Ecology of benthic fishes and echinoderms along the Scotia Arc and the Antarctic Peninsula

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This paper describes our ongoing efforts in antarctic biology since March 1976. Most of the material for current studies was obtained during ARA *Islas Orcadas* cruises 5 and 8 along the Scotia Arc and R/V *Hero* cruise 76-2 in the vicinity of Anvers Island south to Marguerite Bay. Some material dates to *Hero* cruise 72-2 and USNS *Eltanin* cruises 27, 32, and others.

Taxonomy, zoogeography, and population structure of benthic fishes: A revision of the ice-fish genus *Chionodraco* (family Channichthyidae), including the description of a new species, was completed. The results will be in a report on fishes obtained during *Hero* cruise 72-2 being prepared by Hugh H. Dewitt and J.C. Hureau. The revision is applicable to ice-fish collected at the South Orkney Islands during *Islas Orcadas* cruise 8.

Identification and descriptions of fishes obtained during *Islas Orcadas* cruise 5 continued. A new species of skate (family Rajidae) from near South Georgia, allied to *Raja agassizi* from Brazil, was confirmed. Work began on an apparently undescribed eel of the genus *Congrina* (family Congridae) from the upper continental slope off the mouth of the Rio de la Plata.

Faunal analysis of the benthic fishes of the Ross Sea was begun with data from *Eltanin* cruise 27. Similarity matrices were constructed using the coefficients of Baroni-Urbani and Buser (1976) and Ochiai (1957). Preliminary interpretation indicates that sampling during *Eltanin* cruise 27 was not always adequate and that stations at which only one or two species were obtained should be discarded from faunal analysis since these stations' coefficients are determined more by the numbers of species present than by faunal relationships. Four fish-faunal groupings appear to be present, each distributed roughly in northeast to southwest areas in order from the southwest corner of the Ross Sea northward to the continental slope. This pattern is similar to the trend of bottom isotherms in the Ross Sea. The faunal regions also show a correlation with depth, the outermost group occurring on the continental slope north of the Ross Sea. A fifth species group is represented by one station in shallow water near Franklin Island. A computer program is being developed to expand the analysis to data from *Eltanin* cruise 32 and to the results of *Islas Orcadas* cruises 5 and 8.

A review of the snail fishes (family Liparidae) obtained during *Eltanin* cruises has essentially been completed by Linda Tompkins as her masters thesis in the Department of Zoology. The study includes all species recorded from antarctic and subantarctic zones. The *Eltanin* collections are relatively rich in this group and include more than 20 previously undescribed species.

A study on the age and growth of *Notothenia larseni* (family Nototheniidae), the most common shelf species in the Scotia Sea region, from South Georgia in the north to the Antarctic Peninsula and neighboring islands in the south, was begun by Todd Landis, a graduate student in the Department of Oceanography. Scales from 100 individuals were examined, annuli were recognized, and a preliminary growth curve was plotted. The relationship between fresh fish weight and formalin-preserved fish weight was examined for *N. larseni*. The relationship will allow us to convert weights of specimens preserved in formalin back to fresh weights.

Feeding biology of benthic fishes: Studies were made based primarily on stomach contents from repetitive collections (often over 24 to 48 hours) of six benthic fish communities near South Georgia, in the South Sandwich Islands, the South Orkney Islands, and near Anvers Island.

We have concentrated on sorting and identifying fish food items from one of these benthic communities located in 120 to 150 meters of water north of South Georgia. The collection consists of 463 stomachs from ten species obtained in several Blake trawl hauls in the same location over 48 hours. Most of this collection has been sorted, with food items initially identified to major taxonomic group. The three most abundant species in the community are *Notothenia larseni, N. nudifrons* and *N. gibberifrons*. In this area, at least, *N. larseni* feeds mainly on krill (*Euphausia superba*) and mysids; *N. nudifrons*, on amphipods, isopods, tanaids and polychaetes; and *N. gibberifrons*, on a great variety of items including polychaetes, amphipods, tanaids, echiurans, ophiuroids and cumaceans.

Careful identification to as low a taxonomic level as possible is now underway on these sorted food items. The data will then be analyzed in conjunction with Timothy Targett, graduate student in the Department of Zoology, for food resource partitioning in the benthic community of fishes and for possible 24-hour chronology in feeding. Additionally, the interaction between the benthic fishes and their invertebrate prey is of interest.

Studies of digestive physiology and metabolism at cold temperatures by Richard Crawford, a graduate student in the Department of Zoology, are nearing completion.

During *Islas Orcadas* cruise 5 and *Hero* cruise 76-2, three methods were used to determine the gastric evacuation rates of *N. coriiceps neglecta, N. gibberifrons, N. larseni,* and *N. angustifrons*. All three methods were then used to determine the gastric evacuation rate of longhorn sculpin (*Myoxocephalus octodecemspinosus,* family Cottidae) from the Gulf of Maine. Evaluation and comparison of these data by computer are completed. Observations of the effects of shipboard handling on the metabolic rate of *M. octodecemspinosus* are included in this evaluation.

Histological and histochemical preparation of nine regions of the gastrointestinal tracts of *N. coriiceps neglecta,*

N. gibberifrons, N. larseni, and *N. angustifrons* has been completed. Tissues are under study, and photographs are being prepared for publication.

Scales and otoliths of *N. coriiceps neglecta, N. gibberifrons* and *N. nudifrons* are being examined to evaluate the rate of growth of these fishes. Also under study are the effects of feeding and starvation on the proximate analysis of *N. coriiceps neglecta.* Whole fish, liver, gonads, and muscle tissues obtained near Palmer Station are being analyzed. Growth efficiency can be assessed using these data.

Zoogeography, feeding biology, and chemical composition of invertebrates: Analyses continue on echinoderms and other invertebrates obtained during *Islas Orcadas* cruises 5 and 8. Specimens are being sorted to species. Geographic and bathymetric distributions of ecologically important echinoderms are being determined. These data will be correlated with the extensive information accumulating on the prey of benthic fishes. The interactions of the demersal fish *Notothenia gibberifrons* and several echinoderm prey species is of special concern.

Continuing efforts to clarify the predator-prey roles of antarctic asteroids and ophiuroids have involved analyses of several hundred stomach contents for each of five ophiuroid species and smaller samples for six asteroid species. Of particular interest are the foods and feeding biology of the brittlestars *Astrotoma agassizii, Ophiacantha vivipara, Ophiurolepis gelida, O. martensi, Ophioperla koehleri,* and *Ophionotus hexactis.* The latter two species occasionally capture and feed on both moribund and healthy krill.

Studies continue on the composition of echinoderms in conjunction with Edgar Lowe, graduate student in the Department of Zoology. Discs and arms of ophiurods are being analyzed separately for levels of protein, lipid, ash, and calories. To date frozen samples of 13 species of brittlestars have been examined. Differences between disc and arm values are important in understanding the detailed relationships between dermersal fish and echinoderm prey. Fish ingesting only exposed distal portions of brittlestar arms will obtain poor quality food when compared to fish eating entire brittlestars. With the recent acquisition of a Phillipson microbomb calorimeter for antarctic studies, our calorie determinations are now underway. These studies on the composition of echinoderms are correlated with the analyses of fish food habits. We are investigating not only chemical composition but also the size, spatial occurrence, and degree of exposure of brittlestars in regard to their role as prey for demersal fishes.

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