# Weekly Update 4: LMG Cruise 11-01 Palmer LTER
# 23-30 January, 2011

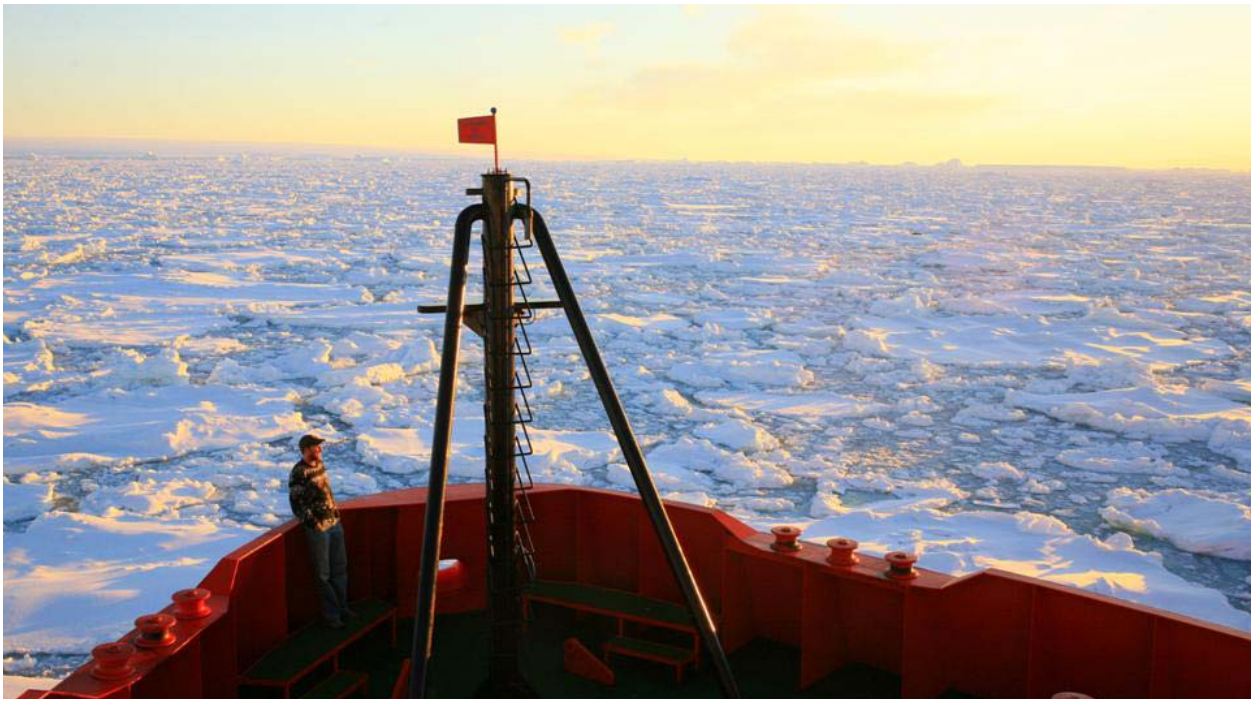

**Photo:** LMG in sea ice, 70º 06' South, 76º West, 29 January, 2011. Courtesy Kuan Huang.

The title of our current award, "Looking back in time through ecological space" is exemplified by this week's process study location near Charcot Island. Consistent with our hypothesis of climate migration southward along the western Antarctic Peninsula, we encountered persisting summer sea ice only in far southern range of our study area (photo above). Following our call at Rothera Base and occupation of several grid stations on the 100, 000 and -100 lines we relocated to the vicinity of the Adèlie penguin colony at Charcot Island and its near-field foraging area over a submarine canyon at 69.8 S, 75.4 W for our third process study (map below). The B-013 team made two successful trips to the colony (see below). Meanwhile the ship's party deployed the Rutgers Glider, conducted CTD, optics and pump casts and zooplankton net tows. Following the return of the birders we proceeded south along 76 West toward a destination just north of Latady Island at 70.5 S, where previous PTT returns suggested the Charcot Adèlies concentrated their foraging activity. We were halted by heavy sea ice near 70.1 S, a new southing record for the LMG. The area was dotted with tabular icebergs, presumed remnants of the Wilkins Ice Shelf. Here we conducted day/night pairs of CTD casts and net tows. Following successful recovery of the glider (photo) we started the return trip northward to occupy a few more stations and deploy the B-021 physical oceanography moorings. Next week's final cruise report will conclude the story, summarize cruise achievements and suggest preliminary findings. We thank ECO and RPSC support personnel for navigating and ship handling to get us to our destinations in heavy sea ice.

