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1911-14
UNDER THE LEADERSHIP OF SIR DOUGLAS MAWSON, D.Sc., F.R.S.

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PART 5.

MARINE BIOLOGICAL PROGRAMME
AND OTHER
ZOOLOGICAL AND BOTANICAL ACTIVITIES

COMPILED BY
DOUGLAS MAWSON,
UNIVERSITY OF ADELAIDE.

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MARINE BIOLOGICAL PROGRAMME
AND OTHER
ZOOLOGICAL AND BOTANICAL ACTIVITIES
BY
DOUGLAS MAWSON.

I.—Introductory Remarks.

Biological observations conducted within the Antarctic Regions are almost entirely concerned with the life of the sea. Ashore there is extremely little of either plant or animal life, but that of the environing seas is astonishingly abundant. Indeed it is the richness of the plankton that determines for Antarctic seas pre-eminence in whale population. But the floor of the sea also is just as remarkable for its rich carpet of life.

The main body of the marine collections was obtained by trawlings and dredgings. These were conducted partly in the shallow waters off each of the shore stations using small hand dredges, and partly in deeper waters from the "Aurora," employing larger dredges and trawls operated by a winding gear specially installed for the job.

The bulk of the general equipment for this work was purchased in London. Other items, some of them very important, were loaned to the Expedition. Thus, we were greatly indebted to that ardent oceanographer H.S.H. Albert I, Prince of Monaco, who loaned valuable equipment from his oceanographic museum and arranged for a member of the Expedition, Dr. Xavier Mertz, to receive instruction and experience in the use of the equipment at Monaco through Dr. J. Richard, the Director of the Museum. The great assistance thus rendered was entirely due to the cordial help and good offices of the renowned French Antarctic explorer, Dr. Jean Charcot, to whom we were indebted as well for help and advice in other matters of equipment.

The South Australian Museum, Adelaide, through the Director, Sir Edward Stirling, and the National Museum, Melbourne, through the Director, Sir Baldwin Spencer, both assisted materially in the provision of biological equipment, especially in the matter of containers and materials for the preservation of specimens. Finally several useful items of equipment were lent by the Commonwealth Department of Fisheries Investigations.

The late Professor W. A. Haswell took a great personal interest in the welfare of the biological work of the Expedition. Through him we secured as a member of the Expedition Staff J. G. Hunter, our able chief biologist, who was then associated with Professor Haswell's Department at Sydney University. On the return of the Expedition Professor Haswell very kindly undertook the distribution to authorities

throughout the World of the collections for examination and report. This great service and the editing of the earlier published biological reports was continued until cut short by his death. Hunter's record throughout the undertaking was an extraordinarily good one.

A brief review of the nature of the operations undertaken can be considered best under the several divisions into which respectively the work naturally fell.

II.—At the Main Antarctic Base.

Located at Commonwealth Bay, 142° 30′ east longitude, the Expedition's main Antarctic base was situated in a virgin area, no coastal station having previously been occupied nearer than Cape Adare to the east and Gaussberg to the west. With open water almost all the year around along that coast a wealth of marine life was offered for investigation. Our very first acquaintance with the shallow waters off Cape Denison and around the MacKellar Islets revealed an unexpected growth of coarse marine algae, recalling that of the coastal fringe of Subantarctic lands, rather than of Antarctica where the grinding of floating ice usually prohibits the growth of marine algae in shallow waters. We were to learn that the violent offshore winds prevailing throughout the year along the coast of Adelie and King George Lands successfully keep the shallow waters free from ice, which is driven out to sea as fast as it forms. There is therefore in that region exceptional opportunity for the existence of shallow water marine life. Consequently from the moment of arrival we looked forward to securing extensive collections.

In the end a great deal was accomplished, thanks to J. G. Hunter, and the help that a number of others of us were able to contribute. But most of what was done was achieved only by making the most of every opportunity offering and at the price of considerable personal hardship. All this was due to the extraordinarily severe weather prevailing along that coast. Rarely except for a few days at midsummer, does the weather calm down sufficiently to allow of the prosecution of marine investigations. The sea is constantly being lashed into foam, so that even were a boat available, it could rarely be used. A fine whale-boat, part of the equipment intended for this work, was torn from what had appeared to be perfectly secure moorings under the icefoot at the head of the small boat harbour near the hut. A section of the icefoot went with it and it was never seen again. Thus relieved early in the occupation of the area of any possibility of using a boat, we looked forward to the freezing of the sea in winter and the conduct of a dredging programme operating from the surface of the bay-ice. But here a further disappointment was in store, for the winds proved so strong and continuous that the lulls did not allow sufficient time for sea-ice to form. So that only for a couple of days in each of the two years of occupation of that station was there bay-ice sufficiently strong to support the weight of men working on it. The first days of September, 1912, were memorable in this connection. A calm spell allowed the ice

to form of sufficient thickness to allow dredging operations to be conducted at a distance of about a third of a mile off the shore at Cape Denison. A number of dredge hauls on each of several types of bottom were secured in that locality. Working thus from the surface of the bay-ice the dredge, secured on an endless rope, is dragged backwards and forwards along the bottom from one hole cut through the ice to a second similar hole at a distance of about 200 yards. These holes are made, where possible, along the course of cracks in the bay-ice, through which the dredge rope can be pushed so that it passes beneath the ice. By cutting one of the holes progressively more and more to one side, as the dredge is repeatedly dragged backwards and forwards, new areas of the bottom are scraped.

In the absence of stronger bay-ice at Cape Denison, we were tempted to conduct dredgings on very thin ice with the result that many of us had a ducking. We discovered that there was a good deal of risk in such work, because the ice was so thin that one broke through it, and having done so, experienced great difficulty in again climbing out onto it for, of course, it was prone to continue crumbling under one's weight. On such occasions the difficulty is aggravated for soon one is semi-frozen and encumbered with clothes heavily laden with seawater.

The thin bay-ice of those early September days went out to sea without warning, driven before a gale of wind which suddenly descended the land slopes. At the time all hands were out on the sea-ice making the most of the opportunity presented. Fortunately everybody just managed to make the land in time to avert a disaster. Nothing but raging water was seen for weeks afterwards.

The dredging stations* worked by the wintering party in the vicinity of the Main Base fall into one or other of five localities marked on the accompanying sketch plan.

Station 1.—Repeated dredgings were made throughout the year in the Boat Harbour in depths of water ranging from 8 to 25 feet. Here the bottom was sandy with some growths of coarse seaweed in the deeper holes. The dredge hauls included holothurians, annulates, small crustaceans, gastropods, polyzoans, starfish, pycnogons, sponges, etc. Fish, crustaceans and a few other forms were regularly caught in the fish-trap. Pteropods and jellyfish were taken in the hand net.

Station 2.—Several hauls were made at a spot about 200 yards N.E. of the eastern entrance to the Boat Harbour. These were in about 30 feet of water on a bottom covered with a rank growth of seaweed. Though the seaweed greatly hindered the operation of the dredge, some useful material resulted, notably an abundance of mollusca including numbers of Anatina (*Laternula elliptica*).

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* Lists of dredging stations have already appeared in two of the biological (Series C) publications of these reports; namely in Vol. III, Part 1, "Fishes," by Edgar R. Waite, and in Vol. IV, Part 1, "Mollusca," by Charles Hedley. The list of dredging stations enumerated in those works corresponds very closely with each other but they are only partial and do not cover the complete activities of the Expedition. They were compiled and adopted by the authors in question to meet their needs in discussing the groups of organisms submitted to them, respectively, for report. This present publication is a wider and more detailed review of the biological field work of the Expedition; and accordingly the complete list of collecting stations is given. The serial numbers adopted for the various stations herein listed do not correspond with those appearing in the above-mentioned volumes.

However, as the data supplied in the lists includes in the case of each station both the data and depth of the sea floor no difficulty is presented in recognising stations in this list corresponding respectively to those of the earlier published partial lists.

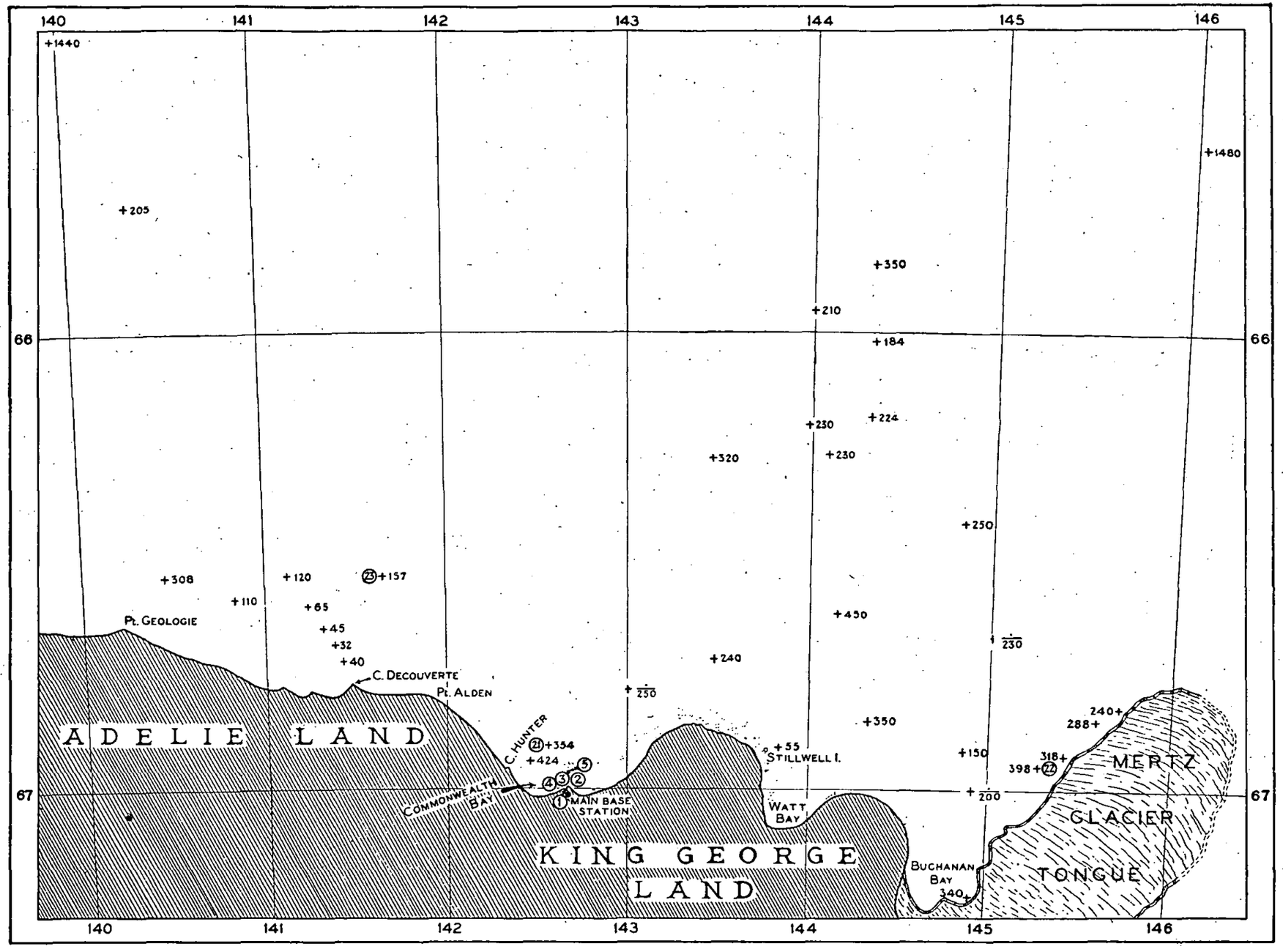


Fig. 8. Showing location of Soundings and Dredging Stations in the Region adjacent to the Main Antarctic Base.

Station 3.—This locality was about 200 yards north-west of the ice-capped islet off the western entrance to the Boat Harbour. There the water was deeper, about 25 fathoms, and the bottom only slightly encumbered by seaweed. A great range of life was taken here, prominent amongst which were pycnogons.

Station 4.—Due west of the entrance to the Boat Harbour and distant half a mile. The range of depth lies between 15 and 30 fathoms; the bottom is partly rock and partly sand. The dredge hauls were prolific including echinoids, tubicolous annulates, starfish, crustacea, pycnogons, mollusca, small annulates, a few holothurians, an actinozoan, a few nemerteans, sponges and ascidians.

Station 4A.—On the 21st December, 1913, a dredging from the motor launch was made about a quarter mile north of Station 4. The depth of the water was about 58 fathoms.

Slime sponges and polyzoa (calcareous and non-calcareous) were in greatest abundance. Hunter's record states " the bottom appears to be nothing but a feltwork of these animals, with other forms mixed—there being in the catch only a very small amount of brown algae and a few small gneissic pebbles. Echinoderms were fairly well represented—Asteroidea, a few (crimson and yellow mainly), Echinoidea, fairly numerous (mostly reddish-purple and also several red-brown spatangoids), ophiuroids, all small pinkish forms and several larger reddish-brown forms. Hydrozoa not very numerous. Two species of alcyonarians (one pink, a fine specimen), a few tunicates, simple and compound. Crustacea, a number of amphipods and isopods; one amphipod was yellow and attached in numbers to a sponge of the same colour, so that at first sight it was difficult to detect them; also several fine red shrimps. Annulates, mostly Polynoidae, but also several coloured annulates found amongst branches of polyzoa and alcyonarians. Mollusca, not very numerous and mostly small, also two soft bodied forms. Lastly several nemerteans."

Station 5.—This was located a couple of hundred yards east of the larger of the MacKellar Islets. There the bottom is sandy with some weed patches. The depth ranges from 3 to 8 fathoms. This locality was not found to be rich in bottom life, the yield corresponding closely with that from Station 1.

Peering down into shallow water off Cape Denison on the rare occasions when calm prevailed, one could see odd starfish, holothurians and molluscs resting on the sandy bottom, pteropods drifting by, and numerous small but active crustaceans traversing the waters at all depths. Where one could gaze down through calm water into groves of giant seaweed, there could often be observed examples of the common coastal fish of Antarctica, a species of Notothenia. These live hidden amongst the kelp, apparently for protection against their enemies—the seals. On one occasion, in the spring of 1913, two of our party fishing at the entrance to the Boat Harbour in

about 15 feet of water, caught over fifty of these scaly folk in one hour. No sooner was the baited hook cast into the water than many inquisitive heads would peer at it from amongst the kelp, and as quickly one or other would be hooked.

Fish traps baited with seal meat or penguin carcases were used with good effect. Invertebrates were also caught in woven wire fish traps, which were made more effective for securing examples of the smaller life by lining the floor and part-way up the sides with cotton mosquito net.

Euphausian life is unbelievably abundant on the bottom in those shallow waters. Standing on the ice-foot on occasions when the seawater was quite tranquil one could observe the Adelie penguins feeding upon these euphausians. When thus feeding, the streamlined bodies of the Adelie penguins could be seen rapidly moving in a tortuous course through the water just above the bottom; without slackening pace, they picked up the small crustaceans as they shot through the water.

In the pack-ice of the off-shore belt, crab-eater seals and sea-leopards are almost always within sight basking on ice rafts. In the pack-ice of the Australian quadrant it is rare to meet with any considerable concentration of such seals, though more than 100 have been observed from the ship's deck at one time.

Where seals are observed on ice rafts drifting within several miles of the coast, or basking on the shore itself or on ice rigidly attached to the land, they are almost exclusively Weddell seals. Only on very rare occasions did we meet either a crab-eater seal or a sea-leopard on the shore ice. Sea-elephants are not unknown in the coastal waters of the Australasian Antarctic but when met they are to be regarded as strays from their Subantarctic haunts. One large young bull elephant seal actually came ashore at Cape Denison whilst we were there.

The home of the Ross seal is undoubtedly amongst the pack-ice, but seen at any distance from the ship's deck it is difficult to distinguish them positively from crab-eater seals. However, on several occasions we were convinced that seals in view on the pack-ice were of the Ross species. The only examples of this rare species captured by the Expedition were all (seven specimens) taken together on the margin of bay-ice rigidly attached to Queen Mary Land in the neighbourhood of the Haswell Islands.

Only two species of penguin were encountered throughout the wide sector of the Antarctic coast visited. The ubiquitous Adelie penguin was, of course, in occupation during the summer at every rocky point along the coast and on the off-lying islands. Odd birds and even bevies of them are a recurring feature amongst the pack-ice. The larger ice-free islets of the Mackellar Group, lying off Winter Quarters, are densely populated with Adelie penguins in summer time. Smaller rookeries are scattered at intervals along the mile of rocky coast of the mainland at Winter Quarters. About the end of March each year, when the young are fully developed, they leave Antarctic shores and do not return until the middle of October, in time for the next breeding season.

