

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

## **Weekly Science Report II**

### **(Jan 8<sup>st</sup> to Jan 15<sup>th</sup>)**

**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)**

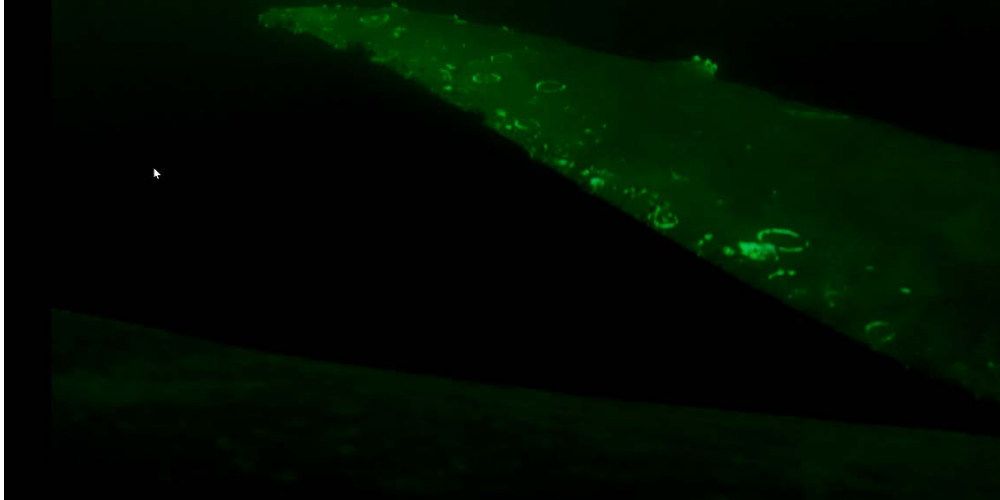
During the second week of LTER science we successfully completed half of the regular grid (600 to 300 lines). During the 500 line, we also conducted a grazing experiment (B-285, Bowman CAREER), and a high-resolution CTD section (O-263, Moffat CAREER). A second grazing experiment as well as additional sampling as part of the B-285 component continued during the rest of the week. The 300 line was full of activity, with the successful recovery and redeployment of the M-8 (now M-9) mooring near the 300.100 grid station. We also deployed two gliders as part of O-263 component, but both developed leaks shortly after deployment. One glider has already been recovered and is being diagnosed for potential redeployment. The recovery of the second one is planned for later this week. A second high resolution CTD section was partially completed off Adelaide Island before a storm hit the Peninsula. On Saturday night we arrived at Avian Island to set up a 5-day camp for seabird censuses and related activities. The camp put in was successfully completed on the evening of January 15<sup>th</sup> under challenging conditions after the storm. We are now looking forward to a second process station at Avian Island, completing the birder camp there, and continuing to make progress sampling the LTER grid.

#### **Group Reports**

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

##### **Team Members: Logan Pallin (lead), Arianna Torello**

This week, the Whalers continued their efforts to conduct bridge surveys of marine mammals. However, a combination of being offshore and poor sea conditions, have made it very challenging to look for whales. The whaling team has focused on offloading tag data and prepping for the next deployment of two more tags near Avian Island. We received some decent 4k resolution video data from our tag which was deployed last week (see below).



*Figure 1: Video still of the left pectoral fin of a tagged humpback whale while on a foraging dive. Note the white circles which are barnacle scars. Humpback whales use these long pectoral fins to precisely maneuver through the water.*



*Figure 2: Video still of the left pectoral fin and part of the belly of a tagged humpback whale while takes a breath at the surface and rolls onto its right side.*

## **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 team continued to work on the collection and quality control of the CTD data, including collecting water samples to calibrate the oxygen sensors of the ship's

sensors. This week, we also focused on the retrieval of the M-8 mooring and its redeployment (as M-9) near the 300.100 grid station site (Figure 3). The M-8 mooring was deployed by ASC in



*Figure 3: UD graduate student Jake Gessay (left) and UD field support tech Michael Cappola (right) deploy the LTER M-9 mooring. Also pictured: Anna McBee (ASC support).*

April 2022 and collected data successfully until we recovered it. As extremely anomalous sea ice preceded the cruise and similarly anomalous hydrographic and sea ice conditions have been observed during the cruise, data from this mooring will provide essential context for the observations collected this summer.