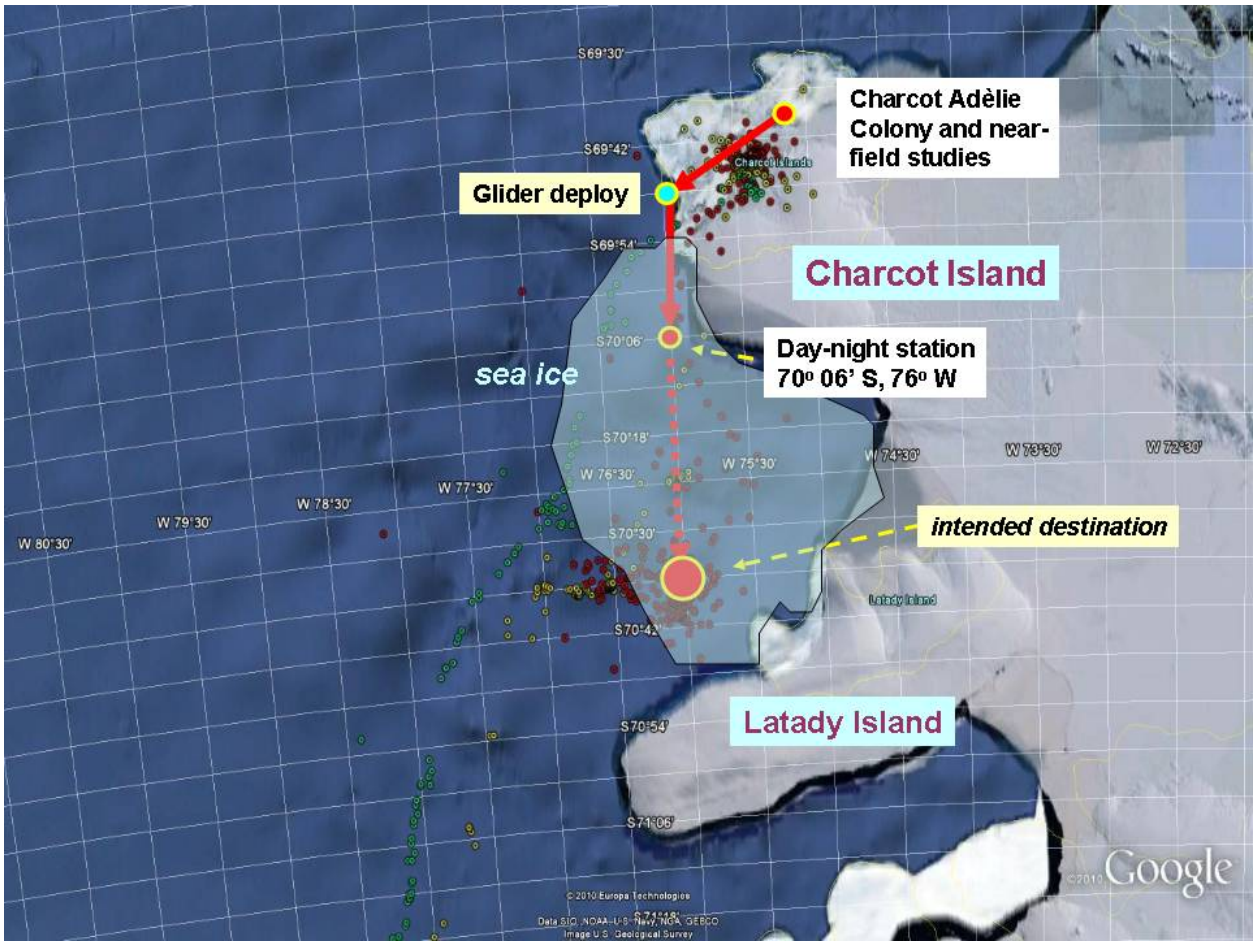


**Figure:** Map of Process-3 study region near Charcot Island in the Adèlie penguin foraging region, as estimated from previous years' PTT satellite tag returns.

