

INTRODUCTION TO HEARD ISLAND<sup>1</sup>By J. L. Gressitt<sup>2</sup> and Philip Temple<sup>3</sup>

*Abstract:* A fauna of about 53 species of land arthropods is now known from Heard Island. The island is still in a fairly undisturbed state, with no introduced vertebrate animals. Thus, there has probably been little if any extinction in very recent times. As the island is now still almost entirely ice-covered, it must have possessed very limited niches for survival of species during maximum Pleistocene glaciation. There appear to be rather few species endemic to Heard, and possibly many of the present species colonized Heard from Kerguelen since maximum glaciation.

Heard Island (lat. 53° 05' S; long. 70° 30' E) has the distinction of being the coldest and most ice-covered of subantarctic islands, the second highest, and one of the most distant from continents. It is not quite as far south as South Georgia and Macquarie, but the Antarctic Convergence is farther north in the area of Heard, giving it a colder climate. Heard is nearly as high in altitude as South Georgia. It is the southernmost isle of the Indian Ocean. As might thus be expected, Heard appears to have the poorest land biota of the major subantarctic islands. Also, it does not have a high percent of endemism, many of the species being in common with Kerguelen.

*History:* Captain James Cook in 1773 sailed 1° south of Heard without seeing it. Heard Island was first sighted by Captain Peter Kemp in 1833. It was rediscovered by Captain John Heard, an American, of the *Oriental*, 23 November 1853, on the way to Australia. The McDonald Islands, 4 small isles 40 km WSW of Heard, were discovered by Captain McDonald, an Englishman, of the *Samarang*, 3 January 1854. After this there was a period when sealers began to visit Heard, depleting the fur seals (*Arctocephalus gazella*) and elephant seals (*Mirounga leonina*). The latter, in particular, occurred in great numbers at Heard. Prior to 1947, only 4 scientific expeditions visited Heard. All the expeditions are listed here.

- 1) *Challenger*. On this expedition F. J. Evans spent several hours at Corinthian Bay on 5 Feb. 1873.
- 2) *Gauss*. The German South Polar Expedition, led by von Drygalski, visited in Feb. 1902 at Atlas Cove. Flora, fauna and rocks were collected.
- 3) Aubert de la Rue. In 1929 (15-23 Jan.) E. Aubert de la Rue and his wife Andrée spent 8 days on Heard, living in a hut at Atlas Cove which had been erected a few years previously by the British Admiralty. They had been making studies at Kerguelen and were transported to Heard, and picked up again on the return, by a British-Norwegian whaling expedition lead by B. Olsen. Aubert de la Rue (1930) published a map of Heard showing the main part of the island 2.5 times as long as wide, whereas it is almost round. In other respects, however, the map was fairly accurate.
- 4) *Discovery* (BANZARE). The British Australian New Zealand Antarctic Research Expedition, under Sir Douglas Mawson, visited Heard in November 1929 and used the same hut mentioned above.
- 5) ANARE. The Australian National Antarctic Research Expedition on 11 December 1947

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established a base on the northwestern shore of Atlas Cove, and maintained a staff in residence continuously for 7 years, to early 1955. Several short visits were made to the island after 1955 during the course of relief ship passages to Mawson Base on the Antarctic continent.

- 6) ANARE. A party of 6 visited Heard January—March 1963. Three men unsuccessfully attempted to climb Big Ben from Long Beach while the other 3 conducted ornithological, biological and glaciological work from the old base at Atlas Cove.
- 7) South Indian Ocean Expedition to Heard Island. This private expedition, backed by the New Zealand Alpine Club, the Mount Everest Foundation, the Trans-Antarctic Fund, the Bishop Museum, and other donors, with Sir Edmund Hillary as Patron, visited Heard from 12 January to 10 February 1965. It is the basis for the contributions in this volume to the knowledge of Heard Island. Philip Temple was the entomologist, representing Bishop Museum. The expedition was entirely on the southern and eastern portions of Heard, and was the first to ascend the summit. Grahame Budd was scientific leader. (Temple 1966)
- 8) A brief visit to Heard, mainly for checking glaciers and vertebrate populations was made in early 1969, under leadership of Dr Grahame Budd.

