

Antarctic Marine Living Resources (AMLR) program

The U.S. Antarctic Marine Living Resources (AMLR) program: 1992–1993 field season activities

JANE E. ROSENBERG, ROGER P. HEWITT, and RENNIE S. HOLT, *Antarctic Ecosystem Research Group, Southwest Fisheries Science Center, La Jolla, California 92037*

The U.S. Antarctic Marine Living Resources (AMLR) program has developed and initiated a research plan tailored to the goals of the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR), part of the Antarctic Treaty System. The primary objective of the convention is to preserve the marine species that are harvested in antarctic waters, as well as all organisms dependent upon them. CCAMLR's unique management regime has come to be known as the "ecosystem approach." In keeping with CCAMLR's mandate, the impact of the krill (*Euphausia superba*) fishery upon dependent predators must be understood.

The AMLR program monitors finfish and krill fisheries, projects sustainable yields where possible, and formulates management advice and options. In addition, the program conducts field research with the long-term objective of describing the functional relationships between krill, their environment, and their predators. The field program is based on two working hypotheses:

- Krill predators respond to changes in the availability of their food.
- The distribution of krill is affected by both physical and biological aspects of their habitat.

As in past field seasons, AMLR field studies were conducted in the vicinity of Elephant Island, one of the South Shetland Islands at the tip of the Antarctic Peninsula. Similar to the past four field seasons, the 1992–1993 field program included a 2-month research cruise aboard the National Oceanic and Atmospheric Administration (NOAA) ship *Surveyor* and land-based studies at a seasonal field camp on Seal Island, off the northwest coast of Elephant Island, and at Palmer Station, a U.S. scientific station on Anvers Island on the Antarctic Peninsula (figure 1).

The specific objectives of the 1992–1993 field season were the following:

- to map the physical structure of the upper 750 meters (m), including the thermohaline composition, oceanic fronts, water-mass boundaries, surface currents, eddies, and turbulent mixing;
- to map the distribution of phytoplankton biomass and production;

- to map the distribution of zooplankton (including krill), encompassing the horizontal and vertical variations in krill density and demographic characteristics;
- to conduct directed studies on acoustic characteristics of krill, diel changes in krill behavior, and seabird foraging patterns in relation to prey distribution; and
- to describe the reproductive success, feeding ecology, and growth rates of land-based krill predators throughout the reproductive season on Seal Island and at Palmer Station.

The *Surveyor* departed Punta Arenas, Chile, on 11 January 1993 to begin Leg I of the AMLR cruise; the leg was completed on 9 February. Following a midcruise port call, Leg II was conducted 14 February to 15 March. A large-area survey of 91 conductivity-temperature-depth (CTD)/rosette and net

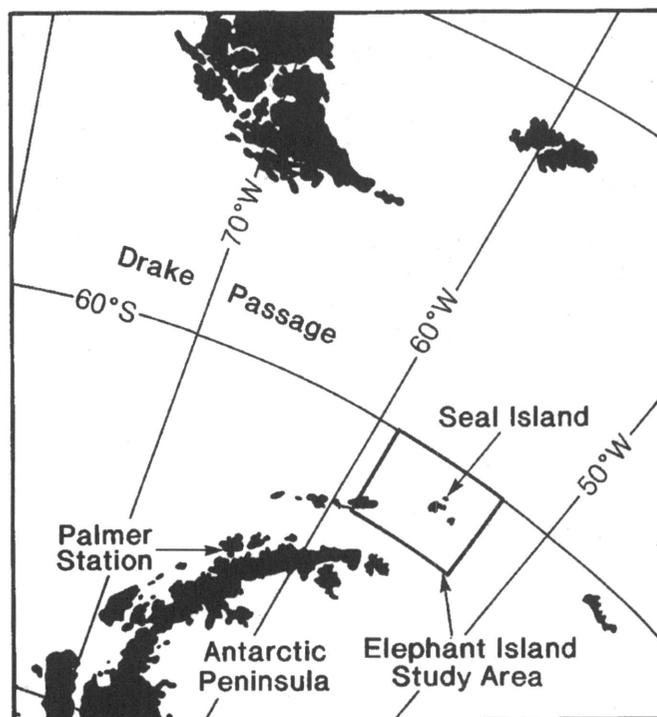


Figure 1. Locations of the U.S. AMLR field research program: Elephant Island Study Area, Seal Island, and Palmer Station.