Individual reports from the LTER component and guest projects follow with further details.

**B-013: Seabird Component.** Project Leader: W.R. Fraser. Field Team Members: Shawn Farry (Field technician) and Kristen Gorman (PhD student).

Our final week of work during LTER 11-01 consisted of additional at-sea observations of seabirds near the Charcot Island area, in addition to 2 days off-ship excursions to a colony of Adélie penguins nesting at Charcot Island. Our fieldwork at Charcot Island replicated many of our tasks at Avian Island including, surveying, weighing and measuring chicks, and diet sampling adult Adélie penguins. The sea-ice conditions around Charcot were heavier than last year, but with low winds and the ship positioning us within the most open water to directly access the colony, we were able to work with the penguins during 2 different evenings. We especially thank Captain Joe Abshire and other ECO personnel for navigating the ship skillfully through areas of thick sea-ice and RPSC MPC Stian Alesandrini, ET/MT Tony D'Aoust, Chance Miller, and Mereidi Liebner for zodiac support. MST Cooper Guest has been instrumental in supplying us with lab equipment such as a dissecting scope and sample storage tubes, items we unexpectedly needed this cruise due to the large diversity of prey items found in our diet samples from Adélie penguins.


**Photo:** Rutgers Glider recovery near Charcot Island on 30 January. Note yellow tail fin of glider in front of Zodiac. Courtesy Travis Miles.

**B-019: Phytoplankton ecology.** Project leader: Oscar Schofield. Field Team personnel: Michael Garzio (MS Student), Bethan Jones (Postdoc), Travis Miles (Tech), Grace Saba (Postdoc), Marie Seguret (Postdoc).

The phytoplankton group continues its station sampling with a full suite of bio-optical measurements (absorption, attenuation, backscatter, downwelling irradiance, upwelling radiance) to complement the phytoplankton measurements. Data so far indicate high productivity values even in the ice covered seas offshore Charcot Island. The productivity and fluorescence profiles indicate a broad subsurface phytoplankton peak in the upper mixed layer depth. This pattern has been confirmed by the Rutgers glider RU05, which was deployed offshore Charcot. The glider suggests that the high fluorescence resides just under a surface low salinity water likely associated with melting ice. Fluorescence data suggests chlorophyll concentration exceeding 20 mg chlorophyll a at many of the stations. This complements the high productivity encountered at Avian island and is in contrast to the lower productivity values found north near Palmer Station. B-019 has also been continuing the high CO2 experiment, and the manipulation is currently in Day 9 and will be harvested in 2-3 days. The manipulations show stupendous phytoplankton growth, with the high CO2 treatment showing the highest biomass. Finally the trace metal tow fish has been successfully collecting many trace metal clean samples throughout the cruise. To date over 90 dissolved and particulate metal samples have been collected.

**Photo:** MT Chance Miller and B-020 team member Joe Cope deploy the 2-meter zooplankton net in sea ice near 76.1 South. Courtesy: Zena Cardman

**B-020. Zooplankton Component.** Project Leader: Deb Steinberg. Field Team personnel: Joe Cope (Chief Tech), Kate Ruck (M.S. student), Caitlin Smoot (undergraduate intern), Kim Bernard (post-doc), Lori Price (M.S. student).

This week we finished full stations on the LTER 100, 000, and -100 lines and concentrated our operations in the Process Study 3 study region near Charcot Island in the Adèlie penguin foraging area. As with the previous process study near Adelaide Island, our aim was to characterize the zooplankton prey field in the penguin foraging region.

