II. MAMMALS OF COCKLESHELL GULLY RESERVE AND ADJACENT AREAS

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INTRODUCTION

The survey of Cockleshell Gully Reserve recorded 9 species of native mammal. All specimens collected have been accessed into the Western Australian Museum with registration numbers M10741 to M10899 and M11653 to M11911 for those collected in October 1973 and May 1974 respectively. All female specimens were dissected and their reproductive organs examined *in situ* for breeding data.

Mammals were trapped using a 'standard' trapline consisting of 10 Elliott traps (32 cm x 10 cm x 8 cm) (Elliott Scientific Instrument Company, Upwey, Victoria) and 10 breakback (self-set) traps in alternate sequence, at a spacing of *ca* 10 metres. Two cage traps (12 x 14 x 40 cm 'National' design) were set at each trapline. Pit traps (P.V.C. tubing 60 cm long, 10 cm diameter) were used wherever soil conditions allowed. Thirty standard traplines were deployed at exactly the same sites each season. 'Universal' bait based on peanut paste, dried mixed fruit, rolled oats and bacon was used for all trapping. Locations of traplines are indicated in **Fig. 1.** A total of 8,856 trapnights were established.

Floristics and structure of vegetation were described at each trapline. Plant specimens collected were identified by the Western Australian Herbarium. Vegetation structure is described according to Muir (1977). The colours of soil A horizons at traplines were described from Munsell soil colour cards (Munsell Colour Co. Inc., Baltimore, Maryland, 21218, U.S.A. 1954 Exhibition), and their texture from Northcote (1971).

Trapping data, catch per unit effort data and descriptions of traplines are presented in **Appendices I, II** and **III.**

ANNOTATED LIST

Western Grey Kangaroo *(Macropus fuliginosus)*

M. fuliginosus were present throughout the Reserve and were most frequently sighted in the Dissected Region. For example, on a vehicle

traverse on 23 October 1973 between 0900 and 1200 hrs covering *ca* 20 km near the eastern boundary, 46 kangaroos were observed. This figure comprised 18 sightings of which the most common combination was an adult with a young at heel. In October and May Kangaroo sightings became progressively fewer towards the western side of the reserve. In May few young at heel were seen. Kangaroos were also frequently seen outside the reserve; on 26 May 1974 a group of *ca* 70 was seen in partially cleared land near Stockyard Gully.

Western Brush Wallaby *(Macropus irma)*

M. irma have not been collected in Cockleshell Gully Reserve but there are confirmed sight records from Cockleshell Gully, Mt Lesueur and Drovers Cave National Park. The Western Australian Museum has only one specimen, collected in 1958, from Hill River district.

Honey Possum *(Tarsipes spencerae)*

T. spencerae were collected with pit traps and once with an Elliott trap. In October 1973, 4 females were collected: 2 near trapline 5, and 2 near trapline 4. In May 1974, 4 females and 1 male were collected near traplines 4, 5, 9, 20. All these traplines were in heath formations on sandy soil and included the following profusely flowering species: *Calothamnus quadrifidus, Petrophile brevifolia, Banksia menziesii, B. attenuata* and *B. pinifolia.*

In October, 1 female (wt = 14.8 g) had 4 pouch young with mean head length 8 mm (supraoccipital to tip of snout). In May, 2 females (12.1, 7.0 g) had 4 pouch young with mean head lenght of 6 mm and 2 mm. Another female (10.7 g) had pouch young which were discarded on capture.

The seasonality of breeding for *Tarsipes* has been briefly reviewed by Kitchener & Chapman (1975). The Jurien results confirm our previous suggestion that the birth season extends at least from mid autumn to mid spring. However, the recent collection of females with very small pouch young from Jerdacuttup in January, and Denmark in February suggests that over its range *Tarsipes* may give birth throughout the year.

Common Dunnart *(Sminthopsis murina)*

Two males were collected in pit traps near trapline 5 in October 1973. In one case, stomach contents were masticated insects, the other had an empty stomach.

Fat-tailed Dunnart *(Sminthopsis crassicaudata)*

One male was collected under a small piece of decaying timber on a samphire flat near Eatha Spring in October 1973. The habitat there was similar to that at trapline 24. Another specimen was collected in similar

habitat by R.E. Johnstone in December 1971. In May 1974 a male and female were found together in a grass nest inside a dead blackboy, *Xanthorrhoea* sp., on heath at trapline 14. All had empty stomachs.

White-tailed Dunnart *(Sminthopsis granulipes)*

A male and female were trapped in heath at trapline 16 in May 1974 and 2 males were trapped in heath at trapline 14. Both these sites were on sandy soil on the Coastal Belt. All had empty stomachs. It is of interest that *S. crassicaudata* was also collected on sandplain heath at trapline 14.

Southern Bush Rat *(Rattus fuscipes fuscipes)*

R. f. fuscipes were widespread and abundant in Cockleshell Gully Reserve during this survey. They were trapped from fore-dunes at the beach to lateritic mesas of the Gairdner Range. In October 1973, 38 individuals were trapped at 6 traplines; in May 1974, 46 were trapped at 11 traplines. (Traps were set at the same sites each season). Catch per unit effort figures are given in **Appendix II.** Generally, *R. f. fuscipes* were present in situations with dense ground cover on sandy or loamy soil with a moist A horizon. The spring sample of 30 females included 14 which were pregnant. Weights of pregnant females ranged from 64.0 to 113.5 g. The number of foetuses ranged between 3 and 7 with a mode of 5 (mean 5.9). The May sample of 14 females included 2 pregnant animals. Both were trapped at trapline 13 which was in a swampy depression where the soil was very moist during May. This may suggest that post-summer breeding is restricted to sites where the soil remains moist.

This study is complemented by a similar work (Kitchener & Chapman 1975), which indicated that *R. f. fuscipes* breed during late spring—early summer at Cape Le Grand National Park on the south coast of Western Australia. In that study 39% of females were pregnant in December; the number of *in utero* embryos per pregnancy ranged between 2 and 7 with a mean of 4.8.

Females were identified as parous or non-parous by the presence or absence of placental scars. Incisor width of all specimens was measured as an index of relative age (see Warnecke, 1972). **Figure 1** indicates the difference in incisor width and relative age between October and May specimens. The variation in incisor width of October specimens suggests that breeding is well advanced and that many young of the year are entering the adult population at this month. The absence in May of specimens with incisor widths less than 0.90 mm suggests that birth of most young ceased well before mid autumn and that recruitment of young from the previous spring and summer into the adult population is largely complete at this month. This is confirmed by the large number of non-parous females in May (79%) compared to October (21%).

