LMG 24-01: PAL LTER Cruise 31
Weekly Science Report 2, 1– 7 January 2024

LTER: Ecological Response and Resilience to "Press-Pulse" Disturbances and a Recent Decadal Reversal in Sea Ice Trends Along the West Antarctic Peninsula

Week 2 overview (Dr. Deborah Steinberg, Chief Scientist):

In Week 2, we finished up Process Study I in the Palmer deep submarine canyon. We then successfully deployed a new physical oceanographic mooring (PC-1) near LTER grid station 600.060. We intended next to install a new Weather Station at nearby Hugo Island, but the weather was too rough to attempt the small boat landing required to transport equipment and personnel. We will try again toward the end of the cruise if conditions permit. After dropping off telemetry equipment to Palmer Station to allow for recovery of a whale satellite tag, we commenced sampling along the 600, 500, 400, and 300 grid lines. Regular, standard station operations occurred at representative coastal, shelf, and slope stations along the lines, as well as underway sampling between the stations. At station 300.100 we successfully turned around a physical oceanographic mooring (recovered M-9 mooring and deployed M-10). The crew/ASC support on the ship has been excellent, with over-the-side operations now settling into a routine, and the kinks worked out of some of the more complicated operations such as mooring turnarounds. It's been mostly overcast, and often foggy, with large icebergs at every station (the latter two occasionally affecting our operations).

Group Reports

C- 021: Physical Oceanography (Dr. Carlos Moffatt, PI; U. Delaware)

Field Team Members: Michael Cappola (lead), Jake Gessay

This week was incredibly busy for C-021. First, we deployed the PC-1 mooring near the 600.060 station. This mooring was configured with 1 RBRsolo Temperature and Pressure Recorder, 4 SBE39plus Temperature and Pressure Recorders, and 11 SBE56 Temperature Recorders. Deployment went exceptionally smooth and the mooring's final location and depth are; Latitude -64 51.8704 S, Longitude -064 51.2609 W, Bottom Depth 502m. PC-1 will be deployed for 2 years and we are very hopeful for the exciting data it will provide on wintertime water mass interactions and flow through Palmer Canyon.

After PC-1, we immediately steamed for Hugo Island to complete the weather station installation. Unfortunately, the weather turned as we arrived, and we were unable to find a suitable landing site at Hugo Island. Hugo is notoriously difficult to land on, being so far out on the shelf, and so requires the calmest conditions. We will attempt to install the weather station when we pass it again near the end of the cruise.

Finally, we completed the turnover of M-9/10 at station 300.100 (**Figs. 1, 2**). During the M-9 operation, we successfully recovered 4 SBE39plus Temperature and Pressure Recorders, and 11 SBE56 Temperature Recorders. We then redeployed M-10, which was configured with 1 RBRduet Temperature and Pressure Recorder, 4 SBE39plus Temperature and Pressure Recorders, and 11 SBE56 Temperature Recorders. Its final location and depth are; Latitude -66 30.7029 S, Longitude -069 53.9720 W, Bottom Depth 497m. This mooring will be deployed for two years and is a part of a long and valuable timeseries in Marguerite Trough.

