REPORT ON A VISIT TO

DIRK HARTOG ISLAND

with

RECOMMENDATIONS ON THE RE-ESTABLISHMENT OF MARSUPIALS

by

ANDREW A. BURBIDGE B.Sc. (Hons), Ph.D.
Fauna Research Branch
Department of Fisheries and Fauna.

and

A.S. GEORGE, B.A.
Western Australian Herbarium,
Department of Agriculture.

February, 1973.

INTRODUCTION

Dirk Hartog Island is a large island of about 62,000 hectares (153,000 acres) which encloses the western side of Shark Bay, Western Australia.

The first recorded landing by a European in Australia was by the Dutchman Dirk Hartog, at Cape Inscription, the northern tip of the island, in 1616. Other early visitors were Vlaming in 1697, William Dampier in 1699, the Baudin expedition in 1801 (report published by Peron, 1807), Freycinet in 1818 (see Quoy and Gaimard, 1824), King in 1821 and Grey in 1837.

More recent visitors who have reported on aspects of the biology of the island include T. Carter in 1916, F. Lawson Whitlock in 1918 and 1920, E. Ashby in 1927, and a group of students from Wesley College in 1967. All the recent reports concentrate on birds and give only fleeting reference to mammals.

Since 1899 Dirk Hartog Island has been held under pastoral lease as a sheep station. The whole island is leased except for 81 ha (200 acres) of freehold land and three small reserves at the northern tip containing the lighthouse and inscription posts (Reserve Nos.A 12715, 14918 and 11634).

In 1972, the present lessee, Sir Thomas Wardle, invited the authors to visit the island and make an inspection. The main aims of the visit were:

1. To investigate the status of mammals, both native and introduced.
2. To compare the habitat with that of Bernier and Dorre Islands.
3. To make recommendations concerning the possible re-establishment of locally extinct native mammals, and
4. To make a representative collection of plants and animals for the W.A. Herbarium and W.A. Museum.

The visit took place from September 2nd to September 8th, 1972. Personnel were A.S. George (Western Australian Herbarium), T. Evans and A.A. Burbidge (Department of Fisheries and Fauna).

The party used a long wheel base Land Rover station wagon which was transported to and from the island by the barge "Dirk". During the visit as much of the island as possible was traversed, using station tracks. The actual coverage is shown in Figure 1. In the daytime plants and animals were collected and observations made on the birds. A considerable amount of time was spent searching for signs of native mammals, such as tracks, bones and droppings. After dark spotlighting was carried out both from the vehicle and on foot looking for signs of nocturnal animals, such as marsupials, bats and geckoes.

Traps were set for small mammals at various localities. They were Elliot live traps (14" x 4" x 3") and metal break-back ("rat") traps. A total of 630 trap-nights resulted in only two captures.

PHYSICAL DESCRIPTION

Dirk Hartog Island is about 79 Km (49 miles) long and a maximum of 11 Km (7 miles) wide with the long axis aligned in a 340°-160° direction.

Geologically it is an elongated mass of Quaternary (probably Pleistocene) Coastal Limestone named by Logan et al (1970) the Tamala Aeolianite. The geology of Bernier and Dorre Islands and the Edel Peninsula is similar but Peron Peninsula is composed of a Quaternary sandstone.

The western side of the island is bounded by steep cliffs varying in height from two or three metres to about 80 metres (250 feet) near Herald Heights. The eastern side has a few fairly low cliffs with extensive beaches in between. Sand dunes lie behind the beaches in places.

The western side of the island is the higher, rising to 185 metres (608 feet) at Herald Heights and to 155 metres (507 feet) and 132 metres (432 feet) further north. The middle parts consist mainly of well vegetated stable sand dunes of reddish or whitish soil although in the area between Herald Heights and Tetradon Loop there are a number of mobile white dunes, one of which touches the sea at Tetradon Loop. A number of low lying areas contain mud pans which are covered with water after heavy rain.

Climatological data is given in Table 1. It can be seen that most rain falls during the winter but that occasional summer

cyclones or thunderstorms provide some rain. The rainfall on Dirk Hartog is higher than that on the adjacent mainland; only Carrarang and Tamala Stations to the south approach the figure for Dirk Hartog. This is probably due to an orographic effect since Herald Heights and the other hills along the west side of Dirk Hartog Island are the highest land for some distance.

There is no standing fresh water on the island except in clay pans for a short time following heavy rain. Drinking water has been provided for the sheep from wells.

Temperatures on the island are probably somewhat milder than those recorded at Carnarvon and Hamelin Pool.

FLORA

Shark Bay is the site of the first authenticated botanical collections to have been made by Europeans in Australia. William Dampier collected these in 1699, and his specimens are still extant at Oxford University, in England. He landed on Dirk Hartog Island but it is not known which of his specimens were collected there.

Later visitors to Shark Bay who made collections included the Baudin expedition in 1801, Freycinet in 1818, Cunningham in 1822 (see King, 1827), Grey in 1839, Milne in 1858 (unpublished) and Mueller in 1877, though not all landed on the island. Since many of their specimens were described as new species, the area is an important type locality.

Mueller (1883) recorded 60 species from the island, though many of the names he used are not in current use and the specimens should be re-located and their identification checked (Table 2). They are all in eastern Australian or European herbaria.

Recent collections from the Island have been few and have added little to Mueller's list. However, the latest expedition concentrated on the floristics rather than the ecology and recorded as many species as possible. Because of the excellent season, some 250 species were collected in flower or in fruit. Many others, both shrubs and herbs, were vegetative only and collections at other times of the year would be necessary to make the list complete. Also, the expedition was unable to cover the whole island in the

time available. Many species have yet to be identified and a full list is not available at this time. It is estimated that the total flora is over 300 species.

The vegetation of Dirk Hartog Island consists mostly of open heath, low shrubland and hummock grassland, with a few areas of tall shrubland. There are extensive blown-out sandy areas where no vegetation occurs, while some steep cliffs and rocky shores are sparsely vegetated, especially where affected by salt spray.

