to a generalized functional response but rather to a highly special part of the environmental mosaic; recombination assures a supply of slight functional variants that may fit into spatial variations in the environment, hand in glove. In this model genetic variability thus is employed to enhance specialization, while flexibility is best achieved by low genetic variabilities.

We are continuing studies on genetic variability in antarctic invertebrates, and in those from temperate and tropical regimes, to determine whether the trends observed to date are general and to subject the trophic resource hypothesis to further tests.

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## Ecology of echinoderms from the Antarctic Peninsula

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During February and March of 1972 and 1973 large collections of echinoderms were obtained along the west coast of the Antarctic Peninsula by University of Maine personnel aboard R/V *Hero*. Stations were made primarily around Anvers Island and south along the coast to Adelaide Island. Depths of capture ranged from the intertidal zone to 750 meters. Details of field operations and personnel involved are reported in Dearborn *et al.* (1972, 1973).

During 1973 and 1974 considerable progress was made in identifying this material. Crinoids, asteroids, ophiuroids, and echinoids have been determined to genus and in most instances to species. Holothurians have not been of direct concern. They have been deposited in the U.S. National Museum of Natural History and will not be reported by us. Our initial sorting and subsequent identification work has been very time consuming because of the relatively large numbers of small and juvenile specimens present, particularly among asteroids and ophiuroids. This has meant that for several ecologically important species—like the brittle stars *Ophionotus victoriae, Ophioperla koehleri*, and *Ophiurolepis martensi*—specimens from tiny juveniles to large adults are available for investigations requiring size series (*e.g.*, considerations of morphological changes with growth and variations in food habits with increasing size).

As expected, the large, 20-armed comatulid *Promachocrinus kerguelensis* dominates the crinoid fauna of the Antarctic Peninsula at the depths sampled. *Anthometra adriani, Florometra mawsoni*, and *Iso-*

*metra vivipara* also are well represented in the collections. Analyses of crinoid species are being made in relation to geographic distribution, bathymetric range, substrate, and associated fauna.

Asteroids are large, conspicuous elements of the benthos in this region. The most common species include *Psilaster charcoti, Odontaster validus, Porania antarctica, Labidiaster annulatus, Diplasterias brucei, Neosmilaster georgianus,* and *Lysasterias perrieri. Labidiaster annulatus* is of special interest to us because of its large size, abundance, and habit of preying on molluscs and other echinoderms, especially brittle stars.

Ophiuroids were the most common echinoderms in our benthic samples. About 42 species are known from the immediate area around the Antarctic Peninsula where our field work was conducted. Currently one half of these have been identified from the present material. Four relatively large species, *Ophiacantha pentactis* (fig. 1), *Ophionotus victoriae, Ophioperla koehleri,* and *Ophiurolepis gelida,* were found to be active predators on one or more of various polychaetes, molluscs, crustaceans, and other ophiuroids.

Our program to date has been the most extensive sampling of this particular region for echinoids. Eleven species were taken including one as yet undescribed. The two sampling periods yielded the same species in about the same percentages. We think a complete echinoid fauna was obtained. Extensions of bathymetric ranges have been made for all species. Some echinoids in this area, such as *Sterechinus neumayeri* and *Abatus bidens* (fig. 2), are shallow-water forms found generally in depths of less than 100 meters. Others, like *Sterechinus antarcticus* and *Abatus curvidens,* generally occur below about 300 meters. Noticeably absent from the echinoid material were several Magellanic species previously reported from the region. These identifications are in doubt and our inability to obtain these species after two seasons of careful collecting supports our belief that the original identifications were in error.

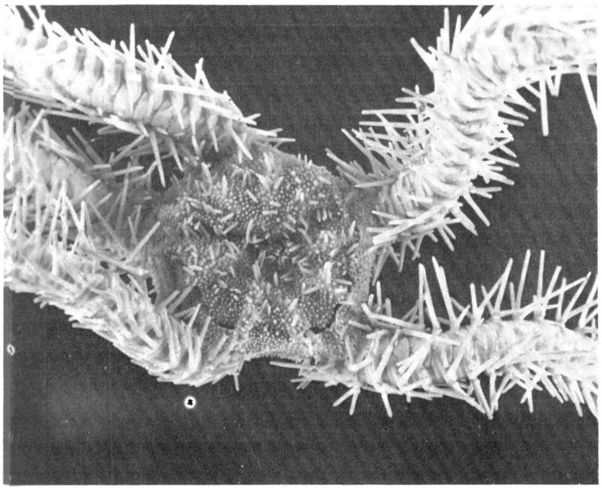

**Figure 1. Aboral view of *Ophiacantha pentactis*, a large and relatively common ophiuroid along the Antarctic Peninsula. The long, erect arm spines are used to obtain zooplankton, particularly larger copepods. Disc diameter of this dried specimen is 17 millimeters.**