*Entomological exploration of Heard Island:* The earliest records of insects from Heard were by H. N. Mosely, who collected during the visit of HMS "Challenger" in 1874. Mosely collected some species, all of them known from Kerguelen, including:

*Calycopteryx moselyi* Eaton, 1875

The Deutsche Südpolar-Expedition (*Gauss*), in 1902 obtained 7 species, recorded by Enderlein in 1909 (new forms asterisked):

*Tullbergia antarctica* Lubbock, 1876

*Apetenus littoralis* Eaton, 1875

*Cryptopygus reagens* Enderlein, 1909

\**Calycopteryx moselyi* var. *minor*

\**Canonopsis sericeus heardensis*

Enderlein, 1909

Enderlein, 1909

*Anatalanta aptera* Eaton, 1875

\**Ectemnorhinus viridis* var. *griseocens*

Enderlein, 1909

None of the forms described as new are now considered valid taxa.

The British, Australian and New Zealand Antarctic Research Expedition (BANZARE) visited Heard in 1929. From this collection Womersley recorded 12 species in 1937.

*Tullbergia antarctica*

*Ectemnorhinus viridis* & var. *fusca*

*Tullbergia bisetosa*

*Ectemnorhinus gracilipes* (Waterh.), 1875

*Cryptopygus antarcticus*

*Ectemnorhinus crozetensis* (error for *Mesembriorhinus brevis*)

*Isotoma octo-oculata*

*Anatalanta aptera*

*Canonopsis s. sericeus*

*Calycopteryx moselyi*

*Canonopsis s. heardensis*

*Amalopteryx maritima*

From the same collection, Hickman (1939) recorded a single species of spider.

*Myro kerguelenensis*

In 1940 Jeannel reported on some specimens of beetles taken on Heard in 1929 by E. Aubert de la Rue (1930), naming one new species (earlier recorded as variety of *E. viridis*).

*Canonopsis sericeus*

\**Ectemnorhinus* (s. str.) *crassipes*

In 1949–50 Australian National Antarctic Research Expedition (ANARE) personnel collected material of 2 species of fleas, which were reported by de Meillon (1952):

\**Parapsyllus magellanicus heardi*

*Notiopsylla kerguelenensis* (Taschenberg, 1880)

On the same expedition an hyadesid mite was taken from a freshwater pool by E. H. M. Ealey, and reported by A. M. Hughes (1955) as representing a new genus and species:

\**Algophagus antarcticus*

In 1951–52 K. G. Brown went to Heard for a year, with an Australian National Antarctic Research Expedition (ANARE), and collected 20 species of insects (including Collembola), 18 of them free-living species. These did not include 1 collembolan and 4 biting lice recorded earlier. Brown (1964) described 5 species as new \*, as well as a new subgenus, but all of them are synonymized in the present work.

<i>Tullbergia antarctica</i>	* <i>Ectemnorhinus</i> (* <i>Heardius</i> ) <i>hoseasoni</i>
<i>Tullbergia bisetosa</i>	* <i>Ectemnorhinus</i> (* <i>Heardius</i> ) <i>forbesi</i>
<i>Cryptopygus antarcticus</i>	<i>Antarctonesiotes gracilipes</i>
<i>Parisotoma octo-oculata</i>	<i>Mesembriorrhinus brevis</i>
<i>Meropathus chuni</i>	<i>Anatalanta aptera</i>
<i>Canonopsis s. sericeus</i>	<i>Calcopteryx moselyi minor</i>
<i>Canonopsis s. heardensis</i>	<i>Amalopteryx maritima</i>
<i>Ectemnorhinus</i> ( <i>E.</i> ) <i>crassipes</i>	<i>Parapsyllus magellanicus heardi</i>
* <i>Ectemnorhinus</i> ( <i>E.</i> ) <i>niger</i>	<i>Notiopsylla kerguelensis</i>
* <i>Ectemnorhinus</i> ( <i>E.</i> ) <i>jelbarti</i>	* <i>Pringleophaga heardensis</i>

In 1954 S. von Kéler recorded Mallophaga as follows:

<i>Austrogoniodes cristati</i>	from	<i>Eudyptes chrysolophus</i>
* <i>Cesareus bicornutus</i>	"	"
<i>Cesareus macquariensis</i>	"	"
<i>Cesareus hamiltoni</i>	"	<i>Eudyptes crestatus</i>

In 1963 Timmermann recorded a louse, *Quadriceps vaginalis* from sheathbill (*Chionis*) on Heard.