The dominant plants are the wattle Acacia ligulata, the myrtle Thryptomene baeckeacea and the "spinifex" Plectrachne sp. The wattle is present in most places, often forming thickets. Commonly associated with it are Alyogyne, Diplolaena, Pimelea, Pittosporum and Exocarpos. The Thryptomene is often present in this open heath, but it becomes more dominant where the tall shrubs are sparse or lacking and then with other low shrubs forms a low shrubland. Similarly, the Plectrachne is also widespread in all associations, but in places is dominant and forms hummock grassland. The other "spinifex" present, Triodia plurinervata, is locally frequent, especially on Herald Heights where shrubs are sparse and low.

There are several saline flats where salt-tolerant plants form a very low shrubland. Various samphires, Arthrocnemum spp. are dominant here.

The flora of the island is extremely interesting. For the first time in W.A., apart from the Kimberleys, species have been found on an island which do not occur on the mainland. Several others are little-known plants which have been rarely seen on the mainland, in some cases being unrepresented previously at the W.A. Herbarium. These are listed in Table 3.

While most of the species occur on the nearby mainland, in some cases the populations on Dirk Hartog Island are well isolated from those on the mainland. For example, Casuarina helmsii and Helipterum oppositifolium are otherwise known only from the Goldfields region, between Southern Cross and the Nullarbor Plain. Both Melaleuca huegelii and M. lanceolata are common in the lower South-West but extend no further than Geraldton except for the Dirk Hartog populations. M. huegelii is further interesting for its sprawling habit and pink flowers: it is usually erect and has white flowers.

Eriochilus dilatatus is the only orchid on the island and is the northernmost record of any of the South-Western orchids. The sedge Gahnia lanigera, whose identity requires further checking, occurs otherwise on the south coast east of Esperance.

Dirk Hartog Island lies at the northern tip of the South-West vegetation province of W.A. Its flora contains a number of typically south-western species and for most of them this is the northern limit of their distribution (Table 4). A few extend to Bernier and Dorre Islands or to the mainland north of Carnarvon. The flora also contains species which are restricted to coastal regions between Geraldton and Carnarvon, while a few species are known otherwise only from regions to the north.

It is interesting to compare the flora with that of Bernier and Dorre Islands. For the latter, Royce (in Ride et al, 1962), recorded 118 species but this was based on a collection made in winter, and further collecting would add to the list. However, the flora of Dirk Hartog Island is obviously richer, as would be expected on a larger island. Of the 118 species on Bernier and Dorre, about 20 were not seen on Dirk Hartog, while over 150 species were recorded on Dirk Hartog which were not on Bernier or Dorre. Perhaps the most interesting of the latter is the Plectrachne, the common "spinifex" of Dirk Hartog which is lacking on Bernier and Dorre.

The flora of Dirk Hartog Island is of great interest from floristic, phytogeographical and ecological aspects. It is also scenically attractive, especially in a good season. Containing elements which are absent on the mainland, it is well worth conservation.

At the time of our visit the vegetation was generally in good condition, especially in the northern half of the island where currently there are no sheep. There is some overgrazing in the south, especially around drinking troughs. Thirty two species have been introduced to the island (Table 5) and many are widespread but apart from a few overgrazed areas they are not dominant. There was no sign of recent fires and we understand that fire has not been used in pastoral management on the island. Provided that populations of grazing or browsing animals do not build up enough to cause general overgrazing the flora should maintain itself without requiring a great deal of management. Any future development should involve consideration of the vegetation in order to prevent its deterioration or the loss of rare species.

FAUNA.

A. MAMMALS.

Dirk Hartog Island once harboured a diverse native mammalian fauna but much of this now appears to be extinct. A number of feral species are established. All species known from the island are listed below.

1. Banded Hare Wallaby (Lagostrophus fasciatus).

This species was first described by Peron in 1807. He reported it as being very common on Dirk Hartog as well as Bernier and Dorre Islands. It is presumably the wallaby listed earlier by Dampier (1729).

Today there is little doubt that this species is extinct on Dirk Hartog as well as on the mainland. It remains only on Bernier and Dorre Islands. Local knowledge on Dirk Hartog puts the date of extinction of the "wallabies" (possibly including the two species below) in the 1920's. It must have been some time ago since we did not locate any skeletal remains. It is interesting to note that Shortridge (1909) in commenting on a visit to Bernier Island in 1907 stated, "It may be noted that sheep had been temporarily introduced there, while in the south of Dirk Hartog there is a large sheep station and the wallabies are said to have entirely left that end of the island" (p.818).

Knowledge of the biology of this animal is summarised by Ride and Tyndale-Biscoe (in Ride et al, 1962).

2. Western Hare Wallaby (Lagorchestes hirsutus).

This wallaby occurs on Bernier and Dorre Islands but is either very rare or extinct on the Australian mainland. While some authors have noted that it probably occurred on Dirk Hartog (e.g. Shortridge, 1909; Glauert, 1933; Main, 1961; Main and Yadav, 1971) it appears that no specimen has been collected and some doubt must remain that it ever occurred there.

No sign of this or any other macropod was noted during the 1972 visit.

3. Boodie (Bettongia lesueur).

The Boodie was first collected as a skull picked up on Dirk

Hartog by Freycinet's Expedition (Quoy and Gaimard, 1824). They obtained no entire animals but caught glimpses of an animal that lived in burrows and foraged in the debris on the beaches at night. This description fits that of B. lesueur, but not any of the hare wallabies. No specimen has been collected on Dirk Hartog since.

This species also appears to be extinct on the mainland and is now confined to Barrow, an unnamed island south of Barrow, Bernier and Dorre Islands. We saw no sign of this species during our visit.

4. Marl or Little Barred Bandicoot (Perameles bougainville).

This bandicoot is common on Bernier and Dorre Islands, but has not been collected on Dirk Hartog. It was first collected on Peron Peninsula by Quoy and Gaimard and the Western Australian Museum has a single specimen from Onslow which was collected in 1909. The only possible reference to this species on Dirk Hartog is the sighting of a "small opossum" on the island by A.C. Cunningham, the botanist with King's expeditions in 1821 (King, 1827). This has been interpreted by Alexander (1915, p.123) as being a reference to Perameles bougainville. We saw no evidence of this species during our visit.

5. Sandy Inland Mouse (Pseudomys hermannsburgensis).

One specimen of this native mouse was captured in an Elliot trap near Sandy Point Outcamp. The trap was in an area of red sand, the dominant shrubs being Alyogyne cuneiformis, Acacia rostellifera, Thryptomene sp., Acacia tetragonophylla, Melaleuca cardiophylla and Acacia coriacea. There was little ground cover.