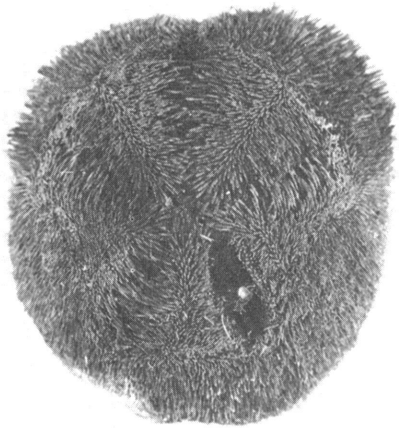

**Figure 2. *Abatus bidens*, female. The spines have been removed from one of the petals to show how it is sunken to form a brood pouch (marsupium) for the young. Direct development without a larval stage is found in most of the antarctic echinoids. Test length of this specimen is 48 millimeters.**

Beyond identification of the material, we have been concerned with the geographic and bathymetric ranges, substrate preferences, food preferences and feeding behavior, reproduction, associated faunas, and morphological variation within selected species of echinoderms exclusive of holothurians. Analyses of data in these areas are continuing. The overall purpose of our work has been to provide a more complete knowledge of the biology of echinoderms in the Antarctic Peninsula region and particularly to discover the predator-prey roles of ecologically important echinoderm species.

We also have been concerned with analyses of stomach contents of fish obtained during the cruises and in several aspects of the general benthic ecology of the region. In this we have been working in collaboration with two French biologists, Jean-Claude Hureau (Paris) and Patrick M. Arnaud (Marseille), and several U.S. colleagues, including Hugh H. DeWitt and James D. McCleave, and Stephen M. Fried.

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# Arthropods near Palmer Station, Anvers Island


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*Temperature tolerance study of* Stereotydeus villosus *(Trouessart) (Acarina: Penthalodidae).* Approximate upper and lower lethal temperature limits were determined for *Stereotydeus villosus* adults. These mites were collected at various sites in the Palmer Station vicinity. The arthropod studies were conducted in the 1972 austral winter. The temperature tolerance study was conducted between November 4 and December 7, 1972.

Test boxes were constructed of plexiglass. The animals were sealed in jars inside these boxes. The boxes were submerged in temperature baths. Gauze pads soaked with water were kept in the sealed jars with the mites to maintain a humidity near saturation. During each temperature test the mites were held in two jars in the one plexiglass container. Each test temperature was run twice. In both the upper and lower lethal temperature experiments the mites were held at 5°C. for about 24 hours before being tested. In the upper lethal experiment the temperature was raised to the test temperature at a rate of about 5°C. per 15 minutes, held at the test temperature for 1 hour, and then lowered at a rate of about 5°C. per 15 minutes. In the lower lethal experiment the temperature was lowered at a rate of about 3°C. per hour, held at the test temperature for 12 hours, and then raised at a rate of about 3°C. per hour. In both the upper and lower lethal temperature experiments the animals were observed for signs of life about 12 hours after starting the temperature adjustments at the end of the test period.

In the upper lethal temperature experiment the results were divided into three data groups: alive, moribund, and dead. The animal was considered moribund if, when observed, it was capable of only very slow or spasmodic movement. Some of the animals classified as being alive were observed to have somewhat impaired walking abilities. The animals had to be transferred from the holding containers to the experimental containers before being tested, and since they are fragile a few probably died due to handling. As seen in table 1, there was a drastic change in the percent of surviving animals from 32°C. to 34°C. At 32°C., 69 percent of the animals survived; 100 percent of the animals died at 34°C.

In the lower lethal experiment the results were divided into two data groups: alive and dead. Once again, a few of the animals probably died due to handling. As can be seen in table 2, there was no drastic change in the percent of animals surviving at any narrow temperature range as occurred at the high temperatures. At −4°C., 4 percent of the animals died; 100 percent died at −16°C. There was a gradual shift in the percent of surviving animals be-

**Table 1. Upper lethal temperatures.**

| Test temperature (°C.) | Alive | Moribund | Dead | Animals tested |
|---|---|---|---|---|
| 26 | 83% (67)* | 9% (7) | 9% (7) | 81 |
| 27 | 77% (50) | 2% (1) | 22% (14) | 65 |
| 28 | 99% (69) | | 1% (1) | 70 |
| 29 | 96% (80) | 1% (1) | 2% (2) | 83 |
| 30 | 76% (55) | 15% (11) | 8% (6) | 72 |
| 31 | 74% (59) | 16% (13) | 10% (8) | 80 |
| 32 | 69% (50) | 15% (11) | 15% (11) | 72 |
| 33 | 14% (11) | 7% (6) | 79% (64) | 81 |
| 34 | | | 100% (71) | 71 |

* Numbers in parentheses are the actual numbers of animals in each category.

**Table 2. Lower lethal temperatures.**

| Test temperature (°C.) | Alive | Dead | Animals tested |
|---|---|---|---|
| −4 | 96% (77)* | 4% (3) | 80 |
| −6 | 88% (73) | 12% (10) | 83 |
| −8 | 85% (77) | 15% (14) | 91 |
| −10 | 56% (44) | 44% (34) | 78 |
| −12 | 37% (31) | 63% (52) | 83 |
| −14 | 9% (7) | 91% (75) | 82 |
| −16 | | 100% (86) | 86 |

* Numbers in parentheses are the actual numbers of animals in each category.