Cicadellidae/Psyllidae, Aleyrodoidea/Coccoidea, Misc. Heteroptera, Thysanoptera, Coniopterygidae, Staphylinidae, Misc. Coleoptera, Psychodidae, Chironomidae, Ceratopogonidae, Scatopsidae, Cecidomyiidae, Sciaridae, Mycetophilidae, Bombyliidae, Empididae, Misc. Brachycera, Lepidoptera and Proctotrupoidea/Chalcidoidea. To do this the remaining mass was then spread evenly by gently shaking the dish until the insects formed a uniform layer up to about two individuals deep. The petri-dish was then placed on the stage of a binocular microscope without deliberately choosing the area to be examined. That portion of the collection appearing in the field of view was then carefully removed using forceps and each individual assigned to one of the remaining twenty-two groups, before placing back in another part of the dish. Only those individuals with their heads appearing in the field of view were counted. This procedure was then repeated to give three counts for those collections made before the end of February. After that, only two counts were made, because the process proved too time consuming. (No actual counts were made to determine the accuracy of the method, but data from the Proctotrupoidea/Chalcidoidea group indicate that the reduction from three to two in the samples counted had little effect on the final number estimated to be present in the collection. The maximum difference was 18% with a mean of 7.5%). To obtain the estimated numbers present in the collection the average number of each group found in the counts was multiplied by twenty. This was the number of fields of view making up the area of the petri-dish. In some collections the volume of insects was too great for a small dish to be used, so a larger one was substituted which was 82 times the field of view. The estimates derived from these collections using only two counts were therefore considerably less reliable. However, using data from the Proctotrupoidea/Chalcidoidea group again, the difference between estimates using one and two field of view counts only had a maximum difference of 100% with a mean of 32%. The estimates are therefore likely to be a good indication of the order of magnitude found in each group. Where insects in a group were in low numbers and only appeared less than one per field of view, further searching of the collection was made to gauge whether the estimate was reasonable, and adjusted if necessary.

The choice of groupings was largely dictated by ease of determination, but subdivisions were made in some cases when a group was found to form an important component of the collection.

Any further individuals found belonging to the eight groups previously removed were counted and added onto the original total.

The periods over which the collections were made varied from three days (an occasion when the motor burned out) to fourteen, but in most cases were for one week. To make the figures more comparable, the estimates have been adjusted to give the expected numbers caught over seven days, assuming the average capture rate per day to be constant for the period.

RESULTS AND DISCUSSION

Table 1 gives estimates for the number of individuals in each of 51 groups of invertebrates caught per week. (The other five groups, such as Odonata and Orthoptera had insufficient numbers to warrant inclusion). Table 2 gives details of selected species or genera when known.

The insects caught in the trap reflect characteristics of the trap and of their behaviour, as well as their relative abundance. Mecoptera, for instance, appear to be abundant during spring, yet did not appear in the trap during 1972 (some have been caught in later years). It would appear from the behaviour of *Harpobittacus similis* that they mainly fly over the ground vegetation and rarely fly at the height of the trap mouth. Odonata and Orthoptera on the other hand, may reach the trap mouth, but are sufficiently strong to avoid capture, although one aeshnid and a tettigoniid were found in the trap. Interference by students may explain these captures because a marine mollusc was found in the trap during a later year. It is unlikely that student interference would affect the smaller