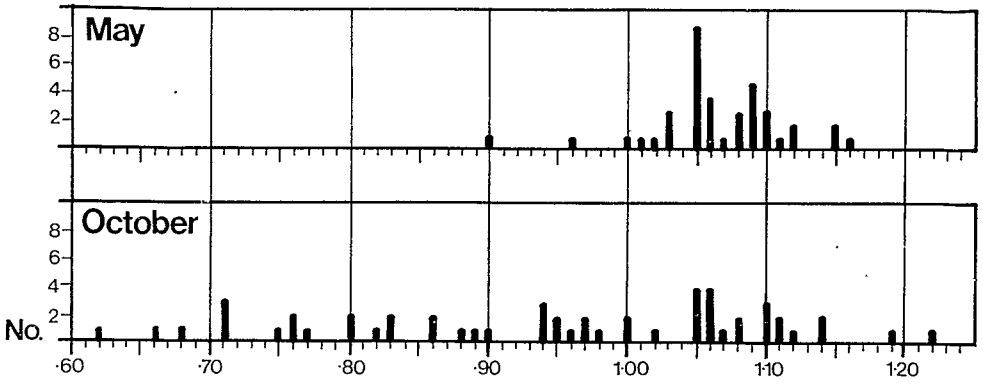

Fig. 1: Incisor Width (mm)

In summary our breeding data from this survey suggest that the major period of births is from early spring to summer, with infrequent births probably occurring through to winter. This conclusion confirms our findings at Cape Le Grand National Park and is in general agreement with those of Taylor & Horner (1973).

Our results also indicate that during spring *R. f. fuscipes* breed mostly in the low lying areas at the Reserve, perhaps because these areas maintain sufficient soil moisture to allow them to construct nest chambers in burrows. In autumn there appears to be a period of dispersion because in May they were captured in more traplines covering a wider variety of habitats than in October (see **Appendix II**).

Ashy Grey Mouse *(Pseudomys albocinereus)*

P. albocinereus were trapped on deep sandy soils from the fore-dunes at the beach to the Gairdner Range pediment and in sandy pockets within the Range. Twenty four were trapped in October 1973 at 6 traplines; 60 were trapped in May 1974 at 12 traplines. Catch per unit effort figures are given in **Appendix II.**

Of 13 females trapped in October 1973, 10 were pregnant, 2 had near-term foetuses with crown-rump length *ca* 2.0 cm, the others had foetuses approximately half this size. Weights of adults ranged from 20.0 to 44.6 g. Number of foetuses was from 2 to 6 with mean 4.5.

It appears that *Pseudomys albocinereus* populations can reach higher densities towards the northern coastal part of its range in Western Australia. Bannister (1969) recorded a catch per trap effort of 15.0% for this species on sandplain heath at Kalbarri National Park, some 300 km north of Jurien. But further south near Perth, Jackson & Morris (1975) recorded a catch per

trap effort of 0.09%, and at Cape Le Grand National Park on the south coast Kitchener & Chapman (1975) recorded 0.04% from similarly conducted surveys. However, we treat this interpretation with caution as rodent population numbers sometimes fluctuate dramatically.

Gould's Wattled Bat *(Chalinolobus gouldii)*

One male and 8 females were shot at Eatha Spring in December 1971 by R.E. Johnstone.

Chocolate Bat *(Chalinolobus morio)*

Not recorded in Reserve, but the Western Australian Museum has specimens from Hastings and Gooseberry Caves which are between Jurien and the Gairdner Range.

Little Bat *(Eptesicus pumilus)*

One female was shot in Marri *(Eucalyptus calophylla)* woodland at Cockleshell Gully in October 1973.

Lesser Long-eared Bat *(Nyctophilus geoffroyi)*

One female was collected under bark of a *Casuarina obesa* tree on the edge of a salt lake 5 km east of Green Head in March 1975, by M. Hanlon. A male was shot at Eatha Spring in December 1971 by R.E. Johnstone.

Australian Sea Lion*(Neophoca cinerea)*

N. cinerea are present on small islands off the Jurien Bay coast and are occasionally seen on the mainland. They breed and maintain a permanent colony on and around the Fisherman Islands (see Chapman, this publication) for location and description. These islands have been visited on 55 occasions by R.E. Johnstone over the past five years as part of a sea bird study (see Dell & Johnstone, this publication). The number present on North Fisherman Island has ranged from 43 individuals (January 1975) to 2 (December 1971). Between 15 and 25 are usually recorded, and variation in number appears to be non-seasonal. The period of births may extend throughout the year as newborn young were recorded in February, April, June, September and November. There is a tendency for the proportion of newborn young in the colony to be highest (up to 40%) in May and June. Newborn young frequently shelter under *Nitraria schoberi* shrubs on the island. Johnstone records a copulation observed on 20 May 1973 as follows: 'Male mounts female from behind climbing up over her back. The female lies on her belly with back flipper spread. She turns her head upwards grasping loose skin on male's neck to stabilize their union. Copulation lasted 24 minutes.'

House Mouse *(Mus musculus)*

M. musculus were widespread and abundant in the Reserve during these surveys. Sixty five were trapped in October 1973 at 17 traplines; 196 were trapped in May 1974 at 25 (out of 30) traplines. *Mus* were absent from traplines on salt lake margins which were either virtually under water or extremely dry. Catch per unit effort figures are given in **Appendix II.**

In October 1973 and May 1974, 10 of 36 and 11 of 60 females were pregnant respectively. Number of foetuses ranged from 1 to 8 with mean 5.4. Weights of pregnant females ranged from 13.3 to 21.0 g.

In other parts of south west Australia where similar trapping surveys have been done, pregnant *Mus* are usually collected in autumn (unpublished data from wheatbelt surveys).

At Cockleshell Gully Reserve the relatively high incidence of breeding in both autumn and spring may be due to local effects such as the high winter rainfall for 1973.

European Rabbit *(Oryctolagus cuniculus)*

Rabbits occur throughout the Reserve; most were seen around the salt lake and samphire complex.

Domestic Cattle *(Bos taurus)*

Some cattle were present on the Reserve. A grazing lease (number 667/41A), which covered approximately 60% of the area of the Reserve, has now lapsed.

Considerable damage has been done to Eatha Spring by cattle trampling the edge of the spring as they come in to water.

Cat *(Felis catus)*

One cat was trapped in a cage trap in October 1973.

Fox *(Vulpes vulpes)*

Foxes were seen on numerous occasions.

Pig *(Sus scrofa)*

Feral pigs are present on the Reserve; they inflict considerable damage to low shrubs and ground cover, particularly along Cockleshell Gully.

