Echinoderm studies along the Antarctic Peninsula

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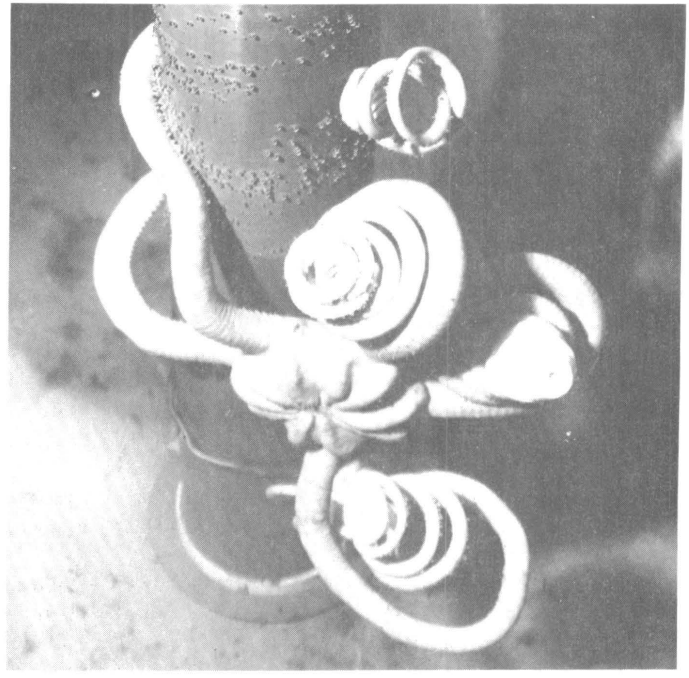
During R/V *Hero* cruise 83–3, 25 February to 22 April 1983, University of Maine personnel K. Edwards, D. Fratt, and W. Zamer conducted field work along the Antarctic Peninsula as part of a study to clarify the trophic position of selected asteroids and ophiuroids (sea stars and brittle stars) within the antarctic marine ecosystem. Several approaches have been used to address this problem, including detailed analyses of stomach contents, observation of feeding behaviors under laboratory conditions, and scanning electron microscope (SEM) studies of the morphology of feeding structures. Underwater photography with a Benthos (Benthos, Inc., North Falmouth, Massachusetts 02556) model 371 underwater camera and model 381 underwater flash was used to observe asterozoans under natural conditions. During this final field season, emphasis was placed on the collection of several asterozoan species not previously found in sufficient numbers for reliable diet analysis. These included the asteroid *Granaster nutrix* and ophiuroids *Astrotoma agassizi* (figure), *Ophiosparte gigas*, and *Ophiurolepis gelida*.



A euryalid brittle star *Astrotoma agassizii* (disc diameter 45 millimeters) clinging to the stand pipe in a laboratory holding tank at Palmer Station. This species uses its flexible arms to capture small zooplankton, primarily copepods. (Photo taken 15 March 1983 by Kelly C. Edwards.)

Sampling localities ranged from the Argentine Islands in the south, to the Bransfield Strait and Hope Bay (Bahia Esperanza) in the north. A total of 17 trawl stations were made at depths ranging from 30 to 676 meters. At three of these stations, intact sediment samples were obtained with a grab sampler. Analysis of this sediment will provide information on bacterial and meiofaunal abundance and on the composition of the diatom flora. Comparisons of environmental sediment with sediment from stomachs of organisms taken at the same sites will help to determine the diets of a number of deposit-feeding echinoderms.

Eight camera stations were made at depths ranging from 52 to 676 meters. A total of 15 rolls of film was used. These photographic data provide information on the distribution, orientation, and associations of echinoderms and other macroinvertebrates.

A total of 153 whole or dissected specimens of asteroids and ophiuroids was taken for morphological study with SEM. Two fixatives were used in processing these samples. Some specimens were fixed in a phosphate buffered solution of 4 percent formalin, 1 percent glutaraldehyde. Others were fixed in 2 percent glutaraldehyde in 77 percent seawater. All specimens were retained in the fixative solutions for transport and subsequent storage.

At each trawl station, extensive collections of echinoderms were preserved for later analysis of stomach contents. Some large asteroids such as *Pilaster charcoti*, *Bathybiaster loripes obesus*, and *Diplasterias brucei* were measured, sexed, and dissected aboard ship. Stomach fullness was noted and gut contents preserved for complete analysis in Maine. Smaller asterozoans were preserved whole. Representative collections of selected invertebrates were also preserved from most localities as part of a cooperative program with the Smithsonian Oceanographic Sorting Center.

In addition to the work conducted aboard R/V *Hero*, numerous shallow-water collections in the vicinity of Palmer Station were made by hand or by traps set from zodiacs. One particular objective of this local work was the collection of the shallow-subtidal sea star *Granaster nutrix*. This little-known asteroid is abundant on rocky substrates throughout Arthur Harbor, but can be extremely difficult to collect because of its habit of wedging itself into crevices and under rocks. Previous attempts at dip-netting this sea star from zodiacs have met with little success. This season a sufficient number of specimens was obtained by wading and SCUBA for reliable analysis of gut contents and morphological variation.

We succeeded in measuring two fundamental physiological parameters of *Granaster nutrix* in the Palmer Station laboratory. Oxygen uptake rates were determined by Winkler titration on animals that had been maintained at $-0.5°C \pm 0.5°$, 34.5 ‰ salinity and starved for 10 days. In two separate experiments 13 animals of the available size range (0.20–0.94 grams whole animal wet weight) were used to determine the metabolism-size relationship for this animal. Values of oxygen uptake ranged from 11 to 64 microliters per gram per hour. The equation relating the logarithm of oxygen uptake (y) to the logarithm of whole animal weight (X) is $y = -0.9298X + 1.0898$; $r^2 = 0.509$. Ammonia excretion rates were measured using a spectrophotometric method. Nine animals were incubated for 90 minutes in 25 milliliters of sea water (34.5 ‰ salinity) maintained at $-0.5°C \pm 0.5°$; all animals were starved for 10 days. Ammonia excretion rates were 8.7–57.0 nanomoles per gram per hour. (Whole animal wet weight range was 0.38–0.94 grams.) From the oxygen uptake data and these ammonia excretion rates, oxygen-to-nitrogen atomic ratios have been calculated. Data were also obtained on the proximate biochemical composition and ash content for this unusual asteroid.

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