



**Sit. Rep. #4**  
**US AMLR Program**  
***R/V Yuzhmorgeologiya***  
**29 January 2007**

1. We are currently anchored off of Cape Shirreff, preparing to initiate the NSF-sponsored AMLR-supported nearshore survey off Cape Shirreff. We completed the AMLR large scale acoustic survey for krill biomass 26 Jan. During the nearshore survey two instrumented zodiacs (*R/V Ernest* and *R/V Roald*) will be operating from Cape Shirreff. The nearshore survey investigates the nearshore ecosystem specifically the physical and biological interactions that may influence the abundance and distribution of krill in the waters surrounding the Cape. During the day, in conjunction with the zodiacs the ship will survey approximately 5 offshore transect lines. At night when the zodiacs are moored at the cape, the ship will survey one transect line conducting 5 stations each station will have a CTD and IKMT net tow. One instrumented buoy will be deployed off of the Cape as well. The nearshore survey will continue until 1 Feb. Then the ship will anchor off Cape Shirreff and recover trash, the nearshore team, buoy, and personnel before departing for Punta Arenas, Chile.

2. Krill and Zooplankton. Postlarval krill were broadly distributed across the Elephant Island Area and were present in 46 of the 48 samples collected here. This 96% frequency of occurrence surpassed the 85% and 91% catch rates in the South and West Areas. The mean catch size of 66 individuals per 1000 m<sup>3</sup> was intermediate to means in the South and West Areas (43 and 159) but, due to the widespread distribution, the median catch of 33 per 1000 m<sup>3</sup> greatly exceeded those in the South and West (22 and 18). Greatest concentrations (360-400 individuals per 1000 m<sup>3</sup>) occurred over the northern and southern shelf regions of Elephant Island. Relatively large concentrations (210-275 per 1000 m<sup>3</sup>) also occurred to the southwest in the channel between King George and Elephant Islands and to the east, over the Clarence Island shelf break.

A wide range of krill lengths was sampled (16-60 mm). Like the West Area, the overall size distribution was bimodal around large (46 mm) and small (28 mm) primary and secondary modes. These correspond to 3+ year old krill representing the 2003/04 and older year classes and 1 year old individuals resulting from the 2005/06 spawn. The Elephant Island Area length-frequency distribution differs from that in the West by inclusion of greater proportions of 40-49 mm krill (42% vs. 30% of total individuals) representatives of the “missing” 2004/05 year class. Juveniles constituted similar proportions in the Elephant Island and West Areas (ca. 28%) but immature stages were relatively more abundant (15% vs. 10%), and mature forms relatively less abundant, in the Elephant Island Area.

Males and females were equally represented although 34% of total individuals were sexually mature females vs. 23% sexually mature males. Decreasing proportions of female stages progressing from those recently mated (11%), undergoing ovarian development (10%), gravid (8%) and spent (0.5%); suggest that this is the peak reproductive period in the Elephant Island Area. With 53% of mature females represented by advanced maturity stages the timing of this reproductive activity is seasonally “favorable” in that the resulting larval stages should have a

sufficient period of elevated primary production to grow and develop before the onset of light limited autumn and winter conditions.

Larval krill were present in 26 of the 48 Elephant Island Area samples with mean and median abundance of 22 and 2 per 1000 m<sup>3</sup>, respectively. The increased frequency of occurrence (54% vs. 45% and 17%) and abundance over the South and West Areas are in part a reflection of the time required for developmental ascent from depths at which the dense krill eggs hatch. All were *Calyptopis* 1 larvae, the first stage to appear in surface waters. These probably were from eggs spawned 3-4 weeks earlier (e.g., late December-early January). Greatest larval concentrations were located south of Elephant Island, over the deep east Bransfield Strait basin suggesting ascent from the area in which they were spawned.

Copepods numerically dominated the zooplankton assemblage with mean and median concentrations (1500 and 720 per 1000 m<sup>3</sup>) similar to those of the West Area (1400 and 582 per 1000 m<sup>3</sup>) and slightly greater than those of the South (950 and 290 per 1000 m<sup>3</sup>). Locations of greatest copepod concentration (1100-22000 per 1000<sup>3</sup> m) were associated with frontal features along the southern and northern lines of the Elephant Island Area and around Elephant Island. Coastal species *Metridia gerlachei* was by far the most abundant copepod represented. Post larvae of the coastal euphausiid *Thysanoessa macrura* followed copepods in mean and median abundance (180 and 57 per 1000 m<sup>3</sup>). *Salpa thompsoni* ranked third in mean abundance (179 per 1000 m<sup>3</sup>) due to relatively large concentrations (1200-1700 individuals per 1000 m<sup>3</sup>) in oceanic waters adjacent to the Shackleton Fracture Zone. However, because this salp was rare or absent in mixed waters to the south, the median value (4 per 1000 m<sup>3</sup>) was relatively small. Postlarval krill followed *S. thompsoni* in mean abundance and ranked third in terms of median abundance. Larval krill was the sixth most abundant taxon with respect to both mean and median abundance.