DISCUSSION

With the exception of *Sminthopsis granulipes* all mammal species recorded in this survey were previously known to inhabit the west coastal sand heaths between Moore and Murchison Rivers. *S. granulipes* has an apparently

limited distribution centred on the wheatbelt. *Sminthopsis crassicaudata*, *S. murina* and *Macropus fuliginosus* are widely distributed in southern Western Australia. Except for the apparent absence of *Isoodon obesulus*, *Cercartetus concinnus* and *Tachyglossus aculeatus*, the Reserve includes all ground mammal species currently known to inhabit heaths and shrublands on southern west coastal sandplains. Of these, *Tarsipes spencerae*, *Macropus irma* and *Sminthopsis granulipes* are endemic to south Western Australia.

The high numbers of *Rattus fuscipes*, *Pseudomys albocinereus* and *Mus musculus* collected on Cockleshell Gully Reserve are of particular interest. During the spring survey *Rattus fuscipes* and *Pseudomys albocinereus* were only trapped at the same trapline on one occasion. During the autumn survey, however, both species and *Mus musculus* were frequently trapped in the same trapline. We consider this change to be due to successful breeding and subsequent dispersal into new areas by young adult animals. In addition the dispersal may have been affected by the high May 1974 rainfall (250 mm) compared with the average (105 mm), rendering low lying areas too wet for rodents.

We have done similar trapping surveys at Cape Le Grand National Park on the south coast of Western Australia (Kitchener & Chapman, 1975) and many others in the wheatbelt (Kitchener, 1976). *Tarsipes spencerae*, *Pseudomys albocinereus* and *Rattus fuscipes* were common to Cape Le Grand National Park and Cockleshell Gully Reserve. This is not unexpected as these species are components of a characteristic sandplain heath fauna found in the southern and western coastal sandplain areas.

With the exception of *Rattus fuscipes* which has a predominantly coastal distribution (Baynes *et al.*, 1976), all mammal species from Cockleshell Gully Reserve have been recorded from reserves in the wheatbelt in the last three years. However, the relative abundance of some species appears to differ between coastal and inland situations. For example *Tarsipes spencerae* and *Pseudomys albocinereus* seem to be more widespread and abundant on Cockleshell Gully Reserve than any wheatbelt reserve. Whether this is because populations of these species on wheatbelt reserves are depleted due to the small size and fragmented nature of these reserves or whether these species achieve different population levels over different parts of their range, is at present unknown.

The mammal fauna of the Jurien Bay area is of particular interest because it is one of the few places in Western Australia where the extant fauna can be compared with a recent fossil fauna. **Table 1** is compiled from data in Lundelius (1957, 1960), the results of this survey, and other Western Australian Museum records. The Lundelius data are based on fossil material

(considered accumulated by owls) from the surface of a deposit in Hastings Cave 8 km NE of Jurien. Lundelius (1957) considers that the surface fossil fauna represents the mammal fauna of the district just prior to European settlement of Western Australia. Further, with the exception of *Macropus irma*, *Antechinus flavipes* and *Canis familiaris dingo* all the 'cave surface' species of Table 1 have been recorded *in situ*, 1-2 cm beneath the surface of Hastings Cave in a separate excavation by A. Baynes. A radiocarbon date of $400^{\pm}$ 70 years (Ga K-2446) has been determined for this layer. (A. Baynes, pers. comm. 1976).

Of the 18 species listed as probably present in the district prior to European settlement, only 6 were recorded in this survey. With the possible exceptions of *Dasyurus geoffroii* and *Isoodon obesulus* which we failed to detect, this discrepancy is probably due to local extinction of species. Of these, *Pseudomys shortridgei* is probably extinct throughout Western Australia (Baynes, 1975). Others have undergone considerable contractions in range. To this category belong *Rattus tunneyi*, *Pseudomys praeconis* and *Dasycercus cristicauda*, now, except for *R. tunneyi* in the Kimberley, restricted to arid and semi-arid areas to the north and east of Jurien. *Pseudomys occidentalis*, *Notomys* sp., *Isoodon obesulus*, *Antechinus apicalis* and *Bettongia penicillata* were probably present in the Jurien area prior to European settlement but are now apparently absent; they still exist elsewhere in the south west of the State.

Table 1 also includes 12 species currently recorded from the district but which are not represented in the fossil fauna. Six of these are introduced exotic species. It is likely that the 4 species of bat in Table 1 were present prior to European settlement, but were not in the deposit either because they are not preyed on by owls, or the cave was an unsuitable roost for bats at the time of the accumulation of the surface layer. The absence of *Tarsipes spencerae* from the fossil fauna probably does not indicate absence from the district because this species is seldom recorded as a fossil because of its small size and delicate skeletal structure (Baynes *et al.*, 1976). *Sminthopsis crassicaudata*, however, has never been recorded in a fossil deposit on the coastal plain in Western Australia (Archer &Baynes, 1973). Its presence in the extant fauna may indicate a recent invasion from the east of the coastal plain near Jurien. This may be associated with the clearing of land for agriculture as this species is often found on cleared land in the wheatbelt. It is also possible that it was introduced by human agency; for example, in a truckload of mallee roots or fence posts.

Table 1: Comparison between mammal species probably present prior to European settlement and extant fauna in Jurien Bay district.

	Cave Surface Fauna	Extant Fauna—W.A. Museum records and 1973/74 Survey
Bettongia penicillata	+	—
Macropus fuliginosus ('M. cangura')[1]	*	+
Macropus irma ('Protemnodon irma')[1]	*	+
Dasycercus cristicauda ('D. blythi')[1]	+	—
Dasyurus geoffroii	*	—
Antechinus flavipes	+	—
Antechinus apicalis	+	—
Sminthopsis murina ('S. hirtipes')[2]	+	+
Sminthopsis granulipes ('S sp.' large)[2]	?	+
Sminthopsis crassicaudata	—	+
Isoodon obesulus	*	—
Tarsipes spencerae	—	+
Notomys sp.	*	—
Pseudomys albocinereus	*	+
Pseudomys occidentalis	+	—
Pseudomys shortridgei	+	—
Pseudomys praeconis ('P. nanus')[2]	+	—
Rattus tunneyi ('R. fuscipes')[2]	*	—
Rattus fuscipes ('R. sp.')[2]	*	+
Macroderma gigas	+	—
Chalinolobus morio	—	+
Chalinolobus gouldii	—	+
Eptesicus pumilus	—	+
Nyctophilus geoffroyi	—	+
Canis familiaris dingo	*	—
Felis catus	—	+
Mus musculus	—	+
Oryctolagus cuniculus	—	+
Vulpes vulpes	—	+
Bos taurus	—	+
Sus scrofa	—	+

— Not recorded
\+ Recorded—Lundelius, (1957) for pre-European fauna. This survey for extant fauna.
* Recorded—Lundelius, (1960) for cave surface layer.
1 Nomenclatural change from Lundelius (1957, 1960) see Ride (1970).
2 Nomenclatural change from Lundelius (1957, 1960) see Archer & Baynes (1973).