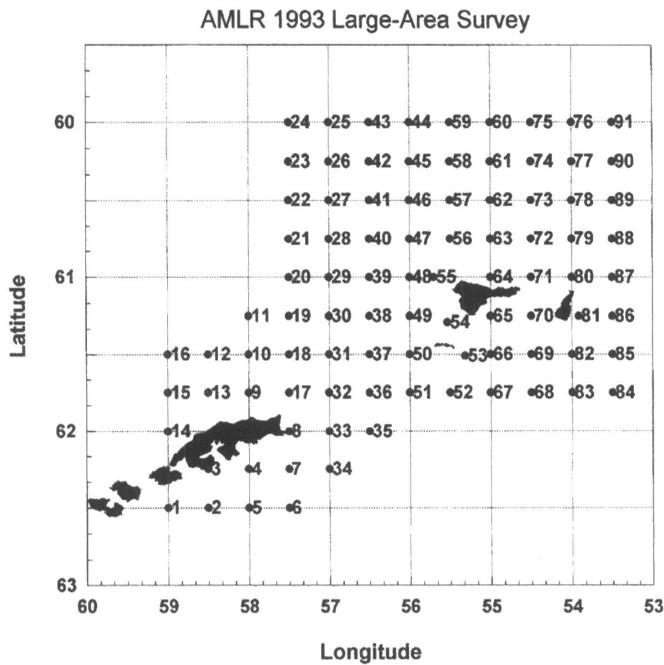


Figure 2. The large-area surveys for AMLR 1993 (Leg I: Survey A; Leg II: Survey E).

sampling stations, separated by acoustic transects, was completed once during each leg in the vicinity of Elephant, Clarence, and King George islands (Survey A on Leg I, stations A1-A91; Survey E on Leg II, stations E1-E91). The grid for this season's large-area surveys was extended, as compared to previous seasons, by 19 stations surrounding the east end of King George Island (figure 2). Data for physical oceanography, primary productivity, and krill distribution and condition studies were collected during the large-area surveys. Operations at each station included the following:

- measurements of temperature, salinity, oxygen, light, transmissometer, and fluorescence profiles;
- collection of discrete water samples at standard depths for analysis of chlorophyll-*a* content, absorption spectra, particulate organic carbon and nitrogen concentrations, primary production, adenosine triphosphate (ATP) and deoxyribonucleic acid (DNA) content, size fractionation, floristics, and inorganic nutrient content; and
- deployment of a 1.8-m (6-foot) Isaacs-Kidd Midwater Trawl (IKMT) to obtain samples of zooplankton and nekton.

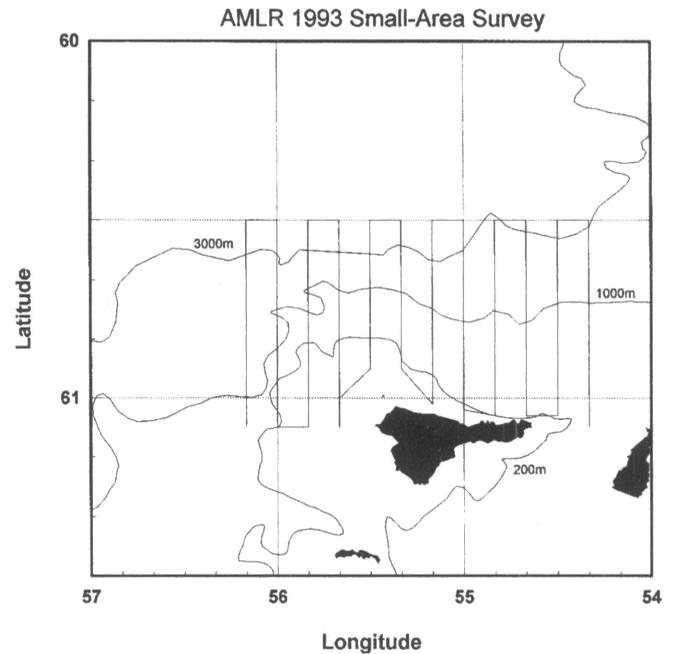


Figure 3. The small-area surveys for AMLR 1993 (Leg I: Surveys B and C; Leg II: Surveys D and F).

A series of CTD/rosette stations was conducted across a frontal zone north of Elephant Island (Leg I: stations X1-X5; Leg II: stations X13-X27), as well as across Bransfield Strait south of King George Island (Leg II: stations X6-X12), to delineate hydrographic and biological features. Small-area acoustic surveys were conducted during both legs north of Elephant Island to describe krill distribution and abundance within foraging range of predators breeding on Seal Island (Surveys B and C on Leg I, Surveys D and F on Leg II; figure 3). In addition, a study to assess the spatial association between pelagic seabirds and krill swarms was conducted during both legs.

A field team occupied the seasonal field camp on Seal Island from 4 December 1992 to 10 March 1993. The team conducted extensive research on the reproductive and feeding behaviors of antarctic fur seals (*Arctocephalus gazella*), chinstrap penguins (*Pygoscelis antarctica*), and macaroni penguins (*Eudyptes chrysolophus*) breeding on the island. Field work at Palmer Station was initiated on 6 October 1992 and completed on 1 April 1993; studies on aspects of the ecology of Adélie penguins (*Pygoscelis adeliae*) were conducted.