Emperor penguins, on the other hand, are comparatively rarely seen in the sector including Adelie Land and extending west to Knox Land. Those observed off King George Land appear to be dispersed from breeding centres lying to the east. In the seas bordering on Queen Mary Land Emperor penguins are strikingly abundant which is not surprising since members of our Western Base party located one very large rookery at Haswell Island. What is almost certainly a second rookery situated at the north end of the Shackleton Ice Shelf was sighted from the " Aurora " during the last cruise in 1914.

Unlike the Adelie penguin, the Emperor remains along Antarctic shores all the year round. With them, winter is the breeding season.

Of other bird life, the seas and coasts visited teem with legions of birds which however, are restricted to a limited number of species. Antarctic petrels, silver-grey petrels and snow petrels are all exclusively Antarctic in their distribution. They all keep within the region of the coastal waters and drifting ice. Cape pigeons and Wilson petrels are more characteristically Subantarctic but are also common along Antarctic coasts and both nest there. The carrion birds, skua gulls and giant petrels are a feature of the coastal life in summer time but depart in autumn when there are no longer eggs and young of penguins and other birds to prey upon. Skua gulls may be found nesting everywhere along the coast wherever Adelie penguin rookeries occur. Giant petrels, on the other hand, are not known to nest on the Antarctic mainland.

During the height of summer, terns may be met with in flocks of many hundreds feeding along the northern margin of the pack-ice. They appear to be restricted to this zone and have never been recorded over the land. They evidently represent a summer migration from islands or lands lying to the north.

Several species of Subantarctic birds range south as far as the pack-ice near the land, but do not come ashore or nest in Antarctica. Included amongst these are cape hens, prions and sooty albatrosses. It should be mentioned, however, that a single exception to the rule was established in the case of a pair of prions, found by McLean, nesting amongst the rocks near Winter Quarters, Cape Denison.

Snow petrels, Wilson petrels and skua gulls nested in numbers in the vicinity of Cape Denison. The first nesting places of the Antarctic petrel ever recorded were discovered by the Expedition. The largest such rookery found is located at Cape Hunter, 8 miles west of Cape Denison. About 30 miles east of Cape Denison, at Stillwell Island and elsewhere in that neighbourhood, silver-grey petrels nest in numbers. Our discovery of this and other nesting areas constitutes the second occasion that the eggs of this bird had been taken. A rookery of cape pigeons was found by a sledging party on a rocky point on the coast about 40 miles east of Winter Quarters. The nesting places of these birds were also found further afield in King George Land as, for example, at the Horn Buff where Madigan's party found miles of thousand-feet high, rocky cliffs densely populated with sea bird life during the summer nesting season.

The abundant bird life haunting the shores of Adelie Land during the summer season moves north as winter approaches. Of the flying birds there remain in winter only the snow petrels, Antarctic petrels and, more rarely seen, the silver-grey petrels. None of these birds come ashore at this season but odd birds and flocks were often seen flying past Cape Denison close to the shore. On rare occasions a few Antarctic petrels and snow petrels would fly just over the land when passing the Cape. On such occasions in winter we were able to shoot numbers of them for the taxidermist to deal with.

Evidently they feared neither the cold winter temperature nor the fierce hurricanes. In a steady off-shore wind of 30 to 40 miles per hour these marvellous birds would bear up steadily into the wind, at times almost hovering motionless, then dipping down to the water within 50 yards of the shore, would, whilst still on the wing, pick up food from the freezing waters. So far as we could judge, the particles they were picking from the drifting ice sludge on the surface of the water were frozen pteropods and small crustaceans.

It is obvious, therefore, that the Expedition had ample opportunities for studying Antarctic bird life. With regard to the publication of these observations and the Expedition records relating to seal and whale life, it has been arranged to include them in volumes respectively dealing with those subjects, to be issued among the publications of the British–Australian–New Zealand Antarctic Research Expedition of 1929–31. This course has been adopted with a view to condensation of reports and consequent saving in cost of printing.

Of real land life there is little to investigate and collect. It consists of a few examples of moss and lichen adhering to the rocks in more sheltered places. This plant life in turn supports a restricted variety of inconspicuous microscopic creatures such as mites, rotifers and the like. Fresh water ponds, though frozen for all but a few weeks in the year, are stocked with obvious growths of a brown alga and with microscopic life, both plant and animal. Such delicate microscopic life needs to be examined on the spot, for it does not lend itself in the same degree to preservation for subsequent examination as do macroscopic forms of life. However, Hunter attempted to record recognisable material by first narcotising it with cocaine and then preserving with Fleming's solution. Also he dried some of the lake alga and specimens of moss both of which supported rotifer and tardigrade life.

Unfortunately the authority to whom the latter material was submitted, Mr. J. Shepherd, of Melbourne, was not able to make much out of it chiefly because the dried material was left too long before cultivation was attempted. By that time the creatures were dead. Ordinarily, on moistening such dried vegetation, even months after collecting,

the rotifers and tardigrades will again become active. Fortunately Hunter had studied these rotifers and tardigrades under the microscope at Winter Quarters and had written the following short notes thereon :—

Rotifers.

Rotifers were obtained from (*a*) glacial lakes and thaw pools, (*b*) mosses.

(*a*) Situated close to Winter Quarters, Adelie Land, were several small glacial lakes and from these rotifers were obtained in great numbers. For the greater part of the year they remain frozen in the ice as it is only during the months of December, January and early February that the lakes are not entirely frozen. As soon as the ice melts, however, the rotifers quickly assume active movement, the fact that they are frozen for the greater part of the year not affecting their vitality. Even when alternatively thawed and frozen they apparently suffered no harm.

The rotifers were obtained in large numbers attached to the algae found in these lakes and specimens could always be obtained during the winter by simply thawing out some of the frozen algae. In summer the stones in the lakes became covered with bright red patches, often a few inches across, formed by myriads of these beautiful red rotifers. In summer, also, large numbers of rotifers were to be obtained from shallow thaw pools.

Rotifers from the lakes and thaw pools, as far as I could judge, belong to two genera—*Philodina* and *Adineta*. They were both very abundant, and if anything, *Adineta* more so than *Philodina*. The two most conspicuous species of both these genera were viviparous; several specimens of *Philodina* contained five young. The *Adineta* forms were coloured light brown, slightly darker in the region of the stomach. Of the *Philodina* species, the largest and most conspicuous was bright red in colour in stomach region, but paler towards either extremity; whilst remaining types were coloured red in stomach region only.

I tried to narcotise specimens with cocaine with the object of fixing them with Fleming's solution, but I was not very successful. Specimens of *Philodina* could be fixed extended (corona not everted) although constricted in middle region of the body. The *Adineta* specimens however contracted into almost a ball, and were not at all amenable to cocaine.

(*b*) Moss rotifers, although numerous, were not nearly so abundant as in the lakes. Like the lake forms they readily thawed out and could be frozen and refrozen without any apparent effect.

As in the lakes Bdelloid rotifers were the only types observed. As far as I could say, there appeared to be one main genus *Adineta*, oviparous and smaller than the lake forms. Specimens were coloured light brown (almost colourless in young forms) or somewhat yellowish brown. Like lake forms they were not amenable to cocaine.

Tardigrades.

Tardigrades were obtained in most abundance from the lakes, very few specimens being observed amongst the moss. Like the rotifers they were frozen for the greater part of the year but soon assumed movement after being thawed out. They could also be frozen and refrozen without impairing their vitality.

As far as I could determine they were all species of *Macrobiotus*, no *Echiniscus* forms being observed. The eggs of one form were very numerous and resembled the egg of *Macrobiotus arcticus*. Most of the forms contained a brownish pigment in the central region, whilst some contained in addition a bluish pigment generally at either end of the brown pigment.

These notes and the material collected were submitted to Mr. J. Shepherd who wrote in reply :—

"Looking over the material and referring to Mr. Hunter's notes I am of opinion that his remarks are all that can now be given. It seems a fairly good report, and I cannot add anything to it. So far as I could judge he is probably correct in his statement as to the two genera of rotifers found, also that the Tardigrada, which by the way are better preserved, are of the genus *Macrobiotus*.

Had the moss been treated by a cultivation method early good results might have been secured. This I was unable to do. No loricate species, as would lend themselves to determination were found by me."

A. L. McLean in addition to his duties as a medical officer at the shore station at Cape Denison, found time to prosecute extensive investigations concerning bacterial life generally and of parasites in the blood of seals and birds.

External and internal parasites of birds, seals and fish were diligently sought for with the result that examples of both classes were found in the case of all the birds and the seals. Even the noble emperor penguin was found to be not without its specific kind of "lice."

All this work executed at the main base, Cape Denison, was in the hands of J. F. Hunter as chief biologist, but much assistance was rendered by others. A great deal of Laseron's time was occupied in assisting Hunter chiefly in the matter of taxidermy. On a summer sledge journey to the region east of Winter Quarters, Laseron collected many birds and the eggs and made valuable biological notes.

A. L. McLean, one of the party under the leadership of C. T. Madigan, that traversed the coast-line of King George Land still further to the east, collected specimens of moss and bird life from Penguin Point and the Horn Bluff. Unfortunately at a late stage on the return journey, in order to save their own lives, much of their geological and biological collections had to be depôted. A retrieving expedition sent out the following year failed to locate the depot owing to excessive snow-fall having obliterated all trace of it.

In the original plan of the Expedition, provision was made for wintering ashore during one year only. When it became necessary to maintain the Main Base station a second year, in order to make a search for the missing sledge party, the party left was of only skeleton proportions. With the bulk of the members returning with the vessel went Hunter and Laseron. Thus biological work conducted during the second year was very limited. During that time McLean was responsible for logging all matters of biological interest at the Main Base station.

Having returned to Sydney, Hunter spent much of his time during the winter of 1913 working on the collections brought back by him. In the middle of November he re-embarked again on the "Aurora" for the final relief cruise to Macquarie Island and the Antarctic. Throughout that cruise Hunter worked at high pressure sorting and preserving the copious marine collections which were a feature of that cruise. Throughout the voyage several members of the staff assisted in the biological programme. Specially to be mentioned in this regard is Hamilton, of the Macquarie Island party, who had joined the vessel when she called at the island on the way south.

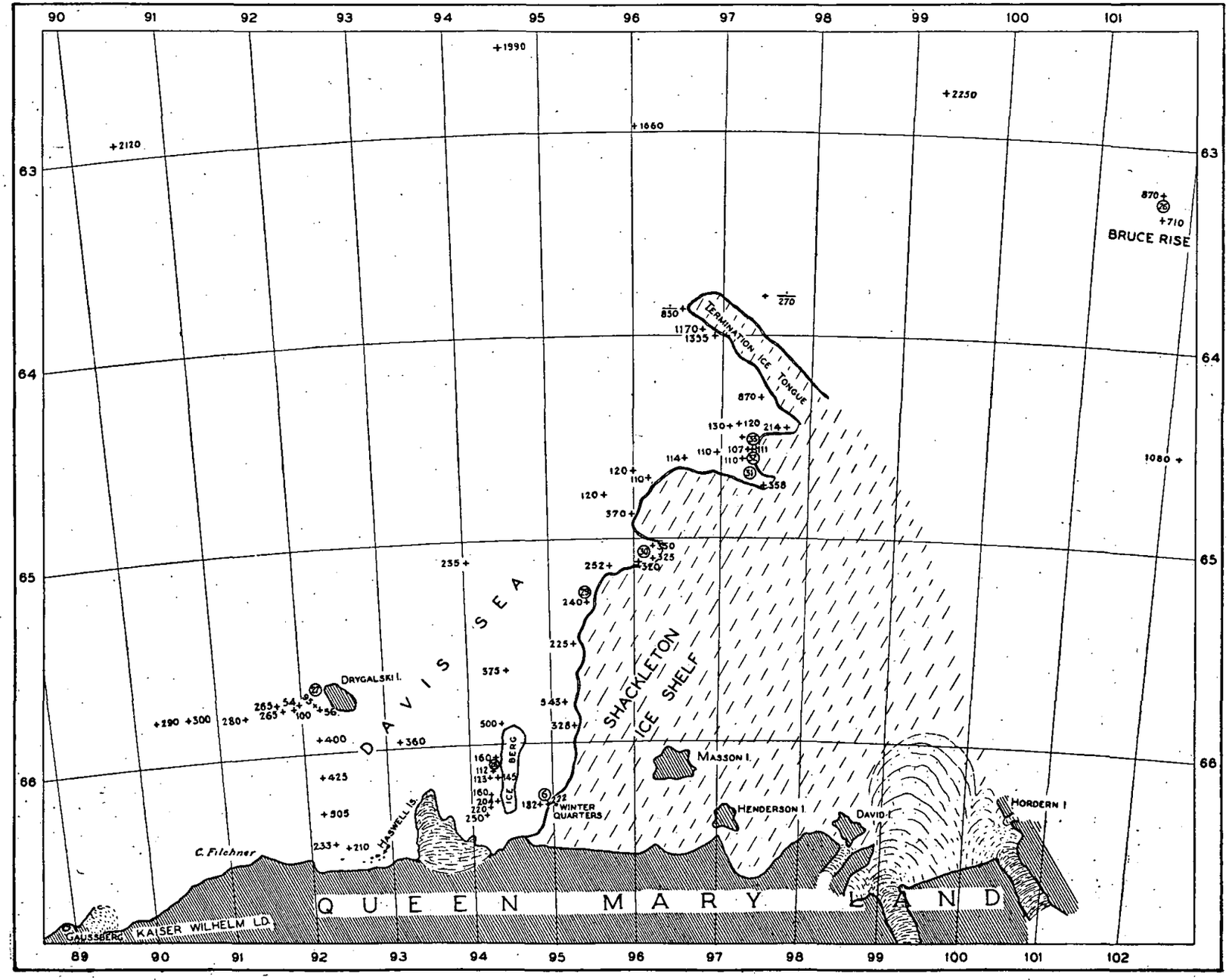


Fig. 9. Showing location of Soundings and of Dredging Stations in the Region adjacent to the Western Antarctic Base.

III.—At the Western Antarctic Base.

Turning now to the Western Base party, which, under the leadership of Frank Wild, wintered on the floating ice sheet of the Shackleton Shelf, we have further biological contributions, thanks to the energy of C. T. Harrisson and S. E. Jones assisted by others. Harrisson was the chief biologist of the party. The possibilities in his department of observation were, unfortunately, limited. Vertical ice cliffs cut them off from the sea most of the year, and there were no rock outcrops anywhere within easy range of the Hut where land life might be studied. When Harrisson was able to get down onto winter bay-ice, he was 17 miles from the coast with 220 fathoms of water between him and the bottom. With the meagre dredging apparatus with which he was equipped it was impossible to dredge at that depth. However, he managed to lower traps to the bottom and succeeded in making a small contribution to the Expedition's marine collections. This location which is recorded as *Station 6* was a few hundred yards off the edge of the Shackleton Ice Shelf adjacent to "The Grottoes," as the Winter Quarter Hut of the party was named. The position of Station 6 was approximately Lat. 66° 18′ S., Long. 94° 58′ E. The most important items taken at this station were fishes, amongst which four species were represented.

The main biological work done at the Western Base was effected on sledge journeys to distant portions of the coastline of Queen Mary Land and its off-lying islands joined to the mainland by bay-ice or shelf-ice. As a member of the Eastern Sledge Party, Harrisson, from several rocky islets visited, made a small but valuable collection of mosses and lichens, as well as birds and their eggs.

The Western Sledge Party under the leadership of S. E. Jones made very valuable observations concerning Antarctic bird life of all kinds which they encountered in plenty on Haswell Island. Their most striking contribution was the discovery of an enormous rookery of Emperor penguins. Only one other rookery of these birds had ever previously been found, namely at Cape Crozier in the Ross Sea, by Captain Scott's "Discovery" expedition. This, however, is only a small and dwindling assemblage of birds. Dr. Jones estimated that at the Haswell Island rookery there were when observed about 7,500 birds of which 7,000 were chicks, which means that, if all the parent birds, which at the time of observation were away in the sea, are accounted, the total strength of the rookery must have been not less than 21.000 adults and chicks.

IV.—At the Macquarie Island Station.