DATE COLLECTION TAKEN FROM TRAP	No. Days	Conversion	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	HEMIPTERA						NEUROPTERA			COLEOPTERA									
												Cicadellidae + Psyllidae	Aphididae	Aleyrodoidea + Coccoidea	Reduviidae	Miscellaneous Heteroptera	Thysanoptera	Coniopterygidae	Osmyloidea + Hemerobioidea	Myrmeleontoidea	Carabidae	Staphylinidae	Pselaphidae	Aphodiinae	Melolonthinae	Buprestidae	Mordellidae	Rhipiphoridae	Curculionoidea	Miscellaneous Coleoptera
4 Jan	14	20		83	2			1	5		12	30	3	1	5	2	8	17	6			6	2		1	1	1		2	23
11 Jan	7	20		135		1	3			1	7	94	8	10	4	4	260	26	5			10	1		3			1	2	80
18 Jan	7	20		240	1			1	5	1	14	47	5		2	10		137	8	1	1	15	3	2		3	2	1	4	47
24 Jan	6	20		100		2			2		1	28	1		1	2	82	22	2			8	6			2		1	2	47
2 Feb	9	20		57			3		2		7	7	7	7	4	2	16	35	3		1	16	4			1	1		2	37
7 Feb	5	20		131		7			9			76	3	10		30	131	55	2	1		9	1	1	1	2	2		6	75
14 Feb	7	20	14	69		2			1		3	47	2	7	4	5	47	35	2	1		3	1		1		3	1	2	20
21 Feb	7	20		67		7					4	34	1	14	1	11	40	14	2	1		42	1	2		1	1		6	71
28 Feb	7	20		189		10				1	2	54	5	293		13	107	24	3	2	1	40	1	1					2	140
No Data																														
20 Mar	7	20		110			1	1			2	10	16	30		22	30	11	2			1		2			1	3	1	80
27 Mar	7	20		50				1	37		2	3	10	10	1	7	60	28				2	2	2	1			6		
3 Apr	7	20	1	213		1	3		6		1	20	18	20	2	8	10	15			3	7	7	2				1	2	50
10 Apr	7	20		60		1			3	1	1	10	4			10	1	7				20	4		1			1		10
20 Apr	10	20		30					2		4	7	15		1	14	14	2			6	28	28	3					1	49
25 Apr	5	20		28					56	1	15	28	20	14		56	42	1	1		2	168	588	1						230
1 May	3	20		78							33	2	7	20					1		1	7	16		2					50
No Data --																														
29 May	7	82		3					56		169	41	5			41		2	1			41	2	43						287
5 Jun	7	20		50					29		73	30	11			40	30	1				40	3	98	1					10
13 Jun	7	82		41					38		90	82	7			5		1	1		3		11	57					2	205
20 Jun	7	20		10					5		50		16			10	40		1		1	80		199					1	10
27 Jun	7	20		30							40	1	2			1	60				1	10	1	65						10
No Data																														
17 Jly	3	20		9							12			9										16						7
24 Jly	7	82	10	35							19		10	10		10	90					3		90	2					1
31 Jly	7	20		3		2					25	1	8			1		1				2		8					1	4
7 Aug	7	20	1	8							30	3	10					2			1			21				1	1	4
14 Aug	7	20		9							15	10	20	20		10	40	3			2	9	2	11				1	1	30
21 Aug	7	20		10							30	10	4			1					2		2	6				1	1	10
28 Aug	7	82		41							220	1	28			3	1	1			6	40		9	2			1	1	40
4 Sep	7	82	1	41					27		152		39			41					4	40		11					1	40
11 Sep	7	20		7					2		51		35			8		1	1		1	2								2
18 Sep	7	20	10	20			1		6		54	2	77	20		13		2			1	8	1	2					1	40
25 Sep	7	82	26	137		26			5		132	27	203	27		27	82	4	8			27	164	2				2	3	410
2 Oct	7	20		20					3		66	40	113	10		4	10	1	1		4	20	10		2					230
10 Oct	8	20		19		1			1		46	10	37	18		4	35	1			1	7								
17 Oct	7	82	26	123					6		114	123	285	574		5	123	2	11		3	14	68					1	2	492
22 Oct	5	20		42						2	69	42	88	120		12	28	1	5		1	70	1							14
30 Oct	8	82		48					3	1	96	179	55	1		24	72	47	9		1	24	48		1				1	251
7 Nov	8	82		143						1	116	48	25	48	3	24	179	25	13		1	72	2					1	1	120
13 Nov	6	20		75							28	51	8	9		19	23	9	33		1	16	11						6	25
21 Nov	8	20		96					4	2	47	44	23	61	2	11	70	12	13		6	11	17	1		1		1	3	56
28 Nov) 4 Dec	13	82		132					1	1	14	132	3	22		44	177	2	22			1	20	1	1				4	88
11 Dec	7	20		250							47	120	1	20	2	150	30	45	12		1	2	2		1			1	1	110

TABLE 1

ESTIMATED NUMBERS WITHIN 51 INVERTEBRATE GROUPS CAUGHT EACH WEEK IN THE SUCTION TRAP DURING 1972.
(The date given refers to the day the collection was removed from the trap. The conversion figure indicates whether the small or large petri-dish was used for the analysis: see text. Periods with no data indicate when the trap was not working).