The material forming the contribution to the knowledge of the fauna of Heard Island in this volume was collected by Philip Temple for Bishop Museum on the South Indian Ocean Expedition to Heard Island (private) of 1964–65, which is described below. Two species of feather mites have already been recorded from this collection by Atyeo & Peterson (1967, in Gressitt, ed., "Entomology of Antarctica"):

* <i>Alloptes chionis</i>	<i>Alloptes aschizurus</i> Gaud, 1952
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#### DESCRIPTION OF HEARD ISLAND

*Geography*: Heard Island is a solitary massive island lying at lat. 53°05' S, long. 73°30' E, its nearest neighbors being the small McDonald Group, 43 km to the WSW. It is nearly 500 km SE of Kerguelen, and is about 4,400 km from both Cape of Good Hope and Cape Leeuwin, Australia. Heard is essentially a single island, but has a very few small off-shore islands and reefs (Shag I., Sail Rock and Drury Rock, all to NE), Wakefield Reef to SW, and a number of small rocks and islets immediately off shore at various points. The island is almost circular, being dominated by a single high mountain mass—Big Ben—but with 2 extensions, to the NW and SE respectively.

Heard is about 40 by 26 km, but the main portion is nearly round. Laurens Peninsula, the NW extension, is about 9 km long and 7 km wide (including Red. I.), with mountains up to 715 m (Anzac Peak). It is largely covered with glaciers, with cliffs or moss-covered rocks around the edges, with many bird rookeries. A projection on the north, Red Island, 94 m high, is connected by a sand spit. The peninsula is connected to the rest of the island by a narrow neck, on which

\*Described as new in publication cited.

is the small Mt. Aubert de la Rue, 124 m high. Just to the south, on the coast is Mt. Andrée, 141 m high. To the NE, across Atlas Cove, is a peninsula largely of lava, up to 100 m altitude, terminating at its northern tip with Rogers Head, 145 m high. These 3 areas are connected to each other, and to the main part of the island, by a considerable area, averaging 2.5 km wide, of low sand, mostly a few meters above sea level. Mt. Drygalski, 210 m, projects into the middle of the sand area from the main mass of the island. The main, subrounded portion of Heard has a fairly even outline, edged with cliffs and glacier fronts, with just a few beaches on the south and east, and only 4 projections: Cape Gazert on the west, Saddle Point and Cape Bidlingmaier on the north, and the long sand spit terminating with Spit Point, on the east. Spit Point is an indeterminate headland due to shifting sands and a shallow underwater bank extends for some kilometers from it to the E.

The spit is of low sand, over 8 km long, largely less than 1 km wide, and has a closed lagoon on the broader base. The lagoon is unstable, varying in size from year to year and sometimes being dry.

The main portion of Heard is largely covered with ice, and areas of vegetation and rookeries are limited, mostly being widely spaced around the coast. The largest such area consists of an *Azorella*-covered lava area extending for some distance inland from Long Beach. The main mountain mass, Big Ben—essentially a single large volcano—is almost entirely icecapped and fringed with more or less distinct glaciers. In most cases the various glaciers merge, and are only in part delimited by lateral moraines. Moraines in general are rather limited on the surface, except in the east where glacial recession is most marked.

Big Ben is capped by Mawson Peak, 2745 m. Campbell Peak, 2415 m, to the NE of Mawson Peak is somewhat conspicuous. There are 4 secondary peaks or domes, slightly lower, to the NW (Fremantle Peak, 2377 m) and SE. The silhouette of the island is very striking. Big Ben appears as a single massif rising from the sea, sweeping upward evenly to the edge of its old eroded crater. The crater is filled with ice and from its SW edge the newer active cone of Mawson Peak rises 500 m higher. Slopes are fairly steep on the higher reaches of the massif but ease as they descend to the coastal cliffs, glacier fronts and beaches. The glaciers are heavily crevassed, and there are few nunataks, though a number of barriers or cliffs. Glaciers are in general of the Spitzbergen type, resembling ice-sheets, modified by plucking action. There is clear evidence of glacial retreat, suggesting that in the Pleistocene the island was almost entirely ice-covered. There is evidence of avalanching and various types of erosion, and little melting above 500 m, though short term melting may take place at any height. Melt water exits from round holes at glacier fronts, discoloring the sea out to 8 km from shore.

*Geology:* Heard is a volcanic island. Various expeditions have offered contradicting opinions on whether it was still active or not, but the 1965 expedition reported activity. Seymour, in 1910, reported that Big Ben was active, whereas Aubert de la Rue (1930) stated that there was no activity, not even fumaroles.

