

LMG 20-01: 30 Dec. 2013 – 05 February 2013 LTER Cruise 22

Weekly Science Report II

Palmer Long Term Ecological Research Project: Looking Back in Time Through Ecological Space.

Cruise Overview (O. Schofield, Chief Scientist):

We kicked off the Palmer dock late on January 4th. We focused efforts in the first two days of the cruise by starting the Palmer LTER Process study 1 and supporting the Project SWARM team, who despite valiant efforts were hampered getting equipment installed due to extremely heavy sea ice in the months of November and December. On the 5th, using RV Gould zodiacs early, SWARM scientists were retrieved, and we headed to the Joubins. Zodiacs were used to shuttle 11,000lbs of equipment to Island 1 on the Joubins. From there equipment was moved up to the CODAR site by hand with a joint team from SWARM and LTER. The picture below shows the team celebrating, note the pile of 36 batteries! The effort led to a 2 day construction of the Joubin CODAR site which is now functional.

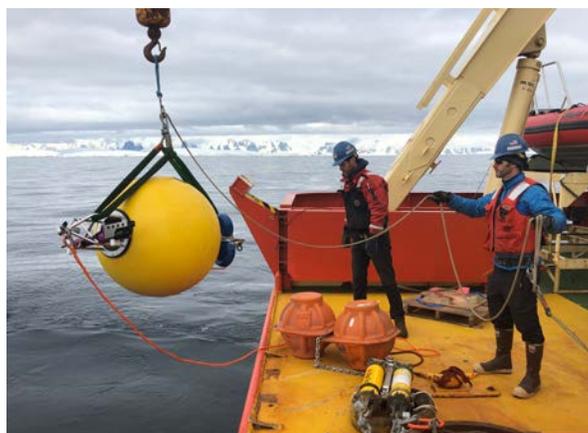


SWARM and LTER celebrating a great team effort.



Functional HF CODAR unit at the Joubins

The second effort focused on the installation of 3 AMLR mooring being utilized by the SWARM team. The moorings provide a cross shore time series that will be complemented by their



Deployment of one the AMLR moorings in Palmer Deep

moorings and the LTER Palmer acoustic surveys and time series sampling. All three moorings

were successfully deployed (see picture above). Despite the effort in supporting these efforts the LTER was able to hit the ground running deploying and recovering 5 whale tags. The LTER also completed its Process 1 survey with 4 full stations, a MOCness midday-midnight survey, and conducted three different manipulative experiments onboard the ship. The Process 1 survey is now completed and LTER is now occupying its grid stations along the Peninsula. The efforts for the different components of the LTER are described below.

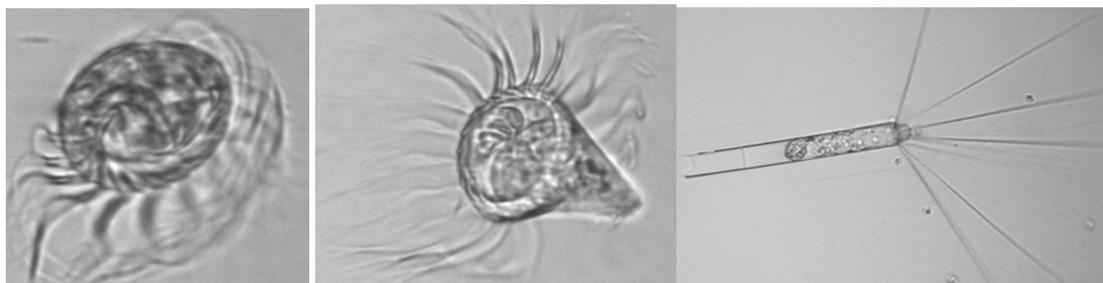
**C-045: Phytoplankton Component (Oscar Schofield, Rutgers University; PI)
Field Team Members: Oscar Schofield, Steve Ackelson, Quintin DiouCass, Jacqueline Veatech, Laura Wiltsee, Gabrielle Rosenthal**

Week 2 for the phytoplankton was busy but very productive. One exciting addition this year is Steve Ackelson from the Naval Research Laboratory. The LTER has used older bio-optical instrumentation over the last two cycles. This year Steve brought his state of the art bio-optics package that not only provides measurements of the inherent optical properties, but has sensors that provides holographic images of material in the water column and the particle size distributions. See picture to the right showing the powerful package of sensors.