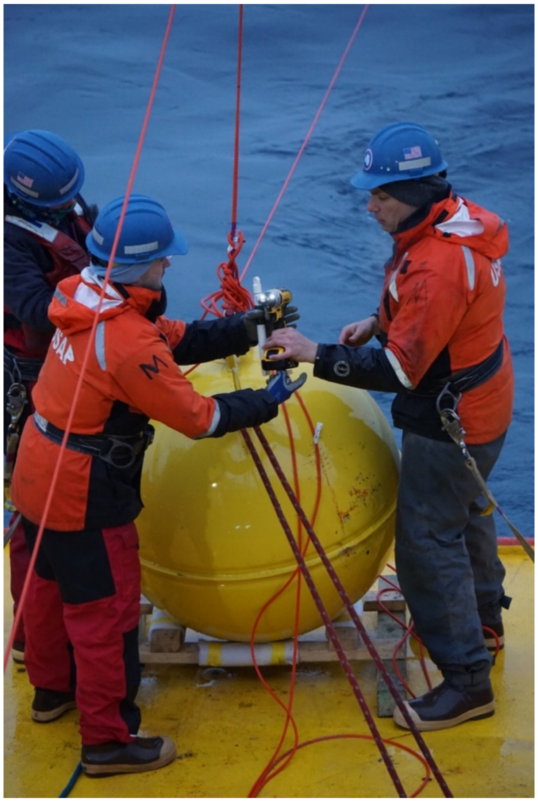

Figure 1. Michael Cappola, Jake Gessay, and Marine Technician Jennie Mowatt, removing sensors from M-9 mooring after recovery. Photo by Allie Northey.

Figure 2. Jake Gessay and Marine Technician Lauren 'Bird' Dixon securing a tag line to M-9 mooring. Photo by Allie Northey.

C-045: Biogeochemistry (Dr. Ben Van Mooy, PI; Woods Hole Oceanographic Institution)

Field Team Members: Zephyr Girard (lead), Hannah Goldberg, Dr. Laura Mota, Rachel Davitt

This week our team successfully recovered our first PIT (Particle Interception Trap) as part of Process Study 1 in the Palmer Deep. Initial visual observations indicate that the particulate organic carbon (POC) export is dominated by krill fecal pellets at all three depths (50,100, and 200 meters) (**Fig. 3**). We also continued our CTD and underway water sampling. These samples will be analyzed for alkalinity/dissolved inorganic carbon, nutrients, flow cytometry, lipids, carbohydrates, POC and oxygen isotopes. We also received fecal pellets (from salps and krill) from the zooplankton group which were collected in live animal incubations that we will use for single particle chemical analyses to better understand export dynamics in the western Antarctic Peninsula region.

Figure 3. Filter for POC analysis from 50 m sediment trap showing krill fecal pellets. Photo by Zephyr Girard.

C-019: Phytoplankton (Oscar Schofield, Rutgers, P.I.)

Field Team Members: Heather Forrer (lead), Jake Gessay, Mya Sharpe, Dr. Ahmed El-habashi

This week has been a busy week for the C-019 group, during which we performed and sampled a total of 19 CTDs and optics casts, and 36 underway samples for core phytoplankton time series measurements, including: Chlorophyll-a and HPLC (**Fig. 4**), photosynthetic quantum yield, and light absorption spectra of particulate phytoplankton pigments. We added an additional optics cast at the coastal sites where particle aggregation experiments were conducted (**Fig. 5**). We also completed the 48-hour diel incubation started at Process Study 1 in the Palmer Deep Canyon. Interesting preliminary results from the experiment indicate light saturation of photosynthesis occurs during the daily light cycle in both surface water and deep chlorophyll maximum water treatments. In addition, phytoplankton in dark bottles showed no changes in their physiology over the diel cycle, indicating there was no endogenous/ biological clock affecting diel changes seen in the light treatments.

Figure 4. Filtering water for High Performance Liquid Chromotography (HPLC) pigment measurements. For phytoplankton community structure.
Photo by Jake Gessay.

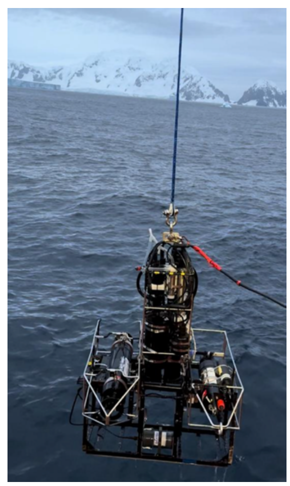

Figure 5. Coastal optics cast.
Photo by Ahmed El-Habashi.