This species was not previously known from Dirk Hartog. On the mainland it has a wide range in the dry inland parts of the continent (Ride, 1970). It is also known from Rosemary Island in the Dampier Archipelago (Burbidge and Prince, 1972).

6. Lesser Long-eared Bat (Nyctophilus geoffroyi).

One specimen was captured flying out of a cave in the cliffs on the western side of the island near West Coast Mill. Several bats which were seen while spotlighting at night were probably this species and the Little Bat (Eptesicus pumilis).

7. House Mouse (Mus musculus).

Two specimens were taken. One was captured in an Elliot trap near Sandy Point Outcamp and the other was shot in a pile of rubble near West Coast Mill. The House Mouse is widely established on the mainland but does not occur on Bernier or Dorre Island.

8. Goat (Capra hircus).

We saw about 140 goats on the island. Four flocks were seen; one of 56, one of about 50 and two of 20. Station hands estimated that there were about 700 goats on the island. Our observations would suggest that this figure may be conservative.

The domestic goat gone wild is now a common animal in many parts of Western Australia and the damage which it is doing to the vegetation is only beginning to be appreciated by pastoralists and the general public. On Bernier Island goats were introduced in 1899 and extensive damage has been done to the vegetation and the number and extent of sand dune blowouts is known to have increased tremendously over the past 20 years. Following the recommendations of a party of scientists who visited the island in 1958 (Ride et al, 1962) the Department of Fisheries and Fauna carried out a campaign of attack on the goats and over a period of eight years in excess of 450 have been shot. We estimate that at the commencement of shooting Bernier Island carried abt 350 goats or 1 goat to twelve hectares (thirty acres). A similar density for Dirk Hartog gives a population of about 5000.

However on Dirk Hartog there are two factors affecting goat denisty not present on Bernier. These are the presence of drinking troughs, which may allow an even greater density, and competition for food from sheep. Sheep numbers in the past have been over 10,000 (see below) and this may have kept goat numbers down. However, goats tend to browse shrubs much more than sheep and competition for food would not be total.

Damage to vegetation on Dirk Hartog was obvious but it did not appear to be worse than that on Bernier Island except where heavy overgrazing had occurred near drinking troughs. There is little doubt that if the goats are allowed to

increase in numbers damage to the vegetation with resulting wind erosion will occur.

9. Sheep (Ovis aries).

Dirk Hartog has been used as a sheep station since 1899. The number of sheep on the island has largely been between 10,000 and 11,000 although the present population is only about 4,000. Only the southern two-thirds of the island is currently stocked.

10. Horse (Equus caballus).

About 12 horses were present on the island during our visit. We were told that they were all mares but that a stallion might be brought over in the future.

11. Camel (Camelus dromedarius).

Carter (1917) records that during his visit camels were used to take rations to men stationed at outcamps and windmills. There are no camels on the island at present.

12. Domestic Cat (Felis catus).

The domestic cat is well established on Dirk Hartog. Although we saw only one animal (near the homestead) tracks were plentiful all over the island. Often we saw tracks in vehicle wheelmarks made the previous evening.

It is not known when the cat became established on the island but in all probability cats were taken there when the sheep station was established. Carter (1917) states that "cats ..... are now becoming numerous on the island" (p.605).

Feral cats are common on the Australian mainland. They are also known from three other islands off the west coast - Trimouille and Hermite Islands in the Monte Bellos and Rottnest Island near Perth. On Hermite they have apparently been responsible for the disappearance of two species of marsupials and two species of birds which occurred there (Burbidge 1971). These were the Spectacled Hare Wallaby (Lagorchestes conspicillatus), Golden Bandicoot (Isoodon auratus), Black and White Wren (Malurus leucopterus) and Spinifex-bird (Eremiornis carteri). On Rottnest Island the cats have been reduced in number by poisoning programmes.

13. Dugong (Dugong dugon).

The Dugong still occurs in Shark Bay, this being the major southern limit of its range on the west coast, although occasional animals have been sighted further south, for example off Geraldton. On September 3rd, 1972, we saw between 30 and 40 Dugong feeding in shallow water adjacent to Quoin Bluff South.

14. Australian Sea Lion or Hair Seal (Neophoca cinerea).

King (1827) records that Cunningham, the botanist accompanying his expedition, saw a Hair Seal on Dirk Hartog Island in 1821. Local knowledge indicates that this species is occasionally found in Shark Bay, although the major northern limit of its distribution is the Abrolhos Islands.

B. BIRDS.

A list of all birds which have been recorded on Dirk Hartog is given in Table 6. The common names used are from "An Index of Australian Bird Names", C.S.I.R.O. Division of Wildlife Research, Technical Paper No.20. In all 76 species have been noted of which 27 are sea and shore birds and the remainder land birds.

The avifauna of Dirk Hartog is interesting although the number of species is not large. Some species are at or close to their northern limits (e.g. Western Silvereye, Southern Emu-Wren, Spotted Scrub-Wren and White-fronted Chat). Others are more representative of the arid parts of the Continent (e.g. Little Crow, Little Wood-Swallow, Zebra Finch). It differs considerably from that of Peron Peninsula where the vegetation is dominated by different species of Acacia and is similar to much of the adjacent mainland. Common birds such as the Wedgebill, Pallid Cuckoo and Crested Bell Bird are absent or uncommon on the island. The avifauna is probably more akin to the country south of Dirk Hartog (Edel Land) which has a similar vegetation.

Dirk Hartog harbours a number of interesting small land birds and in some cases sub-species have been described for the Dirk Hartog forms of these species. These include:

1. Black and White Wren (Malurus leucopterus).

This species is restricted to Dirk Hartog and Barrow Islands and does not occur on the mainland where it is replaced by the Blue and White Wren (Malurus leuconotus). We found the Black and White Wren to be quite common; about a dozen parties were sighted. More were seen in the northern part of the island but this may have been due to the better visibility resulting from the open nature of the vegetation there.

2. Variegated Wren (Malurus lamberti).

Mees (in Ride et al, 1962) records that the race on Dirk Hartog Island is mastersi which also occurs on the mainland while Bernier and Dorre Islands contain two separate races.

