



Sit. Rep. #04
4 February 2008
US AMLR Vessel Survey (*R/V Yuzhmorgeologiya*)
South Shetlands, Antarctica

The weather has remained calm and cool over the last week. We have finished the first survey for krill biomass without any further incidents. We are now at Desolation Island counting penguins about 15 nm east of Cape Shirreff. Later today we will proceed back to the Cape to drop off three biologists before proceeding to Copacabana this evening. We still have about 2 days of work time scheduled, mostly to count fur seals around Elephant Island, and the iron chemist would like to have some Drake water samples for his analysis as we transit back to Punta Arenas. We are looking forward to a couple of days in Punta before heading back out to the South Orkney Islands about 260 nm east of the South Shetlands to begin our NOAA-supported International Polar Year Project to assess the biomass of krill, their distribution and demography and the relationship to birds, whales and hydrography of that area.

Acoustics

Acoustic biomass estimates for the Elephant Island and Joinville Island areas also showed continued large biomass of krill present in these areas. Despite missing several plankton stations around Elephant Island, the acoustic data was complete, and we estimated that about 1.75 million tons of krill were present in this area. This amount is about average for the area. The density of krill in the Elephant island area was about 40 g per m². The relatively ice free conditions allowed us to calculate a biomass for the Joinville Island Area this year. Our estimates indicate that more than 500 thousand tons of krill were present in this area during January. Density of krill exceeded 31 g m⁻². We will present the biomass of the Bransfield Strait and a summary for the first Leg of the 2008 season in next weeks report.

Krill and Zooplankton in Bransfield Strait: the Joinville Island and South Areas

Krill and zooplankton assemblages in the Joinville Island (eastern Bransfield Strait) and South Area (western Bransfield Strait) were represented, respectively, by 10 and 20 net samples. Post larval krill were more unevenly distributed, and had denser concentrations, in the Joinville Island vs. South Area (80 vs. 95% of samples). The three largest catches in the Joinville Island Area (2000-2800 individuals, 700-1000 per 1000 m³) were associated with frontal zones between Bransfield Strait and Weddell Sea shelf water in the easternmost part of Bransfield Strait. The largest catch in the South Area (1800 individuals, 600 per 1000 m³) was located at similar frontal zone in mid-Bransfield Strait, southwest of King George Island. In all cases these dense concentrations were primarily comprised of small krill (<35 mm) representing juvenile and immature stages.

Overall mean abundance in the Joinville Island and South Area (258 and 40 per 1000 m³) were the highest and lowest of the four survey areas. Due to patchiness median krill abundance in the Joinville Island Area was similar to that of the South Area (2.3 and 1.6 per 1000 m³) and both were substantially smaller than that in the Elephant Island Area (22 per 1000 m³).

Krill lengths in the Joinville Island Area were distributed around a strong 27 mm juvenile mode and juveniles and immature stages respectively represented 69% and 27% of the individuals. The South Area krill exhibited bimodal length distributions broadly distributed around 26 mm and 42 mm length modes, representing predominantly one- and two-year old krill. Accordingly, juveniles comprised 48%, immatures 30% and mature individuals 22% of the total. Over 30% of the mature females in the South Area were in advanced reproductive stages.

Larval krill were much more frequent in Bransfield Strait than in the West and Elephant Island Areas (85-90% vs. 36-71% of samples) and included greater proportions of more developed stages, most likely due to the advancing season. Greatest larval krill concentrations (156 and 54 per 1000 m³ mean and median abundance values) and most advanced stages (52% Calyptopsis 2 and 8% Calyptopsis 3) were in the Joinville Island Area. Largest catches here were over and south of the deep eastern Bransfield Strait basin. Mean and median larval abundance in the South Area (59 and 13 per 1000 m³) were slightly elevated over those in the Elephant Island Area (47 and 10) with substantially larger proportions (33 vs. <1%) represented by Calyptopsis stage 2.

Copepods were the dominant zooplankton taxa with proportions, mean and median abundance in the Joinville Island Area (52% total mean abundance, 885 and 830 per 1000 m³ mean and median values) similar to the West and those in the South (65%, 1541 and 1050 per 1000 m³) similar to the Elephant Island Area. Post larval *Thysanoessa macrura* and chaetognaths followed copepods in mean abundance in the South, contributing 18% and 3% of total mean zooplankton abundance there. In sharp contrast, post larval (predominantly juveniles) and larval krill were the second and third most abundant taxa in the Joinville Island Area where they contributed 16% and 10% of the total.

Oceanography

The CTD system performed reliably during the entire large area survey, allowing 105 casts to be done successfully. No major technical malfunctions were experienced; only ongoing servicing, preventative maintenance and auxiliary sensor calibration checking matters had to be addressed. CTD data have been processed to a stage ready for presentation in Ocean Data View and verified against salinometer/bottle sample comparisons. Preliminary, field Water Zone typing have been done for the stations across the survey area. With the survey being completed, the CTD system will now be integrated with the Scientific Computer System (SCS) and the CTD PAR/s sensor logged along with the mast PAR sensors to verify their calibration. We also deployed a further five drifters mostly along the edge of the survey area, although two were deployed within

Bransfield Strait. Additionally, we deployed a number of XBTs to 'fill in' areas along transects that should provide data regarding the amount and distribution of the very cold water that we have observed during this survey.

