Sit. Rep. #5
US AMLR Program
R/V Yuzhmorgeologiya
3 February 2007

1. Our current position is the Strait of Magellan in transit to Punta Arenas, Chile from the South Shetland Islands. The joint NSF / AMLR supported near-shore acoustical survey off Cape Shirreff was completed afternoon of 1 Feb. Personnel, J. Warren, S. Sessions, M. Cox, M. Van Den Berg, R. Holt, C. Champagne and equipment were recovered to the ship along with 4 zodiac loads of materials to be retrograded. Personnel A. Miller and R. Driscoll were transported ashore to Cape Shirreff field camp. All seagoing science operations are concluded for the 2007 AMLR field season. ETA to Punta Arenas, Chile is 1400 4 Feb.

2. Inshore Survey. The goal of the nearshore survey of the area just north of Cape Shirreff, Livingston Island is to map the distribution and abundance of the krill population and to better understand the physical and biological factors that control this ecosystem. Penguin and fur seal colonies are found on Livingston Island and these nearshore waters serve as the main foraging area for these animals.

The broad scale AMLR acoustic and net surveys conducted over the past decades do not survey the nearshore regions due to the inability of vessels to navigate these waters. Therefore starting 2000 and continuing in 2002, 2004-2006, a nearshore survey of the krill population in the waters of Livingston Island. The 2007 nearshore survey consisted of several platforms: the RV Ernest, a 19' zodiac equipped with a meteorological sensor and a dual-frequency echsounder; the RV Roald, a 19' zodiac equipped with a multibeam sonar system; a buoy instrumented with a dual-frequency echosounder; and the *RV Yuzhmorgeologiya*. Due to inclement weather during the AMLR broad-area survey, the nearshore survey period was reduced to a five day period from 28 January to 1 February 2007. Personnel and equipment were offloaded on 28 January. An instrumented buoy was deployed along the 90 m isobath on 28 January 2007. The buoy was programmed to record 3 minutes of data every 15 minutes. While the buoys include battery power, it is supplemented by wind generators located on the masts. Communication with the buoy was established at Cape Shirreff shore station.

Survey operations began on 29 January with the RV Ernest surveying the eastern-most portion of canyon east of Cape Shirreff. Predator observations were made from the RV Ernest during this period. In the afternoon, the transducer arm failed and the RV Ernest returned to shore to effect repairs. The arm was modified and rebuilt with a field test being completed that evening before dinner. Despite these set-backs, three survey lines were completed. The RV Bert surveyed areas that were skipped during the 2006 survey. Survey operations continued the next day with both boats covering substantial areas until the mid-afternoon when weather conditions worsened and both boats returned to anchorage. The next two days consisted of very strong winds from the east which prevented survey operations from continuing. During this time period, communications with the buoys became intermittent presumably due to the sea state or wind tilting the buoy's radio transmission antenna. All equipment and personnel were recovered on 1 February 2007 in adverse conditions. On average 5 - 6 hours during two of the three survey days were spent on the water by both boats. Weather conditions were unusually poor this year with choppy seas deteriorating into wind and ground swell on 30 January 2007.

During this same time period, the *RV Yuzhmorgeologiya* conducted several transects covering the region from the 500 m isobath from the western canyon to the eastern canyon. Two complete passes through the survey grid were completed during nearshore survey. Hydrographic and net tow stations were occupied once in the western canyon and mid-canyon rise and twice in the eastern canyon. In total, twenty CTD stations and IKMT net tows were conducted.

Given the limited time period of the survey and inclement weather which prevented survey operations during part of day two and all of day three; it is difficult to reach significant conclusions regarding the data collected from the buoy and small boats. Initial results from the Ernest survey are similar to previous years. There were large aggregations of scatterers at the edges of the canyons often in waters between 100 and 150 m in depth.

3. Krill and Zooplankton. A total of 23,200 postlarval krill were collected by 98 net tows made across the large survey area. Over 6,000 of these were measured, sexed and staged to establish krill demographics. Krill were broadly distributed across the entire survey area and were present in 93% of the samples. Greatest mean concentrations (370 and 159 per 1000 m^3) in the Joinville Island and South Areas of eastern and western Bransfield Strait were due to dense concentrations of predominantly juvenile krill. These patches were located over the southern rims of deep basins, and across the western portion of Bransfield Strait. Due to this patchiness the median krill concentrations here were relatively low (3 and 22 per 1000 m^3). Krill were more evenly distributed across the West and Elephant Island areas where they exhibited moderate mean abundance values of 43 and 66 per 1000 m^3. The greatest median value exhibited in the Elephant Island Area (33 per 1000 m^3) reflected widespread distributions of moderate aggregation sizes across the entire area.

The overall krill length-frequency distribution was bimodal with a strong primary mode of 27 mm and secondary mode centered around 46-50 mm. Over 69% of the krill were < 35 mm while another 19% were > 45 mm. These correspond to 1-year old individuals (the 2005/06 year class) and krill 3-years old and older (the 2003/04 and previous year classes). Of interest are the remaining 12% of individuals between 35-45 mm that were underrepresented as juveniles during the 2005/06 AMLR survey but now represent the “missing” 2004/05 year class.