3. Southern Emu-Wren (Stipiturus malachurus).

The race occupying Dirk Hartog Island (hartogi)differs from mainland individuals (Serventy and Whittell, 1967). Dirk Hartog is the northernmost locality for this species.

4. Spotted Scrub-Wren (Sericornis maculatus).

The race occurring on Dirk Hartog (balstoni)occurs also on Bernier and Dorre Islands and on the mainland south to Geraldton (Mayr and Welk, 1953; cited in Mees (in Ride et al, 1962)).

5. Field Wren (Calamanthus fuliginosus).

The race occurring on Dirk Hartog (dorrie) occurs also on Dorre Island and on the southern and eastern shores of Shark Bay (Mees, in Ride et al, 1962).

6. Western Grass Wren (Amytornis textilis).

This species was recorded on Dirk Hartog by Carter in 1916 and Whitlock in 1918 and 1920. It has not been recorded since although no extensive searches have been made.

While on the island we inspected the nesting colony of Pied Cormorants at Quoin Bluff South. We estimated the number of nests at about 2500, the same figure worked out by Whitlock in 1920. Only about 1% contained eggs, most contained half grown young. We did not look at the colony at Shag Mia.

Other birds which were breeding during our visit included Grey Teal (young almost fully fledged), Nankeen Kestrel (eggs), Caspian Tern (one nest with 2 eggs on Cape Ransonnet), Crested Tern (one chick on Meade Island), White-breasted Sea Eagle (a chick in a nest at Quoin Bluff South), Osprey (several nests, both eggs and chicks present), Banded Plover (a nest at Two Wells Mill, one young almost fully fledged near Bottom Ten Mile Mill), and little Crow, (several nests, one we inspected had 6 eggs, another at Cape Inscription had newly hatched chicks).

The Domestic Pigeon recorded by us was a single bird roosting at Herald Bay outcamp. It was a stray racing pigeon, carrying a Pigeon Racing Federation band.

C. REPTILES.

The following species have been collected from Dirk Hartog Island, and are lodged in the Western Australian Museum.

GEKKONIDAE (Geckoes)

Gehyra variegata	(Dtella)
Heteronotia bynoei	(Bynoe's Gecko)
Phyllurus milii	(Barking Gecko)
Diplodactylus vittatus	(Festooned Gecko)
Diplodactylus spinigerus	(Soft-spined Gecko)
Nephurus levis occidentalis	(Knob-tailed Gecko)

PYGOPODIDAE (Legless Lizards)

Lialis burtonis	(Snake Lizard)

AGAMIDAE (Dragon Lizards)

Amphibolurus minor	(Western Jew Lizard)
Amphibolurus maculatus maculatus	(Spotted Dragon)
Amphibolurus reticulatus	(Netted Dragon)

SCINCIDAE (Skinks)

Ctenotus fallens (Storr MS)	
Ctenotus sp.	
Lerista praepedita	
Lerista lineopunctulata	
Morethia lineoocellata	
Omolepida branchiale	
Cryptoblephorus plagiocephalus	
Egernia stokesii	(Spiny-tailed Skink)
Tiliqua rugosa	(Bobtail)

VARANIDAE (Goannas)
? Varanus gouldii (Bungarra)

ELAPIDAE (Snakes)
Demansia psammophis (Whip Snake)
Pseudechis australis (Mulga Snake)

HYDROPHIIDAE (Sea Snakes)
Hydrophis elegans
Hydrophis major
? Hydrophis ornatus ocellatus

The specimens collected by us were the first extensive collection of reptiles made on the island. Notable among them was the Ctenotus sp. which is probably a new species. Apart from this all terrestrial species collected are commonly found on the adjacent mainland.

In general the reptiles are faily typical of the warmer and drier parts of the south-west of the State.

The Bungarra (Varanus gouldii) was not collected by us nor was it seen. However, tracks of a large varanid were common and station hands told us the Bungarra was plentiful.

DISCUSSION

Dirk Hartog Island is of considerable value faunistically, even though the larger mammals are now extinct. It would be a valuable Flora and Fauna Reserve or National Park because of the varied, and in some cases unique, animals and plants, as well as its interesting scenery and history. It would be even more valuable if the species of mammal which have now disappeared could be re-established.

The causes of the extinction of the Banded Hare Wallaby and the Boodie are unknown but the main cause probably rests with the feral cat. Grazing by sheep and goats may have had some effect on the hare wallaby's habitat but probably would not have greatly affected the Boodie which lives in burrows. Subjectively, it appeared to us that the vegetation of the island had not been damaged by grazing any more than had that of Bernier Island (where none of the marsupials have died out), although the situation in the past when more sheep were on Dirk Hartog may have been different.

Small species of mammals and birds do not seem to have been adversely affected by the cats. Thus, Pseudomys hermannsburgensis survives even in the face of competition from Mus musculus, and all the wrens (with the possible exception of the Western Grass Wren) are still common.

Any attempt to reintroduce the extinct species of marsupial must be dependent on controlling the feral cats as well as ensuring that the habitat is encouraged to regenerate. The latter will be dependent on a low grazing pressure from feral animals, especially goats.

In considering species for introduction care must be taken that only species which are known to have occurred there in the past are released. Further the release must be done in a controlled manner so that the results can be accurately recorded and analysed.

The obvious species to reintroduce at first is the Banded Hare Wallaby. There is no doubt that this species occurred there in the past nor is there much doubt that it is now locally extinct. Also, it is a species which is in some danger of complete extinction, the only known populations being on Bernier and Dorre Islands. Most species of hare wallaby and most small macropods are solitary animals, and defend a territory. The Banded Hare Wallaby, on the other hand, is gregarious and small groups can be found sheltering under low dense bushes in the day time. Possibly because of this it adapts readily to captivity and there is little fighting as is often found in other macropods (N. Beeck, pers. comm.).

If this re-introduction appears to be successful then consideration could be given to other species. The question remains as to whether the Western Hare Wallaby and Marl ever occurred on Dirk Hartog but this might well be answered by examining cave deposits. There is, however, little doubt that the Boodie did occur on the island and this could also be reintroduced from Dorre Island. It would be more difficult to keep captive in yards because of its burrowing habit but this could be overcome.

RECOMMENDATIONS.

