

Conclusions

A study of temperature and pressure at Norway Station/Sanae shows several features which are not unique to this part of Antarctica and for which the explanations are not apparent. These are: 1) the deceleration or reversal of the summer to winter rate of drop in temperature during May and/or June; 2) the pronounced semi-annual oscillation of the atmospheric pressure over Antarctica, and 3) the pronounced, sustained rise in annual mean temperature from 1971 to 1975. These phenomena ought to be studied for the whole of

Antarctica and surrounding oceans in order to arrive at a complete description of the events and perhaps to find their explanations as well as the implications for middle and low-latitude weather.

References

- South African Weather Bureau. Monthly mean temperature and sea-level pressure at Norway Station and Sanae since 1960. *S. Afr. J. Antarc. Res.*, **1**, 33, 1971.
- Burdecki, F. The climate of Sanae, Part I: Temperature, wind and sea-level pressure. *Notos*, **18**, 4-58, 1969.

Report on South African participation in cruise MD08 of MS Marion Dufresne, March–April 1976

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Introduction

The Administration of Le Territoire des Terres Australes et Antarctiques Françaises (TAAF), through SASCAR, invited our participation in their scientific programme during cruise MD08 of the *Marion Dufresne*. The total complement of scientists and technicians was 23, 15 from France, 3 each from South Africa and the United States, and one each from Portugal and Canada. Cruise MD08 lasted from 8 March to 26 April 1976. Details of the course, station locations and local noon positions of the *Marion Dufresne* during the cruise are given in Fig. 1. This report summarises the nature and extent of the South African contribution to the joint research programme, which was an investigation of the fauna around the Crozet Archipelago and the Prince Edward islands, and observations on the distribution and abundance of seabirds in the south-western sector of the Indian Ocean.

Studies of zooplankton and the marine benthos

(J. R. Grindley and T. H. Wooldridge)

Zooplankton samples were collected at 23 stations during MD08, with a 50-cm diameter WP II net hauled vertically

from 300 m to the surface at a speed of about one metre per second. At depths of less than 300 m, the hauls were made from about 10 m above the bottom to the surface. Nine samples were taken at stations 1–8 in the southern Indian Ocean between Reunion and the Subtropical Convergence at about 40°S. These samples are being studied at the Plankton Sorting Centre, Washington, D.C. One sample was collected at station 9, off Possession Island, Crozets, and 13 samples were collected at different stations in the vicinity of the Prince Edward islands. These latter samples, including the Crozet sample for comparison, are being sorted and studied at the University of Cape Town.

In a preliminary examination of the samples taken around Marion and Prince Edward, the following groups were observed: Copepoda (including the Antarctic species *Calanus propinquus*, *Calanoides acutus*, *Rhincalanus gigas* and *Oithona frigida*), copepod nauplius larvae, Ostracoda, Euphausacea (including juvenile stages), polychaete larvae, gasteropod larvae, lamellibranch larvae, diatoms, Radiolaria, Foraminifera, Dinoflagellata, Oikopleura, Chaetognatha, medusae, eggs and algal detritus. Some samples included large amounts of phytoplankton including *Chaetoceros flexuosus*, *C. neg-*

lectus, *Rhizosolenia hebetata* (including var. *indica* and var. *semispina*), *R. alata*, *R. curvata*, *Thalassiothrix*, *Ceratium* and *Nitzschia*.

The total settled volume was determined on board ship for each sample. Though this measure does not give a completely satisfactory representation of plankton abundance, it does give some indication of the trends. Average settled volume of the samples collected around Marion and Prince Edward was 24.5 ml (range 5.0–40.0 ml). Apart from the two extreme values there was considerable uniformity in the settled volume of these samples. The vertical hauls ranged in depth from 75 to 300 m. Since the entire water column was sampled, the results suggest that plankton abundance was greatest inshore and declined towards the deeper outer stations. In particular, the plankton inshore in the lee of Marion Island was remarkably rich, suggesting high nutrient concentrations in the water. These might be due to the presence of local upwelling or to nutrient enrichment from the large seabird colonies that are concentrated on the eastern plains of the island.

The study of the benthic fauna around the Prince Edward islands constitutes the first detailed survey since the brief visit of H.M.S. *Challenger* in 1873. A total of 27 stations, ranging in depth from 30 to 600 m, was surveyed off the south, east, and north-east coasts of Marion Island, between Marion and Prince Edward, and east of Prince Edward Island. Samples were collected using Charcot dredges, Benne-Okean grabs, Reinecke corers and beam trawls. The hydrology, water chemistry, primary productivity, plankton, meiobenthos and fishes were also studied. The material collected is now being studied by taxonomists in several countries. As soon as these studies are complete reference specimens (including any paratypes) will be sent to South Africa and deposited in the South African Museum.