Marine biological investigations conducted at Macquarie Island were not so extensive as they might otherwise have been, when considered in relation to the long period of occupation of that station. This was due mainly to limitations imposed on the shore party arising from the stormy weather prevailing in that latitude and the fact that they had no boat. On account of the small personnel of the Expedition party at Macquarie Island, the rough seas prevailing around those shores and the absence

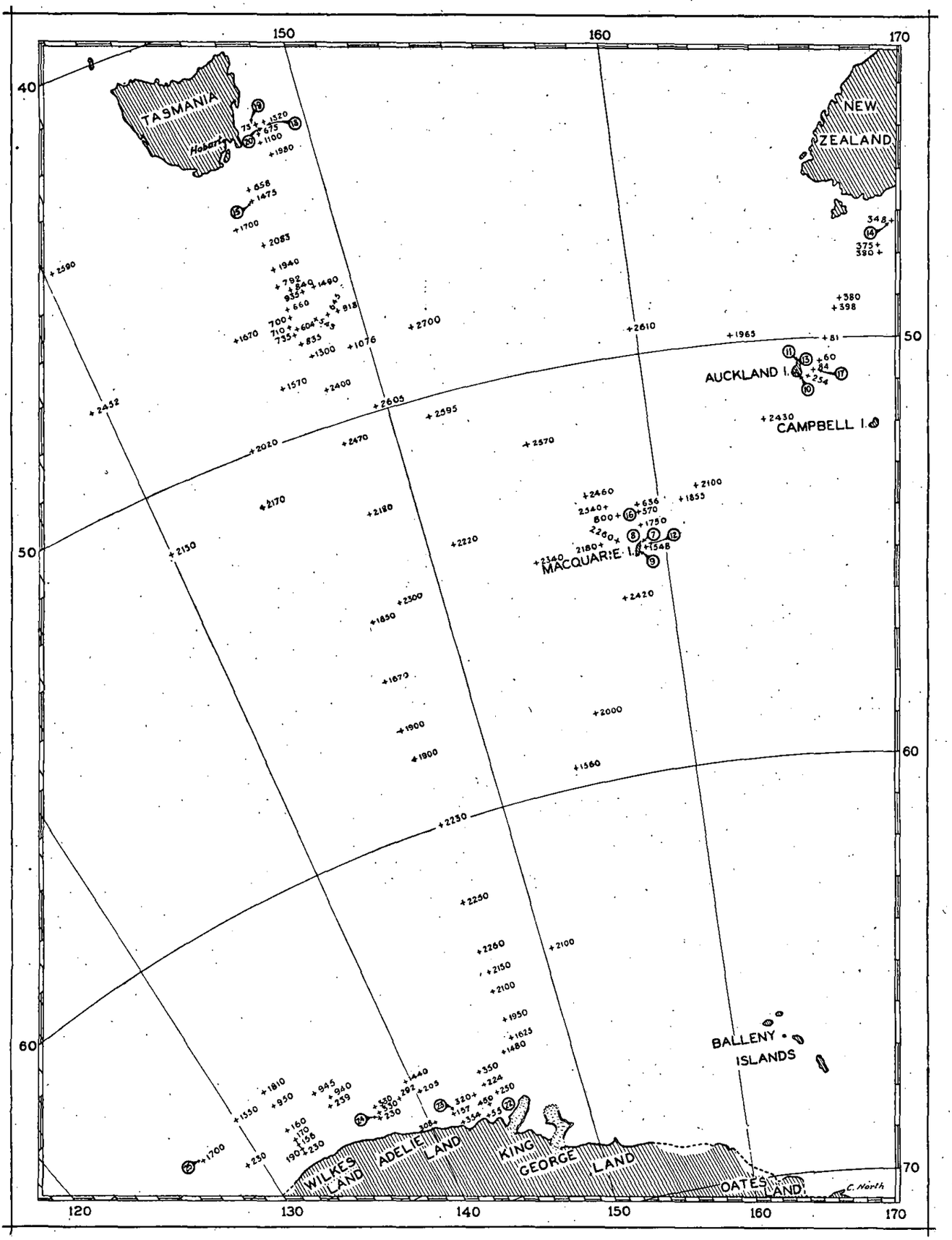


Fig. 10. Showing location of Soundings and of Dredging Stations in the Region between Tasmania and King George Land.

of safe harbours, it was deemed prudent to rely for marine observations mainly upon work to be conducted from the "Aurora" when visiting the island. Unfortunately visits of the "Aurora" in summer time were made when hastening *en route* to the Antarctic, where lay the main work of the Expedition; consequently there was then no time for oceanographic operations. Efforts made by the "Aurora" to achieve useful results in the Subantarctic during a winter cruise were disappointing on account of the high seas running at the time.

Notwithstanding the limited marine programme, Harold Hamilton, the biologist of the Island party, had much to do in collecting and studying the copious land life.

The marine collections made in shallow water at Macquarie Island were the result of hand dredgings augmented by catches made in traps and by the combing of the rock pools at low tide. They were mainly secured at three localities as follows:—

Station 7.—In and off Garden Bay, a small embayment at the northern end of North-East (or Buckle's) Bay. The catches were got from the rocky shore to depths of 15 fathoms on a rock and shingle bottom. The shallower waters, especially where the bottom is rock, support a dense growth of coarse kelp which harbours fish and a plentiful population of small crustaceans and lower forms of invertebrate life.

Station 8.—In and off Aerial Cove which is an embayment well sheltered by off-lying reefs at the north side of Hasselborough Bay, which is on the west coast opposite North-East Bay. Here most of the collecting was done in very shallow water amongst the kelp-covered reefs. Further out, in depths of 10 to 20 fathoms, Hasselborough Bay offers a wide flat shingle bottom for dredging. Here large crabs were caught in a trap.

Station 9.—At Lusitania Bay on the east coast, towards the south end of the island, dredgings were made and good hauls of fish were caught by hook and line using penguin or seal meat as bait. Hamilton caught fish of several species; the largest individual fish weighing 12½ lb. On one occasion he hooked 90 lb. of fish in a half day. Dredgings in 14 fathoms on a sandy bottom yielded a number of gastropods and a few crustaceans, worms, etc.

A very large part of Hamilton's time, however, was devoted to observation of the seal and sea bird life of that remarkable island sanctuary which draws to it, in the breeding season, countless numbers of many varieties of these creatures. At the present day the seal population is mainly constituted of sea-elephants. Sea-leopards are abundant but never in notable concentrations. Occasionally a stray Weddell seal from the southern latitudes gets so far north and an odd sea-lion from more northerly latitudes may get so far south. Fur-seals, which were extremely abundant on the shores of Macquarie Island when it was first discovered, were decimated to vanishing point within a few years. At the time of our occupation of the island a period of about 100 years had passed since the first onslaughts were made by sealers upon the fur-seal population. During all that time, with at the most only odd short intervals of respite, sealers had continued to harass the seal and penguin population. As fur-

seals were always the greatest prize, odd ones which had survived earlier massacres or wandered thither from other refuges never escaped. Little wonder, therefore, that during the whole period of occupation of the island the Expedition party did not sight a single specimen of the southern fur-seal, which was once so abundant in those waters that the catch of a single vessel is recorded to have been 35,000 skins.

At the time of our occupation of the island, sealers from New Zealand were still operating. The products secured were sea-elephant oil and penguin oil, entailing the sacrifice of vast numbers of these creatures annually. Since 1918 the island has been maintained by the Tasmanian Government, by whom it is controlled, as a sanctuary for the preservation of its Subantarctic fauna and flora. On enquiry, the headsman, Bauer, of the New Zealand sealing company, working the beaches at the time of our occupation, informed us that odd fur-seals had been secured from time to time during his association with the Island. It is possible that these had wandered south from the New Zealand Subantarctic islands where at the time, owing to legislation protecting fur seals, they were known to be establishing themselves once again.

To the shores of Macquarie Island many species of sea birds flock during the breeding season, but few reside permanently at the island. Dominican gulls, cormorants and skua gulls are always a feature of the shore, as also are the gentoo and king penguins. Other birds arrive in vast numbers in their respective breeding seasons. Four kinds of penguin regularly breed at Macquarie Island, whilst occasional visits from other species are recorded. The drain upon the penguin population by the depredations of the sealers has certainly greatly modified the relative numbers of the several species. King penguins were found to be approaching extinction owing to their high yield of oil and the edibility of their eggs. Gentoo penguins also, chiefly because of the superior culinary quality of their eggs, have had their numbers reduced. In the case of the royal penguins, however, they were still found in vast congregations, though for many years about the time of our observation, 100,000 to 300,000 had been slain annually for their oil. In the year 1912 the largest rookery of royal penguins covered about 16½ acres and probably accommodated nearly one million birds. The continuance of these birds in such strength appears to rest on the inaccessibility of most of their rookeries. Victoria penguins are numerous in limited concentrations on rocky sections of the coast, and for this reason and because of their small size, have not received much attention from the exploiters of blubber oil. The blubber oil industry at Macquarie Island during the early years of this century was restricted to the exploitation of sea-elephants and royal penguins, though king penguins had been heavily drawn upon in earlier years.

One outcome of the sealing industry has been the encouragement that it gives to carrion birds such as skua gulls and giant petrels. These, especially the former, have increased greatly in numbers, owing to the abundant food supply available in the flensed carcases of the seals left on the beaches. This increase in the numbers of the skua gulls has reacted to the greater destruction of the burrowing prions. Several

species of prion still resort to Macquarie Island in the nesting season, but Hamilton discovered evidence that the number of these birds annually visiting the island has been vastly reduced in recent times owing to two activities: firstly, to the depredations of wild cats descended from ship's cats which arrived with the sealers; and secondly, to increase in numbers of their natural enemies, the skua gulls.

Mutton birds and other petrels are well represented on the island, whilst albatrosses of several species including the sooty albatross are a picturesque feature of the shores.

Of land birds it is interesting to record the absence of the sheath bill or paddy which is met with so widely in the Subantarctic islands of the Atlantic and Indian Ocean. There is, however, well established but in no great numbers a duck which inhabits the lower swampy ground. Several examples of two varieties of small finch-like bird were sighted by Hamilton. These are assumed to be strays which have arrived at the island by accident and have apparently established themselves thereon. Of still greater interest is the record of very numerous flightless green parakeets mentioned by all the earlier visitors to the island. They are now extinct. Reports appear to indicate that they were last seen about fifty years ago. They are recorded as being good eating and easily caught, hence their extinction by man aided by wild cats. New Zealand maori hens, or wekas, are now very numerous on the island. They were introduced from New Zealand by sealers about twenty-five years before our party arrived.

The collection and preservation of a small but interesting invertebrate land fauna occupied some of Hamilton's time. Amongst these were twelve species of insects and three arachnoids. Not having a small portable boat, he was unable to examine thoroughly the many small lakes located on the summit of the island. However, they probably support only microscopic life for they are lakes of but recent glacial origin. Evidence was deduced indicating that the island was entirely or almost entirely overriden by ice in comparatively recent times.

Macquarie Island, unlike the Expedition's Antarctic land stations located further south, is heavily vegetated, though greatly restricted in diversity of species. The lowlands are densely clothed in rank herbage, amongst which tussock grass (*Poa foliosa*) and *Acaena adscendens* figure most prominently. In this luxuriant zone Maori cabbage (*Stilbocarpa polaris*) and a small flowering plant (*Pleurophyllum Hookeri*) are also a feature. On the more exposed highlands the variety of species dwindles and only a few hardy members survive. Cushions of *Azorella selago* are there a dominating feature. Altogether, the vascular flora of Macquarie Island has yielded thirty-six specimens of which three have been recently introduced through the agency of the sealers. Three others are endemic species and argue that some portion of the island remained uncovered by ice during the recent glacial period, thus preserving a remnant of the pre-glacial flora. Trees are, of course, absent, the only plant of a ligneous species being a creeping form, *Coprosma repens*. Cryptograms, on the other hand, are well represented, mosses and lichens being a feature of exposed rocky outcrops.

Such was the field presented to Hamilton for investigation. Most of the time he resided at the hut erected by the party on the north end spit, working the northern half of the island from that base. On a number of occasions, in company with L. R. Blake, the geologist and surveyor of the party, Hamilton carried his equipment to temporary bases near the south end of the island. Thus he was established for some time at Sandy Bay and at Lusitania Bay. His good photographic record of things biological was augmented by valuable additions by Blake. Much of the biologist's time was consumed in preserving the skins and skeletons of birds and seals.

V.—At the Auckland Islands.

Mr. E. R. Waite, who joined the "Aurora" as biologist on the Subantarctic cruise of the winter of 1912, made a small collection of the shore and shallow water life at the Auckland Islands. His chief interest was in the birds and the seals. He was fortunate in securing five specimens of the rare flightless duck endemic to the locality. He also collected marine life with the hand dredge both at Carnley Harbour (*Station* 10) and at Port Ross (*Station* 11).

VI.—Biological Work done on Board the "Aurora."

1.—*General Remarks.*

When planning the expedition considerable importance was attached to the matter of marine biology of the high seas. On the understanding that the late Mr. Charles Hedley of the Australian Museum, who was well experienced in marine dredging operations, would be joining the Expedition in charge of such work, it was resolved to secure suitable equipment for tow-netting and trawling at all depths likely to be encountered between Australia and Antarctica. Amongst the equipment received from Monaco were tow-nets of various types including some with a closing device for taking plankton between definite depth limits.

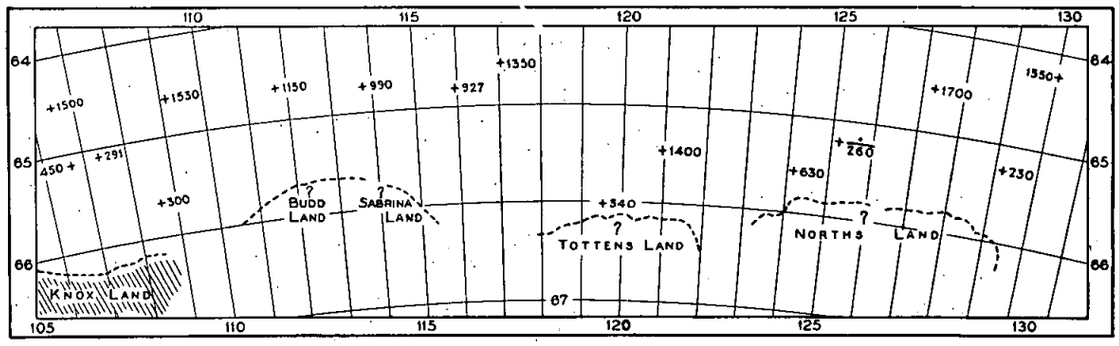


Fig. 11. Showing location of Soundings and of Dredging Stations in the Region between Adelie Land and Queen Mary Land.

The veteran polar explorer Dr. W. S. Bruce gave much help and advice concerning deep-sea dredging. From his rare fund of experience in ocean trawling and hydrology, he communicated much practical advice in the design and employment of suitable equipment, thereby undoubtedly contributing largely to the ultimate success achieved.

Dr. Bruce was also good enough to supervise the making of suitable dredges and trawls for the deep-water work. He rendered still further assistance to our oceanographic programme by lending two valuable items of equipment. The first was a large winding reel and 4,000 fathoms of multi-ply wire for lowering the reversing water bottles of the hydrological equipment. The second was a brass steam-driven winding engine which was installed on the fo'castle head of the "Aurora" to be used in connection with the Lucas sounding machine and the afore-mentioned reel of multi-ply wire.

From Messrs. Bullivant & Co. we obtained a tapered steel dredging cable 3,000 fathoms in length.

With such provision for deep sea work we had every expectation of prosecuting an extended programme. After so much had been arranged it was therefore a great disappointment to learn that the Australian Museum could not spare Mr. Hedley's services. He was as much disappointed as we were. So our plans for the conduct of the work had to be revised at a late stage. All idea of prosecuting such investigations on the first cruise were abandoned, which was perhaps all to the good for the ship's accommodation and staff was strained to the utmost to cope with the transport of the land parties and their equipment.

Arrangement was made for Mr. E. R. Waite, Director of the Canterbury Museum, New Zealand, an authority with considerable marine biological experience, to accompany the ship on a Subantarctic oceanographic cruise during the winter months after the return of the vessel from the Antarctic. It was not until his return from the first Antarctic cruise that the complete equipment for deep-sea trawling was installed on the "Aurora." Captain Davis took a great personal interest in the trawling operations. He had fully discussed with Dr. Bruce the manipulation of the cumbrous gear and was keen to achieve results. On all occasions, he personally superintended the trawling operations.

It was unfortunate that the first trials were made on that winter cruise for then the Subantarctic seas are most unfavourable for successful trawling. As was to be expected, those early efforts were disappointing, but nothing daunted, Davis persevered until eventually successful results were achieved.