1. That Dirk Hartog Island be acquired as a reserve in the event of the present lessee relinquishing it or alternatively, when the lease expires it should not be renewed.

2. That an attempt be made to reintroduce the locally extinct native marsupials, beginning with the Banded Hare Wallaby.

3. That if this is successful an attempt be made to establish the Boodie.

4. That the Western Australian Museum be asked to examine the island for possible cave deposits in order to establish which species of native mammal inhabited the island in the recent past.

5. That a poisoning programme aimed at the feral cat be commenced, following advice from, and with the assistance of, the Agriculture Protection Board.

6. That the number of goats on the island be reduced, either by mustering or shooting.

7. That the number of sheep on the island be kept low, and if the island becomes a reserve that they be removed.

ACKNOWLEDGEMENTS.

We are most grateful to Sir Thomas Wardle, the lessee of Dirk Hartog Station, for inviting us to visit the island and for assisting with the trip in many ways.

Our thanks also go to Dr. G.M. Storr and Mr. A. Baynes of the W.A. Museum for identifying the reptile collection and the Pseudomys respectively.

Mr. N. Beeck, of Katanning, a member of the Western Australian Wild Life Authority, gave advice on keeping Hare Wallabies in captivity.

The Department of Lands and Surveys provided information on the pastoral lease and the Bureau of Meteorology supplied weather data.

Professor A.R. Main, Drs. W.D.L. Ride and G.M. Storr and Messrs. B.K. Bowen, J.L. Bannister and R.D. Royce critically examined a draft of this report and we are most grateful for their useful comments.

Finally we are very appreciative of the pleasant companionship and assistance of Mr. T. Evans who accompanied us to the island and collected many of the specimens.

BIBLIOGRAPHY.

Alexander, W.B. 1914. History of Zoology in Western Australia — Part I. Discoveries in the 17th Century. J. Nat. Hist. Sci. Soc. West. Austr. 5: 13-15.

Alexander, W.B. 1915. History of Zoology in Western Australia — Part II. 1791-1829. J. Roy. Soc. West. Austr. 1: 83-149.

Allender, B.M. 1969. The Ghost Crabs (Ocypode) of Dirk Hartog Island. West. Austr. Nat. 11: 59-65.

Ashby, E. 1929. Notes on the fauna of Dirk Hartog Island, Western Australia. No. 1-Introduction, No.2-Aves, No. 3-Polyplacophera. Trans. Roy. Soc. South Austr. 53: 57-66.

Burbidge, A.A. 1971. The Fauna and Flora of the Monte Bello Islands. Report No.9, Department of Fisheries and Fauna, Western Australia.

Burbidge, A.A. and Prince, R.I.T. 1972. The Fauna, Flora and Planned Usage of the Dampier Archipelago. Report No.11, Department of Fisheries and Fauna, Western Australia.

Carter, T. 1917. The Birds of Dirk Hartog Island and Peron Peninsula, Shark Bay, Western Australia, 1916-17. Ibis (10)5: 564-611.

Dampier, W. 1729. A Voyage to New Holland, Etc., in the year 1699. 3rd Edition. J. and J. Knapton, London (Argonaut Press Edition, 1939, London).

Glauert, L. 1933. The distribution of the marsupials in Western Australia. J. Roy. Soc. West. Austr. 19: 17-32

Grey, G. 1841. Journal of two expeditions of Discovery in North-West, and Western Australia during the years 1837, 38 and 39, etc. T. and W. Boone, London.

Hale, H.M. 1929. Notes on the Fauna of Dirk Hartog Island, Western Australia. No.4 - Crustacea. Trans. Roy. Soc. South Austr. 53: 67-70.

Hughes, R.D. 1965. On the age composition of a small sample of individuals from a population of the Banded Hare Wallaby, Lagostrophus fasciatus (Peron and Lesueur). Austr. J. Zool. 13: 75-79.

King, P.P. 1827. Narrative of a survey of the intertropical and western coasts of Australia performed between the years 1818 and 1822. Vol. II. John Murray, London.

Logan, B.W., Read, J.F. and Davies, G.R. 1970. History of Carbonate Sedimentation, Quaternary epoch, Shark Bay, Western Australia. American Assoc. Petroleum Geologists, Memoir 13: 38-84.

Main, A.R. 1961. The occurrence of Macropodidae on Islands and its climatic and ecological implications. J. Roy. Soc. W. Austr. 44: 84-89.

Main, A.R. and Yadav, M. 1971. Conservation of Macropods in Reserves in Western Australia. Biological Conservation. 3: 123-133.

Mueller, F. 1883. The plants indigenous around Sharks Bay and its vicinity. Parlt. Paper No.26. Government Printer, Perth.

Peron, F. 1807. Voyage de Decouvertes Aux Terres Australes. 3 Vols, Paris.

Quoy, J.R.C. and Gaimard, P. 1824. Voyage Autour du Monde .... sur les corvettes l'Uranie et la Physicienne...Zoologie. Paris.

Ride, W.D.L., Mees, G.F., Douglas, A.M., Royce, R.D. and Tyndale-Biscoe, C.H. 1962. The Results of an Expedition to Bernier and Dorre Islands, Shark Bay, Western Australia in July, 1959. Fauna Bulletin No.2. Ed. A.J. Fraser, Fisheries Department, Western Australia.

Sedgewick, 1967. Birds of Dirk Hartog Island. An annotated list based on observations made during the Wesley College Excursion, September, 1967. Unpublished Report.

Serventy, D.L. and Whittell, H.M. 1967. Birds of Western Australia. 4th Edition. Lamb Publications, Perth.

Shortridge, G.C. 1909. An Account of the Geographical Distribution of the Marsupials and Monotremes of South-West Australia, having special reference to the specimens collected during the Balston Expedition of 1904-1907. Proc. Zool. Soc. London. 55: 803-848.

Stodart, E. 1966. Observations on the behaviour of the marsupial Bettongia lesueuri (Quoy and Gaimard) in an enclosure. C.S.I.R.O. Wildlife Research. 11: 91-99.

Tyndale-Biscoe, C.H. 1965. The female urogenital system and reproduction of the marsupial Lagostrophus fasciatus. Austr. J. Zool. 13: 255-267.