The profiling equipment is complemented with traditional LTER datasets the include High Performance Chromatography, Chlorophyll a measurements, ¹⁴C uptake, eDNA measurements, and FIRE measurements. We also have this year aboard the flow cytobot providing measurements of the particle number, size distribution and high resolution images of the individual plankton. Some of the teams favorite images so far from the inshore waters of the Palmer deep during the first Process Station of the



Undergraduate Gabrielle Rosenthal and Oscar Schofield standing beside the Uber optics package provided by Steve Ackelson, from the Naval Research Laboratory, for LTER cruise.



Microheterotrophs and diatoms encountered in Palmer deep.

cruise. Beyond that sampling, Graduate student began is light manipulation experiment of natural communities onboard the ship. The manipulation will last 10 days.

C-045: Microbial Biogeochemistry Component (Hugh Ducklow, Lamont Doherty Earth Observatory; PI)

Field Team Members: Rebecca Trinh, Natalia Erazo, Beth Conors, Tom Kelly, Natalie Yingling, Dan Lowenstein

Week 2 saw our first process station in the Palmer Deep submarine canyon. Our team (Figure 1) collected samples (Figure 2) relating to microbial biogeochemistry, specifically in reference to bacterial abundance and DNA, nutrient and organic matter cycling, and sediment export. In addition to these core LTER samples, field team lead and PhD student Rebecca Trinh conducted several experiments to understand the role bacteria play in consuming and respiring zooplankton fecal pellets from salps caught in live net tows.

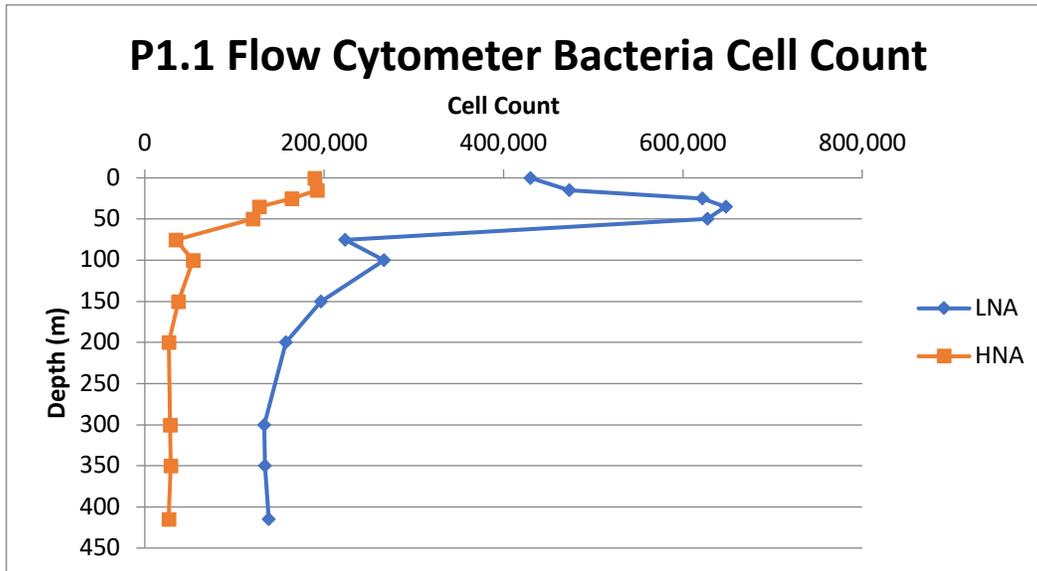


Ducklow field team members (left to right) Rebecca Trinh, Tom Kelly, Natalia Erazo, Dan Lowenstein, Beth Conors, Natalie Yingling on top of the Mar Piedmont glacier behind Palmer Station.