As typical, krill demographics differed greatly between the northern and southern survey areas, with juveniles and individuals < 35 mm clearly dominating in Bransfield Strait and larger, mature stages dominating in the West and Elephant Island Areas. In Bransfield Strait, the length-frequency distributions were centered around 25-28 mm modes and juveniles (the 2005/06 year class) made up 91% and 82% of individuals sampled in the Joinville Island and South Areas, respectively. Although considerably less numerous juveniles comprised ca. 28% of the total krill in both the West and Elephant Island Areas. Within the Elephant Island Area <36 mm juvenile and immature stages (one-year old krill) made up 35%, 36-45 mm intermediate sizes (the "missing" 2004/05 year class) made up 31%, and mature adults > 45 mm (3-years old and older) made up another 34% of the total catch. These results suggest good recruitment success from the past two years. Overall 26% of the krill collected were mature adults and most of these were represented by reproductive stages. Largest concentrations of these were distributed over and just offshore of the northern island shelf regions. About half of the mature females were in advanced stages (i.e., exhibiting ovarian development, gravid or spent) suggesting a more or less "normal" spawning seasonality. This is supported by relatively low concentrations of larval krill, almost all of which were early calyptopis stage 1, resulting from spawning in late December-early January.

Copepods occurred in all samples and numerically dominated the overall zooplankton (63% of mean abundance) plus zooplankton assemblages sampled within each of the areas. Coastal species *Metridia gerlachei* was by far the most numerous and contributed 33% of total mean zooplankton abundance. Postlarvae of the coastal euphausiid species *Thysanoessa macrura* were present in 95% of the samples and followed copepods in mean abundance (9% of the total). While the salp *Salpa thompsoni* ranked third in mean overall abundance its median abundance was quite low due to its distribution limited to oceanic waters generally offshore of the island shelf region. As opposed to previous years, *S. thompsoni* was totally absent from Bransfield Strait. Postlarval krill and larval *T. macrura* ranked 4 and 5 in overall mean abundance. In summary, this assemblage dominated by coastal copepod and euphausiid species, including an abundance of *Euphausia superba*, represents the quintessential Antarctic Peninsula "community" as described by the Discovery Expedition Reports.

With respect to the long term Elephant Island Area data base, mean and median postlarval krill abundance values during January 2007 were well above average with the mean (66 per 1000 m^3) ranking among the peaks of 1996, 2003 and 2004 (60-319 per 1000 m^3) and the median surpassing the high value recorded in 2003 (33 vs. 31 per 1000 m^3). Like 2003, these large values are associated with combined strong representation of the past two year classes. Strong recruitment success was predicted for the 2005/06 year class based on the synchronous mass spawning events in late December (and presumably late January) and dense larval krill concentrations observed during the January 2006 survey. Good recruitment success was also predicted for the 2004/05 year class based on larval abundance and developmental stage composition monitored during the February-March 2005 survey.

This raises the question as to why the proportional recruitment index constructed last year for the 2004/05 year class was so low (0.014) while that from the 2005/06 class is likely to be relatively high. As suggested last year, the new recruits were not adequately sampled because of their

distributional attributes and sampling limitations. This situation could have been caused by a combination of hydrographic conditions such as southward displacement of warm ACC waters and concomitant southward displacement of krill distribution within the survey area and presence of substantial ice in southern Bransfield Strait that limited our survey effort in areas where the highly patchy concentrations of juveniles were then located. Without demographic information from February-March this year it is impossible to predict whether the 2006/07 year class will also be strong. However, given the "normal" spawning seasonality and timing of peak primary production over the South Shetland Island shelves observed during mid-January, modest to strong recruitment would not be out of the realm of possibility.

4. Krill biomass and dispersion. As mentioned above, acoustic data was collected in support of the NSF research conducted by Joe Warren (USB) and Dave Demer (SWFSC). These data have been archived and turned over to our NSF colleagues for analysis. Preliminary processing of the broad-scale survey continues to show a large recruitment event resulting form spawning last year and the year before.

5. Oceanography and meteorology. The 20 stations of the Nearshore Survey brought the total count of CTD casts for the trip to 123. All CTD data for the Large and Nearshore Surveys were processed and distributed. Excellent correlation was achieved when comparing the CTD data to bottle samples measured with the salinometer and dissolved oxygen Winkler process.

Comparisons were also done between the logged thermosalinograph and 7m CTD data and consistent differences were found, comparable to previous years. The GPS, meteorological, and thermosalinograph data from the SCS continuous underway logging system were merged, averaged and distributed to various users.

The Easterlies from Tuesday to Friday brought rough seas, cold temperatures and wind speeds peaking at 40knts. The swing through southwest to northwest across Friday and Saturday brought another 30knt spell and very rough seas while transiting The Drake.

6. Ocean acidification. No samples were collected during the nearshore survey. All samples previously collected have been stored for transport to PMEL or SIO.