The island is largely of basalt, but andesite, dolerite and other lavas are also represented. Laurens Peninsula consists of basalt alternating with tuff. There are areas of basalt covered with scoria (as on Mt. Drygalski). Heard is probably much younger than Kerguelen, which dates back to the end of the Mesozoic. Heard is on the same submarine platform as Kerguelen (the Kerguelen-Gaussberg Ridge), and this lies at a depth varying between about 145 m and 780 m. There were evidently several periods of active vulcanism. Rogers Head is younger than Big Ben. Mt. Drygalski and Mt. Andrée are said to be intermediate between Big Ben and Rogers Head in age. Near Rogers Head there is some older tuff, stratified and eroded, and gray crystalline cal-







Fig. 2. a, Air view of Big Ben, Heard I., from S, ex Walrus aircraft, 1947 (P. Swan, ANARE photo); b, Mawson Peak, Big Ben, from Atlas Cove, 1953, (J. Béchervaise, ANARE photo).

cite, rich in *Globigerina*. Mt. Andrée is of trachyte. The McDonald Is. are also clearly of volcanic origin though no party has ever landed to determine their exact nature.

*Climate:* Heard is probably the coldest subantarctic island. It is the most ice-covered and is higher in proportion to area than any other. Its climatic profile is governed by it lying well within the Antarctic Convergence, it being entirely unaffected by any major land mass, and by its presentation of a high silhouette to the strong prevailing westerlies. Wind is generally from the west, northwest or southwest (rarely from the south, north or slightly east of north) (Bur. Met. 1957). Wind directions and speeds can change very rapidly often causing wide temperature and precipitation variations within half daily periods. Records for Heard are very incomplete, because it has been continuously occupied by scientists for only 7 years, with only a few other visits. The mean annual temperature (1954) is less than 2°C above freezing. In 1954 mean daily maximum



Fig. 3. a, Heard I. from "Patanela", Jan. 1965 (Dr M. Hay, South Indian Ocean Expedition to Heard I. b, Mawson Peak and South Barrier (right) from the west (A. Campbell Drury, ANARE photo); c, American sealers' trypots at Fairchild Beach, overgrown with *Azorella*, 1965 (Warwick Deacock, S. I. O. E. H. I.)

temperature was 3.2°C, mean daily minimum temperature was -0.7°C, highest maximum was 13.3°C, and lowest minimum was -7.9°C. Mean pressure 5 m above sea level was 994.3. Annual precipitation was 1421 mm, with rain on 279 days. Mean wind speed was 19 knots (93 m/sec.) (All 1954).

Snow falls at sea level throughout the year, but dissipates in summer at low altitudes. Cold rain is more common in summer and can occur up to heights of 2000 m—an indication of wide temperature variations caused by fluctuating winds. The snow line is at about 300 m. altitude from December through April, and at sea level in winter. The surface of the ocean freezes or partly freezes occasionally in winter.

Glacial retreat has consisted mostly of reduction in thickness of the glaciers (up to over 50% loss), and to a less extent in recession of the glacier fronts. Some glaciers have retreated quite quickly in recent times, however. The Brown and Stephenson glaciers on the east coast, for example, presented ice fronts to the sea in 1947 but by 1963 had retreated to form beaches and lagoons at their snouts. Glacier movement of Baudissin Glacier was 30 cm/day in winter and nearly 1 m/day in summer (Lambeth 1959). Heard is 90% ice covered (Mercer 1967).

From observations in 1965 it appears as if the lee (east) side of the island receives more favorable weather conditions due to the protection given by the main mountain massif against the prevailing westerlies.

*Vegetation:* The flora of Heard Island is very depauperate. Only 8 species of vascular plants (ferns and flowering plants) have been recorded (Greene & Greene 1963). These include no ferns, 5 herbs and 3 grasses. All are considered native in the sense that they arrived by natural means, and thus no cosmopolitan weeds have apparently been established. The list follows:

- Cruciferae: *Pringlea antiscorbutica* R. Br.
- Caryophyllaceae: *Colobanthus kerguelensis* Hook. f.
- Rosaceae: *Acaena adscendens* Vahl.
- Callitrichaceae: *Callitriche antarctica* Engelm.
- Umbelliferae: *Azorella selago* Hook. f.
- Gramineae: *Deschampsia elegantula* (Steud.) Parodi  
*Poa cooki* Hook. f.  
*kerguelensis* Steud.