(Left to right) Natalie, Natalia, and Beth filter seawater from the CTD rosette to study bacterial dynamics and seawater chemistry.

Preliminary flow cytometry data from our first CTD cast at station P1.1 show a subsurface maximum in low nucleic acid (LNA) bacterial cell counts at about 35 meters depth, just below the mixed layer depth. There is higher abundance of LNA bacteria compared to high nucleic acid (HNA) bacteria (Figure 3).



Depth profile of low nucleic acid (LNA) and high nucleic acid (HNA) bacterial cell counts at station P1.1 of Palmer Deep.

C-020. Zooplankton Component (Debbie Steinberg, VIMS; PI)

Field Team: Joe Cope, Kharis Schrage, Andrew Corso, Kristen Sharpe, and Courtney Lorey.

The objective of our Palmer LTER component is to analyze the effect that zooplankton community structure has on biogeochemical cycling of carbon and nutrients, and the effects of climate change on zooplankton communities on the continental shelf sea of the western Antarctic Peninsula (WAP). This year, with three process study stations, we are examining the role that zooplankton play in the biological pump and in nutrient cycling (grazing, particle or fecal pellet production, and diel vertical migration).

During the first week, we concentrated our operations at a 6-day process study situated in the Palmer Deep canyon, near LTER grid point 600.040. At each station (4 stations total), we performed a pair of net tows, one for larger macrozooplankton (e.g., krill, salps) and one for smaller mesozooplankton (e.g., copepods). Animals from the macrozooplankton tows were identified and counted on board, while the presence/absence of taxonomic groups was noted in the mesozooplankton samples (these samples will be quantified at our home institution). After several years of low abundance, the salp, *Salpa thompsoni*, was dominant in all samples.

To investigate depth distribution and diel vertical migration of zooplankton, we collected day/night samples with the Multiple Opening-Closing Net Environmental Sensing System (MOCNESS). The MOCNESS has eight nets which we can open at discrete depth intervals. Our first pair of tows revealed that salps are concentrated in the bottom layers and are nearly absent near the surface during the day. But at night, salps migrate toward the surface and are

distributed evenly throughout the water column. Antarctic krill, *Euphausia superba*, was abundant in the surface during both day and night.

Two bioacoustics surveys were conducted to compliment research conducted by whales and seabirds LTER components. We collected specimens for zooplankton gut fluorescence (a measure of grazing) and for future physiological studies. Krill and salps were also collected for Palmer Station and LMG LTER scientists.



Steinberg field team (left to right): Kharis, Andrew, Jack Conroy (at Palmer), Joe, Courtney, and Kristen. Courtney with a lot of salps. Photo credit: Kristen Sharpe.

C-013. Penguin and Seabird Component (William Fraser, Polar Ocean Research; PI) Field Team: Anne Schaefer and Leigh West

The objective of this year's cruise for the C-013 seabird component is to continue the long-term dataset of at-sea bird surveys to assess abundance and distribution across the LTER regional study grid as well as during the acoustic surveys conducted near Palmer Station. Additionally, we plan to continue studies of Adélie penguin breeding and foraging ecology at Avian Island, which is located approximately 600 km south of Palmer Station. This southern study area, located in Marguerite Bay, provides a higher latitude comparison with the seabird studies conducted at Palmer Station. Mainly focusing on Adélie penguins (but also southern giant petrels, blue-eyed shags, south polar and brown skuas) we will assess how and if annual environmental variability (e.g. sea ice and snow conditions) affects population trends, foraging success and diet, growth rates, survival and recruitment, as well as seasonal dispersal. If ice conditions and time allow, we also plan to conduct similar fieldwork at Charcot Island and additional historical penguin colony sites along the WAP.

During Process Study 1 we conducted seabird and marine mammal surveys at four process stations and along the entirety of the acoustic transect grid. Species recorded so far include humpback whales, crabeater seals, Wilson's storm-petrels, southern giant petrels, gentoo penguins, chinstrap penguins, skua species, kelp gulls, and light-mantled sooty albatross.