*** Includes the Superfamilies Chrysidoidea, Bethyloidea, Pompilioidea, Vespoidea and Sphecoidea.**

DIPTERA																			HYMENOPTERA				
Tipulidae	*Psychodidae*	*Culicidae*	*Chironomidae*	*Ceratopogonidae*	*Scatopsidae*	*Bibionidae*	*Cecidomyiidae*	*Sciaridae*	*Mycetophilidae*	*Asilidae*	*Mydaidae*	*Bombyliidae*	*Empididae*	*Dolichopodidae*	Miscellaneous	*Brachycera*	*Trichoptera*	*Lepidoptera*	*Ichneumonoidea + Evanioidea*	*Proctotrupoidea Cynipoidea Chalcidoidea*	*Chrysidoidea-Sphecoidea* *	*Apoidea*	[illegible]
11	40	14	490	50			35	1		1		19		3		95	12	275	9	63	4	12	2
8	15	17	710	87			147			2		60				30	9	230	9	532	7	11	6
23	25	40	877	53			167			5	1	194		1		170	22	439	5	560	14	6	59
9	19	18	319	412			101	1		3		90		6		117	30	232	2	342	2	2	56
23	42	23	3952	166			93			1	1	44		1		130	13	267	1	539	4	4	58
15	37	46	766	317			392			2	15	109		1		67	7	558	6	1213	6	3	238
39	173	18	1183	407			200	14			11	107				160	12	339	4	380	6	2	17
23	166	26	3507	320			133	7			21	104	1	2		170		243	1	740	6		47
44	653	44	827	620			367				56	180	1			280	1	520	5	820	25	2	7
12	330	19	900	1250			380				6	85				120		210	1	310	9		4
8	470	28	1820	960	1		410	10		1	8	129				110		370	2	230	13	1	31
2	670	16	890	1130	1		230	3			2	180				60		200	2	420	16		40
2	450	2	670	1190			120	8				1				80		64	1	80	8		50
12	805	10	1225	938			427	10	3		1	70		3		126		168		259	12	1	63
34	868	4	602	938	14		322	40	1			28				210		424		448	11	1	336
28	529	7	417	560	5		420	12	4			1		1		156		359		156	5		40
360	861	24	936	4501	205		615	7	4				82			1025		443		990	2		82
39	200	8	3090	340	30		120	50	20				10	1		130		81		140			70
53	656	19	9092	1107	164		1230	82	5				40			369		63	1	289			5
16	290	24	2850	330	40		540	180	80				190			160		54		100		2	50
10	10	13	2230	160	20		240	170	70				70			30		55					
28	35	2	3267	37	4		117	7	21				16			28		4		245		1	2
7	20	16	6862	294	30		328	92	120				100			160		42		180		1	11
	40	5	277	20	3		460	13	142				8			20		18		20			
1	110	19	1480	120	5		300	60	260				24			70		71		60			
1	170	12	573	140	10		290	100	151				60			30		70		120			
10	50	12	2110	100	10		330	60	80				17			40		54		60			
48	492	15	6068	123	3		451	82	82				40			287		130		165		1	2
71	410	5	1886	246	2	1	1271	205	123				41	1		164		87		248			4
103	50	10	460	6	1	1	590	35	22				7			2		103		10			4
89	310	6	310	180	17	7	340	160	20				7			50		107	1	130	1	1	11
78	8897	53	410	861	52	3	533	219	136				49	6		369		298		908	2	2	55
68	540	24	240	60			430	130	20				1			20		150	1	110			20
31	507	4	368	96	40	1	402	61	10					1		18		98		44	1		9
55	10742	35	328	164	14		574	287	41				20			164		310	3	495	3	1	27
50	5516	24	126	112	14		266	151	28					1		60	1	286		350			8
59	4986	10	4377	215	1		789	164				1	1			48	32	446	4	505	5		1
86	3300	14	335	430	1		395	179		1			1			48	83	496	1	496	6	1	4
42	537	4	350	233	4		478	70		1			12	9		56	58	398	5	245	15		24
22	228	6	245	210	2		210	35		2		1	1	4		88	71	302	7	350	14	7	9
30	66	12	3908	375			375	20				1	1	3		44	49	244	2	422	14	8	22
18	20	55	500	310			170	10		2		160	2	3		80	34	412	5	520	10	15	10

TABLE 1 (Cont.)

