SCIENCE SITREP

FROM: BRUCE SIDELL

P A L M E R S T A T I O N A N T A R C T I C A

SCIENCE SITREP - PALMER STATION - MAY 1991

S-014 ENERGETICS OF THE ADULTS AND LARVAE OF THE ANTARCTIC KRILL, EUPHAUSIA SUPERBA. L. B. Quetin and R. M. Ross, University of California at Santa Barbara.

Larval krill collected during the last week of April were reared on a roller stirrer until they molted into furcilia 3's. Individual larvae (furcilia 3's) were subsequently placed in separate jars and fed daily until they molted into the furcilia 4 stage. Furcilia 4's were then starved and checked on a daily basis. Mortality among the starved larvae is low (less than 5%) and most individuals appear in "good" condition. The larvae are generally active in the jars and show little signs of stress. We plan to monitor the condition of starved larvae for one more week.

We continue to measure the respiration (oxygen consumption) rates of late furcilia stage larvae at two temperatures, i.e., +1.5 C and -1.5 C. During the second and third weeks of May, we ran similar experiments on earlier furcilia stages (f1's and f2's), but experienced some problems. Bacterial respiration, particularly at the +1.5 C temperature, is significant and makes the results of the aforementioned experiments difficult to interpret. We have taken the necessary steps to minimize bacterial respiration in our ongoing experiments.

Preliminary investigations into the role of ice algae in the energetics of juvenile and larval krill were initiated in the laboratory during May. Cultured diatoms (known concentrations) were frozen in known volumes of seawater and presented to krill being maintained in known volumes of filtered seawater. Juvenile/subadult krill were observed scraping the ice and apparently ingesting algal cells at concentrations as low as 2.9 to 4.2 ug/l. Furcilia 5's were also observed feeding on ice algae in separate experiments. Quantitative data on Chl a concentrations (before and after) was collected and is currently being analyzed. This information will provide a basis for more precisely controlled experiments of this nature in the future.

Divers from S-014, at the request of the captain of the RV POLAR DUKE, visually inspected the hull of research vessel on May 25. A verbal account of the damage was provided to the officers and chief engineer allowing them to more accurately assess the seriousness of the situation.

From May 25 through 30, T. Frazer and D. Carlini were aboard the Polar Duke. A majority of this cruise time was spent west of Adelaide Island in the newly forming sea ice. Satellite images provided by N. Wilson (science technician at Palmer) enabled us to predict the location and extent of newly forming ice aiding in the efficient and safe completion of our objectives. Larval krill, exclusively late furcilia stages, were observed feeding on ice on four of six occasions. Several hundred krill were collected by divers for shipboard experiments. The animals collected provided us with data on the following: Instantaneous growth rates, condition factors and chemical composition. This

information will provide insight into the physiological condition of krill during a time period for which there is little available data. In addition to collecting krill, the divers also sampled the ice where the animals were feeding. The ice was melted in the dark and subsequently filtered and analyzed for Chl a content. Similarly, the Chl a concentration of seawater below the ice was determined. Net tows were made in open water at approximately 10, 20, 30 and 40 miles beyond the ice edge. Very few krill were captured and they were developmentally younger than those captured under the ice. Some krill were still in the calyptopis stages, but most were either f1's or f2's. When there were sufficient numbers of animals, they were sorted by stage and frozen for future determination of condition factor and/or chemical composition.

We would like to thank the Captain and crew of the Polar Duke for their continued support and interest in our research. Likewise, we thank the support staff and other scientists at Palmer Station for their help.

S-034 EARLY LIFE HISTORY OF ANTARCTIC FISHES. R. Radtke, University of Hawaii.

Ichthyoplankton Survey

The primary principal objective of our research during Polar Duke cruise 91-4 is to conduct an ichthyoplankton survey along the length of the Antarctic Peninsula. The survey consists of a grid of eight transects and a total of 47 stations. Transects run seaward, perpendicular to the coast. The grid chosen is the same as that run aboard the German "Meteor" expedition in the December-January season and the same as that run during Polar Duke cruise 91-3 last month.

During our first eleven days at sea, we were able to run through transects two through eight. Transect number one will be completed during our next eight days at sea, beginning May 31. Three stations of transect number three were canceled due to storms. These three stations will not be revisited during our next eight days at sea. Two storms were encountered resulting in the loss of two days of fishing.

Our sampling protcol was identical to that of the Polar Duke cruise 91-3 (We sampled the water-column in 600, 300, 200, 140, and 70 meter intervals using a one-meter ring-net with a 250um mesh. The catch was carefully sorted for any fish larvae. When larvae were found, they were identified, morphometrics (standard length, total length, and head length) were recorded. the larvae were preserved in 90% isopropyl alcohol for transport to and further age-development analysis at the University of Hawaii.)However, we were forced to use the CTD system when the XBT broke down. This caused us to run through our stations a little slower than planned. Nor were we able to get as complete coverage of the hydrology of the grid area as we only ran one cast at approximately every third station as opposed to every station that we were hoping to collect with the XBT.