A light-mantled sooty albatross observed during Process Study 1. Photo by A. Schaefer

**C-024. Penguin and Seabird Component (Ari Friedlaender, UC Santa Cruz; PI)
Field Team: Ari S. Friedlaender, Ross Nichols, Amanda Lohmann**

During the first week of LMG20-01 the whale team took advantage of the opportunity to work in the vicinity of Palmer Station and the Palmer Canyon to deploy motion-sensing tags on humpback whales and collect biopsy samples for a suite of population-level studies. Our short-term motion-sensing and (in some cases) video-recording tags provide detailed dive and movement information for periods of ~12-24 hours that allow us to quantify feeding rates, fine-scale habitat use, and temporal trends in feeding versus other behavioral states. During the first week, we deployed 7 tags on humpback whales (see below). The deployment locations were clustered in two main areas: inshore north of the Joubin Islands and south of Biscoe Point, and offshore in the Palmer Canyon. We believe that differences in the distribution, abundance, and behavior of krill will yield significant differences in the foraging behavior of whales in these two regions. Many of the whales we encountered were engaged in bubble-net feeding, a strategy often performed by groups of whales to feed on krill that are very shallow in the water column (see below). Preliminary looks at our data indicate that whales are feeding almost exclusively in the upper 30 meters of the water column. We also collected 25 skin/blubber biopsy samples from humpback whales (see below). These samples will be used to allocate each individual whale to a specific breeding population and females will be tested for pregnancy. Additionally, a subset of these will be analyzed for the presence of persistent organic pollutants. Lastly, we have

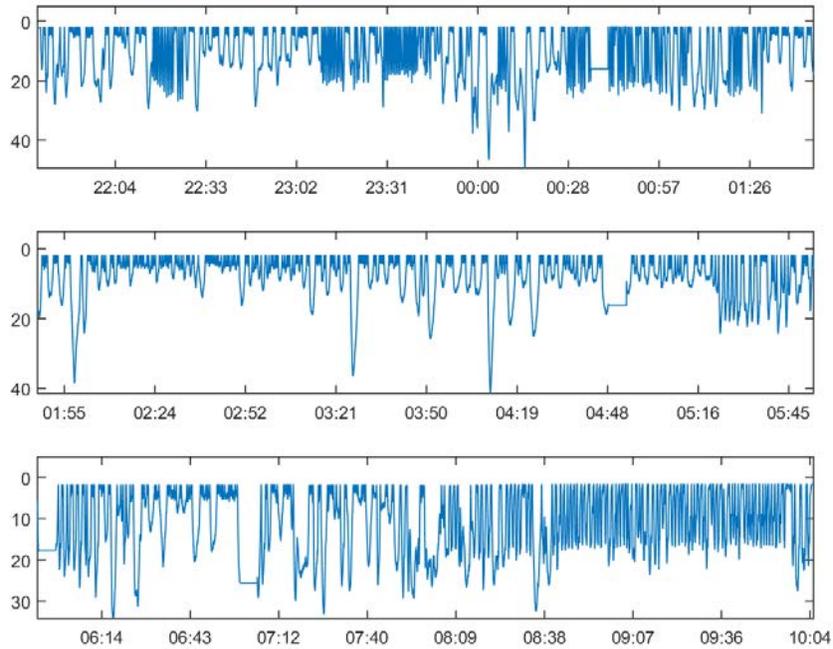
collected flukes images from 30 individual humpback whales. The unique coloration patterns on the underside of the flukes are used to identify individuals and this information is used to understand seasonal and interannual residency patterns as well as migration routes and breeding populations



Motion-sensing and video recording suction cup tag deployed on a Humpback whale in the Palmer Canyon.



Two humpback whales in the Palmer Canyon. A biopsy dart can be seen in the foreground, having collected a skin and blubber sample from the whales that is arching. The individually-identifiable underside of the flukes of a second whale diving can be seen.



A time-depth profile for a suction cup tag deployment on a Humpback whale in the Palmer Canyon. The tag collected data from ~2200 to 1000 the following day. The whale remained in the upper 30 meters of the water column almost exclusively with feeding dives occurring from the surface to ~25 meters.