The bryophytes are much more numerous in species on Heard than are the vascular plants. Mosses recorded from Heard are as follows (Clifford 1953):

- Seligeraceae: *Blindia contecta* (H. f. & W.) C. M.  
*tortifolia* (H. f. & W.) C. M.
- Ditrichaceae: *Ditrichum subaustrale* Broth.  
*Ceratodon purpureus* Brid.
- Dicranaceae: *Dicranoweisia grimmiaea* (C. M.) Broth. (? syn. of *Blindia contecta*)  
*Dicranoloma billardieri* (Schwaeg.) Par.
- Pottiaceae: *Tortula robusta* Hk. & Grev.
- Grimmiaceae: *Grimmia insularis* Mitt.
- Bartramiaceae: *Bartramia papillata* H. f. & W.  
*diminutiva* C. M.  
*robusta* H. f. & W.
- Orthotrichaceae: *Rhacomitrium crispulum* (H. f. & W.) H. f. & W.  
*nigratum* (C. M.) Jaeg.





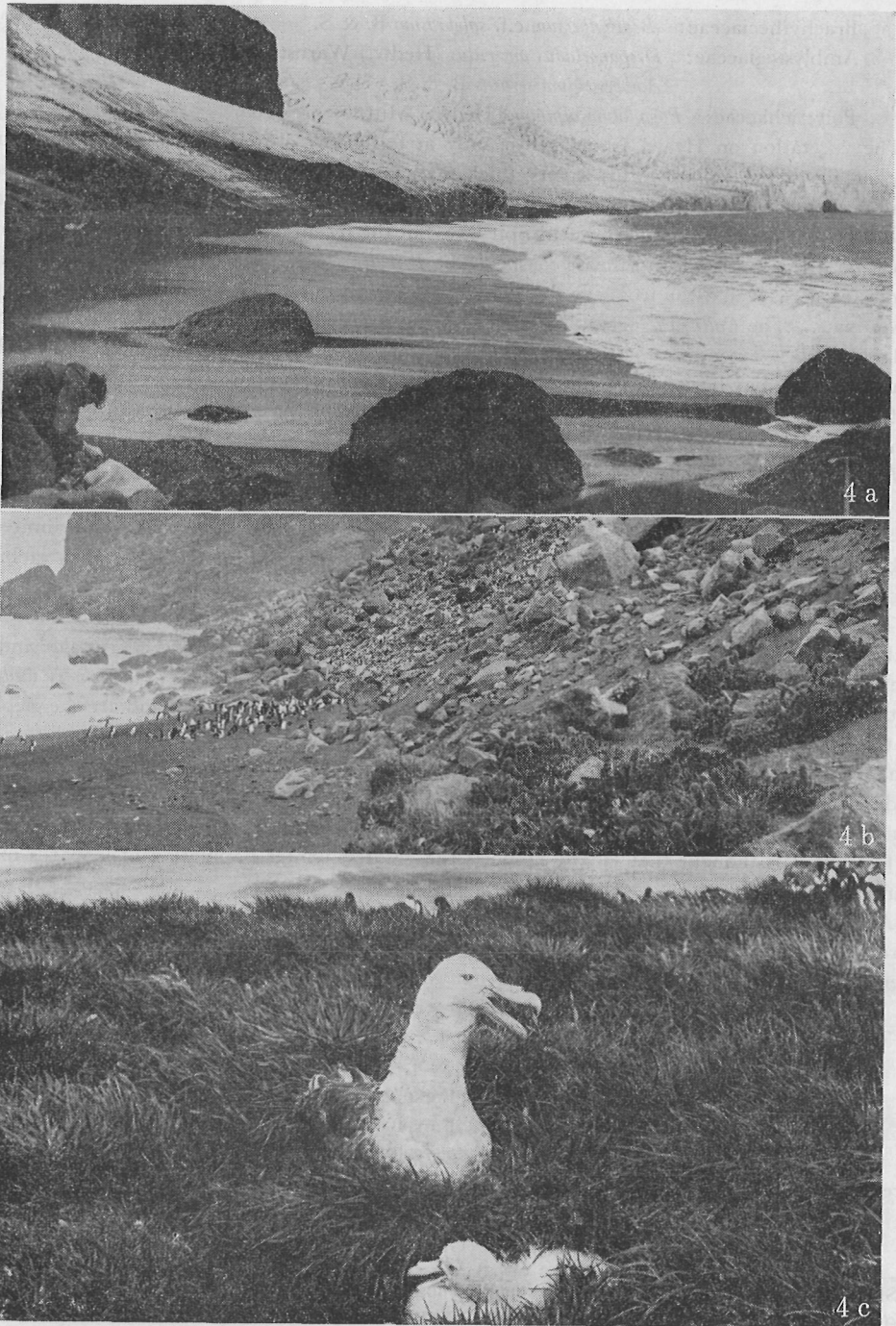


Fig. 4. a, North coast of Heard I., 1963 (Warwick Deacock, ANARE photo); b, Beach by South Barrier, with Gentoo Penguins and Kerguelen cabbage (Warwick Deacock, S. I. O. E. H. I.); c, Giant petrel with young; tussock grass and Gentoo penguins; Long Beach (W. Deacock, S. I. O. E. H. I.).

- Daption capensis* (L.), Cape pigeon. R  
*Thalassoica antarctica* (Gm.), Antarctic petrel. V\*  
*Fulmarus glacialisoides* (Sm.), Silver-grey fulmar. V  
*Pagodroma nivea* (Forst.), Snow petrel. V\*  
*Halobaena caerulea* (Gm.), Blue Petrel. V\*  
*Pachyptila desolata* (Gm.), Dove prion. SR  
     *crassirostris* (Math.), Fulmar prion. R  
*Procellaria aequinoctialis* L., Cape hen (Shoemaker). V\*  
 Hydrobatidae: *Oceanites oceanicus* (Kuhl), Wilson's storm petrel. SR  
     *Fregatta tropica* (Gould), Black-bellied storm petrel. V\*  
 Pelecanoididae: *Pelecanoides urinatrix exsul* Sal., Kerguelen diving petrel. R  
     *georgicus* M. & H., South Georgian diving petrel. SR  
 Pelecani.: Phalacrocoracidae: *Phalacrocorax atriceps nivalis* Falla, Heard I. shag. R  
 Lari.: Stercorariidae: *Catharacta skua loennbergi* (Math.), Southern skua. SR  
 Laridae: *Larus dominicanus* Licht., Dominican gull. R  
 Sternidae: *Sterna vittata vittata* Gm., Antarctic tern. SR  
     *macrura* Naum., Arctic tern. Migrant  
