

LMG 23-01: 22 Dec. 2022 – 06 Feb. 2023, PAL LTER Cruise #30

Weekly Science Report III

(Jan 16th to Jan 22nd)

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

Other projects: CAREER: Understanding Microbial Heterotrophic Processes in Coastal Antarctic Waters (Jeff Bowman, Scripps, PI) and CAREER: The transformation, cross-shore export, and along-shore transport of freshwater on Antarctic shelves (Carlos Moffat, U. of Delaware, PI).

Overview (Carlos Moffat, Chief Scientist)

During the third week of LTER science we successfully completed the birder camp at Avian Island, we finished sampling the 200 grid line collected a significant number of samples for whale biopsies, as well as additional net tows near Rothera Station. The B-285 component led by Beth Connors (Scripps) conducted additional bacterial grazing experiments in addition to regular measurements along the grid. The O-263 component worked on addressing a leak in the RU33 glider that was recovered on January 14th. This glider was successfully deployed again and is now collecting data off Adelaide Island.

The week was also marked by challenging weather conditions, which led to completing the Avian Island Process station only in part. We deployed and successfully recovered a sediment trap and conducted CTD profiles, but the sea state did not allow the Steinberg group to deploy their nets. We also lost our optics profiler (see update from Schofield group below). We did, however, spend some time in the calmer waters off the southeast coast of Adelaide Island (near Rothera Station) and were able to conduct additional whaling activities and net tows. As the week closed and weather improved, Nicole Waite from Rutgers led the successful recovery of the glider that developed a leak last week, and as mentioned above, the re-deployment of the O-263 component glider that we repaired. We have now transited to the Charcot Island region, the southern limit of our study area, to complete the -100 line, conduct other activities on and around the island before working our way up the grid to finish the 0 and 100 lines.

Group Reports

C-024 Whales-LTER (Logan Pallin, Friedlaender Group, UCSC)

Team Members: Logan Pallin (lead), Arianna Torello

This week, the whaling group continued their efforts to conduct bridge surveys of marine mammals and collect skin-blubber biopsy samples when weather conditions allowed. For the first part of the week, weather prevented the whaling team from working, however, Friday January 20th, we were able to drop a zodiac and look for some whales thanks to the continued



support of the ASC/ECO staff and crew. Sightings this week have included several dispersed pairs and groups of humpback whales in the Marguerite Bay and one large group (~50) of type B2 Killer whales that were interspersed among humpbacks. While on the water, the whaling team was able to collect five tissue samples from humpback and tree tissue samples from the killer whales. To date our group has now collected 21 skin-blubber biopsy samples (16 humpback whales; 5 killer whales (2 type A, 3 type B2)). These tissue samples will be used to determine the sex of individuals, hormone markers for health and pregnancy, and will be integrated into our genetic database of over 2,500 samples from the Antarctic Peninsula region since 2010.



Figure 2: Type B2 Killer whales encountered in Marguerite Bay. Photo collected under NMFS Permit No. 23095.

C-021 & O-263 Physical Oceanography-LTER (Carlos Moffat, LTER PI, U. of Delaware)

Team Members: Carlos Moffat (lead), Rike Benz, Jake Gessay, Michael Cappola, Evan Quinter

The LTER physical oceanography group continued work on checking the CTD and underway data. We continue to sample water at each CTD profile to conduct oxygen titrations for quality control of the dissolved oxygen measurements.

As part of the O-263 component, the focus was on working with Nicole Waite (Rutgers, our resident glider expert) on plans for recovery of the UD476 glider, which developed a leak and later could not be steered any longer, and redeployment of the RU33 glider. RU33 had to be recovered on January 14th after it also developed a leak shortly after redeployment. Nicole Waite and David Aragon (assisting remotely from Rutgers) were quickly able to identify the source of the leak and fix it. We planned to take advantage of the improving weather on 1/22 to both recover UD476, which was by now drifting through Johnston Passage off the south-west coast of Adelaide Island. We then transited some 10 nm west to deploy RU33 in safer waters (Figure 3). We will be monitoring RU33 over the following days as it makes its way up the coast of Adelaide Island sampling the Antarctic Coastal Current.