3. Krill biomass and dispersion. Preliminary acoustically derived biomass estimates from Elephant Island area was estimated to be more than 9.6 million tons. Mean densities of krill in the Elephant Island area were very high, exceeding 200 g/m<sup>2</sup>. Thus the total of the biomass estimates across the South Shetland Islands exceeds 13 million tons which is higher than the last biomass peak in 2003 and slightly higher than the biomass calculated in 1996-1997. 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 & Bio-Optical Sampling. Synopsis for phytoplankton distributions in the Elephant Island and Joinville Island Areas. Low surface concentrations of chlorophyll (<< 0.5 mg m<sup>-3</sup>) were associated with low density waters (<27.1 kg m<sup>-3</sup>) along lines 09 and 11. Chlorophyll blooms were found along the front associated with surface densities ~27.2 kg m<sup>-3</sup> (salinity ~34.0 - 34.2) lying just north of the Loper Channel. These blooms were of ~2 mg m<sup>-3</sup>, with the highest concentration found at 57°W 61.3 °S (St A08-06) with surface values of 5.2 mg m<sup>-3</sup>. Moderate concentrations of chlorophyll (1-2 mg m<sup>-3</sup>) were present east of the Shackleton Transverse Ridge (lines 02 - 04) that extended from 60°S to the middle of the Bransfield Strait. Also, surface concentrations ~1 mg m<sup>-3</sup> were present near the Weddell Sea outflow into the

Bransfield strait at ~62°S and south. This year appears a bit richer in phytoplankton than on average, but does not compare with the massive blooming noted last year.

During the AMLR large scale acoustic survey the Integrated Optics Package (IOP) and the Profiling Reflectance Radiometer system (PRR) were deployed at a total of 15 mid day CTD stations; complementary water samples were also taken at all mid day stations. HPLC pigment samples have been collected at a total of 53 stations at surface and 75 m. Thirty photosynthesis vs. irradiance (PvsE) experiments have been run and analyzed, 75 particulate absorption (ap/ad) and dissolved material absorption (as) samples have been analyzed, 119 HPLC pigment samples and 75 particulate CHN samples have been collected.

5. Oceanography and meteorology. The Elephant Island Area CTD stations were completed and seven CTD casts were completed across the Joinville Island Area. These included two additional stations that were added due to the southeast stations not being approachable, due to ice. This brought the total number of CTD casts across the main survey area to 103. The CTD equipment performed reliably after the sea cable problem was solved early in the survey, and the usual attention was paid to the maintenance of underwater connectors. Close correlation was obtained between the CTD data and the bottle samples when compared to a salinometer and doing dissolved oxygen Winkler titrations.

The stations covered during this period, around Elephant Island, produced Water Zone 1 and 2 offshore, and types 3 and 4 on the shelf and to the east of this area. The predominant water type across the Joinville Island Area was Water Zone 4 (Bransfield Strait), with evidence of Water Zone 5 (Weddell Sea) influence in the south eastern stations. Gradual barometer changes from 1012 to 992 millibars were accompanied by South Westerly to North Westerly winds, averaging 15 knots. Several days of clear skies and sunshine were also experienced.

6. Ocean acidification. We have collected water for the determination of dissolved inorganic carbon along several transects in the Elephant Island area. Owing to a miscount in the number of rubber bands supplied to us, 13 bottles had to be closed using electrical tape, yet hopefully these samples will be usable. A total of 96 samples were collected on both shelf and open ocean areas covering the depth range from 10 meters to 750 meters depth. Upper circumpolar deepwater was sampled, as well as a variety of surface water types (high and low chl-a).

7. Predator diet studies. Lipids have been extracted from 56 Antarctic fur seal milk samples. Another 17 milk samples arrived today as well as 20 more scat samples from weeks 4-5. A total of 32 scat samples from weeks 1-4 have been processed to date. There has been no occurrence of myctophid otoliths and only one scat that contained a squid beak. Krill total length, calculated from the carapace length and width, ranged between 35-58 mm with the majority of total lengths averaging between 40-50 mm. processing of scats, milks and frozen krill will continue this week during the nearshore survey

8. Seabirds and Mammals. Data on the distribution, abundance and behavior of seabirds and mammals was collected during underway ship operations in the Elephant Island Area. Thirty-six transects were collected totaling approximately 645 nautical miles of survey effort. Seabird community composition was not concordant with previous AMLR surveys. The community

consisted primarily of Cape Petrels, Antarctic Fulmars, Black-browed Albatrosses, Gray-headed Albatrosses, Giant Petrels, Wilson's Storm Petrel, Black-bellied Storm Petrels, and Chinstrap Penguins. Surprisingly, abundance of White-chinned Petrels, Blue Petrels and Prion species were especially low, and Soft-plumaged Petrels were entirely absent from the Elephant Island area. Other interesting bird sightings include 3 Arctic Terns. In contrast to the West area, the distribution and abundance of feeding aggregations was comparatively lower. Feeding activity, which was predominantly by Cape Petrels, occurred primarily in the western region of the Elephant Island area, and in offshore waters closest to the ACC front.

Fin Whales were the most common cetaceans in the Elephant Island Area. We collected 95 sightings of Fin Whales. Group size was typically 2 to 3 whales, but a few sightings of 6 were observed. We collected 35 of Humpback Whale sightings. As in previous AMLR surveys, Humpback Whales were more common in proximity to Elephant Island, but were more abundant in southern portion of the strata. Southern Bottlenose Whales were observed along the shelf break and on one occasion we observed a group of 7 whales. The most exciting cetacean observation was of 2 unidentified Mesoplodon beaked whales.

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