 Charadri.: Chionidae: *Chionis minor nasicornis* (Reich.), Heard I. sheathbill. R

#### ENTOMOLOGICAL FIELDWORK, 1965

Previous entomological collecting had been done largely in the NW portion of Heard. The work of the South Indian Ocean Expedition to Heard Island was entirely in the southern and eastern portions. Collecting was done on the South Indian Ocean Expedition in the following areas, the two major collecting areas being Poly Gully and Spit Bay.

Long Beach (on south).

South Barrier region (on south) to height of approx. 600 m. This region is the highest unglaciated section of the island. It is clear of permanent ice up to about 1200 m.

Poly Gully (on SE). This is a vegetated valley immediately west of Winston Lagoon.

Winston Lagoon shores (on SE).

Green Valley (on SE). This is a recently vegetated valley to east of Winston Lagoon.

Spit Bay (on east). Area between Spit Lagoon and Dovers Moraine.

Skua Beach (on NE).

Active collecting was continued 31 January to 9 February 1965 inclusive, largely by P. Temple but with assistance of other members of shore party.

*Field notes:* Collecting conditions were mediocre. Bad weather is synonymous with Heard Island and generally strong winds and rain predominated. Weather conditions were distinctly better in the Spit Bay region than at Poly Gully though one good day was encountered while collecting on South Barrier. Travel is always a problem for the scientific collector. It is not possible to travel for more than 5 km around the coast without using climbing rope and ice axe for security in traversing the generally broken glaciers. As an alternative, sea travel in small boats cannot be recommended due to sudden gales, high seas and the difficulty of finding safe landing sites. Even the few open beaches are generally guarded by heavy surf. Dogs and sledges have been used in the north and west but the land configuration of the south and east make their use difficult. In summary, a collector must be a competent glacier traveller and capable of carrying not only collecting materials but food, clothing, camping and climbing equipment.