We began the week at a southern, inshore, coastal station (100.-040) where we came up with tows full of the Antarctic Silverfish (*Pleuragramma*). This important penguin prey item is ice dependant and found in the diets of penguins in the southern part of our grid, but not the north. We contacted Dr. Bill Fraser (LTER seabird PI) and Dr. Jose Torres (USF- PI on a Silverfish grant) who were excited to hear about our catch, as they had not found any fish of this smaller size on their March 2010 cruise- indicating there may be more than one cohort. We saved the fish samples for them to analyze. At other stations along this 100 line we caught mostly *Euphausia crystallorophias*, also an ice-dependant species, and Limacina pteropods. We continued to get salps in tows as well. Interestingly, we found a huge number of krill calyptopis

(larval stage *E. superba*) at the deep slope station 000.180. At this and another deep slope station (-100.180) we caught large numbers of salps and conducted a fecal pellet production experiment. Further onto the shelf along the -100 line we found large numbers of adult *E. superba* (the first time since the beginning of the cruise).

During the process study near Charcot we found few adult *E. superba* in the tows, but numerous *E. crystallorophias* juveniles and some adults The birders found a lot of fish in the diets of the Charcot penguins, but also *E. superba* adults and juveniles, and juvenile *E. crystallorophias.* There thus may be some selection for larger krill by penguins. The most striking difference about the sampling near Charcot vs. other parts of the LTER grid was the large numbers of comb jellies (ctenophores) and copepods at all the stations we sampled for Process Study 3. Finally, we also performed our two dilution experiments to measure microzooplankton grazing in the Process Study 3 study region.

**B-045: Microbial biogeochemistry.** Project leader: Hugh Ducklow. Field Team personnel: Matthew Erickson (Chief Tech), Zena Cardman (Volunteer), Will Daniels (Volunteer), Kuan Huang, (PhD student), Kenneth Legg (Volunteer).

W continue to see high bacterial productivity (BP) values with the overall study area average integrated bacterial productivity being at its highest level since we started regular measurements in 2003. Bacterial activity appears to reach maximum levels in warm water (>2.5C) and/or when phytoplankton biomass accumulates to high levels. These conditions seem to be met, singly or in combination in thin surface layers under calm conditions, which we've experienced often this year. The phytoplankton group reports high primary productivity in these same stratified upper layers.

**B-114: Ecological Physiology of Marine Crenarchaeota Populations from the WAP.** J.T. Hollibaugh, University of Georgia and Lihini Aluwihare, Scripps Institution of Oceanography.

To date we have collected samples for qPCR, RT-qPCR, biogenic silica, and CRD-FISH enumeration of crenarchaeotes from 53 station/depth combinations and run ammonia oxidation rate assays and collected nutrient samples at 40 station/depth combinations. Generally we collect 2 samples per station, one at the temperature minimum in the Winter Water and one at 400 m in the CDW. We have also completed sampling for the first and second Process Stations and are preparing to sample the third. Additional samples were collected for metatranscriptomics and for single amplified genomes at process stations. In addition to the >3000 liters of water filtered for suspended POM at Process station 1, we were able to filter almost as much from both 80 m and 400 m for group's Second Process station using the McLane pumps. As before the goal is to sample both the Winter Water layer and the core of the CDW. The suspended POM isolated from these water masses will be used for crenarchaeol and bacterial lipid characterization and del 13C analyses. At these depths we also conducted ammonia oxidation assays using a variety of substrates including some organic compounds. Large volume dark incubations were also run at both Process stations with 13C-labelled bicarbonate to monitor potential bicarbonate uptake by crenarchaeal populations in Winter Water and Circumpolar Deep Water environments.

We have also examined the time course of ammonia oxidation at one station and set up assays to measure ammonia oxidation rates on shallow water benthic biofilms sampled at various

locations. In addition to the microbial community composition and metabolism studies we are also isolating DOC from the CDW for chemical and isotopic characterization.

While at and around Charcot, we also deployed the McLane pumps at depths between 50-80 m to isolate suspended POM with the goal of determining whether ice algal biomarkers are discernible in this fraction.