

PALMER STATION LTER:

Winter Sea-Ice Ecology In the Palmer Station (PAL) LTER's conceptual model of the marine pelagic ecosystem west of the Antarctic Peninsula, sea ice plays a central role in both biological/physical interactions and in trophic interactions. To test some of these concepts, researchers from all components of the project, from seabirds to light and physics, participated in a cruise in the late austral winter (August/September 1993) to investigate winter ecology and sea ice/water column interactions. Data from the Antarctic winter is very scarce due to both logistical difficulties and the short day (4 hours of daylight). The cruise covered a large region 400 km alongshore and 200 km offshore south of Anvers Island where Palmer Station (64°45' S 64°05' W) is located.

During the month-long cruise, we had the opportunity to sample and compare processes in areas that had been covered by ice for different amounts of time. Thus, the spatial extent of our sampling region also represented duration of ice cover. Within the PAL LTER area the spatial extent, and duration in any specific geographical location, of annual sea ice is variable. The sea-ice model shows some evidence of a persistent six- to eight-year cycle, where consecutive high ice years (1979-82, 1986-87 and 1991-92) alternate with low ice years (1983-85, 1988-90, and 1993-94). The southern part of this region was already ice-covered in June 1993, but sea ice had only appeared in the northern region in the two weeks prior to the late winter cruise. This same large geographical region is also sampled repetitively every summer (January) for interannual comparisons of water column dynamics, grazer abundance and distribution and predator activity. A comparison of summer and winter results on distribution, abundance and rates allows us to evaluate the role of sea ice in the annual energy flow in this ecosystem. In order to compare the under-ice surface and water column habitats, SCUBA divers conducted under-ice surveys of small grazers, using specially designed suction samplers to sample the under-ice surface for plant pigments, gases, carbon and microbial activity, and swam transects while continuously measuring UV (ultraviolet radiation) and PAR (photosynthetically active radiation). The water column was sampled for the same parameters with a bio-optical profiling system (BOPS), water

bottles, nets and bioacoustics. In summer, activity of primary producers and grazers is below the surface, with peak abundance of primary producers and grazers often 10 to 50 m deep in the water column. Almost uniformly, in winter the level of activity or concentration of a parameter shifts close to the surface and is closely linked to the under-ice habitat. One major grazer, larval krill (*Euphausia superba*), moves from day time depths of 200 to 250 m to close association with the sea ice. Grazing pressure shifts from filtering phytoplankton in the water column to scraping algae off the underside of the ice. In the winter phytoplankton concentrations in the water column are low, due to the lack of light and water column stability. Both viruses and bacteria were also in higher abundance within the ice and, in fact, were higher than some summer values. These high activities support the PAL LTER's concept of ice as an important aspect of the functioning of this polar ecosystem, and pave the way for future work on the ice habitat. Robin Ross, Palmer Station LTER