Accommodation also poses problems. Apart from the closed ANARE base at Atlas Cove,

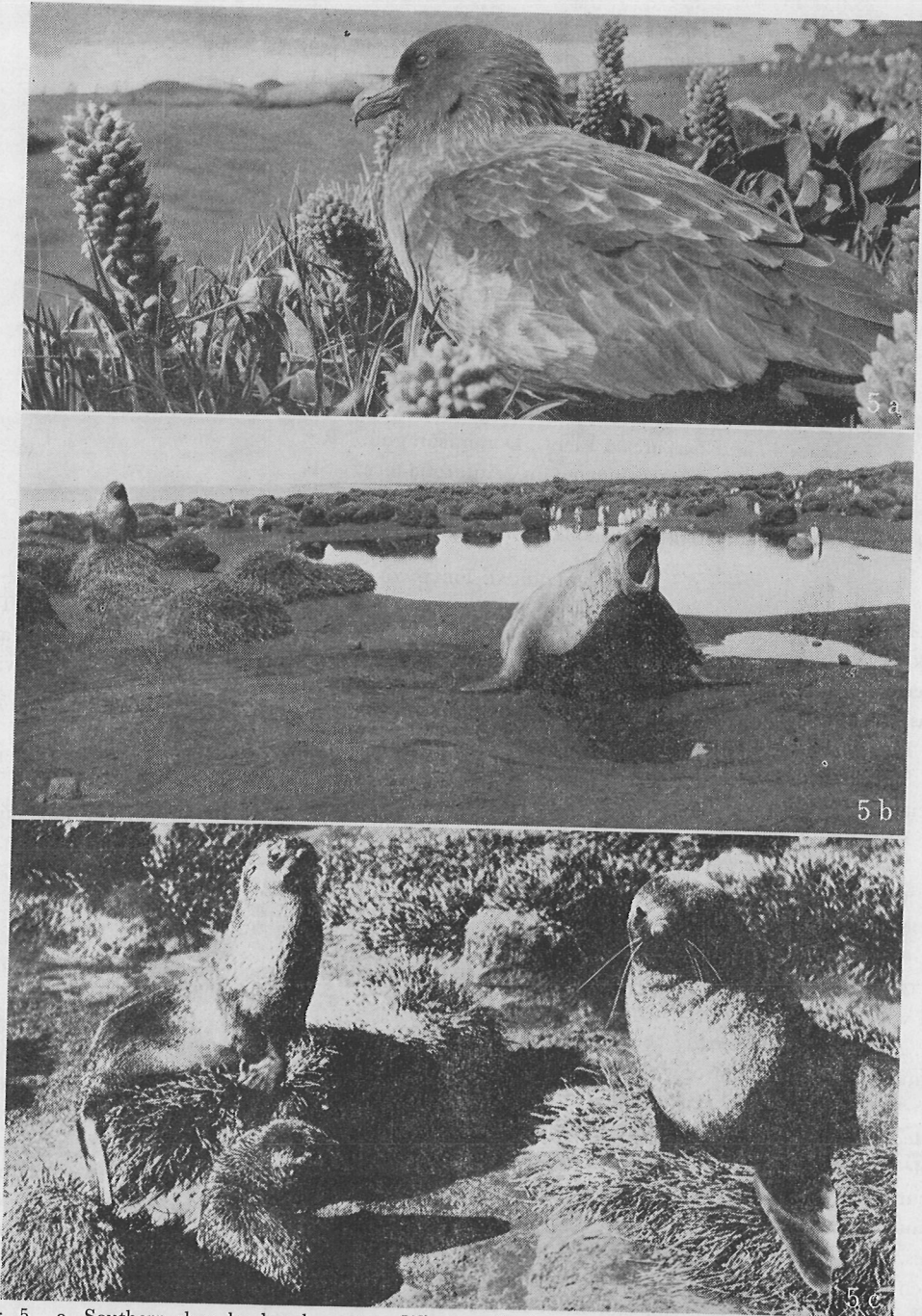


Fig. 5. a, Southern skua by beach next to Winston Glacier lagoon, with Kerguelen cabbage (W. Deacock, S. I. O. E. H. I.); b, Elephant seals, showing trampled tussock (W. Deacock, S. I. O. E. H. I.); c, Fur seals at Heard I. (G. M. Budd, ANARE photo).





Fig. 6. a, Gentoo penguin with young, Long Beach, Heard I.; b, Philip Temple using aspirator to collect flightless flies on *Azorella*, Heard I.; c, Rockhopper penguins, South Barrier. (All taken by Warwick Deacock, S. I. O. E. H. I.).

there are only two small refuges, located at Saddle Point in the north and at Spit Bay in the east. Elsewhere a tent must be used and, with the prevailing weather conditions, this often makes collation and preserving of insects an awkward procedure.