The reasons for the pronounced faunal change in the Jurien district over the recent past are not clear. Factors such as the introducation of feral predators and grazing species, possible alteration to fire ecology by increased frequency of burning the vegetation and clearing with introduction of livestock and climatic change are probably involved. However, although *Antechinus apicalis*, *Isoodon obesulus* and *Pseudomys occidentalis* are probably locally extinct at Jurien Bay, they survive elsewhere in the south west under similar environmental changes to those listed above. This suggests that faunal change is very complex and that local as well as gross environmental changes are involved.

ACKNOWLEDGEMENTS

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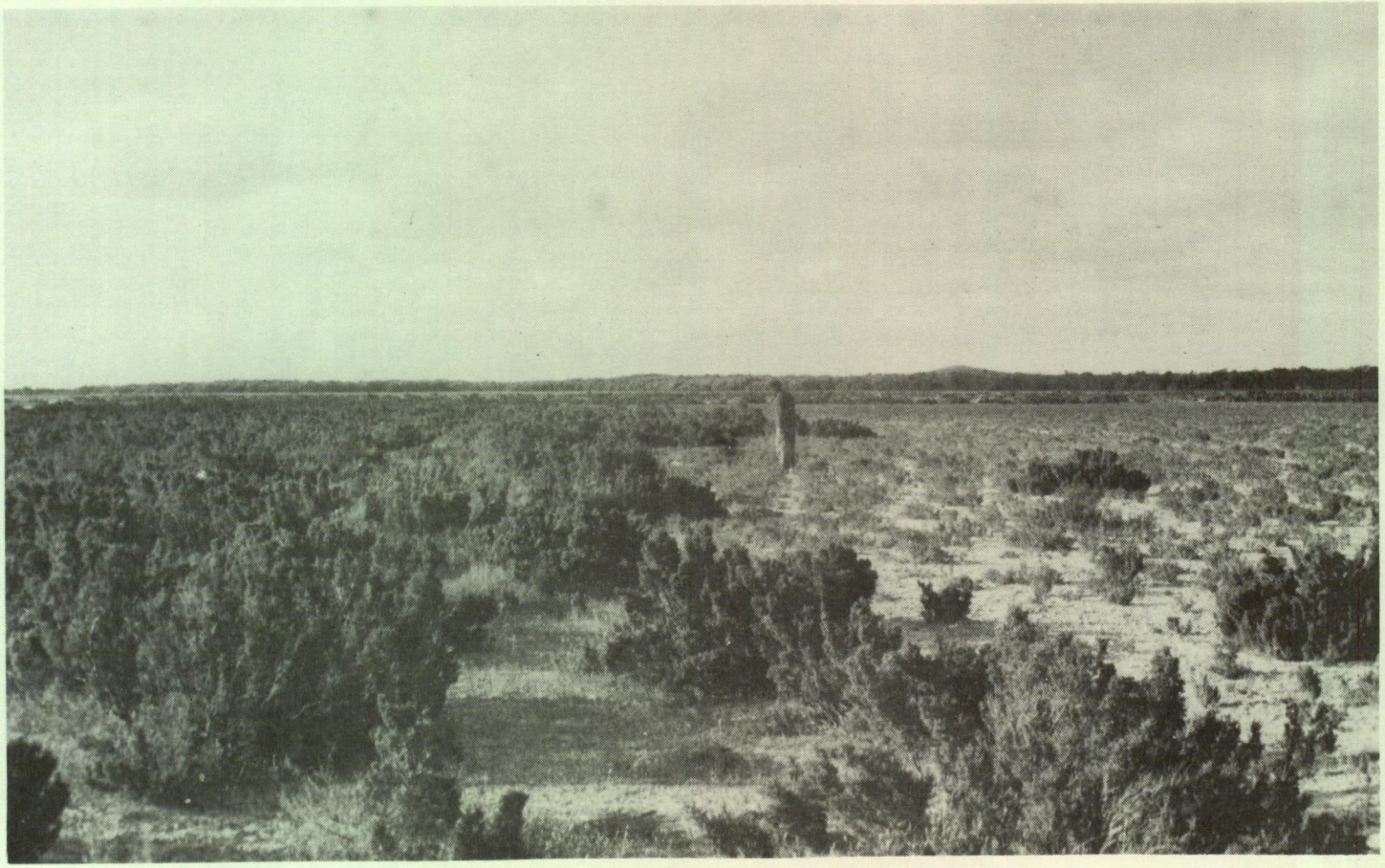

Plate 1. Samphire Vegetation (Coastal Belt)

APPENDIX I TRAPPING EFFORT IN TRAPNIGHTS FOR COCKLESHELL GULLY RESERVE

BB = Breakback trap, E = Elliott trap, C = Cage trap, P = Pit trap

Trapline No.	Description	OCTOBER 1973				MAY 1974			
		BB	E	C	P	BB	E	C	P
1	Woodland *over* Open Low Scrub B *over* Open Dwarf Scrub D	70	70	14	35	50	50	10	0
2	Heath B	70	70	14	35	50	50	10	0
3	Dwarf Scrub D	70	70	14	35	50	50	10	0
4	Dense Heath A *over* Low Heath C *over* Open Dwarf Scrub D	70	70	14	35	50	50	10	30
5	Low Scrub B *over* Low Heath C *over* Open Dwarf Scrub D	70	70	14	105	50	50	10	15
6	Dwarf Scrub C	70	70	14	30	50	50	10	0
7	Heath B *over* Low Heath C	70	70	14	35	50	50	10	0
8	Low Scrub A *over* Low Heath C	70	70	14	35	50	50	10	0
9	Low Scrub A *over* Low Scrub B *over* Dwarf Scrub D	70	70	14	35	50	50	10	15
10	Woodland *over* Heath A *over* Herbs	70	70	14	35	50	50	10	0
11	Scrub *over* Low Scrub A *over* Dwarf Scrub C *over* Open Herbs	60	60	12	24	60	60	12	0
12	Scrub *over* Low Scrub A *over* Dwarf Scrub C *over* Open Herbs	60	60	12	24	60	60	12	24
13	Heath A *over* Low Heath C *over* Low Heath D	60	60	12	24	60	60	12	0
14	Low Heath C *over* Dwarf Scrub D	60	60	12	30	60	60	12	24
15	Dense Thicket *over* Low Scrub A	60	60	12	30	60	60	12	24
16	Low Heath C *over* Open Herbs	60	60	12	30	60	60	12	12
17	Thicket *over* Heath A *over* Open Herbs	60	60	12	30	60	60	12	0
18	Low Woodland A *over* Scrub *over* Very Open Herbs	60	60	12	30	60	60	12	24
19	Heath A *over* Heath B *over* Dwarf Scrub D	60	60	12	30	60	60	12	24
20	Low Heath D	60	60	12	30	60	60	12	18
21	Low Woodland A *over* Dwarf Scrub D	60	60	12	0	60	60	12	0
22	Tall Sedges *over* Dwarf Scrub D	60	60	12	0	60	60	12	0
23	Heath A *over* Low Sedges	60	60	12	0	60	60	12	0
24	Dwarf Scrub C	60	60	12	0	60	60	12	0
25	Scrub	60	60	12	0	60	60	12	0
26	Low Forest A	60	60	12	0	60	60	12	0
27	Dense Thicket *over* Low Scrub A	60	60	12	6	60	60	12	0
28	Low Heath C *over* Open Herbs	60	60	12	0	60	60	12	0
29	Low Heath D	60	60	12	0	60	60	12	0
30	Low Scrub A *over* Low Scrub B *over* Open Low Grass	60	60	12	0	60	60	12	24
		Total = 4888				Total = 3968			

