Sit. Rep. #3
US AMLR Program
R/V Yuzhmorgeologiya
21 January 2007

1. Our current position is 30 nautical miles west of Elephant Island. On Jan. 18th, a raucous southerly storm forced the vessel to heave to delaying our large area survey. But the weather and sea state currently is on our side. The West Area was finished January 19th. All major equipment is functioning.

2. Krill, salps and other zooplankton. Post larval krill were present in 21 of 23 West Area samples with a slightly greater frequency of occurrence than in the South Area (91% vs. 85% of samples). While the overall mean was a third of that in the South (43 vs.159 individuals per 1000 m^3) the median catch sizes in the two areas were similar (18 vs. 21 per 1000 m^3). Greatest concentrations of 240-770 individuals (110-292 per 1000 m^3) were located over the inner shelves of Greenwich and King George Islands.

The krill length range of 19-58 mm was also similar to that in the South Area however the length-frequency distributions differed greatly. Whereas in the South Area lengths were centered around a 26 mm mode in the West they exhibited a bimodal distribution about primary and secondary modes of 50 mm and 31 mm, respectively. Accordingly large mature forms dominated, comprising 61% of the total catch, while juveniles made up only 29% as compared to 82% in the South. Intermediate sized immature forms made up the same proportions (10%) in both areas.

Males outnumbered females by a ratio of 1.7:1 with 36% of the catch represented by reproductively mature male stages. Reproductively mature females comprised 25% of the catch, with the majority of individuals (16% of total) having recently mated as indicated by attached spermatophore packets with no obvious ovarian development. Individuals with developing ovaries made up another 5% of the total. The proportion of mature females in advanced maturity stages (29% with developing ovaries, gravid and spent) was relatively low suggesting a slightly delayed seasonal spawning effort. This is supported by the limited occurrence (4 samples) and low mean abundance (1 per 1000 m^3) of larval krill in the area.

The zooplankton samples were numerically dominated by copepods which had mean and median abundance values of 1400 and 580 individuals per 1000 m^3. Elevated copepod concentrations were distributed across the entire West Area but with maximum values (1000-5000 per 1000 m^3) associated with oceanic water offshore of and over the outer island shelves. Larvae of the coastal euphausiids species *Thysanoessa macrura* and aggregate stages of the salp *Salpa thompsoni* followed copepods in overall mean abundance (430 and 400 per 1000 m^3). Greatest concentrations of these were both located in oceanic water offshore of Livingston Island. While larval *T. macrura* were broadly distributed across the rest of the West Area the distribution of *Salpa thompsoni* demonstrated an obvious association with the ACC as salps were virtually absent from any other water types represented here.

3. Krill biomass and dispersion. Preliminary acoustically derived biomass estimates from the southern and western areas have been calculated this week. Biomass in the Southern Zone, in Bransfield Strait, was calculated as more than 500 000 tons. Within the West zone, more than 3.5 million tons of krill were estimated acoustically. Mean densities of krill in the West area were very high, exceeding 90 g/m^2. This estimate is using the SDWBA method and the krill length delineation, a different method than last year. This is also using day and night data; final analysis will only include day time krill estimates due to diurnal migration. These estimates continue to support the data collected using nets that there has been a very large recruitment event in the South Shetland Islands

4. Phytoplankton. As of midnight, 1/21/07, 31 more stations were sampled and analyzed for chlorophyll (5-200 m); total of 50 stations); 23 stations were sampled for macronutrient profiles (10-200 m), plus 20 other stations at 30 m; six stations were sampled for trace elements (including dissolved and particulate Fe); one trace metal clean incubation was initiated. Phaeopigments concentrations were ~20% those of chlorophyll (r2 = 0.86). In the Bransfield Strait, highest chlorophyll concentrations were found in the upper 50 meters above the pycnocline south of the Shetland Islands (concentrations 1.0-1.5 mg CHL m-3) and lowest along the Peninsular shelf (0.7 - 1.0 mg CHL m-3). North of the Shetland Islands, chlorophyll concentrations were highest along the shelf-break in the upper mixed layer of ~ 30-50 meter depth (1.0 - >2.0 mg CHL m-3), lowest in the pelagic waters of the Antarctic Circumpolar Current with a pycnocline of ~50 m depth (0.06 - 0.2 mg CHL m-3). In the coastal shelves on the Drake Passage side of the Shetland Islands, chlorophyll concentrations were moderate (0.7 - 2 mg CHL m-3). In the Elephant Island Area, only line 09 has been processed to date. Low chlorophyll concentrations in surface waters found in pelagic waters, and blooms >2 mg CHL m-3 in the shelf and shelf-break areas. Deep chlorophyll maximums were found only at ~50% of stations where expected, being Station #s 1505, 1406, 1101, 0904, 0903, and 0902. Some of these stations had maximal concentrations at >100 m.