Figure 3: Re-deployment of RU33 glider equipped with a Rockland Scientific MicroStructure sensor off Adelaide Island. January 22nd, 2023. From right to left (right photo): Nicole Waite (senior tech support, Rutgers University), Rike Benz (U. of Delaware Grad Student), Michael Cappola (U. of Delaware field support), Matt Cabell (ASC MT) and Carlos Moffat (U. of Delaware PI).

C-023 Seabirds-LTER (Megan Roberts, Cimino Group, UCSC)

Team Members: Megan Roberts (lead), Allison Northey

This past week LTER provided opportunities to establish a field camp at Avian Island. With the help of ASC staff and grantees, we were able to establish a camp on Avian Island from the morning of the 15th to the 21st of January. The weather was marginal with precipitation and strong winds nearly every day. Despite this, we were able to complete all science goals we set out to do. Our work at Avian is focused primarily on the breeding success and foraging ecology of Adélie penguins, however we were able to use the limited access to the area to collect samples, and census multiple species for localized population dynamics as well as collect data on foraging. The same data is collected at Palmer and makes for a useful analysis of bird nesting and foraging at two sites with different sea ice characteristics on the WAP.



Figure 4: Adélie Penguin colonies on Avian Island.

While on Avian, we conducted breeding colony censuses of Adélie Penguins (Figure 4), and weighed and measured crèched chicks. In order to better understand foraging, we approach the problem from multiple angles. Diet samples from 29 adult Adélie penguins were collected and two GPS tags were deployed on two different adults in order to look at discreet foraging runs. This data provides interesting insight into foraging at Avian compared to the Palmer area over a short time scale. For long term analysis of fish consumption, we collect excrement material from sediment traps to extract fish otoliths that have accumulated over the course of the year and are eventually used to identify to fish species. Skuas often predate Adélie Penguin chicks leaving the feet and skeleton intact. These chick feet were collected for stable isotope analysis. This is used as another means of analyzing diets that covers a longer time span than the diets we collect while on island.

Full island surveys of nesting Southern Giant Petrels, and Blue-Eyed Shags were completed. South Polar Skua fecal samples were collected and will be analyzed for fish otoliths to better understand Skua foraging. Additionally, this year, we used a handheld GPS logger to map all South Polar skua nests on the island. We collected boli from Blue Eyed Shags, primarily piscivores, to better understand what fish species are found in the general area, as well as to detect long term changes in Blue Eyed Shag diets. A marine mammal census was also conducted. The vast majority of marine mammals seen on Avian are Southern elephant seals, however we also sighted some fur seals and Weddell seals. We would like to sincerely thank the ASC staff, science grantees, and the entire Laurence M. Gould team who helped with the camp set up and deployment at Avian Island (Figure 5).



Figure 5: Camp set up on Avian Island.

C-019 Phytoplankton-LTER (Nicole Waite, Schofield Group, Rutgers University)

Team Members: Nicole Waite (lead), Miah Manning, Ben Fisher, Michael Cappola

This week, weather has kept us from sampling much of the week. Before the storm, we completed the 200 grid line – including 6 underway stations and 3 full CTD grid stations. The HyperSAS radiometers remained off most of this week, as the weather prevented us from re-installing it on the bow, but we were able to have it out during the 200 line. At the very end of the week, we also completed one CTD cast alongside the recovery of the Van Mooy group's sediment trap. Chlorophyll still remained low most of the week, and the community remained dominated by dinoflagellates and cryptophytes, though we did observe a few diatoms on the IFCB in Marguerite Bay during underway sampling. The final CTD of the week for the sediment trap was a drastic change, with high Chlorophyll fluorescence (5 mg/ml) and many large diatom chains. Ben Fisher was able to sample for his work at this last CTD, giving him a different community composition to work with.