APPENDIX II

CATCH PER 100 TRAP NIGHTS FOR RODENT SPECIES TRAPPED IN COCKLESHELL GULLY RESERVE

TRAPLINE NO.	*Rattus fuscipes*		*Pseudomys albocinereus*		*Mus musculus*	
	October 1973	May 1974	October 1973	May 1974	October 1973	May 1974
1.	—	—	—	—	0.7	—
2.	0.7	—	—	—	3.0	10.0
3.	—	1.0	—	1.0	—	24.0
4.	—	8.0	—	2.0	0.7	—
5.	—	—	4.3	11.0	0.7	—
6.	0.7	3.0	2.9	10.0	0.7	5.0
7.	—	—	—	1.0	5.0	12.0
8.	—	5.0	—	9.0	0.7	3.0
9.	—	—	0.8	5.0	—	5.0
10.	—	—	—	—	2.9	17.0
11.	—	—	—	—	—	1.7
12.	—	—	—	—	3.3	5.8
13.	5.8	3.0	—	—	9.2	5.8
14.	—	—	3.3	3.3	—	4.2
15	—	—	—	—	—	4.2
16.	—	2.5	0.8	6.7	2.5	5.8
17.	2.5	2.5	—	—	1.7	15.0
18.	—	—	—	—	0.8	8.3
19.	—	—	—	—	3.3	5.0
20.	—	—	0.8	0.8	3.3	6.7
21.	—	—	—	—	—	3.3
22.	—	3.3	—	—	0.8	1.7
23.	3.3	1.6	—	—	4.2	5.8
24.	—	—	—	—	—	1.0
25.	—	1.6	—	—	—	5.0
26.	—	—	—	—	—	1.7
27	—	—	—	—	—	—
28.	—	—	—	—	—	2.5
29.	—	—	—	1.4	—	—
30.	13.4	10.9	—	2.5	—	9.2

APPENDIX III

VEGETATION DESCRIPTIONS AT TRAPLINES

Note: Plant species in each stratum are listed in approximate order of decreasing abundance. Native mammal species are listed in alphabetical order.

TRAPLINE 1

Key Description: Woodland *over* Open Low Scrub B *over* Open Dwarf Scrub D *on* light clay. Code: eMi.xSBd.xSDr/LC.

Stratum 1. *Eucalyptus wandoo, E. rudis* trees, 15-30 m tall, 10-30% canopy cover.

Stratum 2. *Melaleuca rhaphiophylla, Acacia lasiocarpa* var. *lasiocarpa* shrubs. Several other species present. Stratum to 1.5 m tall, ⟨10% canopy cover.

Stratum 3. *Hakea lissocarpha, Trymalium spathulatum* shrubs. Several other species present. Stratum to 0.5 m tall, ⟨10% canopy cover.

Comments: *E. wandoo* and *E. rudis* follow creek bed. Leaf litter: Absent. Soil: Light olive brown, 2.5Y 5/4, 6, light clay. Mammals recorded: *Mus. musculus.*,

TRAPLINE 2

Key Description: Heath B *on* heavy clay. Code: xSBd/HC.

Unstratified. *Viminaria juncea* shrubs. Also present were *Darwinia nieldiana, Cryptandra arbutiflora* var. *tubulosa, Olearia axillaris, Melaleuca platycalyx* and *Hakea lissocarpha* shrubs. Stratum to 1.5 m tall, 30-70% canopy cover.

Leaf litter: Sparse, clumped. Soil: Dark yellowish brown, 10YR 4,3/4, heavy clay. Mammals recorded: *Rattus fuscipes, Mus musculus.*

TRAPLINE 3

Key Description: Dwarf Scrub D *on* clayey sand. Code: xSDi/CLS.

Unstratified. *Verticordia huegelii* and *Dryandra* sp. shrubs. Also present were *Hakea undulata, Melaleuca* affin. *scabra, Baeckea grandiflora, Hakea incrassata, Petrophile seminuda, Daviesia* sp. and *Scaevola glandulifera* shrubs. Stratum 0.5 m tall, 10-30% canopy cover.

Comments: *Xanthorrhoea* sp. emergent. Trapline situated on gravelly hill slope. Leaf litter: Sparse. Soil: Dark greyish brown, 10YR 4/2, clayey sand. Mammals recorded: *Pseudomys albocinereus, Rattus fuscipes, Mus musculus.*

TRAPLINE 4

Key Description: Dense Heath A *over* Heath C *over* Open Dwarf Scrub D *on* loamy sand. Code: xSAd.xSCc.xSDr/LS.

Stratum 1. *Hakea trifurcata, Daviesia nudiflora* and *Melaleuca acerosa* shrubs. Stratum to 2 m tall, 70-100% canopy cover.

Stratum 2. Several species of shrubs including *Calothamnus quadrifidus, Hibbertia lineata, Verticordia densiflora, Petrophile brevifolia, Grevillea amplexans* and *Melaleuca platycalyx*. Stratum to 1 m tall, 30-70% canopy cover.

Stratum 3. *Pimelea imbricata, Eryngium pinnatifidum* shrubs and *Leptocarpus coangustatus* sedge. Stratum 0.5 m tall, 10% canopy cover.

Comments: *Eucalyptus wandoo* and *E. calophylla* trees to 14 m tall along sides of creek. *Cassytha racemosa* (hemiparasitic climber) present on low shrubs, particularly *Calothamnus quadrifidus.* Trapline situated along creek bed. Leaf litter: Sparse. Soil: Very dark greyish brown, 2.5YR 3/2, loamy sand. Mammals recorded: *Pseudomys albocinereus, Rattus fuscipes, Tarsipes spencerae, Mus musculus.*

TRAPLINE 5

Key Description: Low Scrub B *over* Low Heath C *over* Open Dwarf Scrub D *on* loamy sand. Code: xSBi.xSCc.xSDr/LS.

