# Studies on the Pelagic Marine Ecosystem

The British Antarctic Survey has undertaken a programme of shipborne marine biological research for fifteen years. This has aimed to describe the functioning of the Antarctic open ocean ecosystem, with investigations of the major groups of animals and plants, and their environment.

The present study was stimulated by concern in the 1970s that fisheries in the Southern Ocean were increasing, but the biological knowledge needed to regulate these fisheries was not then available. Particular concern was expressed over the potential fishery for the shrimp-like crustacean krill. Antarctic krill is very abundant in the Antarctic seas and forms the diet for many groups of predators, including fish and squid, and the birds, seals and whales which form such a conspicuous element of the marine life in the Antarctic.

Krill live in the upper water column, where they commonly form dense swarms hundreds of metres across. It is this behaviour which makes it possible for large predators to feed on them, and also has important implications for the way in which they interact with their environment and food supply. Investigations of krill focus on swarms, and the implications of this behaviour for all aspects of krill biology. Various techniques are used to investigate the spatial and temporal variation in the character of swarms as individual units, and the animals which are contained in them. Research is also undertaken on the basic aspects of krill biology which are important for population biological studies, and hence for fisheries regulation. One key aspect is the estimation of the abundance of krill. Echosounders provide the means to measure the amount of krill over large areas, but this technique is dependent on the accurate assessment of the way that krill reflect the sound signal used to detect them. Current research is aimed at using multiple frequency echosounders to obtain more accurate information from acoustic techniques.

Krill are not the only small animals - zooplankton - in the Southern Ocean. Several other crustaceans, such as copepods, fill a similar niche and are themselves prey for larger predators. The zooplankton also contains predatory groups. Studies on the zooplankton are aimed at understanding the complex interactions which take place in this community. The species composition of zooplankton from different samples reflects seasonal changes and geographic variation. On a smaller scale, the distribution of zooplankton can be linked to environmental features and variation in their food supply. Competition between different zooplankton species may also be a factor in determining these patterns.

Squid are difficult subjects for study as they are hard to catch in the nets usually employed in scientific studies. Much information can be gained from analysis of the gut contents of predators such as seabirds, and by obtaining material from commercial fishing operations - the latter predominantly from outside the Southern Ocean. However, it is by the use of larger research trawls that most useful systematic information is obtained. This work supports the contention that squid are an important feature of the Southern Ocean ecosystem. They form an important dietary item for several predator species, and are themselves significant consumers of krill. However, much work needs to be done before the role of squid in the Southern Ocean can be assessed realistically.

The fish found in the Southern Ocean are mainly members of a unique group adapted to the cold waters of the Antarctic. Several species are already the subject of commercial fishery. They breed in shallow water, and the larvae and juveniles spend their lives in the nearshore environment. As small fish, they form part of the zooplankton community and are active predators on copepods and other small animals. Investigation of their role in this community is important to an understanding of the biology and recruitment of several fish species of commercial importance. The fish migrate offshore as adults, and there become active predators on krill, and are significant components of the diet of several species of seals and seabirds. Studies of adult fish are carried out to measure their growth and physiology.