ISOPTERA

Date	[illegible] sp	[illegible]	[illegible]	[illegible]	[illegible]termes sp	Cryptotermes [illegible]	C. [illegible]	Heterotermes sp.	[illegible]termes [illegible]	Isoptera unidentified sp
4 Jan					+					
11 Jan										
16 Jan	+									
24 Jan										+
2 Feb	+									
7 Feb	+									
14 Feb										
21 Feb										
29 Feb										
No Data										
20 Mar										
27 Mar		+								
3 Apr		+								
10 Apr		+		+						
20 Apr										+
25 Apr		+		+					+	
1 May										
No Data										
29 May										
5 Jun								+		
13 Jun								+		
20 Jun								+		
27 Jun										
No Data										
17 Jly										
24 Jly										
31 Jly										
7 Aug										
14 Aug										
21 Aug										
28 Aug										
4 Sep						+				
11 Sep						+				
18 Sep						+				
25 Sep						+				
2 Oct	+									
10 Oct										+
17 Oct			+				+			
22 Oct			+							
30 Oct			+							
7 Nov										
13 Nov										
21 Nov										
28 Nov										
4 Dec					+					
11 Dec										

PSOCOPTERA

Date	Blaste [illegible]	B. lunulata	B. funerella	[illegible]stigma [illegible]	C. dugum	Ptycta [illegible]	P. emarginata	P. cornigera
4 Jan								
11 Jan								
16 Jan								
24 Jan								
2 Feb								
7 Feb								
14 Feb								
21 Feb								
29 Feb								
No Data								
20 Mar								
27 Mar								
3 Apr								
10 Apr						1		
20 Apr								
25 Apr								
1 May								
No Data								
29 May	2				1		1	1
5 Jun	1							
13 Jun	8	1						
20 Jun	4	2				1		
27 Jun	3							
No Data								
17 Jly	1							
24 Jly	3							
31 Jly	1							
7 Aug								
14 Aug		1	1					
21 Aug								1
28 Aug								
4 Sep								
11 Sep	1							
18 Sep								
25 Sep	1							
2 Oct	2							
10 Oct	1							
17 Oct	2							
22 Oct	15							1
30 Oct	24		1					
7 Nov	1		2					
13 Nov	5							
21 Nov								1
28 Nov								
4 Dec			1					
11 Dec	1							

APHIDOIDEA

Date	Acyrthosiphon malvae	Aphis craccivora	A. gossypii	Aphis sp or spp.	Aulacorthum solani	Brachycaudus helichrysi	Brevicoryne brassicae	Capitophorus elaeagni	Cavariella aegopodii	[illegible]ferella [illegible]	Chaetosiphum tetrarhodum	Dysaphis foeniculus	Hyadaphis foeniculi	Hyperomyzus lactucae	Lipaphis erysimi	Macrosiphum euphorbiae	M. rosae
4 Jan		1															
11 Jan							1										
16 Jan																1	
24 Jan																	
2 Feb		1					2			1						1	
7 Feb		1								1							
14 Feb		1								1							
21 Feb										1							
29 Feb																	
No Data																	
20 Mar										2							
27 Mar										3			1				
3 Apr		1															
10 Apr																	
20 Apr																	
25 Apr							1						1				
1 May							1						1				
No Data																	
29 May		1															1
5 Jun		1					1							1		1	1
13 Jun		2												1			
20 Jun		2	1		1												
27 Jun																1	
No Data																	
17 Jly																	
24 Jly																	
31 Jly									1								
7 Aug						1											
14 Aug	1			1													
21 Aug																	
28 Aug	8				1											1	1
4 Sep	5	1		1	1									3		1	
11 Sep	3	2		1	4									2		1	
18 Sep	5	3			5	2			1					1	1		
25 Sep	3	17	1		9	5		2						3	43	3	
2 Oct		9	1	1	2	1		1			1			1	19	2	
10 Oct	1	2			4	3		1						3	3	2	1
17 Oct	1	25		1	1	4	1							1	64	3	
22 Oct		12		3	3	5		1							2	1	
30 Oct		11					1								3	2	
7 Nov		4				1											1
13 Nov		2				1								1			
21 Nov		2				1	1							1			
28 Nov																	
4 Dec																	
11 Dec																	

TABLE 2

THE FREQUENCIES OF CERTAIN IDENTIFIED SPECIES OF INSECT CAUGHT IN THE SUCTION TRAP. ACTUAL NUMBERS RECORDED IN EACH COLLECTION OMITTING SOME FURTHER INDIVIDUALS FOUND LATER. (+ = present in the collection).