After a steep barometer drop during the early hours of Wednesday, and an accompanying brief spell of 35 knot Northwesterlies, the barometer recovered and stabilized, producing "glassy" seas and wind speeds dropping to around 1 knot on Thursday and Friday, as the wind direction slowly traversed the compass back to Northwesterlies on Thursday. The good weather allowed stations close to the continent to be reached and sampled. Friday to Monday saw wind speeds averaging below twenty knots, sunny skies and mild sea conditions, making the remainder of the passage through the Bransfield Strait comfortable.

Phytoplankton

Phytoplankton survey completed without complications, 100 stations sampled. Total of 15 stations sampled for iron concentrations; 31 stations sampled for macronutrient concentrations at 6 depths (10, 30, 50, 75, 100, and 200 meters) with 10 additional stations sampled for macronutrient concentrations in the upper mixed layer; 27 stations sampled for phytoplankton abundances (microscope) in the upper mixed layer. Eleven stations had upper mixed layer depths less than 30 meters, averaging 1.3 mg chlorophyll-a m⁻³; 19 stations had upper mixed layer depths more than 100 meters, averaging 0.7 mg chlorophyll-a m⁻³. Mean chlorophyll-a in the upper mixed layer were 0.8 mg chlorophyll-a m⁻³ for all stations sampled, with highest concentrations measured in the Bransfield Strait, with three high biomass stations located north of Elephant Island. Lowest chlorophyll-a concentrations (<0.3 mg m⁻³) were measured in the Drake Passage, while cold, saline waters from the Weddell Sea outflow into the Bransfield Strait (near Joinville Island) also had low concentrations (0.3-0.8 mg chlorophyll m⁻³). Chlorophyll-a in the upper mixed layer for the West Area was 0.58 ± 0.61 mg m⁻³; the Elephant Island Area had chlorophyll-a concentrations of 0.73 ± 0.51 mg chlorophyll-a m⁻³; the Joinville Island Area was found to have 0.99 ± 0.59 mg chlorophyll-a m⁻³; and the South Area was found to have 1.02 ± 0.43 mg chlorophyll-a m⁻³. Highest fluorescence yields were measured in blue Drake Passage waters north of the continental margin and west of Elephant Island.

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 taken at 16 mid day stations allowing for 32 PvsE experiments and sampling of 77 depths for ap, ad, and as analysis, measurement of particle number and size distribution, and particulate CHN. HPLC pigments samples were collected at 99 stations at surface and subsurface chlorophyll maximum. The surface PRR 810 continues to record surface irradiance at 19 spectral channels. Mati Kahru has continued to provide ocean color satellite image support. The composite image for the second half of January indicates the surface chlorophyll a concentrations in Bransfield Strait and east of the Shackleton Transverse Ridge largely decreased compared to the first half of month. AMLR'08 Leg 1 survey sampled the end of a bloom.

Seabird and Mammal Observations

Data on the distribution, abundance and behavior of seabirds and mammals were collected during underway ship operations in the Elephant Island, Joinville and South strata. 30 transects were collected covering approximately 610 nautical miles of survey effort. We found that feeding aggregations of Cape Petrels were spatially associated with a strong sea-surface temperature front that traversed the Elephant Island region. A Southern Right Whale was observed on the last transect in the Elephant Island region adjacent to Clarence Island. This is the first time this species has been observed in the AMLR region since 2004. The seabird community in the Joinville Island strata consisted of (percentage-wise): Adelie Penguin, Southern Fulmar, Chinstrap Penguin, Wilson's Storm Petrel, Southern Giant Petrel, and Antarctic Petrel. 59 Humpback Whales and 3 Fin Whales were observed. Additionally, Antarctic Fur Seal, Crabeater Seal, Weddell Seal and Leopard Seal were observed in the Joinville area. The seabird community in the South strata consisted of (percentage-wise): Adelie Penguin, Chinstrap Penguin, Southern Fulmar, Wilson's Storm Petrel, Cape Petrel, Gentoo Penguin, Southern Giant Petrel and Black-browed Albatross. A very unusual sighting of a King Penguin was observed on 31 January at 62.5 S, 56 W. A total of 77 Humpback Whales and two Minke Whales were observed in the South stratum. Antarctic Fur Seals were highly conspicuous in the South stratum, with the highest numbers occurring near the ice edge in the vicinity of the Antarctic Sound and Joinville Island.

Report submitted by AMLR researchers aboard the *R/V Yuzhmorgeologiya*, conducting surveys of the pelagic ecosystem in the peninsula region of the Antarctic. These reports are posted at <http://swfsc.noaa.gov/aerd-field.aspx>.