2.—*The Trawling Equipment.*

In describing the trawling equipment and its manipulation, I cannot do better than quote Captain Davis's own report on the subject as follows:—

The form of trawl used is known as "The double-headed Monagasque trawl." It is of simple construction and possesses the advantage of having both sides of the metal head frame similar. Consequently, it is immaterial which side of the trawl lands on the sea-floor. A manilla swab (the whiskers) is attached to the side of trawl or to the cod end with the object of entangling certain forms of organisms such as starfish, brittle stars, sea lilies and other forms of deep-sea life.

An olive-shaped weight is attached by a rope to the cod end of trawl, 28 lb. being generally sufficient. When the net is flowing with its head in good position and streaming neatly aft, an olive weight of 28 lb. is fixed on the steel trawling wire a few fathoms from the bridle. If trawling in water about 2,000 fathoms deep, a second weight may be put on the wire a little ahead of the first.

The derrick spar was made of Oregon pine with a slight taper towards each end, the diameter varying from 9 to 11¼ inches. It was 27 ft. 9 in. long, and strapped with iron at both ends.

Six inches from the head, there was an iron band with 4-eye bolts and rings attached for the topping span, guys and dynamometer; to the latter a gin-block is shackled. A second iron band located 3 feet from the first had one ring to which the preventer guy was shackled.

At the lower end of the derrick, 7 inches from the heel, there was an iron band with a ring for the heel block. At the heel there was a goose-neck pin which fitted into two bands bolted to the starboard side of foremast. A piece of hardwood, 4 feet long and 6 inches deep was bolted to the mast to give additional support. The maximum strain which could be supported (when trawling) was 10 tons.

In paying out, the trawling wire was led from the head of derrick to a specially designed knocking-out block, fitted on the starboard quarter. This block kept the wire clear of the propeller, and allowed the speed of the ship to be regulated while paying out. By knocking out a pin, the trawling cable was disengaged immediately, even when a heaving strain is on it.

The end of the trawling cable was then taken on board and shackled to the swivel on the bridle of trawl-frame.

Before topping-up the derrick, the fore yard was cockbilled to avoid chafe on the span, which was 36 feet long and made of 2¾ in. wire cable. When the derrick was hoisted at an angle of about 35 degrees, the head cleared the ship's side by 12 feet. The span was led through an iron gin-block, fixed under the foretop. The topping-lift was a three-fold 3 in. manilla purchase.

The trawling wire was made of tapered steel, varying from 1¾ in. to 1½ in. (in circumference), its weight in air being roughly 1 ton per 1,000 fathoms. We were provided with 3,000 fathoms, wound on a large reel, mounted on standards and controlled by a friction brake. This reel was provided with a chain messenger which, when the wire was being wound in, enabled it to be driven from No. 1 deck winch.

The steam windlass used for heaving in was fitted with a large drum, constructed to absorb the crushing strain and then allow the slack wire to be wound on to the reel which was driven, as nearly as possible, at the same speed. The approximate rate of "heaving in" was 450 fathoms per hour.

The diameter of drum was 26 in. and that of spindle 4 in. The clutch was 9 inches in diameter. A hand brake was used in "slacking away." When heaving in, the clutch was put in and the brake opened. When slacking away, the brake was applied and the clutch pulled out, the weight of the trawl being sufficient to keep the drum turning as the brake was eased.

The Operation of Trawling in Deep Water.

For working the trawl, five men are required, distributed as follows:—

No. 1 works the steam windlass;
No. 2 takes the slack off drum;
No. 3 guides the slack on to the reel, oiling it at the same time;
No. 4 stands abaft the reel and the coils on;
No. 5 works No. 1 deck winch.

The vessel is stopped and a sounding obtained. Then the derrick is hoisted and the wire rove through the various blocks, the trawl shackled on and the men distributed at their stations. When all is ready, the engines are put at half-speed (3 knots), a course given to the helmsman, and the trawl lowered into the water. When flowing nicely just astern, the order "slack away," is given, the wire being paid out evenly by means of the friction brakes. In 1,500 fathoms of water, after the 2,000-fathom mark has passed out, the order is given to "hold on and make fast." Speed is now reduced to 1½ knots and the wire watched

until it gives a decided indication of the dragging of the trawl over the bottom. The strain is now taken by the windlass barrel controlled by a screw-brake, backed if necessary by a number of turns round the forward bitts. Dragging slowly over the bottom is generally continued for an hour or longer. The engines are then stopped, and the order "Stand by to heave away," given. This is quickly followed by "Knock out," which means the disengaging of the after-block from the wire; this being done by knocking a pin out of the block, the vessel then swinging round head-on to the wire. "Vast heaving" indicates the appearance of the net at the surface, when the derrick is topped up vertically; the lower end of the net being dragged inboard and the cod-end loosed, allowing the contents to fall on deck.

Text Figure 12, supplied by Captain Davis, illustrates the streaming of the Monagasque trawl and the winding gear on the deck of the "Aurora."

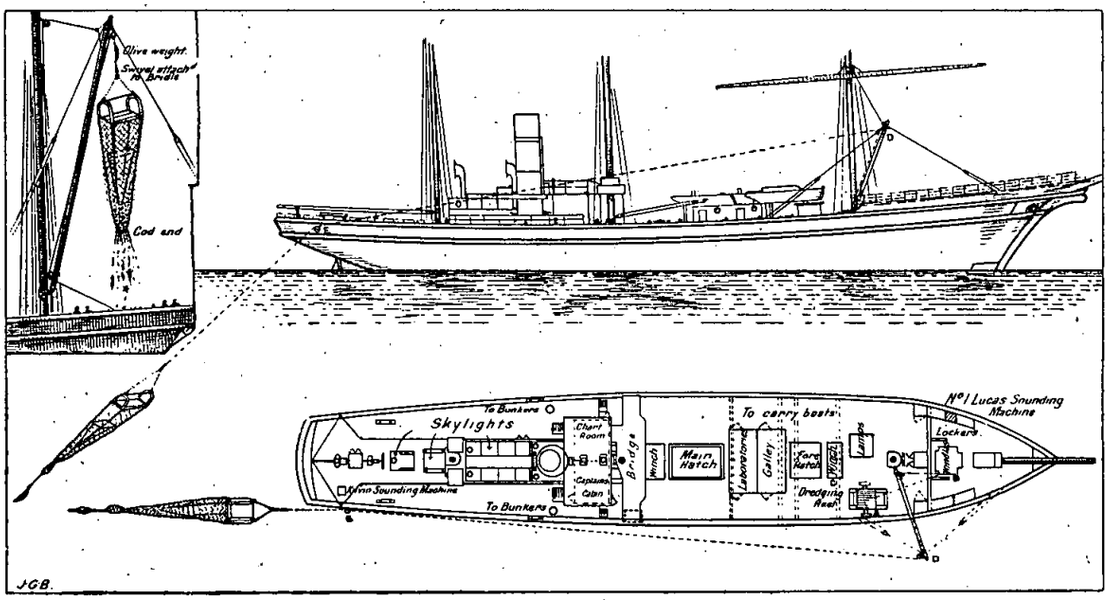


Fig. 12. Illustrating the working of the Trawl on board the S. Y. "Aurora."

It should be added that the practice advocated by Dr. Bruce and adopted on the "Aurora," namely, when dredging to pay out cable to a length of 500 fathoms additional to the depth of the water, works very well at shallow depths; but it is, I believe, not so satisfactory for really deep water unless the speed of the vessel is reduced to a drift of say $\frac{1}{2}$ a knot. In any case in Antarctic waters it is well to reduce speed to not more than 1 knot when the trawl has reached bottom because the floor of the sea is everywhere strewn with erratic boulders, some of great size.

The hauling equipment described by Captain Davis in the foregoing pages also served to operate a large, rectangular-mouthed dredge of orthodox pattern and a metal bucket dredge. The latter was useful on rough ground, which might tear the nets to pieces and break the dredge frames.

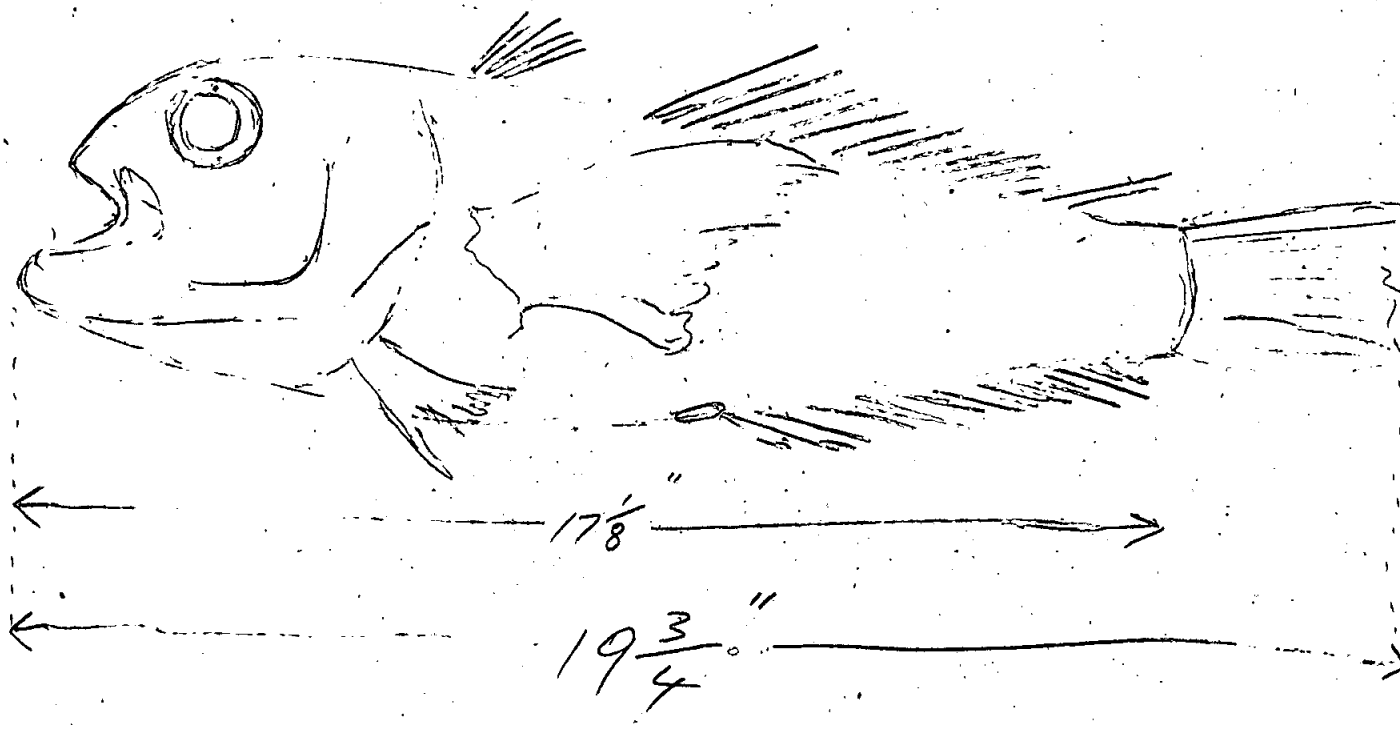
Large plankton nets were also streamed on the same cable, but the amount of plankton work done was very limited. Of course surface high-speed tow nets were streamed at frequent intervals.

Reference will now be made to the dredging and trawling stations worked from the "Aurora." No detailed account of the plankton nettings will be made.

anal 28 rays
pectoral 22 rays
dorsal II rays
34-35 rays
caudal 15 (13)

Noto. Rossica

Length 560 mm
weight 4 lbs



$\frac{16}{1} \times \frac{13}{3}$ (4, 12)

$\frac{52}{3}$ $17\frac{1}{4}$"

$15\frac{3}{4}$

3.—*First Subantarctic Cruise, May 19th to July 11th, 1912.*

The object of this cruise was to advance knowledge concerning the Subantarctic oceanic region lying south of Australia and New Zealand. Included in the programme was a call on the Expedition party established at Macquarie Island. The port of departure was Sydney. The ship passed through Bass Strait to the west side of Tasmania then south and west to Macquarie Island; from thence via the Auckland Islands to New Zealand.

Edgar R. Waite, Director of the Canterbury Museum, accompanied the "Aurora" as zoologist.

The constant high seas prevailing in that region throughout the winter taxed all hands severely. By dint of good handling Captain Davis brought the ship through successfully, but though he was able to secure a number of soundings it was found impossible to successfully operate the big trawl. Mr. Waite's ultimate collections included tow-nettings on the high seas, dredgings in the harbour waters at the Auckland Islands, and shore material from both Macquarie Island and the Auckland Islands. On the passage between Macquarie Island and the Auckland Islands, in heavy seas, two fishes, afterwards determined as *Myctophum antarcticum* and *Aurion effulgens*, were washed on to the deck. At the Auckland Islands the pilchard (*Clupanodon neopilchardus*) was added to the known fauna.

The big trawl was lowered only three times during this voyage, on each occasion with disappointing results, as follows:—

Station 12.—On June 20th in about 600 fathoms off North-East Bay, Macquarie Island. Operations were cut short by a rising sea and it is almost certain that the trawl did not reach bottom.

Station 13.—On July 6th Captain Davis steamed out from Port Ross (Auckland Isles) to a distance of 5 miles and there trawled in 40 fathoms. The net came up badly torn on the rocky bottom and empty.

Station 14.—On July 9th when in Lat. 47° 16′ S. and Long. 169° 52′ E. the trawl was essayed in 348 fathoms on a hard bottom. The bag of the trawl was hitched up blocking the mouth. Nothing appeared in it.

4.—*Second Subantarctic Cruise, November 12th to December 14th, 1912.*

During the month of August while the "Aurora" was refitting at the dockyard, at Williamstown, Captain Davis joined the Commonwealth Fisheries Investigation vessel "Endeavour" for a fortnight's cruise. He reports: "I shall always feel grateful for this exceptional opportunity of seeing the working of deep-sea appliances under the direction of Mr. Dannevig, on board that vessel. Different patterns of nets and a variety of deep-sea apparatus were used during the trip."

On the occasion of the second Subantarctic cruise the weather was as favourable for the prosecution of the oceanographic programme, as it ever is in those Subantarctic latitudes. Consequently an excellent series of soundings was obtained as well as some successful trawlings. Professor J. T. Flynn of the University of Tasmania accompanied the vessel in charge of the biological work.

Proceeding on a course south from Hobart, Captain Davis soon located an important rise in the sea floor to which the name "Mill Rise" has been applied. The "Aurora" was then headed towards Macquarie Island.

Close to the island on November 21st, in Lat. 53° 46′ S., Long. 158° 47′ E., the trawl was tried in 1,405 fathoms (*Station* 16). On arrival back on deck it was found to have been dragging along a rough rocky bottom with the result that the frame was bent and the net badly torn. The contents had been washed out except for one fish 4 inches long and some Gorgonia.

After a brief call on the Expedition party at Macquarie Island a course was set for the Auckland Islands. Whilst the trawl was being repaired a bucket was lowered in 198 fathoms within sight of the land, Lat. 50° 44′ S., Long. 166° 54′ E. (*Station* 17) but it came up empty.

On the return voyage to Hobart it was decided to again visit the Mill Rise area for further amplification of the programme of soundings. Then, the trawl having been repaired, Captain Davis determined to make some trials in the less tempestuous seas off the east coast of Tasmania. There good success was achieved at a distance of about 30 miles from the coast before calling at Hobart to refit for the forthcoming Antarctic cruise. The following trawling stations were there occupied :—

Station 18.—This trawling was made on December 12th, in 1,320 fathoms on a Globigerina ooze bottom in position Lat. 42° 43′ S., Long. 148° 40′ E. Though 2,000 fathoms of cable was paid out the trawl came up fouled and empty. However, whilst the trawling was proceeding a tow-netting secured a useful haul including *Salpa*, *Sagitta*, various crustaceans, *Beroe*, medusae, etc., also fish were taken on a line.

Station 19.—Later in the day in Lat. 42° 39′ S., Long. 148° 23′ E. a successful trawling was made in 64 fathoms. A large haul was secured including ophuroids, various crustaceans including monster crabs, mollusca, sponges, tunicates and fish. Of the fish two were of special interest, namely, *Indiacanthus aurora* and *Antimora viola.*

Station 20.—The following day a trawling in 1,270 fathoms on an ooze bottom was made in Lat. 42° 48′ S., Long. 148° 41′ E. A length of 1,800 fathoms of wire was paid out. The catch included a very large octopus, ophuroids, polyzoa and deep-sea fish.

5.—*Second Antarctic Cruise, December 26th, 1912, to March 14th, 1913.*

An important series of soundings were made by Captain Davis during this cruise, but no deep water dredgings or trawlings.