The following species were found: Notolepis coatsi and annulata (32 specimens), Notothenia kempi (34 specimens), Bathylagus antarcticus (2 specimens), Electrona antarctica (114 specimens), and Nototheniops larseni (3 specimens).

Rearing Experiments

While at the station, our otolith validation experiment was continued. The objective was to determine at what rate increments are formed and the otolith grows. Much work from a wide range of species throughout the world suggests that a daily increment

deposition rate is universal. There have been, however, few such studies performed upon anarctic fishes.

Otoliths of living fish may be marked with oxytetracycline. By injecting oxytetracycline intramuscularly, a flourescent increment is deposited on the growing surface of the otolith. This offers a time-zero mark for age and growth studies.

Our experiment was run on juvenile and young adult Notothenia gibberifrons and Nototheniops nudifrons. Three experiments were being run simulataneously using two different dosages of oxytetracycline. In two experiments, fishes were injected March 31 with dosages of 25 and 37mg oxytetracycline/kg tissue. In another similar experiment was beggining on April 29 fish were injected with a heavy dosage (37g tetracycline/kg tissue). In all, 107 fish were used in these three experiments. All experiments were terminated on May 30 and the otoliths are currently being disected.

Plans for the Remainder of Polar Duke cruise 91-4

We plan first to finish the uncompleted transect of our grid. We will then make surface tows in the Gerlache Strait for eggs of Notothenia coriceps neglecta, the second of the major objectives for this cruise. The eggs of this species appear in the neuston in late May and are among the only non-demersal eggs of all Nototheniid fishes. The eggs will be shipped alive back to the University of Hawaii and reared until they are juveniles. This will allow a very detailed description of the growth of the otolith and its correlation to the growth and development of the larvae. We hope to collect about five-hundred eggs.

S-036 PHYSIOLOGICAL AND ULTRASTRUCTURAL ADAPTATIONS OF ANTARCTIC FISHES TO CHRONICALLY COLD BODY TEMPERATURE. B. Sidell, University of Maine.

During May, personnel at Palmer Station for our project were: B. Sidell (P.I.), graduate student N. Desaulniers and Dr. Michael Vayda, all of the University of Maine. Vayda arrived at Palmer after transit from Punta Arenas at the beginning of cruise 91-4. We have been continuing our studies of the physiological consequences of high lipid content in Antarctic fishes.

Trawling operations from R/V Polar Duke were conducted on behalf of our project by ASA personnel and crew of the vessel off the south shores of Low and Brabant Islands during initial transit from Punta Arenas to Palmer at the beginnning of this cruise. Specimens of icefish, Chaenocephalus aceratus and a second species of icefish tentatively identified as Chionodraco rastrospinosus were captured. Additional specimens of N. gibberifrons, N. nudifrons and P. charcoti were obtained. All were tranported to Palmer Station and transferred for holding to the aquarium facilities at the station prior to use in experiments. Later in the month, another successful fishing trip was made between 21-25 May. Following observations made in earlier seasons by the crew of R/V Polar Duke, we were able to locate new grounds suitable for fishing with benthic otter trawl, just off the south shore of Livingston and Snow Islands (62 54'S, 61 22'W to 62 52'S, 61 14'W). These grounds are significant in that they are located in the lee of the islands during westerley gales, when our normal trawling grounds off Low and Brabant Islands are exposed. After surveying these grounds, a short side trip was made to nearby Deception Island to permit the captain of Polar Duke to gain first-hand knowledge of the sheltered anchorage there. In negotiating the entrance to the harbor, the ship did contact ground but without significant damage to the hull. Preliminary indications are that calibration of one of the radar systems is in error. This incident did not affect the balance of fishing efforts during this trip, however. Specimens of icefish, Chaenocephalus aceratus, and N. gibberifrons were captured successfully during trawling operations at Low and Brabant

Islands and three exploratory trawls with the 2M IKMT were conducted in Dallman Bay, yielding a small number of myctophid specimens and one snailfish.

At Palmer Station, our laboratory work progressed on several fronts.

1. Previously encountered technical difficulties with the apparatus for determining oxygen solubility in oxidative muscle tissues from Antarctic fishes were overcome. We now have collected solubility data for pectoral muscle from N. gibberifrons (n=6) and have begun experiments with tissues from T. newnesi. When combined with the diffusion coefficients for oxygen through these muscle tissues that were obtained during last year's field season, these solubility values will permit calculation of diffusion constants for oxygen through the tissues.

