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Introduction to the Symposium: Antarctic Marine Biology[1]

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''We have added a great deal of knowledge of life in the pack from observations of the whales, seals, penguins, birds and fishes as well as of the pelagic beasts which are caught in tow-nets. Life in one form or another is very plentiful in the pack, and the struggle for existence here as elsewhere is a fascinating subject of study.''—Robert F. Scott, *Scott's Last Expedition: The Journals of Captain R. F. Scott*, 1913

The history of antarctic exploration, which now dates back over two full centuries, is rich with adventure, discovery and tragedy. In the early nineteenth century, the first documentations of the abundant marine life that characterized antarctic waters were revealed through the eyes of those hunting for seals including Nathaniel Palmer and James Weddell. Numerous expeditions followed these early sealers and contributed significant information on the diversity and distribution of antarctic marine life, perhaps most notably the Challenger expedition (1872–1876) led by Sir Charles Wyville Thomson. Arguably, it was the 1901–1904 British National expedition of Robert Scott that can be credited with the first true studies of antarctic marine biology. For here among Scott's men were intrepid naturalists such as Edward Wilson and Thomas Hodgson who braved the brutal elements to sample antarctic marine life year-round. These collections were integral in establishing the current taxonomy of the antarctic biota. The first marine biological studies to focus on both the pelagic and benthic biota of Antarctica took place during the British Discovery expeditions (1925–1939). Truly modern studies of antarctic marine biology were initiated during the International Geophysical Year (1959). Since this time, the scope and scale of marine biological studies has blossomed. Today, many developed countries enjoy well established marine biological programs in Antarctica.

Collectively, antarctic studies have painted a picture of a biologically diverse and heterogeneous marine environment (see reviews by Llano, 1977; Bonner and Berry, 1980; Laws, 1984; Walton, 1987; Arntz *et al.,* 1994; Dayton *et al.,* 1994; Battaglia *et al.,* 1997; Davison *et al.,* 2000). The environmental conditions that characterize the antarctic marine system include seawater temperatures that are both constant and low (generally −1.8 to 1 C) and dramatic seasonal shifts in photoperiod. The upwelling of deep circumpolar waters brings nutrients to fuel primary production during the late austral spring and summer. While early studies focused on descriptive components of the antarctic marine environment, more recent studies have begun to explore more dynamic global issues including the flow of carbon, nutrients and energy through marine food webs, the effects of ozone depletion on planktonic and benthic organisms, and global change processes.

A decade has passed since the Society of Comparative and Integrative Biologists (formerly the American Society of Zoologists) and the Western Society of Naturalists co-hosted a symposium on Antarctic Marine Biology in San Francisco, California (McClintock and Pearse, 1991). The present symposium was designed to highlight antarctic research that has taken place over this time period and to once again share antarctic marine biology with a broad audience. At the same time, the symposium provided a means to bring together those working in diverse areas of antarctic marine biology, providing an exciting synergy and

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an opportunity to lay collaborative plans for the future and encourage even more frequent symposia. Over the past decade much new knowledge has been acquired on many aspects of antarctic marine biology. To name just a few cases in point, the field of antarctic marine chemical ecology simply did not exist ten years ago. While the hole in the ozone over the continent was well documented, the influence of the resultant increases in UV radiation on antarctic marine organisms was only beginning to be studied. Little information was available on macroalgal physiology under the unique light, temperature, and nutrient conditions of Antarctica.

Our 2000 symposium opened with a presentation by Drs. Roberta Marinelli and Polly Penhale of the U.S. National Science Foundation's Office of Polar Programs that highlighted the critical role this federal agency has played in providing support for antarctic marine biological research. This includes providing research funds to individual and multi-investigator programs, in addition to comprehensive infrastructural support, including the development of sophisticated platforms to allow interdisciplinary, process-oriented investigations of organisms and biological processes in an environmental context, with the goal of predicting how organisms will influence and respond to global change (Marinelli and Penhale, 1999). Information was also presented on how the NSF effectively oversees and manages the three U.S. antarctic research stations; South Pole Station, McMurdo Station (Ross Sea), and Palmer Station (Antarctic Peninsula), with the latter being devoted almost entirely to marine biological studies.

Our symposium papers were organized within three broad themes. The first set of papers focused on aspects of antarctic community dynamics and the influence of UV light on marine organisms (Bosch and Karentz), the chemical ecology of marine organisms (Amsler, McClintock, Baker), climate change and benthic community structure (Aronson) and an overview of the Palmer Station long term ecological research (LTER) program examining community dynamics of peninsular marine ecosystems (Smith *et al.*). Our second theme examined aspects of energetics including papers on biogeochemical contributions of sea ice algae to marine ecosystems (Lizotte), environmental variability and its impact on reproduction of krill (Quetin and Ross), competition for food resources among Weddell seals and Emperor penguins (Burns and Kooyman), and food web structure on the Antarctic Peninsula (Dunton). The final theme deals with thermal adaptation and features a paper on the adaptive evolution of gene expression in antarctic fish (Detrich).

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