

## **LM GOULD 04-01 Week 3 and Final Science Report (21 – 31 January, 2004)**

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

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The good luck and good weather we experienced in the first 2 weeks failed to continue just when we needed them most. Sustained 40 knot winds finally forced us to suspend science operations on the evening of 21 January at LTER grid station 300.100. We resumed work the next day but were unable to complete the 300 line of stations before we had to break off to transit to Avian I Island at the southern end of Adelaide Island to deploy the B-013 group ashore on 23 January (see their report below). Completing each and every station of the grid (200 - 600 lines) is the top priority for meeting our scientific objectives, so we reserved a day to reoccupy the inshore end of the 300 line at the end of the cruise.

After a successful shore operation at Avian Island, we carried out standard operations in Marguerite Bay (Stations 200.-020 and -060) then proceeded to Rothera Station early 24 January. Our custom each year is to spend a full day at Rothera meeting with our colleagues from the British Antarctic Survey and conducting joint hydrographic operations. 15 members of our own science team went ashore, exchanging places with 12 members from Rothera who came aboard for the day. Under the direction of science leader Lloyd Peck, the Rothera group carried out hydrographic work at 3 stations in Marguerite and Ryder Bays. A primary goal of this work is cross-calibration of the Rothera and LMG CTD's and fluorometers. After return to Rothera, the full science party, Raytheon technical staff and LMG officers and crew joined 77 Rotherites in a celebration of Robert Burns birthday – Burns Night at Rothera Point.

We departed Rothera at 0730 25 January, undaunted but, ah, *tired*, and initiated our second major Process Station at a site with (somewhat) elevated biomass and depressed ocean  $p\text{CO}_2$  in Marguerite Bay (further details below). Next we continued to occupy stations along our southernmost sampling line, eventually completing the 200 line of 15 stations late on 29 January. We successfully completed LMG 04-01 science operations at 2 'inside' or nearshore stations in Crystal Sound north of Adelaide Island on 31 January and proceeded back to home base at Palmer Station.

Our work the past month would not have been possible without the dedicated support and friendship of many individuals in Punta Arenas, at Palmer Station and of course on board the LMG. We extend special thanks to Captain Rob and the officers and crew of LM GOULD, and Andy Nunn at the Raytheon technical staff for making our cruise a success.

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

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

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

We started the third week of the cruise maintaining our bird observations from the bridge on the 300 line. Once again, our notes did not include any penguin sightings, though we observed the standard suite of Cape Petrels, Black Browed Albatross and Southern Fulmars following the ship.

Though weather forced us to tack the last two stations of the 300 line on the end of the cruise, we did not lose any time on Avian Island. January 23, we were dropped off at 10AM with gear for a 4 day camp. Given favorable weather, we were able to deploy on Adelie Penguins 2 dive depth recorder tags for recovery and 4 satellite tags to stay attached to the birds until molting in

mid-March. Additional Adelie work included multiple colony counts and collection of diet samples every evening of our 4 day camp. Analysis of the diet samples suggests the birds are eating primarily krill, but continue to supplement their diet with fish in the Marguerite Bay region, as we have found in the past. Other island work included extensive surveys of breeding seabirds, a census of mammals hauled out on the island and general notes regarding this season.

Returning to the ship on January 27, we maintained observations on the 200 line, completed the 300 line and will also conduct stationary surveys on the 2 remaining inside stations of the Crystal Sound area.

In summary, we found Adelies in our two known Southern-most peninsular breeding hot spots to be feeding primarily on krill, though supplementing their diets with fish. Observations indicate penguins may be feeding inshore this year, though other seabirds are foraging off shore, particularly near the shelf break.

**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,

Throughout the remaining sample lines (400, 300 and 200), the phytoplankton ecology and marine optics groups continued to complete the full suite of measurements at all 32 core stations sampled. During this time, water sampling was also completed at two Inside North Stations, on the Palmer Inshore grid (three stations), at Palmer B and E, and two inside South Stations. Two process stations were also occupied, where two Microzooplankton Grazing experiments, two ultraviolet exposure primary production experiments, and time series short term photosynthesis measurements were completed. Preliminary estimates continue to show relatively low levels of both primary production and biomass along the LTER grid, with the highest production measured on the inside stations of the 200 line and during the final process station, where we picked up what appeared to be the tail end of a bloom of mixed diatoms and *Phaeocystis sp.* Chlorophyll a concentrations during the final process station were the highest measured for the month ranging between 5 and 9  $\mu\text{g L}^{-1}$ . However, maximum rates of primary production were relatively low, indicating the possible senescence of this bloom.

The PRR was deployed at all but station 300.120, where high winds prevented deployment of the instrument from the back deck. The FRRF was deployed through that same station on the 21st, but failed to function shortly thereafter. The instrument was diagnosed by the ETs as having a failed 12V crossover regulator, but after some creative exploratory surgery, a temporary fix was put in place, and the instrument was regularly deployed again by January 27<sup>th</sup>, at station 200.060. We thank Kevin Pedigo, Joel Lenorovitz and Andy Nunn for their patience and diligence in coming up with a solution to get the FRRF running again for the duration of the cruise.

**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.

On the two southernmost transect lines Antarctic krill were more abundant and salps less abundant on the inner shelf stations than in the north. Salps were still abundant on the outer stations. Of particular interest was the contrast between the lack of young-of-the-year Antarctic

krill on the northern lines and their moderate abundance on the southern lines. Both indicator species for the cold continental shelf waters (Antarctic silverfish larvae and ice krill) also made their appearance in the south. Instantaneous growth rate and spawning frequency experiments with Antarctic krill continued. Spawning frequency and egg production rates increased, particularly on the southern most (200) transect line. Neither Antarctic krill nor salps were found at the process station in Marguerite Bay, which was east of the Faure Islands. However, at the stations just to the west Antarctic krill were in abundance and feeding well, as evidenced by high fecal production rates.

We would particularly like to thank Captain Robert and the mates of the LM Gould for their ship handling skills, and willingness to slightly change our net retrieval procedures in order to bring zooplankton back in better condition. The changes were of significant benefit. Andy Nunn was persistent in tracking down the cause of the problems we have been having with the net depth sensor, and we appreciate his efforts as well as those of Kevin and Joel (the ETs). Lastly, Jamee and Greg (the MTs) were great to work with on the back deck. Many thanks to all for making the research go so well.

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

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

In the final week we completed sampling for all standard biogeochemical and microbial properties across the LTER Grid, as well as at several inside stations and other stations in Marguerite Bay. Radioisotope-based assays for bacterial production rate were completed, and data were processed aboard the vessel for all grid stations, allowing us to make a preliminary assessment for the region. In general, the highest rates were observed inshore and the lowest offshore, but bacterial production rates were rather uniformly distributed from north to south and from the inshore to offshore stations. Overall, bacterial production averaged about 5% of the grid-averaged primary production. This proportion is low compared to lower latitude systems but consistent with other estimates from the Southern Ocean. Surface temperatures varied by about 2°C across the sampling grid (+0.4 - +2.2°C) and were as low as about -1.5°C at the lowest depths we assayed (50-75 m). Improved BP estimates will be based on empirical temperature corrections.

We want to extend special thanks to Science Tech Eric Hutt for his assistance with waste disposal and our work in the radioisotope van. Greg and Jamee always had the CTD Rosette armed and set to go and get our samples, and Kevin and Joel conducted all CTD sampling operations with efficiency, patience and good humor.