2. Measurements of the maximal activities of several key enzymes of energy metabolism (cytochrome oxidase, citrate synthase, hexokinase, malate dehydrogenase, pyruvate kinase and lactate dehydrogenase) were performed with brain tissue of several species of Antarctic fishes, including N. gibberifrons, C. aceratus, N. neglecta, P. charcoti and C. gunnari. These data are being collected as part of a collaborative effort with Dr. G. Somero, Scripps Institution of Oceanography, to extend our studies of metabolic cold adaptation of polar fishes.

3. We have also prepared oxidative muscle tissues from several species, including N. gibberifrons, C. aceratus, C. gunnari and N. neglecta for transport back to our CONUS laboratory to study the nature of the intracellular fatty acid binding protein (FABP). Work during last season established that when tissue is frozen in liquid nitrogen and subsequently lyophilized, the binding ability of FABP from these animals is retained and the functional protein can be purified subsequently.

4. Dr. Michael Vayda, a molecular biologist colleague from the University of Maine, has joined our field team for this cruise to begin molecular genetic experiments ultimately aimed at the cloning and sequencing of the gene for icefish FABP. During May, we have been able successfully to obtain total RNA extracts and DNA preparations from tissues of C. aceratus, C. gunnari and C. rastrospinosus. The latter may be particularly important because we have established that the intracellular hemoprotein, myoglobin, is expressed in ventricular muscle of C. rastrspinosus. This is the only example to our knowledge among the channicthyid icefishes for expression of respiratory hemoproteins and may offer an excellent opportunity for comparative studies with other channicthyid species to determine the molecular basis for the control of expression of these genes.

As always, the staff of Palmer Station and Master and crew of R/V Polar Duke have performed in an exemplary fashion in supporting our work and have earned our sincere thanks for their efforts.

S-106 -- VLF TRIMPI STUDIES AT PALMER STATION.
-- VLF REMOTE SENSING OF THUNDERSTORM AND RADIATION BELT COUPLING. U.S. Inan (P.I.),

No personnel on station. Equipment being monitored and maintained by station Science Technician Ned Wilson.

The usual weekly printouts of Trimpi data summary charts were faxed to Stanford University.

System maintenance involved the removal of a section of damaged VLF transmission cable and splicing the line back togeather.

S-275 UM/DOE ATMOSPHERIC MONITORING PROGRAM at Palmer Station.

T. Snowdon, University of Miami; C. Sanderson/N. Chui, EML/DOE N.Y.
No personnel on station. System being run by ASA science technician Ned Wilson.

Sampling continued to be conducted with a weekly schedule of calibration, background, and sample counts, with one sample filter being exposed for the duration of the week. Data was logged on computer disk, as well as transmitted via NOAA satellites.

At the request of the principal investigators, the input hose and filter head assembly of the air sampling unit were inspected and cleaned. A detailed description of the procedure, as well as observations and suggestions were sent via e-mail to the P.I.'s.

Exposed filters will be sent on the Polar Duke when it departs Palmer Station on June 9, for the weeks ending on the following dates: 26-APR-91, 03-MAY-91, 10-MAY-91, 17-MAY-91, 24-MAY-91 and 01-JUN-91. 3.5" data archive disks for the months of April and May will also be shipped to the principal investigators at this time.

T-312 TERASCAN SATELLITE IMAGING SYSTEM. R. Whritner, Scripps Institute ARC.

No personnel on station. System being run by ASA science technician, Ned Wilson.

The satellite collection schedule continued with four daily passes: (1) high elevation pass, one (1) pass to the east of Palmer over the Wedell Sea, one (1) pass to the west over the Bellingshausen and (1) pass of arbitrary elevation and azimuth. The satellite image data was collected digitally on 8mm video tape. Both HRPT and DMSP satellite data were recorded.

Orbital elements were received and entered into the Terescan imaging and Telonics tracking systems.

Tracking system time continued to be controlled with the Omega clock which maintains accuracy to within one second, calibrated with the GOES satellite clock.

Beginning on May 18, only NOAA-11 and F-8 satellites were used for data collection, per instructions of Bob Whritner, S.I.O.A.R.C. NOAA-12 capability is anticipated in the near future.

Anticipate the arrival in August of a new bit-sync unit which will solve present problems with DMSP pass capture.

The S-014 science group (Ross-Quetin) were able to utilize TeraScan satellite images and graphics to follow the ice-edge prior to and during their science cruise, which involved larval krill ice-edge studies.

Eight satellite data archive tapes (PAL100 - PAL107) will be shipped to Bob Whritner on the Polar Duke on June 9.

Images processed from data uploaded via the Vectra PC continue to look good.

T-313 NSF UV MONITORING EXPERIMENT. C. Booth, Biospherical Instruments.

No personnel on station. System being run by ASA science technician Ned Wilson.

UV data and calibration scan information continued to be collected and sent to BSI on a daily basis. Voltage adjustments were made to the data scan as well as response and wavelength calibration scan procedures, per request of BSI.

Isolated incidents of unstable current output for the UV Spectraradiometer response calibration lamp are under investigation.