INTERLINKING OF PHYSICAL AND BIOLOGICAL PROCESSES IN THE ANTARCTIC OCEAN (ABSTRACT)

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Most Antarctic production takes place in the sea, phytoplankton and ice algae being the main primary producers. Antarctic productivity is limited by light, nutrients rarely being in short supply. Day length and pack-ice cover (Fig. 1) vary so much with the seasons that animals which overwinter are effectively food limited. Many of the larger Antarctic animals feed on krill and there is evidence that the various components of the krill biocenosis interact with one another. Thus crabeater seals and Adélie penguins are thought to have increased in numbers as a consequence of intensive whaling. For reasons such as this, the international Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) intends to manage the resources of the Antarctic as a single ecosystem.

Both physical and biological factors need to be understood if the Antarctic ecosystem is to be managed effectively and wisely. For example, the light available to Antarctic phytoplankton is attenuated in pack-ice areas by the snow and ice above and also by the pigmentation of epontic algae growing in the pack. In ice-free areas, the light available to phytoplankton is attenuated by wind stress on the surface of the sea (Fig. 2) which mixes the surface water column to considerable depths; SEASAT photographs indicate that this constraint may be severe north of the Antarctic Polar Front, and particularly severe in the Australian Subantarctic Sector.

The range of Antarctic species is generally circumpolar, the principal habitats corresponding with the East Wind Drift, adjacent to the Antarctic Continent, and with the West Wind Drift, further north. There is evidence that some species maintain their zonal range by migrating seasonally between surface waters with a northerly drift component and deeper waters with a southerly drift component.

The local distribution of pelagic organisms in the Antarctic is extraordinarily patchy and there is no concensus yet about the cause. The possibility needs to be examined that pelagic patchiness is accentuated by the heterogeneity of the pack ice. The habitat of *Euphausia superba* is blanketed by pack ice in the winter and there is evidence that, in summer, populations retreat southward with the pack. The contribution of ice algae to the pelagic food chain needs urgently to be investigated.

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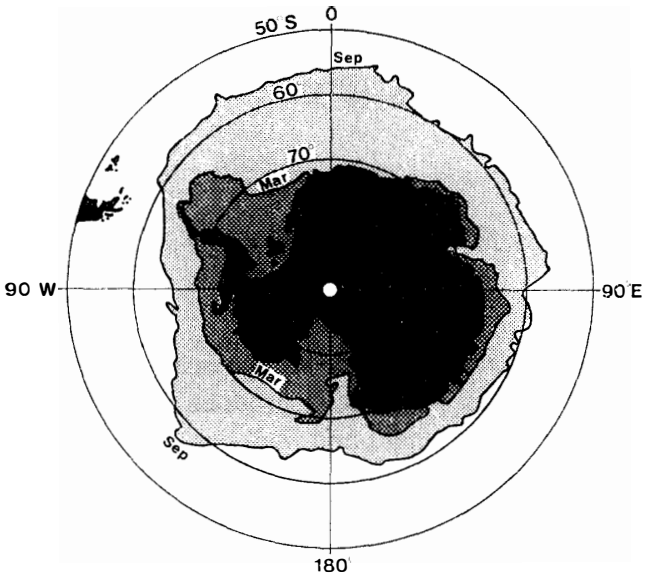

Fig. 1. Seasonal variation in the cover of pack ice on the surface of the seas surrounding the Antarctic Continent.

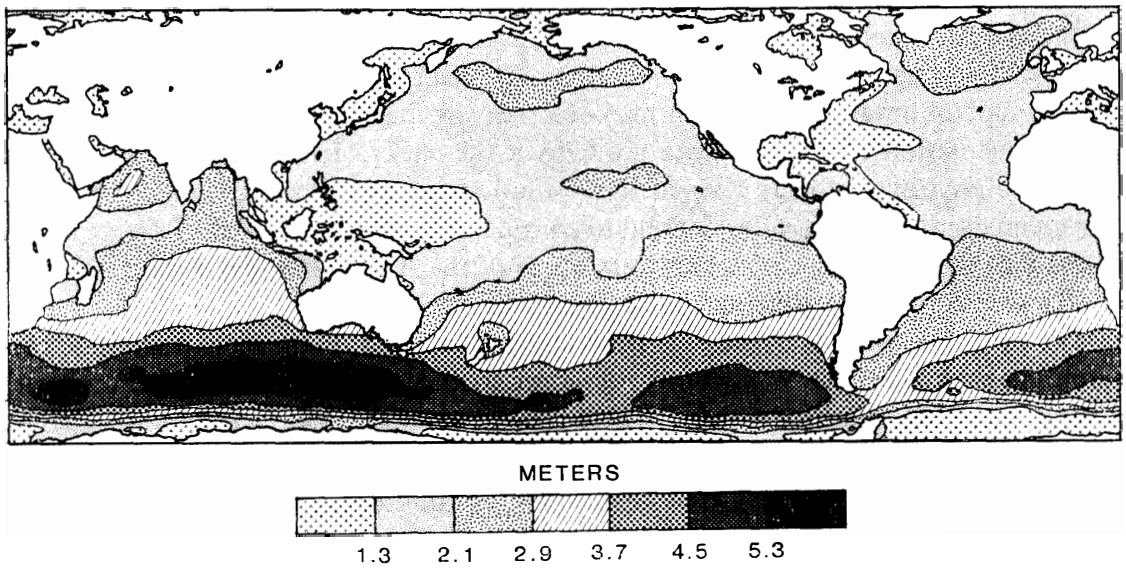

Fig. 2. Wave height in the Southern Ocean compared with that of other oceans (SEASAT imagery, July 7–October 10, 1978).