Whitlock, F.L. 1921. Notes on Dirk Hartog Island and Peron Peninsula, Shark Bay, Western Australia. Emu 20: 168-189.

APPENDIX.

PROPOSED METHOD OF RE-ESTABLISHMENT OF THE BANDED HARE WALLABY ON DIRK HARTOG ISLAND.

1. Construction of two yards near Dirk Hartog Homestead in an area of thick shrubby vegetation. Each yard to be approximately 0.05 ha (1/8 acre). Fences to be of 6 foot, 1½ inch mesh, wire netting, the bottom 1 foot to be buried, the top 1 foot to be tilted outward at 45° angle. Four strands of barbed wire at 3 inch intervals to be placed above the wire netting.

   Each yard to be provided with six 44 gallon drums on their side (for shelter) with one end cut out and with cut brush piled on top to provide shade. Each yard to be provided with one drinking trough. Food to be provided.

   The cost of the yards would be approximately $500 (Perth prices) plus transport and labour.

2. Commence poisoning of cats in area of yards, gradually extending outward to include rest of island.

3. Capture ten to twenty pairs of wallabies on Dorre Island and transfer to yards. Each animal to be ear tagged and its sex, weight and breeding condition to be noted.

4. Inspect at regular intervals in order to document breeding success, growth rates, any effect of cats, etc.

5. When yard population is increasing commence releasing surplus animals to the wild in the region of the yards.

6. If wild population establishes near yards, release animals elsewhere on the island.

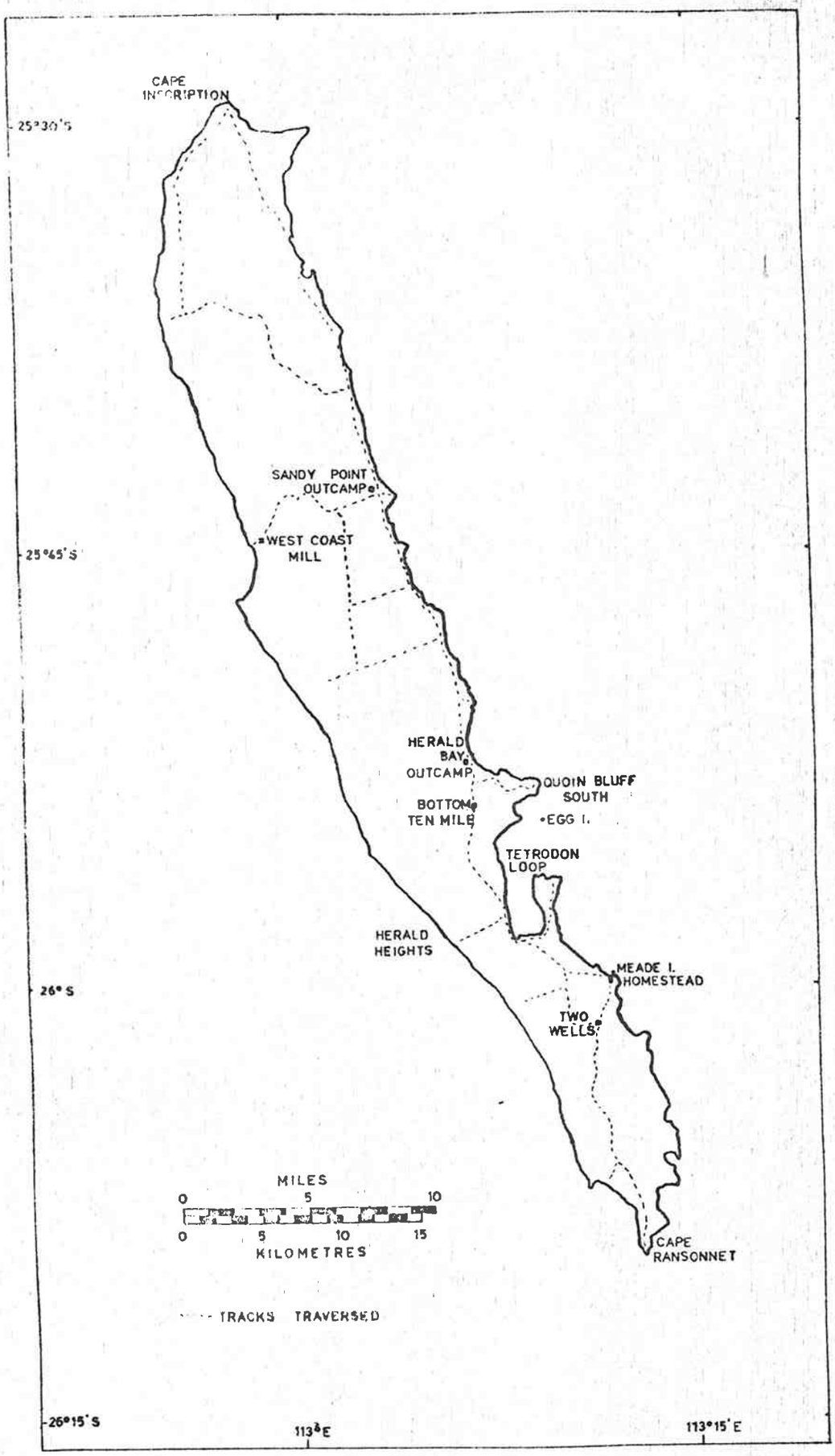

Figure 1. Dirk Hartog Island.