We attempted to conduct a station at 200.-040 in Marguerite Bay for our second process study but were unsuccessful due to stormy conditions and sea state. Unfortunately, during this attempt, we also lost our optical cage with our LISST-200x particle size distribution sensor (Figure 6) during a cast. The loss was through no fault of any person and was due to an unlucky set of circumstances related to the ocean conditions and rigging failures. Most importantly, no one was injured during this incident. In total this cruise, we collected 21 profiles down to 150m throughout the grid. We appreciate all the support deploying the LISST throughout the cruise to help us collect bio-optical data.

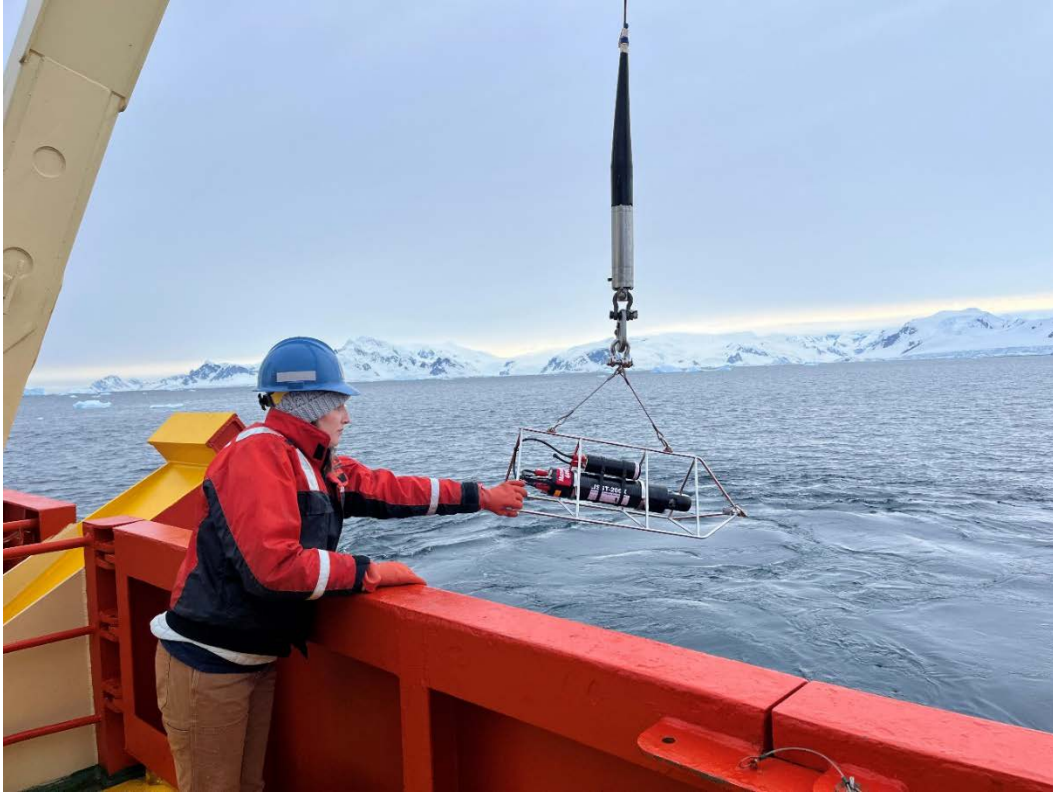


Figure 6: LISST cage being deployed by Nicole Waite during LMG23-01.

C-020 Zooplankton (Joe Cope, Steinberg Group, VIMS)

Team Members: Joe Cope (lead), Tor Mowatt-Larsen, Maya Thomas, and Meredith Nolan

We finished sampling the 200 grid line, completing the “South” portion of the core grid. The shelled pteropod *Limacina* exhibited unusually high abundance (high anomaly, measured as deviation from the annual mean - Figure 7) in both the North and South, while the krill *Thysanoessa* had lower abundance than usual. Salps did not deviate much from the annual mean.