Stratum 1. *Conospermum triplinervium* and *Adenanthos cygnorum* shrubs to 1.5 m tall, 10-30% canopy cover.

Stratum 2. *Banksia menziesii* and *B. attenuata* shrubs to 1.0 m tall, 30-70% canopy cover.

Stratum 3. *Eremaea* sp., *Jacksonia floribunda, Baeckea grandiflora, Petrophile brevifolia, Andersonia heterophylla, Hibbertia lineata* shrubs, *Conostylis aculeata* ssp. *preissi, Phlebocarya filifolia, Stylidium adpressum* herbs, *Spinifex hirsutus* bunch grass to 0.5 m ⟨10% canopy cover.

Comments: Trapline on sandstone derived sands in pockets of Dissected Region. Leaf litter: Sparse. Soil: Very dark grey, 2.5YR 3/0, loamy sand. Mammals recorded: *Pseudomys albocinereus, Sminthopsis murina, Tarsipes spencerae, Felis catus, Mus musculus.*

TRAPLINE 6

Key Description: Dwarf Scrub C *on* clayey sand. Code: xSCi/CLS.

Unstratified. *Dryandra* sp. nov., *Dryandra nivea, Melaleuca* affin. *scabra, Verticordia chrysantha, Hakea undulata, Jacksonia restioides* and *Xanthosia tomentosa* shrubs 0.5-1.0 m, 10-30% canopy cover.

Leaf litter: Absent. Soil: Dark greyish brown, 10YR 4/2, clayey sand. Mammals recorded: *Pseudomys albocinereus, Rattus fuscipes, Mus musculus.*

TRAPLINE 7

Key Description: Heath B *over* Low Heath C *on* clayey sand. Code: x.SBc.xSCc/CLS.

Stratum 1: *Gastrolobium spinosum, Melaleuca* affin. *scabra, Acacia lasiocarpa* var. *lasiocarpa* shrubs 1.0-1.5 m, 30-70% canopy cover.

Stratum 2. *Hakea undulata, Petrophile brevifolia* shrubs 0.5-1.0 m, 30-70% canopy cover.

Comments: Trapline situated in eroded gully *ca* 7 m deep. Leaf litter: Sparse. Soil: Light olive brown, 2.5Y 5/4, 6, clayey sand. Mammals recorded: *Pseudomys albocinereus, Mus musculus.*

TRAPLINE 8

Key Description: Low Scrub A *over* Low Heath C *on* clayey sand; Code: xSAi.SCc/CLS.

Stratum 1. *Jacksonia floribunda* and *Xanthorrhoea* sp. shrubs to 2 m, 10-30% canopy cover.

Stratum 2.*Calothamnus quadrifidus, Eremaea* sp., *Hakea conchifolia, Lambertia multiflora, Petrophile brevifolia, Isopogon linearis, Synaphea spinulosa, Conospermum triplinervium, Dryandra nivea, Baeckea grandiflora* and *Xanthosia* sp. shrubs to 1 m, 30-70% canopy cover.

Leaf litter: Sparse and clumped. Soil: Dark greyish brown, 10YR 4/2, clayey sand. Mammals recorded: *Pseudomys albocinereus, Rattus fuscipes, Mus musculus.*

TRAPLINE 9

Key Description: Low Scrub A *over* Low Scrub B *over* Dwarf Scrub D *on* loamy sand. Code: n_1SAi.xSBi.xSDi/LS n_1 = *Adenanthos cygnorum*

Stratum 1. *Adenanthos cygnorum* shrubs to 2.0 m, 10-30% canopy cover.

Stratum 2. *Banksia menziesii, B. attenuata* shrubs to 1.5 m, 10-30% canopy cover.

Stratum 3. *Eremaea* sp., *Jacksonia floribunda, Pityrodia bartlingii, Melaleuca rhaphiophylla, Andersonia heterophylla, Verticordia ovalifolia, Calothamnus quadrifidus, Stirlingia latifolia* shrubs, *Stylidium crossocephalum* herb, *Spinifex hirsutus* bunch grass to 0.5 m, 10-30% canopy cover.

Leaf litter: Moderately abundant. Soil: Very dark greyish brown, 10YR 3/2, loamy sand. Mammals recorded: *Pseudomys albocinereus, Tarsipes spencerae, Mus musculus.*

TRAPLINE 10

Key Description: Woodland *over* Heath A *over* Herbs *on* loamy sand. Code: eMi.xSAc.xJc/LS.

Stratum 1. *Eucalyptus calophylla* and *E. rudis* trees 10-30 m, 10-30% canopy cover.

Stratum 2. *Calothamnus quadrifidus, Acacia pulchella* var. *glaberrima, Viminaria juncea, Melaleuca rhaphiophylla, Phyllanthus calycinus, Hakea lissocarpha, Acacia rostellifera* and *Acacia saligna* shrubs 1.5-2.0 m, 30-70% canopy cover.

Stratum 3. *Drosera gigantea, Conostylis aculeata* ssp *preissi, Podolepis lessonii* herbs, *Erynguim pinnatifidum* shrubs, *Lepidosperma costale* sedge 0.-0.5 m, 30-70% canopy cover.

Comments: Trapline situated along banks of Cockleshell Gully. Leaf litter: Absent. Soil type: Very dark greyish brown, 10YR 3/2, loamy sand. Mammals recorded: *Tarsipes spencerae, Mus musculus.*

TRAPLINE 11

Key Description: Scrub *over* Low Scrub A *over* Dwarf Scrub C *over* Open Herbs, *on* loamy sand. Code: xSi.xSAi.xSCi.xJi/LS.

Stratum 1. *Kingia australis, Banksia menziesii,* and *B. attenuata* shrubs to 4 m, 10-30% canopy cover.

Stratum 2. *Adenanthos cygnorum, Guichenotia ledifolia* shrubs to 2 m, 10-30% canopy cover.

Stratum 3. *Eremaea beaufortiodes, Jacksonia floribunda, Hibbertia hypericoides* shrubs to 1.0 m, 10-30% canopy cover.

Stratum 4. *Conostylis aculeata* ssp. *preissii* herbs, *Xanthorrhoea* sp. shrubs ⟨0.5 m, 10-30% canopy cover.

Leaf litter: Moderate, evenly distributed. Soil: Dark grey, 10YR 4/1, loamy sand. Mammals recorded: *Mus musculus.*

TRAPLINE 12

Key Description: Scrub *over* Low Scrub A *over* Dwaft Scrub C *over* Open Herbs, *on* loamy sand. Code: x.Si.xSAi.xSCi.xJi/LS.