Hyperspectral measurements of ocean color:
The reasonably calm seas permitted continuous operation of the Hyperspectral Acquisition System (HyperSAS) this week, allowing us to collect 169 hours and 36 minutes of spectral data. We finally were able to program a setup file to view the insitu data in SatView software. Below is an example of recorded spectra from the 300.040 station (**Fig. 6**).The HyperSAS collected spectra from the 600, 500, 400, and 300, lines this week, as well as the 600.040 process station (**Fig. 7**).

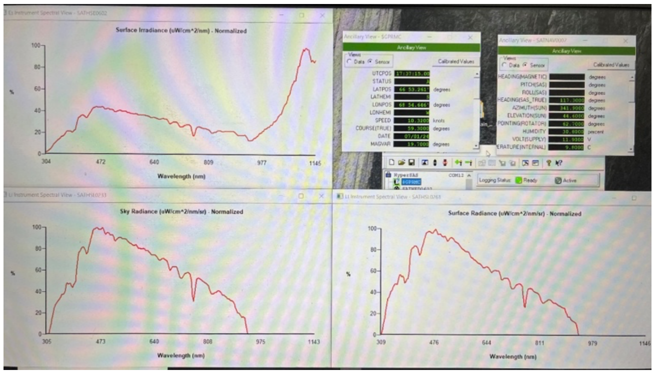

Figure 6. Example of recorded spectra from the HyperSAS at the 300.040 station.

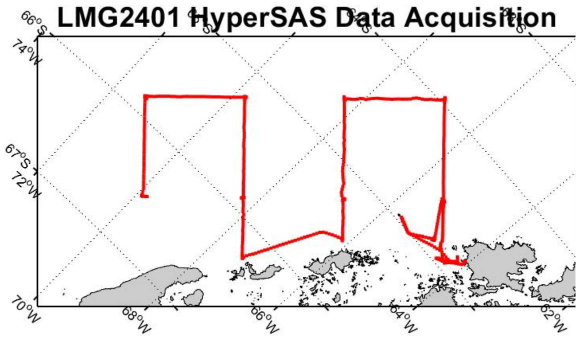

Figure 7. HyperSAS data collection in week 2.

C-020: Zooplankton (Dr. Deborah Steinberg, PI; Virginia Institute of Marine Science)

Field Team Members: Deborah Steinberg (lead), Joe Cope, Meredith Nolan, Hannah Gossner, and Connor Shea

In the second week, we completed net tow sampling (**Fig. 8**) along the 600, 500, 400, and 300 grid lines. At each station we performed a pair of net tows for larger macrozooplankton (e.g., krill, salps) and smaller mesozooplankton (e.g., copepods). In the tows we are still mostly seeing the euphausiid (krill) *Euphausia superba* with a bimodal distribution of size/life stages (both small juveniles and large adults), although juvenile *E. superba* dominate the coastal stations (in high abundance, **Fig. 9**). The smaller krill species *Thysanoessa macrura* is relatively abundant, and we are occasionally seeing the krill *E. crystallorophias*. At most stations we are finding fish larvae (and juveniles), especially those of the Grey Rockcod *Lepidonotothen squamifrons* (this species particularly abundant at 300.100). Rare thus far this year are *Limacina* shelled pteropods and salps. We are surprised to see such high krill abundance following a record warm and low sea ice year. Also surprising is the scarcity of salps (*Salpa thompsoni*) as they usually occur in warmer, more ice-free, open-water years. At Station 500.100 (over the shelf) we found some individuals of adult *Euphausia superba* that we believe to be parasitized; we froze some and also preserved some to send to colleagues with relevant expertise.