In order to get more authoritative information concerning the whales of the Antarctic seas, the services of an old-time whaling skipper, James Davis, then resident at Hobart, were secured for this voyage. At the conclusion of the voyage Capt. James Davis submitted a report on the whales seen during the cruise.

6.—*Third Antarctic Cruise, November 19th, 1913, to February 26th, 1914.*

Dr. John Hunter, the senior biologist of the Expedition, joined the "Aurora" in Hobart and greatly assisted in a very successful trawling programme. His biological log book has been drawn upon extensively in the preparation of the following notes concerning the various trawling stations occupied. Captain Davis had already acquired experience in the handling of the trawling gear under all conditions of the sea and looked forward with special interest to the prospective deep-sea operations of this voyage.

On this occasion the ship's staff was assisted in the prosecution of the oceanographic programme by the Macquarie Island and the Main Base parties as they were in turn picked up by the ship. Thus the voyage was, in the main, an Antarctic oceanographic cruise with an adequate trained staff to cope with the undertaking. It is not surprising therefore that the results achieved both in hydrology and biology were quite notable.

Trawling Station 21.—On the 22nd December a fine haul was made in about Lat. 66° 50′ S., Long. 142° 6′ E. This was only a few miles north-west of the Main Base at Cape Denison. The depth was 354 fathoms. The bottom was a muddy diatomaceous ooze with abundant organic life. A length of 500 fathoms of cable was paid out and the trawl dragged on the bottom for about 30 minutes. As regards the catch, Hunter's log runs as follows:—

"There were a few rocks, mostly schists, and one piece of brown alga, but the great bulk of the material was composed of polyzoa, calcareous forms (mostly broken), and non-calcareous forms. What a wonderful sight it would be to be able to go down and view the floor of the ocean in such a locality—to see the beautiful crinoids and polyzoa and hydroids and alcyonaria—all in their natural state. The floor of the ocean in such a locality must be simply carpeted with animal life. Now as regards the individual groups:—Sponges, as usual, were in great evidence, and next to polyzoa were the most abundant. Some were of very large size, measuring 18 inches to 2 feet long; mostly white in colour but there were several yellow slime sponges and a peculiar greenish form. Of Coelenterates, hydroids were fairly abundant but not so much as in shallower waters. *Sertularia* was principal type. Of Actinozoa, I obtained one very

fine specimen with reddish coloured tentacles, but there were great masses of Alcyonarians and these were more abundant than the Hydrozoa, occurring in masses of a foot to 2 feet long. One form pink, another white, others brown. There were only a few small nemerteans. Asteroids were in great evidence and there must have been at least a dozen species, some small, others very large—arms reaching 4 to 6 inches long; commonest colour yellow, but also brown and pink. Ophiuroids were extremely numerous but all small; pink was the predominant colour but red and grey also. These forms were extremely abundant but I do not think there are many species, probably six at outside. Holothurians were also abundant—and what a size! Some 6 inches long, pink and red-brown commonest. Of smaller forms some were light pink, others white, others dark brown. I should think there would be about a dozen species. One of the best parts of the haul were the crinoids; they were more numerous than any other echinoderm. But oh! how badly broken, there was not one complete. However, in such a haul it would be almost impossible to obtain any complete owing to their brittle calcareous arms. Still, I obtained quite a number of fairly decent specimens—some pink, others brown, others deep purple and on some I noticed myzostimidae. The obtaining of such a haul of echinoderms was most pleasing. Annulates were not very numerous but there were a few very nice polynoids. Crustacea were not very numerous; there were a number of shrimps, reddish coloured, a few amphipods and a few isopods but small crustacea were not in evidence. Polyzoa were extremely abundant, especially the non-calcareous forms which occurred in great felt-like masses and there is no doubt that they are the predominant type in these seas. Mollusca were not much in evidence. I obtained several soft-bodied forms, particularly two large specimens of a white form; but shelled forms were not very numerous—probably about a dozen species. Ascidians were also numerous and there were some fine simple and colonial forms. One coloured type, pink, occurred in great numbers (a *Botryllus* type). Then there were numerous simple forms, one particularly fine type with a clear test. There were only six fish—apparently two species (of *Notothenia* type). There were only about a dozen pycnogonids, several small brown forms, rest larger including one large form (similar to forms obtained last year) coloured red."

Station 22.—On the 28th December a dredging was made in Lat. 66° 57′ S., Long. 145° 20′ E. adjacent to the wall of the Mertz Glacier Tongue. The depth was 288 to 318 fathoms; a length of 620 fathoms of wire was run out. The trawl was dragged along the mud bottom at dead slow for an hour. Once more the haul was a good one. Hunter's log runs :—

"Sponges were not in such quantities as before (*Station 21*) although there were large felt-like masses of dead sponge: about four species. Hydrozoa not plentiful, only about two species. Actinozoa good, obtained six specimens of a fine actinian, also about four species of alcyonarians and a dead actinian—flabellum-like form. One nemertean. Echinoderms again well represented. About fifteen species of stars, numerous ophiuroids—about six species including some creamy-white forms with

very long arms and numerous pink forms with purple radial bands. Holothurians not so numerous but included some fine Elpidiidae, pink in colour, about three species. Some fine crinoids, almost perfect, purple and pink. Annulates, only a few, but several fine Gephyreans and about six specimens of a very fine polynoid with long setae; also several specimens of marine leech. Crustacea were well represented, this being the best haul of crustacea to date. Two species of fine shrimps and number of species of amphipods (including peculiar *Caprella*-like forms) and specimens of a very fine isopod-like form; about twenty species. Polyzoa again numerous, though not so much as before (*Station 21*), mainly calcareous forms. Got numerous specimens of a fine brachiopod. Of mollusca—a good haul. One adult cephalopod and several young forms; some fine gastropods (*Neobuccinum*) and also pelecypods; at least twenty species—a good haul. Ascidians—not nearly so numerous as last time; a few simple forms and several colonial types, about three species. Four fish, three of one kind and one of another. Pycnogonids—more numerous and about six species, usual big red forms."

Station 23.—On December 31st in Lat. 66° 32′ S. and Long. 141° 37′ E. a trawling was made on muddy bottom. The depth was 157 fathoms. About 300 fathoms of wire cable was run out, and the trawl dragged on bottom for an hour. It was brought up about one-third full of a variety of marine life. Hunter records :—

"Sponges again in evidence, large forms, including the spiky form recorded on 22/12/13 and as far as I can make out, five species. Hydrozoa, scarce; actinozoa again, several actinians (two species ?) and about four alcyonarians. Echinoderms again well represented, there being six large stars of four species—red, cerise, brownish and yellowish in colour; then several small species; echinoids, several fine specimens with large spines and one form with thin corona with small spines. Then holothurians, numerous large reddish-brown to flesh pink (as before); also some small fine pinkish forms and small white forms—about four species. Crinoids, some fine specimens of reddish colour, almost intact, also yellowish forms, almost intact, and forms with light purple pinnules—three species. Ophiuroids again numerous—some fairly large with long arms, remainder small—at least five species. Annulates, more than usual. A fine polynoid; some fine tubiculous forms with apparent crown at end; several forms from amongst alcyonarians, about five species. Crustaceans, very poor; but a very good find, obtaining some fine acorn shells with other barnacles attached, but ordinary crustacea were very few, about four species of amphipods and one or two isopods and one broken macruran. Pycnogonids not so numerous—two species including two large red specimens. Polyzoa were extremely abundant, mainly soft forms; they formed great felted masses with a few ophiuroids and mollusca between them but nothing else. Apparently we were on muddy bottom only for a short time as there was a small amount of mud in which were the crustacea but amongst polyzoa practically nothing. Some more specimens of brachiopods; mollusca also very few, only about five species, also Dentalium. Ascidians again numerous, large reddish and greenish colonial forms,

also other colonial forms including a pretty little specimen at end of stalk; also simple ascidians, about six species. Two species of fish, one of each; one quite a new kind. One would expect more fish from such a large shallow bank.

N.B.—Also a new kind of leech, one specimen."

Station 24.—On January 2nd, 1914, in Lat. 65° 50′ S., Long. 137° 30′ E. the trawl was put over in 230 fathoms with 400 fathoms of line out. When brought on deck it was found to contain only a very small catch. On resounding, found the water had deepened to 330 fathoms, consequently suspect that the trawl was not properly on the bottom but must have touched it for a moment. As to the contents of the trawl, Hunter records :—

"There were a few things—a sponge; several fine actinians, two species, one white, other mottled red; an alcyonarian; two specimens of a starfish; two species of ophiuroids; some fine specimens of Elpidian Holothurians. Annulates—peculiar forms with gelatinous investment. Polyzoa as usual—several species; two specimens of a pycnogonid; two species gastropods; a Dentalium; several specimens of a small colonial ascidian and two peculiar forms."

Station 25. On January 6th in Lat. 64° 34′ S., Long. 127° 8′ E. a trawling was made in 1,700 fathoms. The bottom was glacial mud and stones. About 2,500 fathoms of wire was paid out. The ship proceeded at dead slow for some time when it was discovered that the trawl had caught on the bottom and had actually anchored the ship. It took six hours to bring the trawl to the vicinity of the surface; it was then found to be half full of mud and stones with a minor admixture of organic life. Hunter records :—

"The collection comprised :—One fish, peculiar form with ventral mouth (like *Macrurus*), one fine octopus, two pycnogonids (one extremely large, the largest we have yet obtained; legs about 6 inches long), one polyzoan, two starfish (one fine red specimen and another badly damaged one), three kinds of ophiuroids (fourteen of one kind, all damaged, pinkish with radial faint purple markings, one each of two other kinds); no echinoids but fragmentary remains of one with very small spines, and some large spines of another species. Holothurians were easily the best represented group and included some very large peculiar forms with mouth ventral and peculiar tail-like piece—characteristic deep sea forms—there were nine specimens, five deep purple and four pale purple. In addition there were two other species of holothurians—apparently about four species of holothurians. Then there was a very fine alcyonarian (Gorgon) and two other alcyonarians; then a dense calcareous mass (Hexactinellid) with a small polyzoan attached, and attached to rocks were several serpulae tubes—altogether about eighteen species—a comparatively rich haul for deep water. Fragments of annulates were caught on dredge rope."

Station 26.—On 14th January in Lat. 63° 13′ S., Long. 101° 42′ E. a trawling made in 870 fathoms on a mud and stone bottom. The trawl was left dragging for nearly two hours on the end of 1,200 fathoms of cable. The trawl came up with a heavy load of large rocks and badly torn in places, but still a very fair haul of marine life remained. Hunter refers to the examples of life as follows :—

" Two specimens of an interesting fish—Macruridae—both sound. These have previously been recorded in the Antarctic by the " Challenger " Expedition. Then there were several dozen—quite a number whole—of a large bright red shrimp, about 3 inches long with antennae measuring 13 inches; probably a species of *Acanthephyra*, it has golden yellow eye. Then five specimens of an interesting Isopod (like *Serolis*)—three in good condition. Then one amphipod—probably caught in upper layers. Then a few echinoderms—one small starfish, two ophiuroids (two species); two echinoids—two broken specimens of a heart urchin, like *Pourtalesia*; a whole small sea urchin with thick spines; and fragments of a larger sea urchin; then holothurians again up to the fore—about four species; forms like *Oneurophanta* and *Elpidia*. One polyzoan; two alcyonarians (one fine species); sponges—about four species, all small; also foraminifera and radiolaria in ooze."

Station 27.—Trawling 3 miles off the west side of Drygalski Island on a hard bottom in 50 fathoms with 75 fathoms or a little more of wire out. A fine haul, notably rich in fish, resulted. Hunter records :—

" The result of the catch is roughly as follows. Fish were very well represented, both in numbers and species. The total catch was thirty-five and probably seven or eight species. Six specimens (two species) had very large gapes (one with snout like duck) and with pectoral fins produced into bulbous swellings at end. This is our best fish haul to date. Ascidians also fairly well represented—at least nine species. There were four specimens of an extremely large simple form besides smaller simple and colonial forms. Mollusca—about fourteen or fifteen species, mostly small gastropods but also several soft-bodied gastropods and some specimens of *Buccinum*; no cephalopods; one or two bivalves; several chitons. Pycnogonids—very numerous; over a dozen large red forms besides numerous smaller brown forms; probably about six species—including a whitish ten-legged form. Crustacea—not very numerous but well represented in species—probably about sixteen, including a light red shrimp, yellow and armoured amphipods, isopods of peculiar form. Polyzoa remarkably scarce, only about three species and poorly represented. No brachiopods. Annulates—numerous specimens of a long tubicolous form and also polynoids, reddish tubicolous forms and non-tubicolous forms—about six or seven species. Also several specimens of a nemertean and of a nematode (as in Commonwealth Bay). Echinoderms were very well represented. There was only one crinoid, about four holothurians, all small and about three echinoids, including about dozen specimens of a fine heart urchin; sea urchins were extremely numerous but poor in species. Ophiuroids were very numerous and also well represented in species. Majority small—commonly red or pink but also several

large forms pink and brown, about 10–12 species. Starfishes were the most numerous of echinoderms in species and next to brittle stars in number—about fifteen species—some small, some extremely large, a foot across. Colours vary—cerise, pink, creamy white and red, brown, white, yellow, etc. There were several species of alcyonaria and two actinians, one a very small one, and other an extremely large reddish form, 6 inches long and about 4 inches broad. Hydrozoa sparse—about three or four species and mostly *Sertularia*. Sponges extremely abundant, most prominent of all, especially a yellow slime sponge which occurred in great abundance, probably about nine species of sponges. Also numerous specimens of a Pontobdellid leech. There was a fair amount—mostly fragments—of red algae. Altogether it was an extremely good haul and the richest to date."

Dr. McLean obtained parasites—*Echinorhynchus*—from fish obtained from this station.

Station 28.—On 27th January, when close by the west side of a very large grounded berg in Lat. 66° 8′ S., Long. 94° 20′ E., the large trawl was lowered in 145 fathoms on a rocky bottom. The ship was apparently travelling too fast for such a bottom and after a few severe jerks the whole dredge was torn away.

In its place a dredge with a 3-ft. wide mouth was lowered and the ship allowed to drift on it. On being brought to the surface it was found to be full; in fact there was so much in it that the load broke the netting. The catch was described by Hunter as follows :—

"Fishes entirely absent. Ascidians a few, about three or four species. Mollusca —one octopus, several bivalves, about three species; gastropods about three species, and several soft-bodied forms—three. One chiton. Pycnogonids—about a dozen specimens of about four species including red 10-legged form. Crustacea—about dozen shrimps, several isopods but mostly amphipods; altogether about seven species. Polyzoa—extremely abundant and formed nearly whole of dredging—mostly calcareous —about ten species. Annulates—tubicolous and errant—about six species. Nemerteans —about six specimens, two species. Also one Polyclad—a fine specimen with blackish spots—the first I believe recorded so far south. Unfortunately there was only one specimen. Echinoderms—not so numerous, only a few stars of about three species; fair number of holothurians, about three species; crinoids—a few of about three species; but ophiuroids were extremely numerous and altogether about ten species. Echinoids only a few, about two species. Alcyonaria again fairly abundant, about three or four species; hydrozoa, not very much, about three species; sponges, a few, of about four species. Altogether a nice little haul. When the wire rope came up at first attempt there was clinging to it yards (several) in length of a gelatinous filamentous mass (like long tentacles)."

Floating on the surface of the sea at this location and probably disturbed from the bottom by the dredge and floated up were three specimens of a colonial ascidian ? with gelatinous bodies, biconcave in shape; also a large pink, simple ascidian about 6 inches long.

Station 29.—On the 28th January in Lat. 65° 20′ S. and Long. 95° 27′ E. a dredging was made on a mud bottom in 240 fathoms. Wire cable to a length of 380 fathoms was paid out. The catch was not a bulky one, but it was most interesting. There was in the net as well a little mud and some small granite pebbles.