Stratum 1. *Kingia australis, Banksia menziesii,* and *B. attenuata* shrubs to 4 m, 10-30% canopy cover.

Stratum 2. *Guichenotia ledifolia* shrubs to 2 m, 10-30% canopy cover.

Stratum 3. *Eremaea beaufortiodes, Jacksonia floribunda, Hibbertia hypericoides* shrubs to 1.0 m, 10-20% canopy cover.

Stratum 4. *Conostylis aculeata* ssp. *preissii* herbs, *Xanthorrhoea* sp. shrubs 0.5 m, 10-30% canopy cover.

Leaf litter: Moderate, evenly distributed. Soil: Dark grey, 10YR 4/1, loamy sand. Mammals recorded: *Mus musculus.*

TRAPLINE 13

Key Description: Heath A *over* Low Heath C *over* Low Heath D *on* loamy sand, Code: n_1SAc.mSCc.xSDc/LS n_1 = *Viminaria Juncea*

Stratum 1. *Viminaria Juncea* shrubs to 2 m, 30-70% canopy cover.

Stratum 2. *Melaleuca rhaphiophylla, M. viminea* shrubs to 1 m, 30-70% canopy cover.

Stratum 3. *Calothamnus* sp., *Verticordia* sp., *Petrophile seminuda, Dryandra nivea* shrubs, *Gahnia trifida, Leptocarpus coangustatus* sedges, *Scaevola longifolia* and *Drosera gigantea* herbs, 30-70% canopy cover.

Comments: Trapline situated in swamp depression. Leaf litter: Absent. Soil: Dark greyish brown, 10YR 4/2, loamy sand. Mammals recorded: *Rattus fuscipes, Mus musculus.*

TRAPLINE 14

Key Description: Low Heath C *over* Dwarf Scrub D *on* loamy sand. Code: n_1SCc.xSDi/LS n_1 = *Conospermum stoechadis.*

Stratum 1. *Conospermum stoechadis* shrubs to 1.0 m, 30-70% canopy cover.

Stratum 2. *Banksia pinifolia, Hakea incrassata, Dryandra sessilis, Scholtzia umbellifera, Melaleuca scabra, Hibbertia hypericoides, H. racemosa* shrubs, *Scaevola paludosa, S. canescens Patersonia* sp., *Lechenaultia* sp. herbs, *Mesomelaena stygia* sedge to 0.5 m, 10-30% canopy cover.

Comments: Trapline situated in area of limestone outcropping. *Conospermum stoechadis* may indicate regrowth following fire. Leaf litter: Absent. Soil: Very dark greyish brown, 10YR 3/2, loamy sand. Mammals recorded: *Pseudomys albocinereus, Sminthopsis granulipes, S. crassicaudata, Mus musculus.*

TRAPLINE 15

Key Description: Dense Thicket *over* Low Scrub A *on* loamy sand. Code: aSd.xSAi/LS.

Stratum 1 *Acacia rostellifera* shrubs to 4 m, 70-100% canopy cover.

Stratum 2. *Banksia pinifolia, B. menziesii, Macrozamia riedlei, Jacksonia ulicina, Eremaea beaufortiodes, Viminaria juncea, Melaleuca rhaphiophylla, Dryandra sessilis* shrubs 1.5-2.0 m, 10-30% canopy cover.

Leaf litter: Sparse, evenly distributed. Soil: Dark greyish brown, 10YR 4/2 loamy sand. Mammals recorded: *Mus musculus.*

TRAPLINE 16

Key Description: Low Heath C *over* Open Herbs on clayey sand. Code: xSCc.n_1Ji/CLS. n_1 = *Conostylis aculeata.*

Stratum 1. *Calothamnus quadrifidus, Daviesia nudiflora, Hakea incrassata, Hibbertia hypericoides, Melaleuca scabra* shrubs to 1 m, 30-70% canopy cover.

Stratum 2. *Conostylis aculeata* herbs to 0.5 m, 10-30% canopy cover.

Leaf litter: Sparse, clumped. Soil: Very dark greyish brown, 10YR 3/2, clayey sand. Mammals recorded: *Pseudomys albocinereus, Rattus fuscipes, Sminthopsis granulipes, Mus musculus.*

TRAPLINE 17

Key Description: Thicket *over* Heath A *over* Open Herbs *on* loamy sand. Code: aSc. xSAc.n_1Ji/LS. n_1 = *Conostylis aculeata*

Stratum 1. *Acacia rostellifera* to 4 m, *Dryandra sessilis, Guichenotia ledifolia* shrubs 2 m, 30-70% canopy cover.

Stratum 2. *Calothamnus quadrifidus, Labichea cassioides, Melaleuca scabra, Hibbertia lineata, Jacksonia floribunda* shrubs to 2.0 m, 30-70% canopy cover.

Stratum 3. *Conostylis aculeata* herbs to 0.5 m, 10-30% canopy cover.

Leaf litter: Sparse, clumped. Soil: Very dark greyish brown, 10YR 3/2, loamy sand. Mammals recorded: *Rattus fuscipes, Mus musculus.*

TRAPLINE 18

Key Description: Low Woodland A *over* Scrub *over* Very Open Herbs *on* loamy sand. Code: eLAi.xSi.n_1Jr/LS. n_1 = *Conostylis aculeata.*

Stratum 1. *Eucalyptus calophylla* trees to 10 m, 10-30% canopy cover.

Stratum 2. *Acacia rostellifera, Jacksonia furcellata, Melaleuca cardiophylla, Jacksonia sternbergiana,* shrubs >2 m, 10-30% canopy cover.

Stratum 3. *Conostylis aculeata* herbs to 0.5 m <10% canopy cover.

Comments: Stratum 3 species reduced due to cattle grazing. Leaf litter: Sparse, clumped. Soil: Very dark greyish brown, 10YR 3/2, loamy sand. Mammals recorded: *Mus musculus.*

TRAPLINE 19

Key Description: Heath A *over* Heath B *over* Dwarf Scrub D *on* loamy sand. Code: n_1SAc.xSBc.n_2Di/LS n_1 = *Dryandra sessilis* n_2 = *Spyridium complicatum.*

Stratum 1. *Dryandra sessilis* shrubs to 2.0 m. 30-70% canopy cover.

Stratum 2. *Calothamnus quadrifidus, Hakea incrassata, Banksia pinifolia, Hakea costata, Melaleuca scabra, Scholtzia umbellifera* shrubs, 1.0-1.5 m, 30-70% canopy cover.

Stratum 3. *Spyridium complicatum* shrubs 0-0.5 m 10-30% canopy cover.