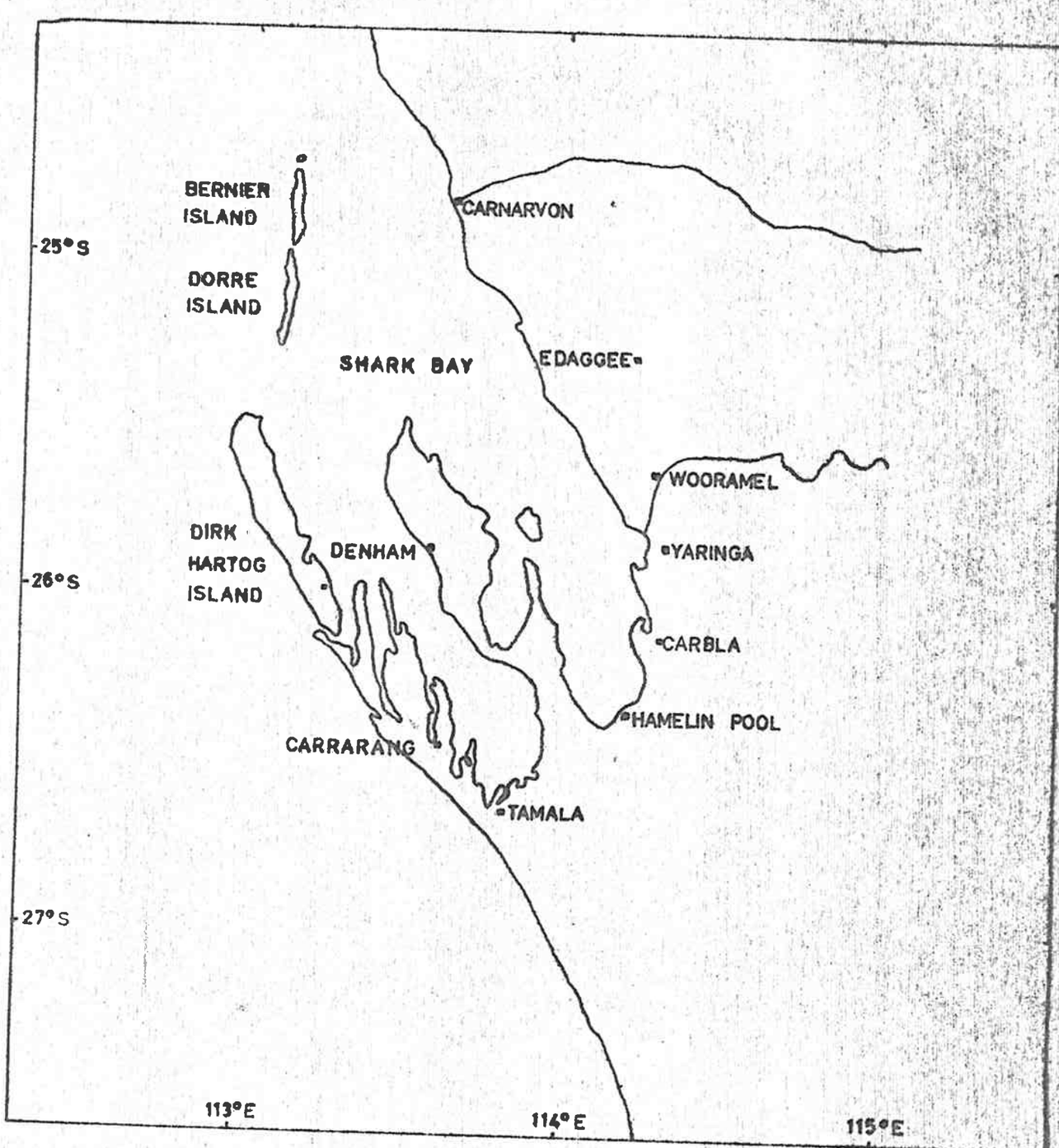

Figure 2. Shark Bay Area.

TABLE 1.

WEATHER DATA.

From information supplied by the Bureau of Meteorology.

1. RAINFALL. (Points)

Dirk Hartog Homestead	Mean and Range	
January	24	(0-349)
February	46	(0-532)
March	51	(0-510)
April	63	(0-292)
May	220	(11-1176)
June	347	(20-873)
July	244	(70-795)
August	139	(15-482)
September	55	(0-242)
October	28	(0-156)
November	7	(0-44)
December	9	(0-135)
Annual	1233	(424-2679)

Other Stations.	Mean annual (See Figure 2.)
Carrarang	1096
Tamala	1150
Denham	885
Hamelin Pool	793
Carbla	828
Yaringa	794
Wooramel	773
Edaggee	755
Carnarvon	862

2. EVAPORATION.

	Annual average in inches
Denham	80
Hamelin Pool	83
Carnarvon	85

3. TEMPERATURE.

Averages in Degrees Celsius.

	Carnarvon		Hamelin Pool	
	Max	Min	Max	Min
January	31.0	21.7	36.8	20.5
February	31.6	22.2	36.5	21.1
March	31.2	21.4	34.6	19.9
April	29.4	18.4	30.4	17.0
May	26.0	14.5	25.1	13.3
June	23.6	11.8	21.4	10.6
July	22.5	10.6	20.6	9.2
August	23.3	11.5	24.2	9.4
September	24.6	13.5	25.4	11.1
October	25.7	15.7	28.1	12.9
November	27.7	18.3	31.8	15.8
December	29.3	20.2	34.6	18.2
ANNUAL	27.2	16.7	28.9	14.9

TABLE 2

Species recorded by Mueller but not by recent expedition

Many of these names are not in current use and the identifications require checking before the species can be added to the list of species on the Island.

Acacia spathulata
Amyema linophylla
Angianthus milnei
Anthotroche walcottii
Aristida arenaria
Baeckea pentagonantha
Pityrodia hemigenioides
Convolvulus sepium
Cymodocea zosterifolia
Danthonia penicillata
Dicrastylis fulva
Gnephosis skirrophora
Gnephosis tenuissima
Kennedia bracteata (=prostrata)
Melaleuca holosericea
Myoporum serratum
Phyllanthus crassifolius
Ptilotus striatus
Rhagodia gaudichaudiana
Trichodesma zeylanicum
Tricoryne elatior
Verticordia pennigera

TABLE 3

Little-known and new species on Dirk Hartog Island

Acacia retinervis Benth.
Angianthus microcephalus (F.Muell.) Benth.
Arthrocnemum sp. nov. ASG 11454a D.H. only
Chrysopogon sp. ASG. 11544 D.H. only
Cryptandra nudiflora F. Muell.
Dichopogon sp. ASG 11417
Dicrastylis sp. ASG 11617 D.H. only
Gnephosis macrocephala Turcz.
Limosella australis R.Br.
Neosciadium glochidiatum (Benth.) Domin
Olearia sp. ASG 11568 D.H. only
Plectrachne sp. ASG 11428 D.H. only
Ptilotus sp. ASG 11603
Spyridium complicatum F. Muell.
Spyridium ? divaricatum Benth.
Swainsona sp. ASG 11570
Trachymene elachocarpa (F. Muell.) B.L. Burtt.
Triglochin trichophora Nees