Referring to it Hunter remarks: "Unfortunately a stalked crinoid passed out of the trawl just as it came to the surface. Of fishes there were sixteen, comprising thirteen of one kind and three of another; of ascidians there was only one specimen; of molluscs there were about eight species—valves of delicate pectens, large forms almost completely invested by mantle; mostly gastropods with but one bivalve. Pycnogons—one species, about six specimens; crustacea, six specimens of light reddish shrimp with greenish eggs and a few amphipods—about four species. Crustacea very few. Obtained seven very fine specimens of that peculiar trilobite-looking isopod, all first class. Polyzoa—very scarce—only one specimen. Annulata—only a few, several Polynoids, several tubicolous [illegible]s and a fine, almost transparent specimen—about five species. Echinoderms—[illegible]noids (two almost complete) about two species. Holothurians—two very large [illegible]bout 8 inches; several Elpidiids, besides simpler forms—six species. Echinoids [illegible]numerous, in fact the predominant type. There were about three dozen heart [illegible]chins and innumerable sea urchins—probably about three species; and then three specimens of urchins with long spines—altogether about five species. Ophiuroids again abundant, mostly small—about eight species. Stars—five species—including three specimens of a very large star, over a foot across. Nemerteans, one species; Actinozoa were well represented, numerous specimens of a *Flabellum* mostly alive, a few dead; six specimens of anemone, all good; as usual—alcyonarians again—one; Hydrozoa—only one kind. Sponges—several large forms, also smaller types—six species. A very nice haul."

Station 30.—On the 29th January in Lat. 65° 5′ S., Long. 96° 0′ E. a trawling was made in 340 fathoms on a mud bottom. About 450 fathoms of cable were paid out. The dredge came up with a moderate content chiefly a sticky ooze, with which there was a small but very interesting catch. Hunter's report reads:—

"Fish—fourteen specimens and six species, so that considering shortness of trawl, size of dredge and rate it travels there appears to be a good rich fauna in these seas. There were two most interesting forms, one almost transparent and pink in colour and the other longer, brown and with numerous white spots; in latter pelvic fins very rudimentary and both forms much like eels in appearance. There were a few ascidians, probably three or four species. Of mollusca there were two octopuses—one large and one small, the large being light brown, the other a blue-black; gastropods—mostly small; a bivalve; a chiton; and a *Dentalium*—about nine species; also a soft-

bodied form. Two pycnogons of same kind. Very small amount of Polyzoa of three kinds. Brachiopods—fairly numerous and included some large forms—two kinds. N.B.—Amongst the mollusca were a great number of pectens—these in fact being the predominant type of the catch. Most of the valves were broken but obtained quite a number of intact forms—several alive. Crustacea—there were a large number of those peculiar trilobite-looking types, all intact; about six shrimps; another peculiar isopod and about five species of amphipods—altogether about nine species. Annulates—only a few; some nice serpulids, several polynoids, etc., six species. Echinoderms again to front. Starfishes about four species, mostly small but one fairly large, cerise coloured, form; numerous reddish astropectens (?); echinoids—about five species, including heart urchins, two types, one very elongated and sharp pointed; long thick spined forms—large and small; and ordinary types—about five species. Ophiuroids again abundant—nearly all small, one type with very long arms—about nine species. Holothurians, nearly all Elpidian types—about three species. Crinoids, a few of two species. Actinozoa again well represented—specimens of *Flabellum*, two alcyonarians and a large number of actinians—probably three species—nearly all attached to spines of echinoids. They were preserved extended; sponges, several large forms, already obtained and smaller types—about four species."

Station 31.—On 31st January a dredging was made in Lat. 64° 40′ S., Long. 97° 22′ E. on a mud bottom in 358 fathoms of water. A length of 450 fathoms of dredge cable was paid out. There was but a small catch embedded in a mass of sticky ooze. The types yielded were mostly similar to those of Station 30. Hunter's record states :—

"There were eleven fish—of four species, two different to what we have already obtained. Two octopuses—a large pinkish form and a very small form. Only a few ascidians. Molluscs—pectens again very abundant and obtained some very fine large specimens; also a few *Dentalium* as well as forms obtained on 29th. More brachiopods and very little polyzoa. One fairly large red pycnogon; only several crustacea, including a peculiar *Mantis*-like form. Only a few annulates (as on 29th). Echinoderms again numerous; but much the same as on 29th; but several new stars and a greenish holothurian; plenty of echinoids (as on 29th) and same with the ophiuroids. A few crinoids; one nemertean; a few nice large actinians; alcyonaria not as abundant as usual but there was one new type; a few sponges as on 29th."

Station 32.—On 31st January in Lat. 64° 35′ S., Long. 97° 21′ E. the dredge was lowered in 110 fathoms but came back empty. Probably it did not reach bottom.

Station 33.—Later on 31st January in Lat. 64° 32′ S., Long. 97° 20′ E. the dredge was lowered again in 103 fathoms on a sandy bottom. A length of 180 fathoms of dredge cable was paid out. Concerning the result, Hunter records :—

"What a sight this time! The large trawl was fully two-thirds full with large ascidians hanging all over the iron framework, while the main bulk of the catch appeared to be made up of these ascidians. When we emptied the trawl on to the deck there were

ascidians everywhere—nearly all a large pale reddish species, with a short stalk of several inches and averaging 8-9 inches long. There were simply hundreds of them. Of fishes there were few—thirteen individuals (ten very small) and three species—apparently not a fish ground. Of ascidians there was a great abundance both in numbers and species—about nine species. There were the large red forms already alluded to, small unstalked, simple, oval-shaped forms—pink and creamy white in colour— and other colonial forms. Of mollusca—no cephalopods, three specimens of a very fine large chiton, several species of bivalves, a *Dentalium*, but mainly gastropods—including four species of soft-bodied forms, altogether about fifteen species. Of Pycnogons there were the usual large red forms besides other kinds—three or four species. Polyzoa not abundant but well represented in species—eight or nine. No brachiopods; crustacea, not numerous, but good number of species—nine—a number of schizopods of one kind, a peculiar (*Mantis*-like) form, amphipods and one isopod. Of annulates, not a large number but about seven species—serpula, tubicolous form, polynoids (mainly), etc. Of echinoderms there was again a great abundance—of stars about fourteen species (yellow, red, etc.—mostly small); of ophiuroids about 10–11 species (again most numerous); of echinoids—about four species (including a large number of a prominent spined form); of holothurians, about nine species—apoda, elasipoda and ordinary forms—very numerous; crinoids also fairly numerous and managed to obtain quite a number of forms, almost complete—three species. Several nemerteans of two kinds; actinozoa—about three species of actinians, fine specimens, and three alcyonarians; hydrozoa about three species and sponges about nine species, mostly small forms. Then lastly a brownish form of *Cephalodiscus*. This was thus an extremely good haul."

Station 34.—On 24th February, when near the South Australian coast, in Lat. 35° 55′ S., Long. 134° 18′ E. a deep dredging was made. The depth of bottom was 1,800 fathoms and the bottom was *Globigerina* ooze. The trawl was put over the side at 11 a.m. and was aboard again at 7·10 p.m. There was a very small catch. Possibly the length of dredge cable out, namely 2,600 fathoms, was not sufficient for the best results. Regarding the small catch Hunter remarks :—

"There was not a great deal in dredge. No mud. Large fish—Macrura type—pinkish dorsally, pale ventrally; operculum bluish streaked four peculiar sea urchins, soft-bodied—one kind; six stars, small—one kind; eleven ophiuroids—one kind; twelve ophiuroids—another kind; one holothurian (?), four actinians (?)—two kinds; one alcyonarian; and one fine crustacean."

VII.—Concerning Descriptive Reports submitted for Publication, dealing with Sections of the Biological Collection.

The extensive collections accumulated during the course of the Expedition were distributed for report to authorities on the various groups represented. Professor W. A. Haswell of Sydney kindly undertook this distribution of materials as well as the editing of the biological reports.

Dr. John G. Hunter, the Chief Biologist of the Expedition, after completion of field activities still devoted much of his time to the sorting and preservation of the materials collected and to the preparation of notes relating thereto.

Professor Haswell's greatly-to-be-regretted death, in 1923, definitely set back the progress of the publication evolving under his direction. Since then arrangements for distribution and publication have principally devolved upon me. However, in the matter of the editing of the biological reports great help has since been accorded by well known zoologists—first, by Professor Launcelot Harrison of Sydney until his untimely death in 1927, and then by Assistant Professor E. A. Briggs of Sydney, until the cessation of printing in 1930. Thirty-one of the biological reports had already been published by that date, when unfortunately the publication was suspended owing to shortage of funds.

Arrangements have since been made for the balance of the manuscripts in hand to be printed. These have been seen through the press by Professor T. Harvey Johnston.

These biological reports appear as Series C of the Expedition publications. Their scope is outlined in the following list of parts. These have all been published with the exception of that dealing with Mammalia, which is in press.

VII.—List of Reports dealing with the Biological Collections.

1. Aves: R. A. Falla (Auckland).
2. Mammalia: Dr. T. Harvey Johnston (Adelaide).
3. Fishes: Edgar R. Waite (Adelaide).
4. Pterobranchia: Dr. W. G. Ridewood (British Museum, London).
5. Ascidiae simplices: Sir William A. Herdman (Liverpool).
6. Ascidiae compositae: Dr. Hervé Harant (Montpellier).
7. Rhabdopleura: Dr. T. Harvey Johnston (Adelaide).
8. Insecta: Collembola, Lepidoptera and Diptera by Dr. R. J. Tillyard (Canberra): with appendices on Hymenoptera by Dr. C. T. Brues (Boston) and Coleoptera by A. M. Lea (Adelaide).
9. Arachnida: W. J. Rainbow (Sydney).
10. Acarina: H. Womersley (Adelaide).
11. Mallophaga and Siphunculata: Dr. L. Harrison (Sydney).
12. Ixodoidea: Dr. T. Harvey Johnston (Adelaide).
13. Pycnogonida: Dr. Isabella Gordon (British Museum, London).
14. Ostracoda: Frederick Chapman (Melbourne).
15. Brachyura: Dr. Mary J. Rathbun (Washington).
16. Cladocera and Halocypridae: Dr. G. S. Brady.
17. Copepoda: Dr. G. S. Brady.
18. Euphausiacea and Mysidacea: Dr. W. M. Tattersall (Manchester).
19. Cumacea and Phyllocarida: Dr. W. T. Calman (British Museum, London).
20. Amphipoda (Hyperiidea): Dr. K. H. Barnard (Capetown).
21. Amphipoda (Gammaridea): Dr. G. E. Nicholls (Perth).
22. Isopoda and Tanaidacea: H. M. Hale (Adelaide).
23. Crustacea Cirripedia: Freda Bage (Brisbane).
24. Crustacea Decapoda: Freda Bage (Brisbane).
25. Pelecypoda and Gastropoda: Charles Hedley (Sydney).
26. Cephalopoda: Dr. S. Stillman Berry (California).
27. Brachiopoda: Dr. J. Allan Thomson (Wellington).
28. Chaetognatha: Dr. T. Harvey Johnston and B. Buckland Taylor (Brisbane).
29. Gephyrea inermia: Dr. W. B. Benham (Dunedin).
30. Marine Free-living Nemas: Dr. N. A. Cobb (Washington).
31. Nematoda (Parasitic): Dr. T. Harvey Johnston (Adelaide).

32. Polychaeta : Dr. W. B. Benham (Dunedin).

33. Oligochaeta : Dr. W. B. Benham (Dunedin).

34. Cestoda : Dr. T. Harvey Johnston (Adelaide).

35. Trematoda : Dr. T. Harvey Johnston (Adelaide).

36. Leeches : Dr. J. P. Moore (Philadelphia).

37. Acanthocephala : Dr. T. Harvey Johnston and E. W. Best (Adelaide).

38. Echinodermata Asteroidea : Dr. René Koehler (Lyons).

39. Echinodermata Ophiuroidea : Dr. René Koehler (Lyons).

40. Echinodermata Echinoidea : Dr. René Koehler (Lyons).

41. Crinoidea : Dr. Austin Clark (Washington).

42. Echinoderida : Dr. T. Harvey Johnston (Adelaide).

43. Polyzoa : Miss L. R. Thornely (Ambleside, England).

44. Bryozoa (Polyzoa), Supplementary Report : A. A. Livingstone (Sydney)

45. Actiniaria : Dr. O. Carlgren (Lund) and Dr. T. A. Stephenson (London).

46. Alcyonaria, Madreporaria and Antipatharia : Dr. J. Arthur Thomson and Nita Rennet (Aberdeen).

47. Calcareous Sponges : Dr. Arthur Dendy (London).

48. Non-Calcareous Sponges : Dr. M. Burton (British Museum, London).

49. Hydroida : Dr. E. A. Briggs (Sydney).

50. Foraminifera : Frederick Chapman and W. J. Parr (Melbourne).

51. Parasitic Infusoria : Dr. T. Harvey Johnston (Adelaide).

52. Diatoms : Dr. Albert Mann (Washington).

53. Ecological Notes and Illustrations of the Flora of Macquarie Island : H. Hamilton (Wellington).

54. Vascular Flora of Macquarie Island : T. F. Cheeseman (Auckland).

55. The Algae of Commonwealth Bay : A. H. S. Lucas (Sydney).

56. Mosses : H. N. Dixon and W. W. Watts (Sydney).

57. Bacteriology and Other Researches : A. L. McLean (Sydney).

In the case of the first two of the above sections, Aves and Mammals, the publications are in the form of a joint report dealing with the observations of both the Australasian Antarctic Expedition, 1911–14, and the British–Australian–New Zealand Antarctic Research Expedition of 1929–31. The remainder constitute series "C" of this publication.

No final provision has yet been made for report upon the following groups: Holothuroidea, Radiolaria, Medusae, Siphonophora, Lichens. It is hoped that arrangements can be made for inclusion of these items with the corresponding groups of the British–Australian–New Zealand Antarctic Research Expedition collections for joint report.

Two groups of the collection have been lost. The first of these, the Hexactinellid sponges despatched to Prof. I. Ijima of Tokyo were lost in transit. The second, a collection of three species of Cyclorrhaphous Diptera from Macquarie Island sent through Professor Brues to Mr. F. Knab (Washington) were not reported upon at the time of the latter's death and have not since been located.

VIII.—Explanation of Plates.

Plate VII.

Fig. 1. John G. Hunter, Chief Biologist of the Expedition. Photograph taken during the final Antarctic cruise. Hurley (Neg. H90).

2. C. T. Harrisson, Biologist of the Western Base Party. Photographed when in Queen Mary Land. Moyes (Neg. H78).

Plate VIII.

Fig. 1. Skinning a seal on fast sea-ice off the coast of Queen Mary Land, Long. 94° 14′ E., February, 1912. Watson (Neg. P46).

2. Summer life on the bay-ice of the Boat Harbour at Cape Denison (Main Base Station), Commonwealth Bay. Weddell Seals and Adelie Penguins. Hurley (Neg. H523).

Plate IX.

Fig. 1. Dredging on the shores of the Boat Harbour, Cape Denison, during a temporary lull of the winter hurricane. The surface of the water is covered by young ice which immediately formed when the wind abated. McLean (Neg. Q623).

2. Preparing to haul up the fish trap attached to the rope seen passing through the sea ice, Boat Harbour, Cape Denison, in autumn. McLean (Neg. Q625).

Plate X.

Fig. 1. The biologists take advantage of a calm period early in September, 1912. They are off to dredge through the sea-ice at Cape Denison, Commonwealth Bay. The hand dredge and other necessary equipment are on the sledge. McLean (Neg. Q624).

2. Hauling a hand dredge along the bottom across the mouth of the Boat Harbour, Cape Denison, during a winter lull. With a long tail rope as well as a leading line, the dredge could be pulled backwards and forwards by parties stationed one on each side of the harbour. McLean (Neg. Q622).

Plate XI.

Fig. 1. Hand dredging equipment transported to a dredging station half a mile off Cape Denison. This steel hand cart was preferable to a sledge when on sticky young sea-ice. The figures are: Laseron on the left and Hunter on the right. Mawson (Neg. C241).

2. Preparing for dredging through the bay ice off Cape Denison. A long track is cut through the ice with a pick. Through this the dredge rope with dredge attached is passed, so that the dredge can then be pulled backwards and forwards on the sea bottom below the ice. McLean (Neg. Q634).

Plate XII.

Fig. 1. H. Hamilton, the Biologist of the Macquarie Island Party. He is seen amongst tussock grass on the island. Blake (Neg. H143).

2. A sea-leopard on the shore at Macquarie Island. Hamilton (Neg. H379).

3. A group of half-grown sea elephants basking amongst the Royal penguins at South-East Point, Macquarie Island. Hurley (Neg. C134).

Plate XIII.

Fig. 1. Hamilton hand netting macro-plankton as the "Aurora" slowly traversed the calm waters amongst the pack-ice in January, 1914. Hurley (Neg. H108).

2. A large circular net for towing at a depth behind the "Aurora." Hurley (Neg. H106).

Plate XIV.

Fig. 1. The large winding drum for the cable of the Monagasque Trawl. Hurley (Neg. H107).

2. The trawling cable being wound on to the drum as the trawl is being hauled in. The cable is seen passing up through a snatch block attached to the lower end of the derrick boom. Davis (Neg. P272).

