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Introduction to the Symposium: Antarctic Marine Biology[1]

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"The biology of Antarctica is almost wholly a marine biology"

Stephen J. Pyne
The Ice: A Journey to Antarctica
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It was only a little over 200 years ago that James Cook penetrated the pack ice and established that if there was an antarctic land mass at all, it was surrounded by a frozen sea. In 1820, members of British, Russian, and American expeditions all might have been among the first people to see the antarctic shore. Since that time this immense continent and its surrounding islands have captured the imagination and curiosity of scientists and laypersons alike. Exploratory expeditions during the 1820s led by the American and British sealers Nathaniel Palmer and James Weddell revealed a continent whose coasts teemed with marine life, including vast numbers of seals, penguins, and whales. Observations on the nature of antarctic marine life continued during the expeditions of Durmont d'Urville (France, 1837–1840), Charles Wilkes (United States, 1838–1841), and James Ross Clark (United Kingdom, 1839–1843). The Challenger expedition (1872–1876), whose scientific staff was led by Sir Charles Wyville Thomson, contributed vast amounts of information on the morphology, taxonomy, and geographic distribution of antarctic benthic and pelagic marine organisms, setting the stage for some of the paradigms that remain with us today.

The birth of antarctic marine biology, however, probably should be placed with Robert Scott's British National Antarctic Expedition to McMurdo Sound in 1901–1904. During that expedition a small group of workers, faced with horrendous conditions, managed to collect specimens year round. A large proportion of the antarctic marine biota today is based on that material. In the early part of the twentieth century the land-based expeditions led by Shackleton, Borshgrevink, Bruce, Mawson, Charcot, De Gerlache, and Nordenskjold made further observations on coastal marine life (Walton, 1987). The first long-term study of antarctic pelagic and benthic ecosystems was conducted during the British Discovery expeditions between 1925 and 1939. The resulting "Discovery Reports" contain extensive published information on both fauna and flora of Antarctica. "Modern" marine biological studies in the antarctic began in 1958–1959 during the International Geophysical Year. During the past 30 years marine biological studies have increased enormously in importance and scope, and now they are major components of research efforts by many nations in Antarctica.

Past and contemporary studies of antarctic marine biology reveal a rich and varied marine biota, in many respects without any temperate or tropical counterpart (see reviews by Holgate, 1970; Stonehouse, 1972; Llano, 1977; Bonner and Berry, 1980; Laws, 1984; Walton, 1987). The antarctic marine environment is characterized by constant, low water temperatures (generally −1.8°C), yet marked seasonal patterns of pack-ice movement and photoperiod. The offshore biotic system is fueled by upwelling, nutrient-rich, deep circumpolar waters, which support rich

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primary productivity during the antarctic austral summer. Although antarctic marine biology is a relatively young science, research has gone far beyond description of plants and animals found in antarctic waters. More fundamental aspects of how these biota live and interact have been studied. In particular, attention has been paid to processes that allow this environment to be part of our biosphere. These processes then can be compared in more general terms to living processes in other regions of the globe. Dynamics of production, reproduction, and ecological stability and interaction have been well developed over the past few decades. Indeed, in some ways we know more about the "remote" antarctic environment today than we do about more familiar environments closer to home.

This symposium was intended to bring some of the more recent findings to a wider audience than those working in the antarctic. Some of the more familiar and established paradigms about life in antarctic waters are no longer valid, and we are at a time of ferment and reassessment. The enormous productivity traditionally attributed to antarctic waters may not be all that enormous after all. Adaptations to the perpetual freezing temperatures and oliogotrophic conditions may be quite different than we have formerly assumed, and the misleadingly "simple" communities may be as complex and diverse as in other parts of the world. This symposium was also intended to bring workers in different areas together to aid in their reassessment of common problems; the field of workers, in fact, has grown substantially and in diverse directions during the past few years.

In organizing the symposium papers, our approach has been to begin with antarctic marine organisms at the base of the food web, and then move on to those organisms occupying higher trophic levels. The first group of papers concentrates on primary and secondary productivity of antarctic coastal waters. These address such topics as the regulation of pelagic primary production (Rivkin), microbiota and heterotrophic processes in antarctic sea ice (Garrison), and the ecology and distribution of nearshore macroscopic algae (Miller and Pearse). The second group of papers focuses on aspects of the ecology, reproduction and physiology of antarctic krill (Quetin and Ross), modes and tempos of reproduction (Pearse, McClintock and Bosch) and adaptations to low temperature and oligotrophic conditions (Clarke). The final group of papers focuses on marine animals at the highest trophic levels: the fishes, birds, and mammals. These include papers on the evolution of antarctic fishes (Eastman), the foraging energetics of pinnipeds and sea birds (Costa), the ecology of polar birds (Hunt), and the population dynamics and social biology of antarctic seals (Siniff).

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