

## **LM GOULD 04-01 Week 2 Science Report (14 – 20 January, 2004)**

(Palmer, Antarctica Summer Cruise, 2004 -- Hugh Ducklow. Chief Scientist and P.I.)

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During the past week we experienced good weather with no stoppage of operations due to high seas. Our work in week 2 found us moving along the LTER sampling grid, completing the 500 and 400 lines as well as two inshore or “inside” stations in the Grandidier and Lemaire Channels, to the north of Renaud Island. These stations provide information on inshore water properties, for example surface waters influenced by glacial meltwater, and specific plankton populations such as the ice krill, *Euphausia crystallorophias*. We returned to the Palmer Station area, occupying Stations B and E in Arthur Harbor and conducted a daylong high-density grid survey to related penguin foraging to krill distribution over subkilometer scales. On 16 January we successfully recovered the sediment trap mooring deployed on LMG 03-01, and deployed a new mooring in the same location, 64° 29 S.; 66° 03W. On 17 January we conducted a 24-hour Process Station to the south of Renaud Island, near Armstrong Reef to the south of Renaud Island. This is a new sampling location for PAL-LTER (see the B-013 report below). From there we resumed occupation of standard PAL hydrographic stations, completing the 400 grid line and starting the 300 line as the week ended.

During the high-density grid in Arthur Harbor we were joined by National Geographic writer and photographer Fen Montaigne and Peter Essick, who are residing for the month at Palmer Station, as part of the USAP Artists and Writers Program.

As always we thank the officers and crew of LM GOULD and the RPSC support group for outstanding help allowing us to address our scientific objectives. For specific information on scientific accomplishments please read the individual reports below.

### **Individual Science Team Reports:**

#### **B-013-L: Seabird Ecology (Bill Fraser, PI).**

**Team members:** Heidi Geisz, Brett Pickering

We initiated this week with a 10 x 20km high-density foraging grid pattern started near the Palmer Station area and heading southwest. Adelie satellite tag information indicated the birds were feeding in our grid area a few days preceding our survey. Though krill appeared to be present along the grid, we observed very few penguins and only noted Adelies on the most inshore area of the grid.

During the Process Station 2, we were able to deploy a Zodiac with four passengers to the Armstrong Reef on the south end of Renaud Island. Our objective was to census Adelie penguin colonies in the area, searching for a substantial population from which to diet sample. We found 7 islands with Adelie colonies, 2 islands having substantial populations. On 3 islands, we noted blue eyed shags breeding in the Adelie colonies in numbers ranging from 10 nests to 125nests. We were able to map and survey 3 islands in detail, photograph 6 and secure 10 diet samples. The penguins seem to be eating similar size krill to what they are finding at Palmer Station and we found only two samples with evidence of fish.

Continuing our bird observation transects and stationary censuses on the 400 and 300 line, we have again not observed any penguin activity. Again, our largest censuses were

recorded near the shelf break of both lines, with the exception of the mid-300 line, where hundreds of cape petrels were recorded feeding.

**B-016-L: Phytoplankton Ecology (Maria Vernet, PI)**

**B-032-L: Optics and Remote Sensing (Ray Smith, PI)**

**Team members:** Wendy Kozlowski (field team leader), Karie Sines, Joe Grzymiski, Peter Horne, Erin Bostrum, Brian White, and Eli Loomis,

During the first two cardinal LTER sample lines (600 and 500), the phytoplankton ecology and Marine Optics groups were able to complete the full suite of measurements at all 21 core stations (see previous report for sampling descriptions). Additionally, the Profiling Reflectance Radiometer (PRR) was deployed at the start of each station to determine light level depths, and on all stations on these lines, the Fast Repetition Rate Fluorometer (FRRF) was also deployed on the CTD rosette for photosynthetic biophysical measurements. Preliminary estimates of primary production show the typical onshore/offshore gradient that is commonly seen in this area during this time of year. Euphotic zone (0.5% of the surface light) levels on the 600 and 500 lines averaged approximately 0.41 and 0.42 gC/m<sup>2</sup>, respectively, which is slightly lower than estimates of the same lines one year ago. Chlorophyll data follow the same onshore / offshore trend as seen in production, with euphotic zone integrated chlorophyll a levels ranging from a high of approximately 65 mg/m<sup>2</sup> on the inside of the 600 line to a low of 18 mg/m<sup>2</sup> on the outside of the 500 line. Preliminary results of dissolved inorganic nutrient measurements show the same on/off shore gradient in silicic acid and ammonia, and relatively stable levels of nitrate and nitrite at the surface on both the 500 and 600 lines, perhaps suggesting the presence of diatoms inshore. Pigment samples have been processed and will be analyzed to verify phytoplankton composition. Euphotic zone depth measurements varied from 53 to 130 meters, both seen on the 600 line (inside and outside, respectively). Our brightest day (data through 1/14) was the twelfth, with over four times the light seen on the darkest day (1/14).