Bio-Optical Sampling. The Integrated Optics Package (IOP) and the Profiling Reflectance Radiometer system (PRR) have been deployed at 9 mid day CTD stations; complementary water samples were also taken at the mid day stations. HPLC pigment samples have been collected at a total of 24 stations at surface and 75 m. 18 photosynthesis vs. irradiance (PvsE) experiments have been run and analyzed, 45 particulate absorption (ap/ad) and dissolved material absorption (as) samples have been analyzed, 49 HPLC pigment samples and 45 particulate CHN samples have been collected.

So far, 84 samples were collected from 11 stations for determination of total and dissolved Fe. Besides iron, samples were collected at the same stations for determination of bacterial number and diversities, phytoplankton (fixed in formalin), DOC, POC and nitrate reductase. A deck incubation experiment was started in order to test the effect of Fe and light on the water collected from a DCM depth in two different light regimes (50 % and 5 % of incident light).

5. Oceanography and meteorology. A Southeaster, averaging 30 knots and peaking at 50 knots, accompanied rough seas from Wednesday to Friday. A swing to a 25 to 30 knot Northwester on Friday saw a continuation of the rough seas until Sunday. 39 CTD stations were completed across the West and Elephant Island Area with 2 stations having to be abandoned due to rough

seas. The CTD hardware was swapped with the spare system while faultfinding intermittent communications and bottle triggering problems. The problem was traced to an earth leakage in the braid of the new coaxial sea cable being used. The braid was disconnected and the CTD grounded on the cable's outer steel armor. Dissolved oxygen data was lost on Station A07-02 when a connector leaked. The predominant water type in the West Area was well defined Water Zone 1 (ACW) zones at the deep offshore stations, Water Zone 2 stations along the shelf break, and on the shelf itself, north of the islands.

6. Ocean acidification. We have collected water for the determination of dissolved inorganic carbon along several transects on the west area, and will continue to collect samples within the Elephant island area. The storm that occurred over the last week required a change in deployment strategy, as several stations along one transect were not sampled. Seven casts have been made on the shelf and in ACC waters and we will collect water from two more ACC like and two more shelf locations around Elephant Island. Ten percent of the bottles will be used as replicates. We have preserved pteropods from all areas of the Bransfield Strait and we will continue to collect and preserve samples from Elephant Island area.

7. Predator diet studies. Lipids have been extracted from 44 Antarctic fur seal milk samples. At the commencement of the nearshore survey, more milk samples will be arriving onboard on 26 January 2007. Additionally, 20 more scat samples will be arriving from weeks 4-5. A total of 22 scat samples from weeks 1-3 have been processed to date. There has been no occurrence of myctophid otoliths or squid beaks. Krill total length, calculated from the carapace length and width, ranged between 36-57 mm with the majority of total lengths averaging between 40-50 mm. This shows a dominance of 3-4 year old krill taken by Antarctic fur seals at Cape Shirreff, Livingston Island. This is also reflected in the zooplankton net tows where the krill median length-frequency is around 46 mm for the West Area (per. comms. V. Loeb) where the fur seals are foraging. In order to continue with developing regression equations and discriminate functions for calculating krill total length and sex respectively from the scats, 300 krill will be measured (100 have already been measured) over the next two weeks (collected from the net tows). Approximately 30% of the krill caught in the net tows to date are juveniles (33 mm or less); this age class has been needed for our data.

8. Seabird and mammal observations. Data on the distribution, abundance and behavior of seabirds and mammals was collected during underway ship operations in the West Area. Twenty-four transects were collected totaling approximately 530 nautical miles of survey effort. Seabird community composition was concordant with previous AMLR surveys. The community consisted primarily of Cape Petrels, Black-browed Albatrosses, Gray-headed Albatrosses, Giant Petrels, Blue Petrels, Antarctic Prions, Black-bellied Storm Petrels, Wandering Albatrosses, Light-mantled Sooty Albatrosses and Chinstrap Penguins.

Cape Petrels were the most conspicuous avian predator and were observed feeding throughout the West Area. The numbers of Cape Petrels observed in West Area are the highest ever recorded during an AMLR survey. However, the majority of Cape Petrels were observed on 2 transits in a few dense aggregations. On transit to stations 12.08 and 11.07, there were numerous feeding frenzies, which coincided with large densities of krill collected during net sampling. At these locations, krill were actively mating and spawning (Per. Comms. V. Loeb). To determine

what feeding petrels were probably consuming, a Manta net was towed along side the vessel to sample surface plankton. Krill, pteropods, amphipods and copepods were present in net samples.

Other interesting bird sightings include 1 Arctic Tern and 1 Antarctic Petrel.

Humpback Whales were the most common cetaceans in the West Area. We collected 38 sightings of Humpback Whales. Group size was typically 2 to 3 whales. In addition, Minke Whales, Fin Whales and Southern Bottlenose Whales were observed.

Report submitted by AMLR researchers currently onboard the *R/V Yuzhmorgeologiya*. These reports are also posted at *http://swfsc.noaa.gov/aerd-field.aspx*.