											CULICIDAE						TRICHOPTERA				APOIDEA			
[illegible]	[illegible]	[illegible]	... sp.	[illegible]	[illegible]	[illegible]	[illegible]	Genus ... sp. nov.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	... sp. nov.	... sp. nov.	[illegible]	[illegible]	... sp. minimum	sp.	[illegible]	[illegible]
						2					2	1	8		10	6	1	19			18	2		
						4		1			2		1	2	6	5	5	14			9			1
											5		3	2	20	9	1	20			5	1		
											2		1	2	9	1	1	19			1	1		
											1	1		2	19	6	3	14			4			1
												1		2	28	2	1	4			2			
												1		2	11	4	6	4	1		1		1	
	5										1		1	1	16	7								
													2	2	34	6					1		1	
	13							1					1	1	12	5								
	3										1		2		20	5							1	
	3										1			1	9	5								
	3									1					2							1		1
	14													5	6	3								1
	3									1				2	1									1
	1												1	1		1								
	3											4	8			12								
	3					1						5	5			1								
	2			1		1					1	3	9			9								
	1					1						3	3			11								2
	1															7								
													1											1
											2	1	4			9								1
				1	3	3						1	3			1								
				1	2	1		5			1		2			9								
	6			1	8	3		4					1			11								
	1				2	1						1				11								
	1	1				1		11				1	1			6								1
	6			2	4	1		14				1				2								
	4			1	4			10			1	4	1											
	11			2	7	1		24			1	2	1								1			
2	28			7	28			19		1	1	7	42								2			
	13			3	20			16		1	2	4	17			1								
	8			1	3			9		1	2		2											
2	54			3	6	1		31		2		12	21			2					1			
1	15		1					17	1		4	7	5				1							
2	20			2		2		19		1	6	3	2				11							
1	15					1		5			3	6	6				82				1	1		
3												1				3	45		1					
7	6					1	1	5			2	1	2				61				7	1		
1	1					2					10	[illegible]	1			3	61				17			1
						1					5	6	13	2	10	19	62	1	1		9	2	1	

TABLE 2 (Cont.)

insects, which form the bulk of the collections. Bushflies only seem to be caught when people look into the traps (only few were found in the samples). Apart from Orthoptera and Odonata, other groups not included in Table 1 due to small numbers were Strepsiptera, Megaloptera and symphytan Hymenoptera.

Most of the intermediate sized invertebrates entering the trap would be caught, but of the very small species, many would be lost through the wire mesh. These would include certain Collembola, Acarina, Aleyrodoidea/Coccoidea, Thysanoptera and Proctotrupoidea/Cynipoidea/Chalcidoidea. In addition, these groups would be under-recorded because their small size made it difficult to find them in the collections.

It is unlikely that most insects would be either attracted or deterred by the trap, although the trap could have attracted blood-sucking Nematocera by its air turbulence and warm motor. This may have been so for Culicidae which had a ratio of 63 males to 619 females. For this group it is equally possible that only females left the lake and were hence likely to be trapped. The numbers of insects caught which must have come from the lakes indicates that the trap may sample populations flying or drifting over considerable distances. This was certainly true for many aphids, which were found to include species characteristic of plants not found in the Marsupial Breeding Station, such as conifers. The appearance of large numbers of the spotted alfalfa aphid within weeks of its arrival in the State in 1978 demonstrates this, as does the occurrence of various fig wasps, which were found in 1972, well before *Ficus* became established in the area near the trap. On the other hand, some species might be expected to enter the trap, but have not so far been found, such as an undescribed species of aphid in the genus *Anomalaphis*, which has been abundant around the lake on *Astartea fascicularis*. Another aphid living on *Melaleuca* spp. in the same area (*Sensoriaphis* sp.), has been caught in the trap.

Little data on seasonal occurrence of different groups exist in Australia for comparison with the data in Tables 1 and 2. These data will be referred to in later publications arising from the project and may be of value to people working on the individual groups. While further information is available on request it is worth recording the following notes.

