



Sit. Rep. # 7
2 March 2008
US AMLR Vessel Survey (*R/V Yuzhmorgeologiya*)
South Shetlands, Antarctica

We completed the survey of the South Orkney Islands very early despite a severe storm that forced us to stop sampling for more than 50 hours. Surprisingly, there were no deviations owing to ice which was entirely unexpected. We transited from the southwestern side of the South Orkneys shelf to the Elephant Island area, and again there was no ice to block our route. At present we are steaming south along transect 5.5 west of Elephant Island. We expect to conclude this area by late on the 4th.

Acoustics

Acoustically derived biomass of the southern fraction of the South Orkney Islands grid (south of 60.5S) an area of about the Joinville Island Area of the South Shetlands grid was more than 950 Ktons of krill. This southern area is approximately 140000 km². The estimated CV of the five transects was 34%, well within useable limits. Mean density of krill estimated in this area was lower than the north side of the South Orkneys and averaged about 40 g/m². Summing the northern and southern fractions of the survey area together yields more than 1.5 million tons in this area. This represents a similar biomass to the Elephant Island area, with just a small increase in the CV.

Krill and Zooplankton: South Orkney Islands Area Summary

Post-larval krill were present in 32 of the 37 net samples collected in the South Orkney Islands Area (86%) with overall mean and median abundance of 272 and 8 per 1000 m³, respectively. While they were equally frequent and had similar mean abundance values over the northern and southern island shelves (240 and 294 per 1000 m³) their median abundance was greater (24 vs. 3 per 1000 m³) and distribution much patchier south of the islands. Greatest concentrations (1350-2375 per 1000 m³) were at four stations over or adjacent to the shelf break; three of these were in the northern portion, near to where the fishing activity was taking place.

Krill lengths ranged from 18-52 mm with a median length of 29 mm reflecting a generally young population (i.e., primarily one- and two-year-old individuals). The overall catch was numerically dominated by juveniles (66%) and 80% of the krill were < 35 mm in length. The age/maturity/length structure, however, differed between the northern and southern portions with substantially greater proportions of small juveniles in the south (73% juveniles, 71% of individuals < 30 mm). Only 6% of the animals over the southern shelf were mature. Here the length-frequency distribution was centered on a strong one-year-old 29 mm length mode. In contrast, the length-frequency distribution of krill over the northern shelf was bimodal around 29 mm and 42 mm length modes, reflecting contributions of both one-year-old (ca. 64%) and two-year-old and older individuals (ca. 36%). Nearly 26% of krill over the northern shelf were mature

and the majority of these were females in early reproductive stages. Very few of the mature females were in advanced stages. The krill lengths here resembles that sampled in the South Shetland Island area last month, with the bimodal length-frequency distribution of the Elephant Island Area and unimodal length-frequency distribution of the Joinville Island Area represented, respectively, north and south of the South Orkney Islands. With respect to maturity stage composition, the southern shelf region again most resembled that of the Joinville Island Area but that in the northern shelf region was more like the West Area sampled last month, indicating a substantially delayed spawning season.

Larval krill were infrequently collected in the area, present in low numbers in three samples each from the northern and southern portions. The two largest catches (22 and 76 per 1000 m³) were over the trench northwest of the islands, suggesting an ACC source region. In conjunction with the overall maturity stage composition these results suggest that this is not a major source area of krill. Furthermore, the length-frequency distribution patterns suggest downstream advective transport from the South Shetland Islands.

The zooplankton assemblage was fairly homogeneous across the entire South Orkney Island Area. Like the Elephant Island Area ubiquitous taxa included copepods, post-larval *Thysanoessa macrura*, chaetognaths and the amphipod *Primno macropa*. Also like the Elephant Island Area, copepods, post-larval krill and *T. macrura* and chaetognaths were among the numerically dominant taxa and were represented by similar mean abundance values. The paucity of larval krill in the South Orkneys Area was a major exception to this similarity. Other frequently occurring taxa in the South Orkneys Area that set this apart from the South Shetlands were the larval decapods (*Acanthyophyra pelagica*), unidentified siphonophores and larvaceans.

Oceanography and Meteorology

The week started off with winds averaging around 40 knots, gusting at times over 50 knots. The weather system was associated with low pressures of around 975mbar. After the windy start to the week the weather improved and stayed stable till Saturday when the pressure, first dropped from 985 to 968mbar and then increased sharply to 997mbar over a period of 24 hours, causing winds averaging 40 knots from the west to blow for a period of +50 hours. After the system passed the pressure steady increased to end the week around 1014mbar. The wind switched to the east and north-east, blowing steady at around 20knots. With the fluctuations in the atmospheric pressure the air temperature associated with this reached a maximum of 3.5°C ; minimum of -1.9°C, averaging round 1°C for the week.

The survey area around the South Orkneys Islands was completed during this period bringing the total number of CTD casts for the area to 48 with 12 additional XBT deployments made between stations. Routine maintenance, and the usual running repairs on the CTD system (mainly underwater connectors), were limited to the transits between stations, resulting in no time being lost due to CTD technical problems. The oxygen sensor used from the start of leg 1 malfunctioned at the beginning of the week and was replaced with a spare unit.

CTD/salinometer comparison figures were entered, showing very good agreement between the two instruments. CTD/thermosalinograph comparison figures were also obtained.

Phytoplankton

The South Orkney Islands section completed. In total, 8 stations sampled for iron concentrations (2-4 depths each); 21 stations sampled for nitrate, phosphate, and silicate for depth (10, 30, 50, 75, 100, and 200 meters) plus an additional 10 stations sampled for macronutrient concentrations at 15 m; 51 stations sampled for chlorophyll-a concentrations at 5, 10, 15, 20, 30, 40, 50, 75, 100, and 200 m. Samples for iron and nutrients will be processed onshore, and chlorophyll-a samples have been processed.

Within the South Orkney Islands shelf region (60°S 47°W to 61.5°S 44°W; 36 stations), upper mixed layers were generally shallow (average 33 meters) due to a fresh water lens (salinities averaged 33.4). Highest salinities were found in the northwest quadrant and lowest salinities in the southeast quadrant. Highest phytoplankton biomass tended to be associated with higher salinities (the relationship was not significant), with lowest chlorophyll-a (<0.5 mg Chl-a m⁻³) located along the southern portion of the survey area, and highest concentrations (>1 mg Chl-a m⁻³) in the north central portion of the survey grid. Fluorescence yields (log voltage / log Chl-a) were highest in the low-salinity, low Chl-a waters to the south, and lowest in high-salinity, high Chl-a waters to the north. Mean chlorophyll-a concentrations were 0.8 mg m⁻³ for the area, with a maximum concentration of 1.9 mg Chl-a m⁻³ for station 20 (shelf waters northeast corner of Signy Island), while the lowest concentrations were <0.3 mg Chl-a m⁻³ at ~20% of stations surveyed.

Birds and Marine Mammal Observations

Data on the distribution, abundance and behavior of seabirds and mammals were collected during underway ship operations on the south shelf of the South Orkneys. Seventeen transects were collected covering approximately 305 nautical miles of survey effort. By comparison, there were significantly fewer seabirds on the south shelf than on the north shelf. The seabird community south of the South Orkneys consisted of (percentage-wise): southern fulmar, chinstrap penguin, prions, cape petrel, Wilson's storm petrel, black-bellied storm petrel, black-browed albatross, southern giant petrel, snow petrel, white-chinned petrel, grey-headed albatross, and wandering albatross. We did not encounter any feeding aggregations of seabirds. There was a sighting of a southern right whale and a sighting of three killer whales (type A).

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>.