Comments: Trapline situated in area of extensive limestone outcropping. Leaf litter: Sparse, clumped. Soil: Very dark greyish brown, 10YR 3/2, loamy sand. Mammals recorded: *Mus. musculus.*

TRAPLINE 20

Key Description: Low Heath D *on* loamy sand. Code: xSDc./LS.

Stratum 1. *Banksia pinifolia, Hakea incrassata, Dryandra sessilis, Scholtzia umbellifera, Melaleuca scabra, Conospermum stoechadis, Hibbertia hypericoides, H. racemosa* shrubs, *Scaevola paludosa, Patersonia* sp. herbs, 0-.0.5 m, 30-70% canopy cover.

Leaf litter: Sparse. Soil: Dark greyish brown, 10YR 4/2, loamy sand. Mammals recorded: *Pseudomys albocinereus, Tarsipes spencerae, Mus musculus.*

TRAPLINE 21

Key Description: Low Woodland A *over* Dwarf Scrub D *on* silt loam. Code: cLAi.xSDi/SiL.

Stratum 1. *Casuarina obesa* trees, 5.0-10.0 m, 10-30% canopy cover.

Stratum 2. *Sporobolus virginicus* bunch grass, *Threlkeldia diffusa, Salicornia* sp. shrubs to 0.5 m, 10-30% canopy cover.

Comments: Trapline surrounded freshwater spring on edge of saltlake. *Juncus maritimus* and *Typha* sp. grew within the spring. Leaf litter: Moderately abundant. Soil: Dark greyish brown, 10YR 4/2, silt loam. Mammals recorded: *Mus musculus.*

TRAPLINE 22

Key Description: Tall Sedges *over* Dwarf Scrub D *on* silt loam. Code: n_1VTc.xSdi/SiL. n_1 = *Juncus maritimus.*

Stratum 1. *Juncus maritimus* sedges ⟨1 m, 30-70% canopy cover.

Stratum 2. *Salicornia* sp. shrubs, *Wilsonia humilus* mat plants, 10-30% canopy cover.

Comments: Trapline situated on edge of saltlake. Leaf litter: Absent. Soil: Dark greyish brown,10YR 4/2 silt loam. Mammals recorded: *Rattus fuscipes, Mus musculus.*

TRAPLINE 23

Key Description: Heath A *over* Low Sedges *on* sandy clay loam. Code: mSAc.n_1VLc/SCL n_1 = *Gahnia trifida.*

Stratum 1. *Melaleuca* sp. shrubs 1.5-2.0 m, 30-70% canopy cover.

Stratum 2. *Gahnia trifida* sedges ⟨1 m, 30-70% canopy cover.

Comments: *Casuarina obesa* to 5 m emergent. Leaf litter: Sparce, clumped. Soil: Dark greyish brown, 10YR 4/2 sandy clay loam. Mammals recorded: *Rattus fuscipes, Mus musculus.*

TRAPLINE 24

Key Description: Dwarf Scrub C *on* fine sandy loam. Code: xSDi/FSL.

Stratum 1. *Arthrocnemum halocnemoides* var. *pergranulatum, Salicornia* sp. shrubs to 0.5 m, 10-30% canopy cover, Leaf litter: Absent. Soil: Dark grey, 10YR 4/1, fine sandy loam. Mammals recorded: *Mus musculus.*

TRAPLINE 25

Key Description: Scrub *on* sandy clay loam. Code: mSi/SCL.

Stratum 1. *Melaleuca huegelii, M. cardiophylla* shrubs to 4 m, 10-30% canopy cover.

Leaf litter: Sparse, restricted to bases of shrubs. Soil: Dark greyish brown, 10YR 4/2, sandy clay loam. Mammals recorded: *Rattus fuscipes, Mus musculus.*

TRAPLINE 26

Key Description: Low Forest A *on* sandy clay loam. Code: cLAc/SCL.

Stratum 1. *Casuarina obesa* trees to 7 m 30-70% canopy cover.

Leaf litter: Abundant, (*Casuarina* needles). Soil: Dark greyish brown (10YR 4/2) sandy clay loam. Mammals recorded: *Mus musculus.*

TRAPLINE 27

Key Description: Dense Thicket *over* Low Scrub A *on* sandy loam. Code: aSd.mSAi/SL.

Stratum 1. *Acacia rostellifera* shrubs ⟩2 m, 70-100% canopy cover.

Stratum 2. *Melaleuca huegelii* and *M.* sp. shrubs to 2 m, 10-30% canopy cover.

Comments: Trapline situated in swale between consolidated sand dunes. Leaf litter: Moderate, clumped. Soil: Dark greyish brown, 10YR 4/2, sandy loam. Mammals recorded: None.

TRAPLINE 28

Key Description: Low Heath C *over* Open Herbs *on* sandy loam. Code: xSCc.n_1Ji/SL. n_1 = *Conostylis aculeata.*

Stratum 1. *Melaleuca* ? *acerosa, Acacia lasiocarpa* var. *lasiocarpa, Rhagodia preissii* shrubs to 1 m, 30-70% canopy cover.

Stratum 2. *Conostylis aculeata* herbs to 0.5 m, 10-30% canopy cover.

Comments: Trapline situated on consolidated dune. Leaf litter: Absent. Soil: Dark greyish brown, 10YR 4/2, sandy loam. Mammals recorded: *Mus. musculus.*

TRAPLINE 29

Key Description: Low Heath D *on* sandy loam. Code: xSDc/SL.

Stratum 1. *Melaleuca huegelii, Pimelea ferruginea, Melaleuca* ? *acerosa, Acacia lasiocarpa* var. *lasiocarpa, A. cuneata* shrubs to 0.5 m, 30-70% canopy cover.

Leaf litter: Absent. Soil: Greyish brown, 10YR 5/2, sandy loam. Mammals recorded: *Pseudomys albocinereus.*

TRAPLINE 30

Key Description: Low Scrub A *over* Low Scrub B *over* Open Low Grass *on* sand. Code: n_1SAi.xSBi.xGli/S n_1 = *Atriplex isatidea*

Stratum 1. *Atriplex isatidea* shrubs to 2 m, 10-30% canopy cover.

Stratum 2. *Olearia axillaris, Scaevola crassifolia* shrubs to 1.5 m, 10-30% canopy cover.

Stratum 3. *Spinifex longifolia* bunch grass. *Tetragonia decumbens, Rhagodia preissii, Zygophyllum* sp. *Acanthocarpus preissi* herbs to 0.5 m, 10-30% canopy cover.

Comments: Trapline situated on foredunes at beach. Leaf litter: Absent. Soil: Light grey sand. Mammals recorded: *Pseudomys albocinereus, Rattus fuscipes, Mus musculus.*