Some preliminary general conclusions are possible on the basis of the information so far available. At depths less than 50 m, algae, particularly the reds, are common and ophiuroids and amphipods were abundant. The fauna of the shelf zone,

lying between 50 and about 200 m, appeared to be dominated by Bryozoa and Echinodermata. Faunal diversity appeared to increase in the deeper water down to 600 m, and the dominant groups were Coelenterata and Porifera. King crabs *Lithodes murrayi* were collected in this deeper water. Groups that were well-represented overall included the Coelenterata, Crustacea and Annelida. Several species of Pycnogonida were found on the sponges.

The diversity of fishes (10 species) and apparently the diversity of other groups also, appears to be lower than that recorded from around the Crozets and on the Kerguelen plateau, areas with which the Prince Edward islands appear to be linked biogeographically. This difference may be related to the shorter geological history of the Prince Edward islands and, perhaps, to their relative isolation from source areas which, because of west wind drift in these latitudes, must lie predominantly to the west.

Studies on the distribution and abundance of seabirds

(P. G. H. Frost)

A total of 252 hours of detailed observation was made during the 45-day cruise, though most observations were concentrated in those periods when the ship was in transit between the different islands. A 180° arc was scanned to a distance of about 1 km and all birds seen were recorded. Birds following the ship were noted separately every 10 minutes. A total of 17 201 birds of 46 species was recorded during the counts.

Generally, birds were very sparsely distributed over the subtropical waters of the Indian Ocean north of 40°S. Many of the 25 species recorded were subantarctic species that penetrated the area to about 30°S. Sooty Terns, *Sterna fuscata*, were recorded in fairly large numbers south of Madagascar. Barau's Petrel, *Pterodroma baraui*, was recorded as far south as the Subtropical Convergence (40°S). The feeding grounds of this recently described species from Reunion have not been identified before, but these data suggest that they lie between 1 200 and 2 000 km south west of the island.

Seabirds were abundant and widely distributed in the subantarctic zone. They were most numerous around the islands and in the Subtropical Convergence zone, where up to 400 birds per hour were occasionally recorded. Thirty-nine species were identified, including two races (*cauta* and *salvini*) of the Shy Albatross, *Diomedea cauta*, hitherto unrecorded from this region. Also of interest was the capture, at night, of a Grey Backed Storm Petrel, *Garrodia nereis*, off Crawford Bay, Marion Island. The bird had a well-developed brood patch and was one of a number seen flying towards land that night. This is the first evidence that this species might breed on the Prince Edward islands.

There is a paucity of data on the biomass of seabirds at sea in the southern oceans. Preliminary results indicate marked differences in the overall biomass of birds between subtropical and subantarctic waters. In the region 20–30°S the overall biomass was approximately 0.7 kg km⁻²; between 30–40°S, 1.6 kg km⁻²; and between 40–50°S, 7.7 kg km⁻².

Sightings of whales and other cetaceans were made during the cruise. Thirty-four sightings were made, 9 of which were of Sperm Whales, *Physeter catodon*, in subtropical waters. These sightings form the basis of a separate paper (Frost & Best, in prep.).

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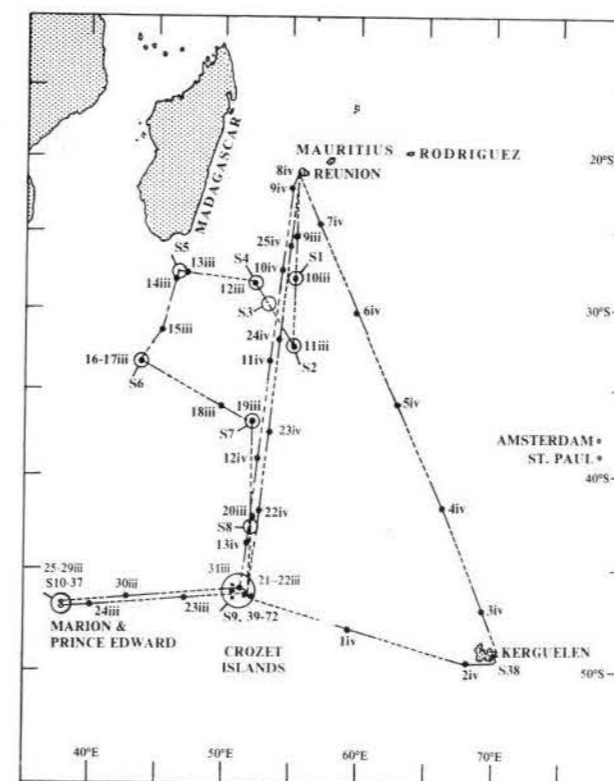


Fig. 1. Cruise tracks, dates, local noon positions and station numbers for *Marion Dufresne* cruise 08, March–April 1976.