3. The trawl net just hauled in is seen to be loaded with animal life. Hurley (Neg. H110).

Plate XV.

Fig. 1. The Monagasque trawl just emerging from the water as it was being wound up to the surface. Hurley (Neg. H111).

2. The trawl just after it had been hauled on board. Members of the staff are pressing around to get a view of the marine creatures brought up in the net. Hurley (Neg. H125).

Sydney: Thomas Henry Tennant, Acting Government Printer—1940.

FIG. 1.—JOHN G. HUNTER, CHIEF BIOLOGIST.

FIG. 2.—CHARLES T. HARRISON, BIOLOGIST AT WESTERN BASE.

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FIG. 1.—SKINNING A SEAL ON THE BAY ICE OFF QUEEN MARY LAND.

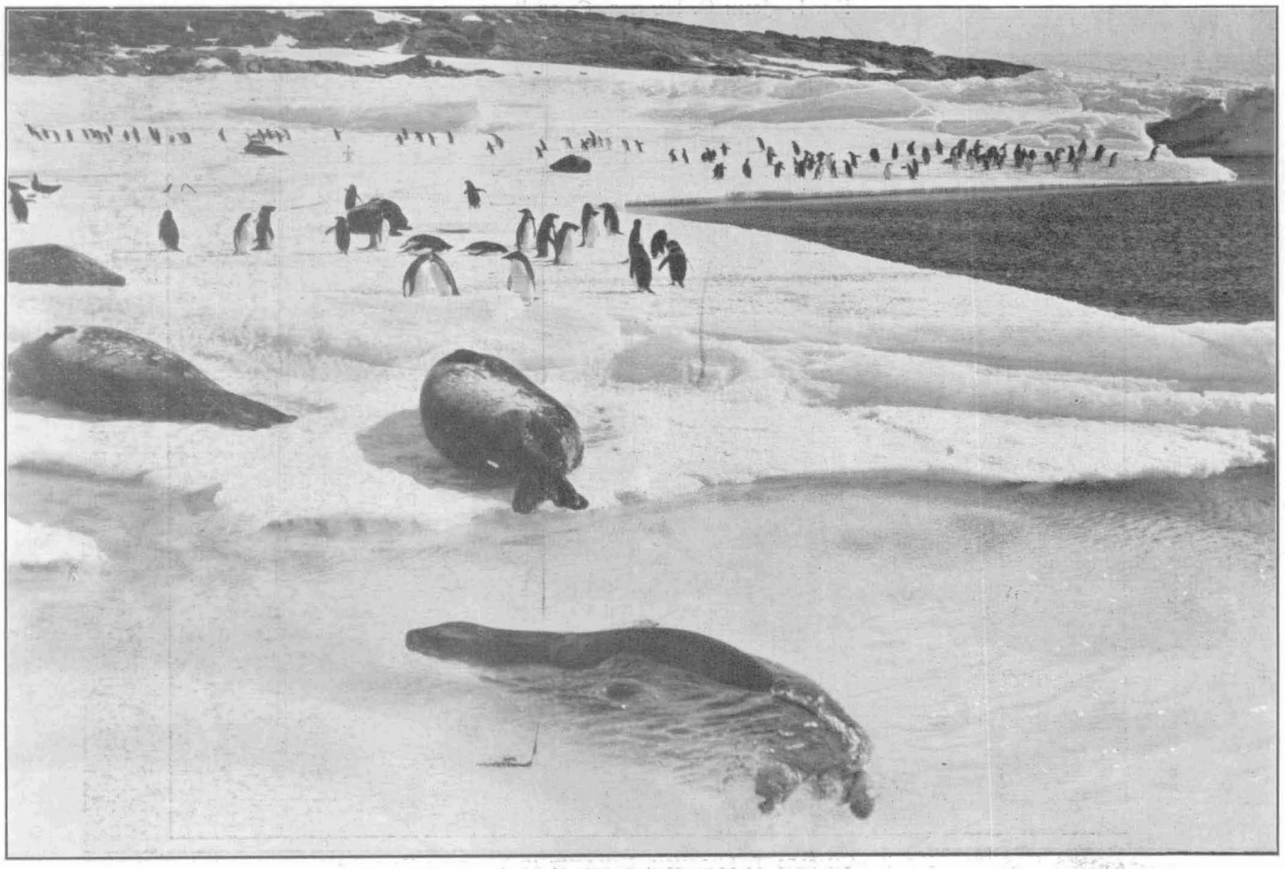

FIG. 2.—SUMMER LIFE; THE BOAT HARBOUR, CAPE DENISON.

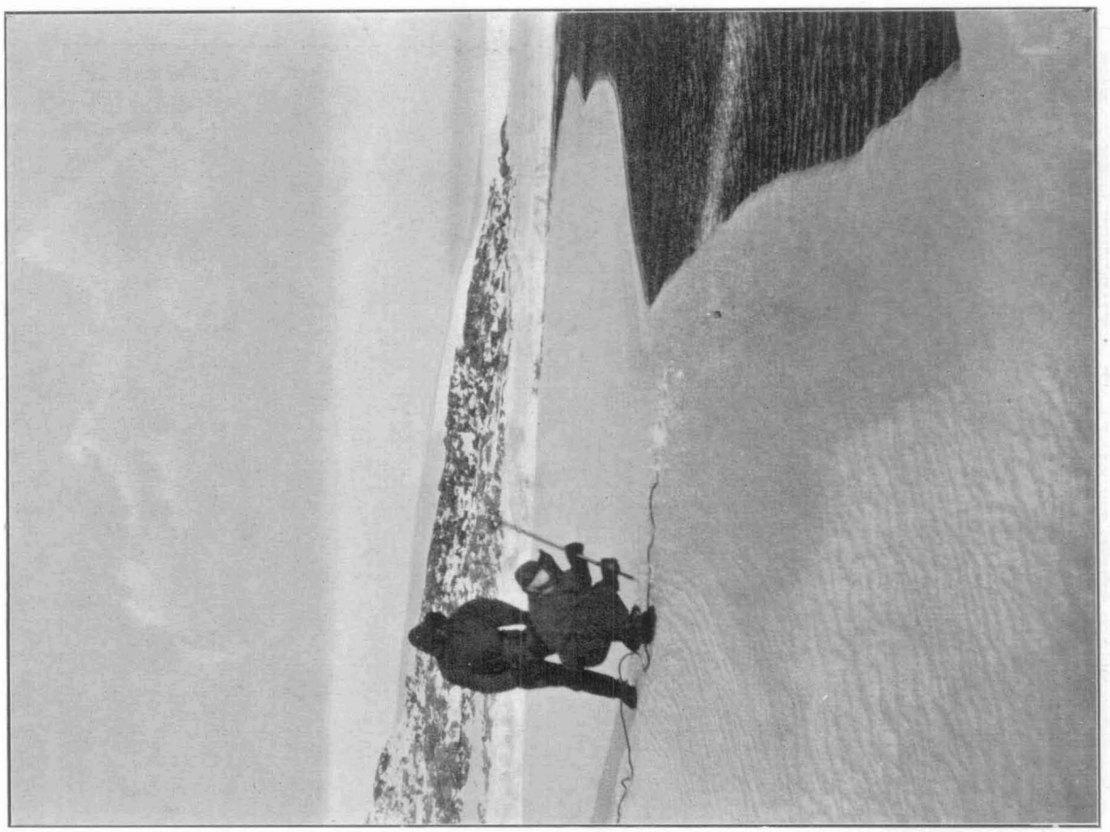

FIG. 2.—PREPARING TO HAUL UP THE FISH TRAP.

FIG. 1.—HAND DREDGING IN THE BOAT HARBOUR.

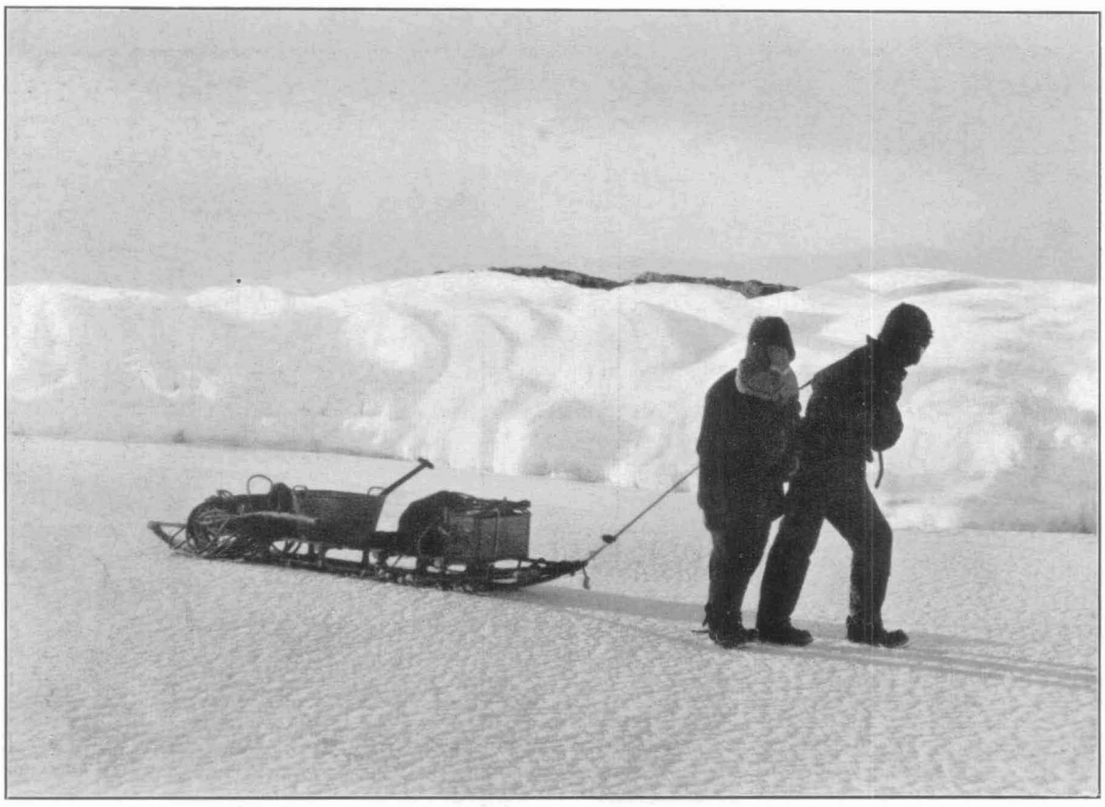

FIG. 1.—SETTING OUT TO DREDGE THROUGH THE SEA-ICE.

FIG. 2.—DRAGGING THE HAND DREDGE ALONG THE BOTTOM OF BOAT HARBOUR.

FIG. 1.—TRANSPORTING HAND DREDGING EQUIPMENT ACROSS STICKY SEA-ICE.

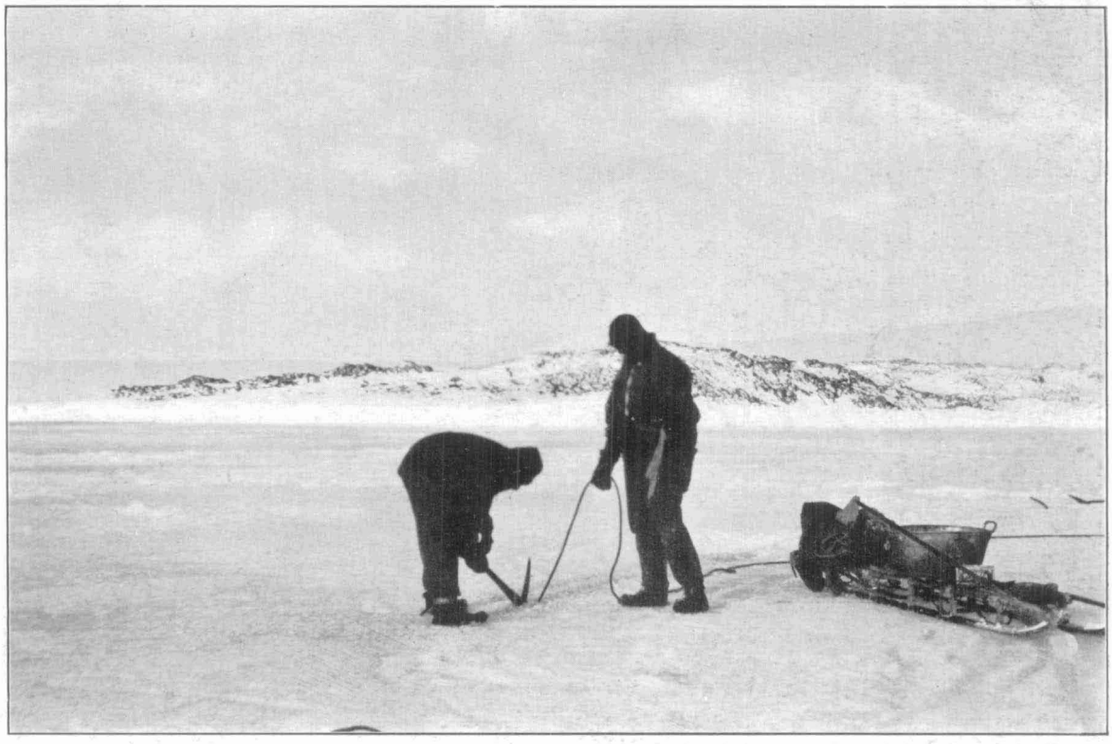

FIG. 2—CUTTING A TRACK IN THE BAY ICE FOR THE HAND DREDGE ROPE.

FIG. 1.—HAROLD HAMILTON: MACQUARIE ISLAND PARTY.

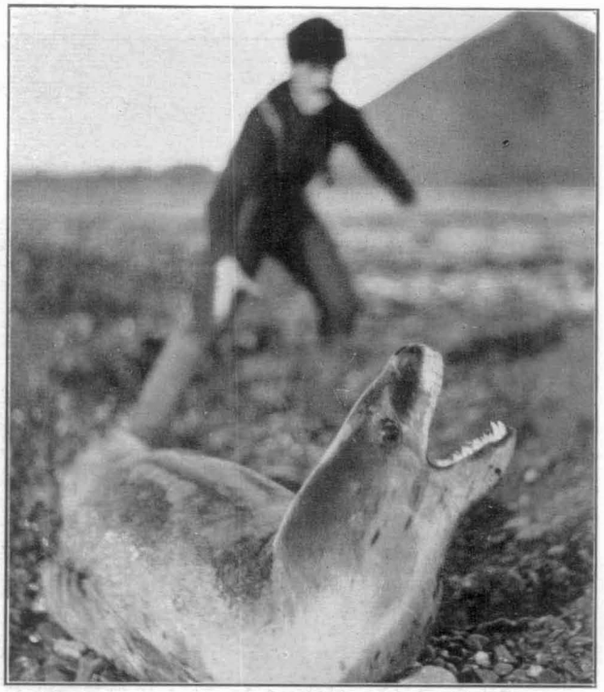

FIG. 2.—SEA LEOPARD: MACQUARIE ISLAND.