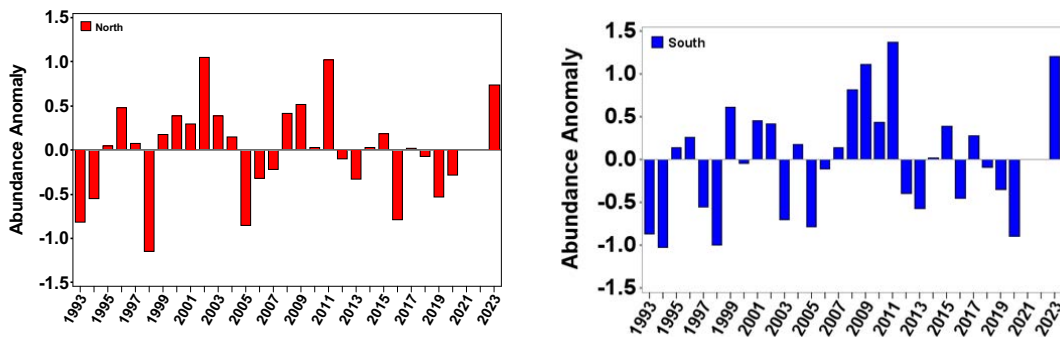


Figure 7: *Limacina* annual anomaly by year.

In Marguerite Bay, we took some tows to collect live animals for experiments. Several tows caught a large and diverse assemblage of larval fishes, including Antarctic silverfish, *Pleuragramma antarctica* (Figure 8). Two size-classes of silverfish were retained for studies to describe gut microflora and feeding selectivity in larvae of this ecologically important fish. Experiments by graduate student Tor Mowatt-Larsen measured the critical thermal maximum (CT_{max}) of two families of fish, white-blooded icefish, Channichthyidae, and plunderfish, Artedidraconidae. Preliminary results indicate that larval icefish have a lower thermal tolerance than plunderfish. Plunderfish are represented by two species in this region, which show a significant interspecific variability in the thermal tolerance.



Figure 8: Larval Antarctic silverfish (left) and a juvenile caught in a glider (right).
(Photo credit: Tor Mowatt-Larsen.)

C-045 Biogeochemistry (Shavonna Bent, Van Mooy Group, WHOI)

Team Members: Shavonna Bent (lead), Henry Holm, Mackenzie Curtice, Aidan Kenny

While the weather was in opposition this week, the Van Mooy group was able to complete sampling of the 200 line of the grid, including full CTDs and all underway stations. In addition, we deployed a particle interceptor trap (PIT), at 100 m to collect sediment for approximately four days. Due to the bathymetry of the area and the sea state during deployment, we opted to only deploy a single trap at 100 m, rather than attempting to replicate efforts at 50 and 200 m as well. Initial results from this trap's collection indicate a much more diverse assemblage of sinking material than was observed at the process station at Palmer Deep. While krill fecal pellets were still present, more flocky, marine snow type material was present in the traps as well (Figure 9). Investigations with the Steinberg group are underway to determine if this is another type of fecal pellet, or perhaps detrital phytoplankton. We complemented the trap deployment with two shallow (200 m) CTD casts at the deployment and recovery site, to gain a sense of the end-members of water column conditions that the trap traveled through. Due to

the prevailing winds and currents, the trap drifted ~25 nm during its four-day deployment, and thus having this information will be helpful in interpreting the conditions in which the trap drifted.



Figure 9: Sinking material collected from 100-meter trap at Avian Island process station (200.-040), consisting of fecal pellets and marine snow.

B-285 Bacterial Communities (Beth Connors, Bowman Group, Scripps)

In our third week of the cruise, two additional grazing experiment were successfully completed at an offshore (200.200) and a shelf station (200.040). In addition to the two successful grazing experiments, water was collected at each of the LTER Grid Stations for measurements of bacterial community structure, abundance, activity, and energetics. This week, 4 CTD casts were undertaken in the Southern section of the LTER grid (200 line) and the Avian Process Station.