At least some of the Acarina and all the chelifers were attached to insects.

Some samples of spiders examined in detail were found to consist mainly of juveniles, and belonged to many genera. These spiders were probably dispersing.

The alate Isoptera (Table 2) were difficult to identify without other castes. They appear to belong to species normally found on the coastal plain. One caught in August, 1977 appears to be an unknown species of *Coptotermes*.

The Psocoptera include a number of new species as given in Table 2. (See New 1974, and Thornton and New 1977).

In 1972 the aphids reached their peak in spring (Table 2), but in other years an autumn peak also occurred. Twenty-nine species were found, including the one not caught in the trap. Only four were native Australian species (Carver 1978).

The aleyrodids form the bulk of the division including coccids. Many were very small and likely to be missed. The Reduviidae are nearly all members of the Emesinae.

A sample of the Tipulidae were all in the sub-family Limoniinae and included the genera *Molophilus*, *Limonia*, *Limnophila* and *Trimicra*.

The Culicidae and Chironomidae reflect the condition of the lakes and vary from year to year. After the winter of 1971 the lakes filled to a high level and large numbers of mosquitoes appeared in the spring. Less rain fell in 1972 and no spring peak is apparent (Table 2). The chironomid swarms are of various species with *Polypedilum nubifer* forming the bulk in some swarms.

The Ceratopogonidae numbers are shown in Table 1. Although not split into species in Table 2, one sample which was investigated included *Culicoides marksi*, *Leptoconops longicornis*, about seven species of *Forcipomyia*, two species of *Monohelea*, *Nilobezzia* and *Stilobezzia* (?).

A few Anisopodidae were caught in spring but not recorded in the list.

The numbers of bombyliids are higher than expected because the bulk of the collections are made up of minute flies in the rarely collected genus *Glabellula*.

The miscellaneous Brachycera include many groups, the most important being Phoridae. Many very small individuals of this family were present in most collections. No Drosophilidae were found.

The Trichoptera (Table 2) include four species of which three are new. The majority were made up of an undescribed species of *Ecnomina*. *Hellyethira litua* was described from the specimens caught (Wells 1979). A specimen of *Oecetis pechana* was caught on 6 December, 1971 but not in 1972.

No attempt has been made to classify the Lepidoptera. The majority of individuals are very small, the macro-Lepidoptera only occurring in numbers up to about 70. The macro-Lepidoptera make up to 16-39% of the Lepidoptera individuals caught between 13 June and 22 October, after that the numbers form less than 10% of the Lepidoptera and decline to zero on 28 February.

The Proctotrupoidea/Cynipoidea/Chalcidoidea group include a wide variety of forms down to a size of about 0.5 mm in length. The introduced cynipid, *Aulax hypochoeridis* is common in spring, Agaonidae occur sporadically and a species in the genus *Inostemma* was also found.

No introduced social wasps have been caught by the trap even though *Polistes tasmaniensi* occurs in the area.

The Apoidea (Table 2) include the introduced honeybee, which is the only species to be caught between 20 April and 11 September.

The alate ants belonged to approximately thirty-three species.

Although these results are necessarily biased due to the many variables indicated, the periods of activity are clearly shown for most groups in the Tables. Also the relative numbers between groups and between weeks are sufficiently consistent to suggest that they are a reasonable guide to abundance in the samples.

Many changes have taken place in the surrounding countryside since 1972 and later papers will document these changes and seek correlations between them and differences in the invertebrate samples collected.

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REFERENCES

Carver, M. (1978) - A new species of *Sensoriaphis* from New Guinea (Homoptera: Aphididae). Pacific Insects 19: 31-38.

Johnson, C.G. and Taylor, L.R. (1955) - The development of large suction traps for airborne insects. Ann. appl. Biol. 43: 51-61.

New, T.R. (1974) - Psocidae (Psocoptera) from southern Australia. J. Aust. ent. Soc. 13: 285-304.

Thornton, I.W.B. and New, T.R. (1977) - The Phillotarsidae (Insecta: Psocoptera) of Australia. Aust. J. Zool. Suppl. Ser. 54: 1-62.

Wells, A. (1979) - A review of the Australian Genera *Xuthotrichia* Mosely and *Hellyethira* Neboiss (Trichoptera: Hydroptilidae), with descriptions of New Species. Aust. J. Zool. 27: 311-329.