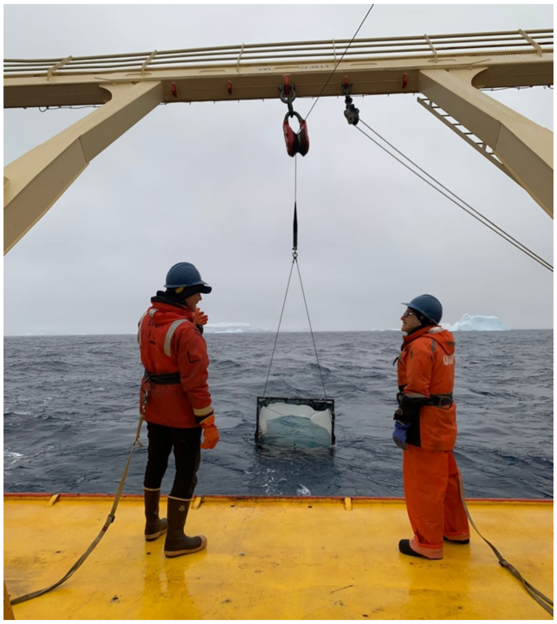

Figure 8. Performing a zooplankton net tow amongst the icebergs. Photo by Hannah Gossner.

Figure 9. A lot of juvenile krill caught at a coastal station. Photo by Debbie Steinberg.

C-013: Seabird Component-LTER (Megan Cimino, PI; UC Santa Cruz and NOAA)

Field Team Members: Allie Northey (lead), Helena Dodge

During our second week of bridge-based surveys, we conducted stationary surveys during CTD casts and plankton net tows, and led transect surveys between grid stations. These surveys were conducted along the 600, 500, and 400 LTER grid lines. We observed a myriad of albatrosses in small numbers; a single wandering albatross, black-browed albatross, and light-mantled sooty albatross (**Fig. 10**). As we travelled further along the grid, visibility was reduced due to fog and made it difficult for cetacean observations. Nevertheless, humpback whales were sighted semi-regularly. During this time, we also observed a few Blue petrels and Southern fulmars. We have also observed White-chinned petrels and Black-bellied storm petrels, which were notable as they are relatively rare along the LTER grid.

This past week we had hoped to conduct surveys at Hugo Island, which has not been censused by the seabird team since 2019. Unfortunately, were unable to land on the island due to large ocean swell. Fingers crossed for a safe landing at a later point in the cruise.

Our team has also been preparing for our upcoming field deployment to Avian Island next week. Once there, our research will primarily focus on the foraging ecology and breeding success of Adélie penguins. Additionally, the team will conduct a full census of all other nesting seabird species and marine mammals on the island. This study site serves as an important comparison to LTER data we collect at Palmer Station. In preparation, we tested communication devices, labelled and prepared items for sample collection, configured tags that will be deployed, and staged gear.

Figure 10. Light-mantled sooty albatross in flight. Photo by Allie Northey.

C-024: Cetacean Biology & Ecology (Ari Friedlaender, PI; UC Santa Cruz)

Field Team Members: Ross Nichols (lead), Dr. Jennifer Allen

This week, the Whalers continued their efforts to conduct bridge surveys of marine mammals. Sighting and surveys were minimal this week, as the foggy weather was unconducive to deployment of the small boat for marine mammal field work. Our sampling operations require close approaches to marine mammals, and involves careful consideration for the safety of both the humans aboard the vessel and the animals we sample. Poor weather can increase risk for both, thus our group employs a conservative threshold for sea state and visibility when deploying on marine mammals. While no samples were collected this week, our team continued to work on data from the previous week's collection in the form of Individual ID using Fluke matching. By sorting fluke images (**Fig. 11**) by the individual and cropping the image for clarity, we can submit fluke photos to the HappyWhale platform, which uses machine learning to match flukes of whales across the world. We have submitted images collected by our team, as well as by others aboard the LMG who collected photos of flukes using their personal cameras, which has been incredibly helpful.

Figure 11. A fluke of a Humpback whale performing a dive. This fluke will be used like a fingerprint, allowing us to match it to other fluke photos taken around the world.