TABLE 4

Species at their northern limit on Dirk Hartog Island

Acacia idiomorpha A. Cunn. ex.Benth.
Acacia leptospermoides Benth.
Angianthus microcephalus (F. Muell.) Benth.
Aphanopetalum clematideum (Drumm. et Harv.) C.A. Gardn.
Bossiaea rufa R.Br. var. foliosa Benth.
Calytrix strigosa A. Cunn.
Casuarina helmsii Ewart et Gordon
Conostylis candicans Endl.
Diplolaena microcephala Desf.
Eriochilus dilatatus Lindl.
Dodonaea aptera Miq.
Dodonaea inaequifolia Turcz.
Gahnia ? lanigera (R. Br.) Benth.
Geleznowia verrucosa Turcz.
Grevillea brachystachya Meisn.
Guichenotia ledifolia J. Gay.
Helipterum oppositifolium S. Moore
Leschenaultia linarioides Nees
Lepidobolus preissianus Nees
Loxocarya flexuosa (R. Br.) Benth.
Melaleuca huegelii Endl.
Melaleuca lanceolata Otto.
Neosciadium glochidiatum (Benth.) Domin.
Opercularia spermacocea Labill.
Pimelea gilgiana E. Pritzel
Pityrodia atriplicina (F. Muell.) F. Muell. ex Benth.
Podotheca angustifolia (Labill.) Less
Podotheca gnaphalioides Grah.
Rulingia cygnorum (Steud.) C.A. Gardn.
Tetragonia amplexicoma (Miq.) Hook. f.

TABLE 5

Introduced species on Dirk Hartog Island

Anagallis arvensis L. var. caerulea Gouan
Arctotheca calendula (L.) Levyns
Avena barbata Brot.
Brassica tournefortii Gouan.
Briza minor L.
Bromus gussonii Parl.
Cenchrus ciliaris L.
Cenchrus setigerus Vahl.
Centaurea melitensis L.
Cerastium glomeratum Thuill.
Chenopodium murale L.
Diplotaxis muralis (L.) DC.
Ehrharta brevifolia Schrad.
Emex australis Steinh.
Erodium cicutarium (L.) L'Hér. ex Ait.
Hordeum murinum L.
Hypochoeris glabra L.
Koeleria phleoides (Vill.) Pers.
Lavatera plebeia Sims.
Lolium loliaceum (Bory et Chaub.) Hand-Mazz.
Medicago polymorpha L. subsp. polymorpha
Melilotus indica All.
Poa annua L.
Polycarpon tetraphyllum (L.) L.
Ricinus communis L.
Silene gallica L.
Sisymbrium irio L.
Sisymbrium orientale L.
Solanum nigrum L.
Sonchus oleraceus L.
Spergularia rubra (L.) J.et C. Presl.
Urospermum picroides (L.) Desf.

TABLE 6.

THE BIRDS OF DIRK HARTOG ISLAND.

	Carter 1916	Whitlock 1918 1920	Ashby 1927	Sedgwick 1967	Burbidge & Evans 1972
Wedge-tailed Shearwater	X	X		X	X
Wilson's Storm Petrel	X				
Australian Pelican	X	X	X	X	X
Pied Cormorant		X	X	X	X
Red-tailed Tropic-Bird			X		
Reef Heron	X	X	X	X	X
Mountain Duck				X	
Grey Teal					X
Black-breasted Buzzard					X
Australian Goshawk	X	X			
Collared Sparrow-Hawk	X	X			X
Wedge-tailed Eagle	X	X	X		X
White-breasted Sea Eagle	X	X	X	X	X
Spotted Harrier	X	X			
Osprey	X	X	X	X	X
Nankeen Kestrel	X	?	X	X	X
Brown Hawk	X	X		X	
Little Quail		?		X	
Australian Bustard	X	X	X	X	X
Pied Oystercatcher	X	X	X	X	X
Sooty Oystercatcher	X	X		X	X
Banded Plover	X	X	X	X	X
Red-capped Dotterel	X	X		X	X
Large Sand Dotterel	X				X
Grey Plover	X	X			
Turnstone	X	X		X	X
Whimbrel	X	X	?		
Eastern Curlew	X	X	X	X	
Greenshank		X		X	
Grey-tailed Tattler					X
Sharp-tailed Sandpiper		?	X		X
Red-necked Stint	X	X	X		X
Bar-tailed Godwit	X	X			X
White-headed Stilt				X	X
Southern Stone-Curlew	X				X
Pacific Gull	X	X	X	X	X
Silver Gull	X	X	X	X	X

	Carter 1916	Whitlock 1918 1920	Ashby 1927	Sedgwick 1967	Burbidge & Evans 1972
Caspian Tern	X	X		X	X
Bridled Tern		?			
Fairy Tern	X	X	X	X	
Crested Tern	X	X	X	X	X
Domestic Pigeon					X
Rock Parrot	X				
Pallid Cuckoo	X	X			
Golden Bronze Cuckoo	X				
Horsfield Bronze Cuckoo		X	X		
Boobook Owl		X			
Spotted Nightjar	X			X	
Welcome Swallow	X	X	X	X	X
Tree Martin		X		X	
Australian Pipit	X	X	X	X	X
Black-faced Cuckoo-Shrike	X			X	
Brown Songlark		X			
Black and White Wren	X	X	X	X	X
Variegated Wren	X	X	X	X	X
Southern Emu-Wren	X	X	X		X
Brown Thornbill				X	?
Spotted Scrub-Wren	X	X	X	X	X
Field Wren	X	X	X	X	X
Western Grass Wren	X	X			
White-fronted Chat	X	X	X		X
Crimson Chat	X			X	
Red-capped Robin		X			
Hooded Robin	X	X		X	
Willie Wagtail	X	X		X	X
Crested Bell-Bird	X	X			X
Mistletoe Bird	X	X			
Western Silvereye	X	X	X	X	X
Brown Honeyeater		X	X	X	
Singing Honeyeater	X	X	X	X	X
Zebra Finch	X	X	X	X	X
Black-faced Wood-Swallow	X	X		X	X
Little Wood-Swallow				X	X
Magpie-Lark		X			
Grey Butcher-Bird				X	X
Little Crow	?	X	?	X	X