#### *Collecting methods*

1) Aspirator. Due to the restricted nature of collecting areas, poor weather conditions and the secretive habits of most species, the aspirator proved the most effective piece of collecting equipment. It was particularly useful for collecting beetles and springtails. Essential.

2) Sweeping. The use of a net was not recommended to the collector but one was taken ashore and was found especially useful in grassy wallow areas where good numbers of flies and moths were obtained. Useful.

3) Funnelling. A Berlese funnel was used but due to restricted accommodation and wind buffeting of tents, its effectiveness was reduced. In an effort to obtain more specimens from soil a new funnelling method was adopted. Ordinary, small plastic funnels with wire gauze at the orifices were inserted in large vials of alcohol. These combinations were placed in padded tins for safety, then debris was packed firmly in the funnel mouths with a liberal layer of naphthalene sprinkled on top. Overall a piece of polythene was firmly tied for protection and to prevent specimens escaping. It was found when left overnight that hundreds of mites and springtails had dropped into the vials. Berlese funnel—recommended where hut accommodation is available. “Speed” funnels—essential.

4) Light trap. Since no flying insects had been recorded on Heard Island, a light trap was not taken ashore. A pressure lamp was found at the Spit Bay refuge, however, and this was used with a sheet for a few hours one night with almost negative results—only a few specimens of beetles being attracted along the ground. Not useful.

5) Parasite collection. Neither time nor facilities were available for an examination of all species of vertebrates. When circumstances and time permitted, some birds were captured and examined though some priority was given to search of prion (*Pachyptila desolata*) burrows. This was rewarding and most parasite material was collected from this source.

#### HABITAT NOTES

*Collembola*: Very common. Found most often in humus, roots of vegetation, especially where there approximated rock, wood (i.e. remains of sealers' huts) or bare earth. Different species appeared to associate with each other.

*Coleoptera*: Common. Found in or near most types of vegetation, often on bare earth or rock. Larvae in close packed roots of *Azorella selago*. Highest beetles were collected at 600 m plus and were found under scoria stones on South Barrier; larvae were in patches of moss. This is probably the highest point at which insects have been collected on Heard Island and it is possible that Coleoptera could be found up to 1000 m in this region.

*Diptera*: Fairly common. *Anatalanta aptera* were common in penguin rookeries and seemed to be mainly associated with birdlife. *Amalopteryx maritima* were generally found in seal wallows and adjacent grassy areas. *Calcopteryx moselyi minor* were associated with *Pringlea antiscorbutica* but were not found at higher levels where the plant was present though sparse. There was an almost total lack of weed or kelp on the beaches (probably due to heavy surf conditions) and no flies were observed on the littoral.

*Siphonaptera*: Probably widespread but since parasite collecting was incomplete were only observed in numbers during excavation of prion burrows.

*Mallophaga*: Again, probably widespread but collecting in this area was only superficial. Some lice were collected from specimens of *Catharacta skua* and *Eudyptes chrysolophus*.

*Lepidoptera*: Common. Moths were found in good numbers at both Spit Bay and Poly Gully, especially prolific at Spit Bay, and were found in and between clumps of tussock grass. Numbers found and dates of collection suggest that this moth's life cycle extends to mid-February at least and not end of January as suggested by Brown.

*Arachnida*: Ticks were found only in prion burrows but mites were widespread, not only in burrows but in vegetation roots and subsoil and among rocks. Araneida were always found in conjunction with good mite populations.

*Conclusion*: About 23 species of land arthropods were collected. This is about as many as had been collected previously but includes several new species, as some of the earlier records represent misidentifications or synonyms (partly of other species occurring on Heard).

It is unlikely that the full range of land arthropods on Heard has yet been collected. Extensive funnelling work needs to be continued over a period of time for further soil inhabiting species and a concerted effort made to examine all vertebrates for parasites. In addition, collections to date have not sampled all vegetated or vertebrate inhabited areas of the island.

*Kerguelen*: M. C. Hay, cinephotographer of the 1964-65 expedition collected insects at Kerguelen while the *Patanela* was anchored there during the land-based operation at Heard.

*Acknowledgments*: We are greatly indebted to various authors of this volume for studying the collections from Heard Island. We are likewise indebted to the members of the South Indian Ocean Expedition to Heard Island for making the expedition a success, and to the many supporters of the expedition, who made it possible.

*Note*: References will be found at end of final chapter of this volume. See particularly, Temple, 1966, The sea and the snow; Cassell, Melbourne.