**BP-028-L: Zooplankton and Micronekton - Langdon Quetin and Robin Ross (PIs).**

**Team members:** Robin Ross, Brian Cheng, Amy Kaiser, Jason Watts, Robin Cadiz, Shannon Talley.

The distribution pattern for Antarctic krill and the salp *Salpa thompsoni* on the three northernmost transect lines followed a pattern commonly found over the past 12 years. Salps were abundant at deep water stations off the shelf on all lines, with pockets of high abundance on the inner shelf of the 600 line just south of Palmer Station where Antarctic krill were also abundant. Antarctic krill in the 35 to 45 mm size range were in moderate abundance throughout most of the 500 and 600 lines, but scarce on the 400 line. During the high density grid within the foraging range of the Adélie penguins nesting near Palmer Station, we conducted surveys of acoustic biomass and did net tows to assess the prey distribution in the water column at the same time that members of the BP-013 field team assess the distribution, abundance and behavior of the foraging penguins.

Instantaneous growth rate and spawning frequency experiments were done with Antarctic krill on the inner and outer shelf of each transect line. Molting frequencies were high, and the derived intermolt periods ranged from 15 to 24 days. Spawning frequency, on the other hand, was quite low, averaging 2%, the second consecutive year with apparent low or delayed spawning. During the process station at the southern tip of Renaud I, we assessed diel differences in the grazing impact of Antarctic krill with assays of pigment content and fecal pellet production experiments.

**B-045-L: Microbial Biogeochemistry (Hugh Ducklow, PI).**

**Team members:** Mary Turnipseed (field team leader), Nicole Middaugh, Anne Mills, Shana Rapoport and Jennifer Salerno.

During week 2 we continued hydrographic operations at all stations along the grid. Our sampling includes specifically: dissolved oxygen and dissolved organic carbon (all depths and all stations), dissolved inorganic carbon and alkalinity (surface at all stations), bacterial abundance (all depths at all stations), bacterial production rates (euphotic zone, all stations), and oxygen-17 isotopic content (surface at selected stations, in collaboration with M. Reuer and M. Bender, Princeton University). The latter measurement provides a geochemical (no-incubation) estimate of net and gross primary production integrated over the previous ~10 days.

The highlight of our week was successful recovery of the new McLane Mark IV sediment trap array we deployed last year. The trap was recovered smoothly, in 20 knot winds by Andy Nunn and the RPSC support team (MT's Jamee Johnson and Greg Buikema, Sci-Tech Eric Hutt). Data were recovered from both the trap, indicated it performed as programmed, and the MicroCat temperature/conductivity data logger attached to the trap frame. The new Benthos Continental Shelf Releases performed flawlessly (fortunately). The original PAL trap array, now reconditioned at McLane over the boreal summer, was successfully deployed, following efficient turnaround by ET's Kevin Pedigo and Joel Lenorovitz. Visual inspection of the contents of trap sample cups suggested that the annual summertime sedimentation 'bloom' had not commenced by the recovery date. The trap samples yield information on the rates and composition of particle sedimentation, the particulate "rain" falling through the oceanic water column.

At the Process Station near Renaud Island we collected a large volume water sample (~150 liters) for lipid biomarker analysis. Lipid biomarkers provide specific information on the taxonomic composition of plankton, and on the origins of organic particles in the water column. Samples are analyzed at VIMS, in collaboration with Dr. Elizabeth Canuel. With the O-17 and biomarkers we provide geochemical counterparts to biological measurements of properties and rate processes made by the other PAL teams.