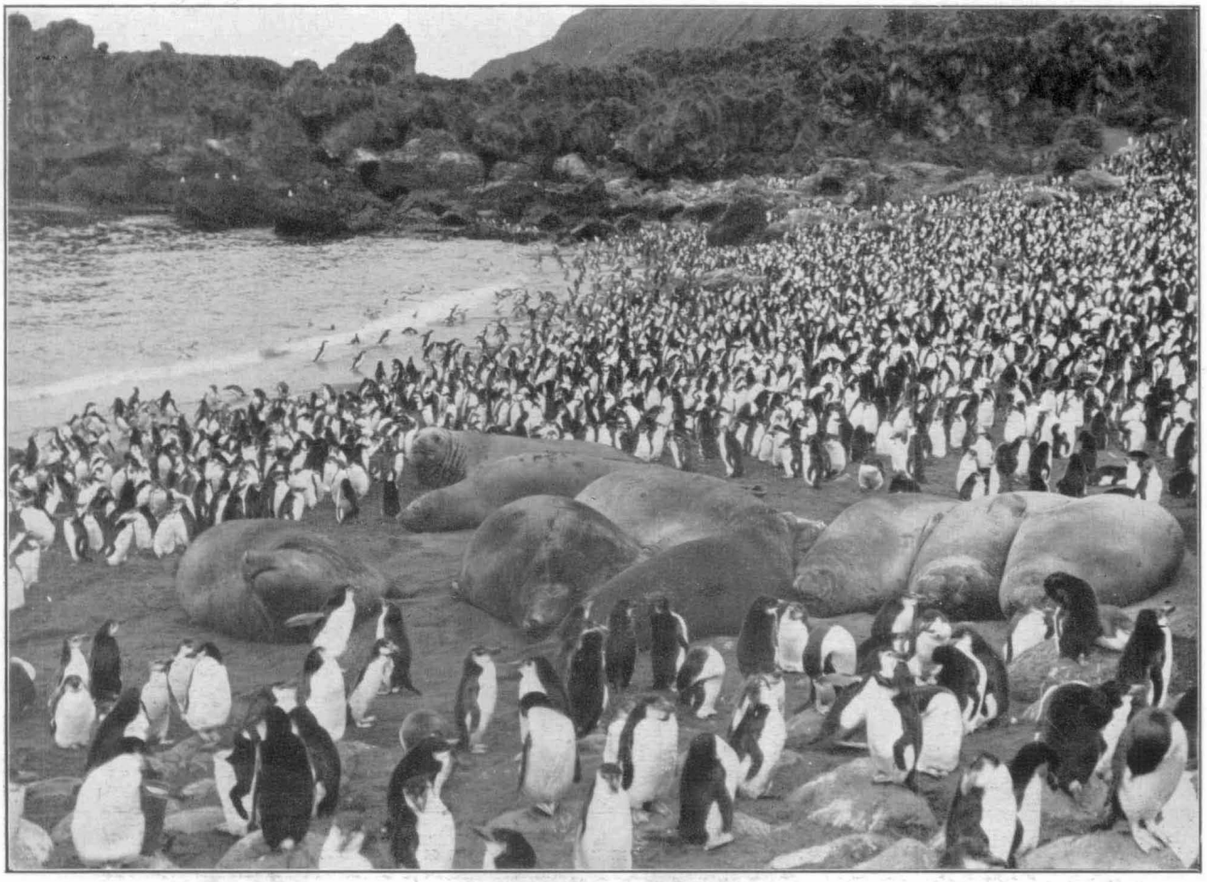

FIG. 3.—YOUNG SEA-ELEPHANT AND ROYAL PENGUINS: MACQUARIE ISLAND.

FIG. 1.—HAND NETTING MACRO-PLANKTON FROM THE AURORA.

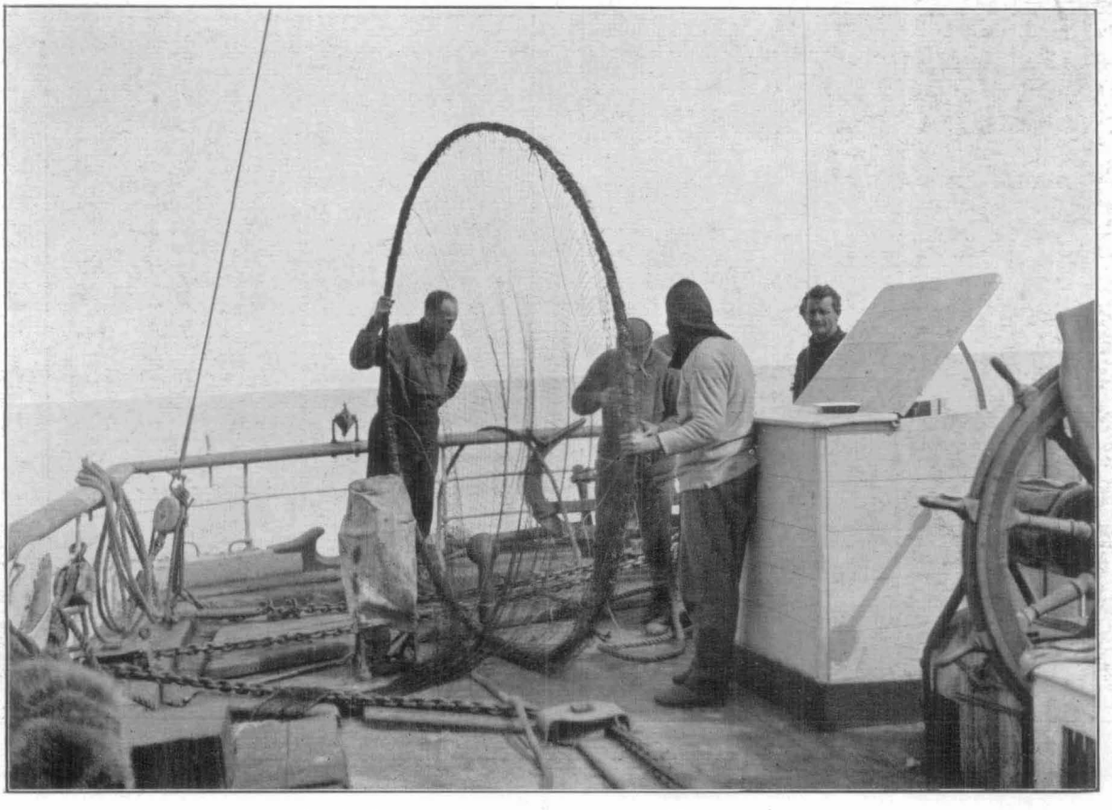

FIG. 2.—LARGE CIRCULAR TOW NET FOR MACRO-PLANKTON.

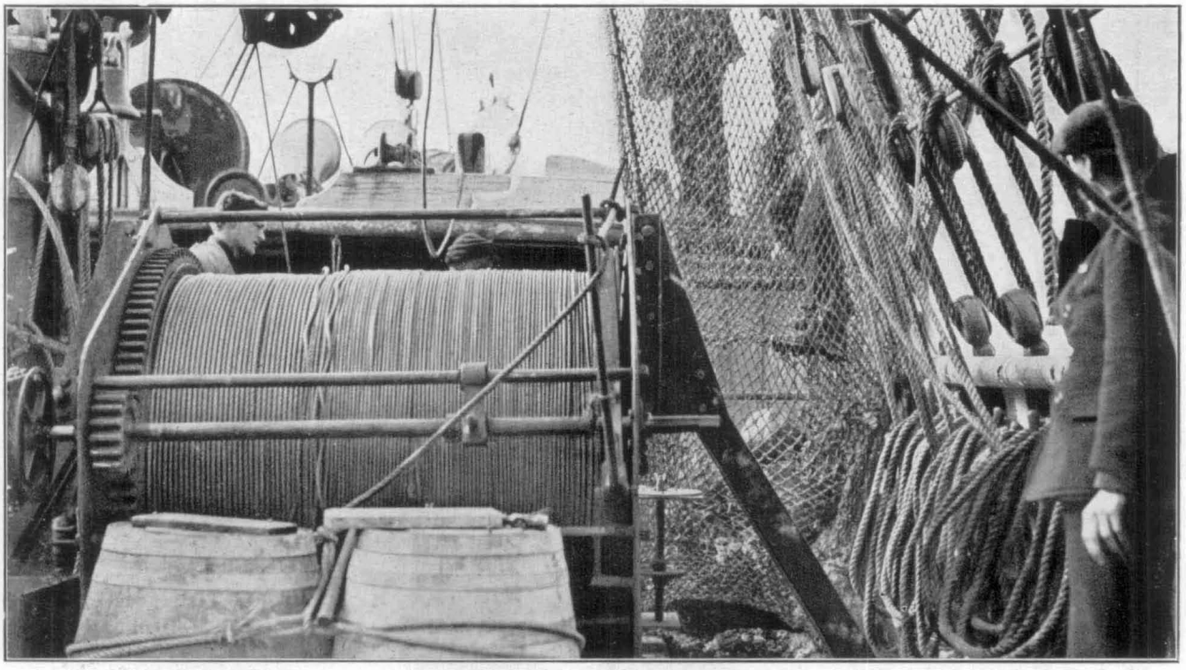

FIG. 1.—WINDING DRUM FOR CABLE OF THE DEEP-SEA TRAWL.

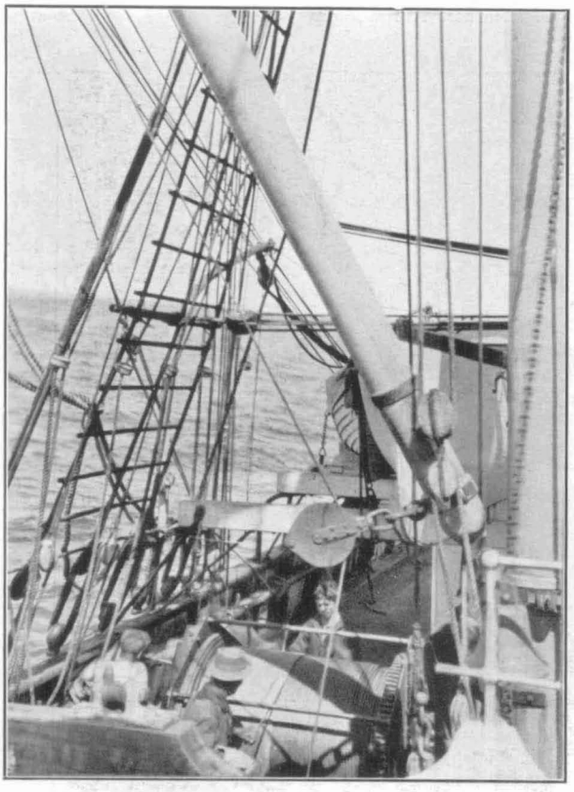

FIG. 2.—WINDING IN THE TRAWL CABLE.

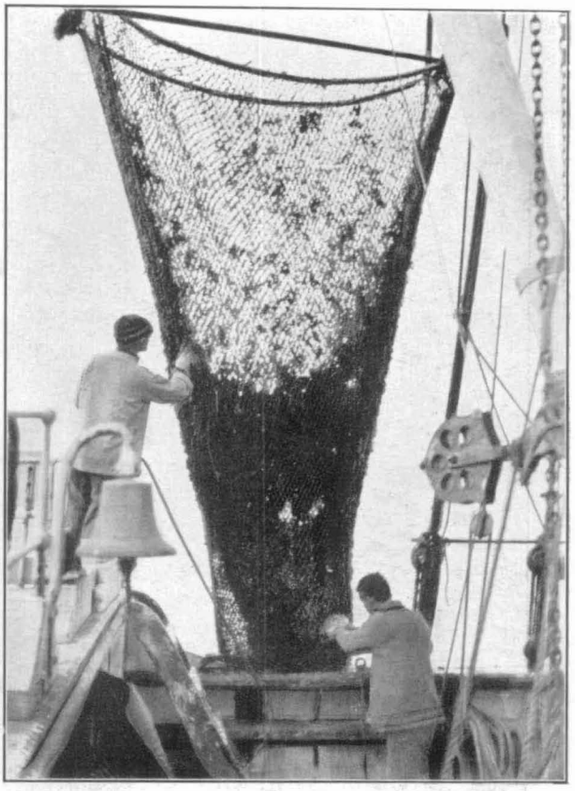

FIG. 3—TRAWL COMES ON BOARD WITH CATCH.

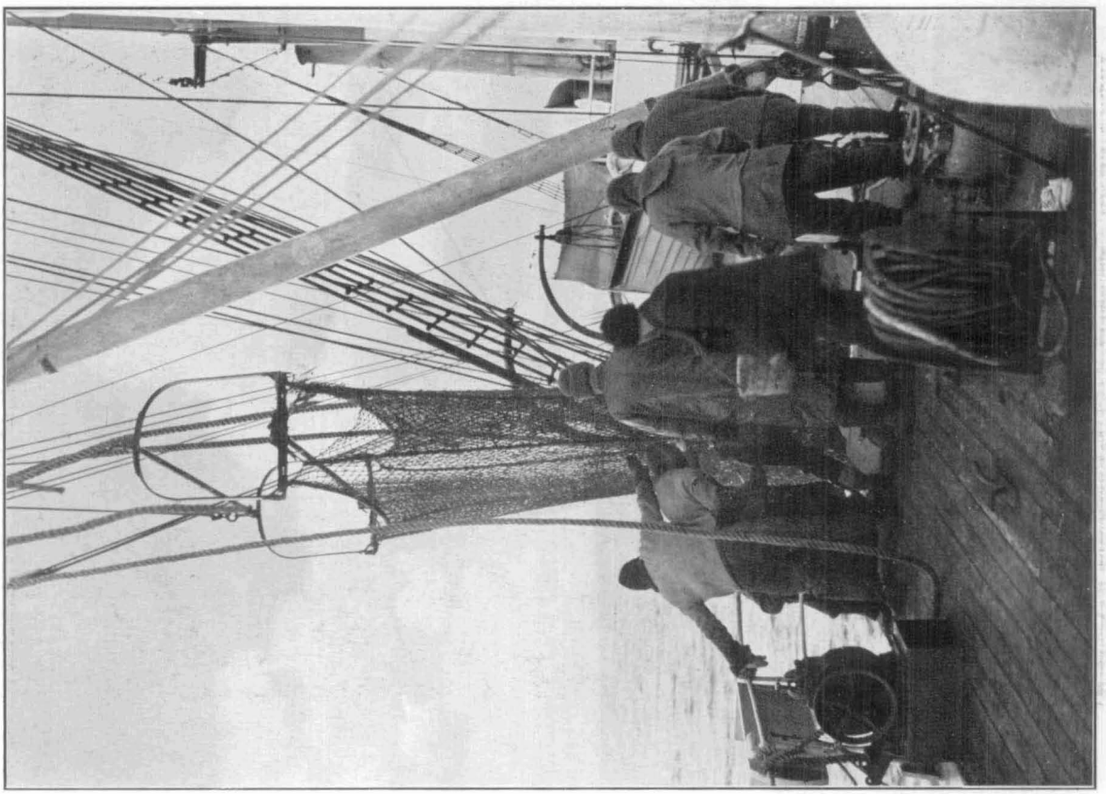

FIG. 2.—TRAWL SWUNG ON BOARD.

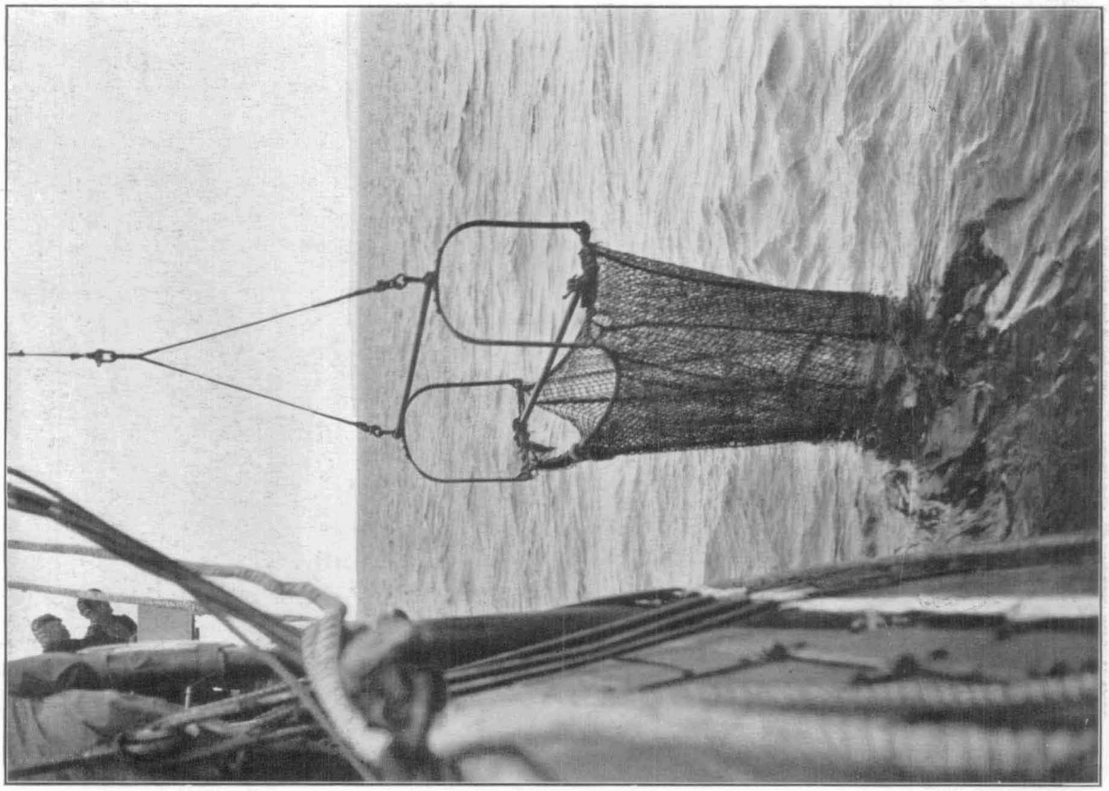

FIG. 1.—TRAWL EMERGING FROM THE SEA.

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