As part of the O-263 component, a main focus this week was the deployment of two gliders off Adelaide Island to sample the frontal region of the Antarctic Coastal Current, as well as to complete a high-resolution section. We were able to deploy the two gliders, but both develop leaks within a day or so of the deployments. We have recovered one glider and are diagnosing the source of the leak. A recovery operation for the second glider is planned next week. About two thirds of the high-resolution hydrographic section off Adelaide Island was completed before we had to shift operations to glider recovery. As we continue south, we expect to collect additional near-shore sections.

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

**Team Members: Megan Roberts (lead), Allison Northey**

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, 400, and 300 LTER grid lines. Notably, a group of Chinstrap penguins and a Minke whale was sighted during a stationary survey at an offshore grid station. We observed a myriad of albatrosses in small numbers; grey-headed albatross, black-browed albatross, and light-mantled sooty albatross. As we travelled further along the grid, a large group of Cape petrels were attracted to the ship and followed over the course of many surveys. During this time, we also observed an Antarctic petrel, Antarctic prions, Blue petrels, and Southern fulmars. Similar to last week, we observed White-chinned petrels and Black-bellied storm petrels, which was again notable as they are relatively rare along the LTER grid.

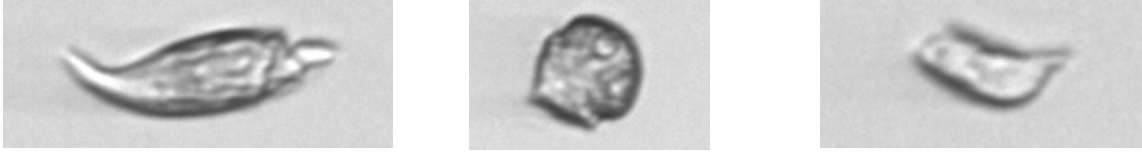
This week, our team also prepared for our upcoming field deployment to Avian Island next week. Once there, our research will primarily focus on the foraging ecology and breeding success of Adélie penguins. Additionally, the team will conduct a full census of all other nesting seabird species and marine 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 vials for sample collection, configured tags that will be deployed, and staged gear.

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

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

It has been a busy week for the C-019 team. After waiting out a large storm at the start of the week, we were finally able to start the regular grid sampling. We completed the 600, 500, 400, and 300 grid lines – for a total of 11 CTD and LISST optical profile stations and 23 underway surface water stations. Our full suite of water measurements and samples were collected at all stations. Additionally, Ben Fisher collected two more sets of samples for his dissolved organic matter work at the 500.200 and 400.040 grid stations.

Overall fluorescence has been extremely low compared to past years. The fluorescence has remained at about  $1 \text{ mg/m}^3$  or less at all depths and stations, aside from 600.040 in Palmer Canyon. We have not observed a summer upper mixed layer, and instead phytoplankton have been mixed down to the winter water layer where we see peak fluorescence at 50-80m depth. We continue to see mostly small phytoplankton cells throughout the grid – dominated by dinoflagellates and cryptophytes (Figure 4).



*Figure 4: Images of phytoplankton from the IFCB seen this week along the LTER grid. From Left to Right: Dinoflagellates Katodinium and Gymnodinium, and Cryptophyta.*

The HyperSAS mounted on the bow was powered down and removed on 1/6/2023 at 01:14 UTC due to severe inclement weather. Though the HyperSAS is hardened and can handle rough seas, the frame it sits on extends past the leading edge of the bow. A wave breaking over the bow will likely damage the cable fittings, so a sensor removal criterion of 40 knot winds or 4-meter seas was set. On the 6<sup>th</sup>, this criterion was met and the sensor was removed. Unfortunately, the inclement weather continued throughout much of this week and the HyperSAS was not installed for any of the 600, 500, or 400 lines. During this time, we received the instrument setup file and SatView software was configured to provide local data logging and real-time data analysis. On 1/12/2023 at 18:02 UTC, the weather conditions fell below the removal criteria and the sensor was re-installed on the bow. The minimum solar elevation limit configuration setting was lowered from 10 degrees to 5 degrees to maximize the time that the HyperSAS was recording. Data acquisition began again at 18:53 UTC and continued as the ship completed the 300.100 and 300.040 grid stations, as well as underway stations 300.080 and 300.060. Several transects were made between these two grid stations while the ship conducted two glider deployments and a mooring turnover (Figure 5). Data was then collected as the ship transited south along the Adelaide coast, but inclement weather forced the sensor to be removed on 1/14/2023 at 22:13 UTC. During this period that the sensor was on, we had one day of clear sunny skies and were able to visually verify that the Solar Tracker was choosing the correct viewing angle. We were able to review the data with SatView software which was a huge improvement. Pictured below (Figure 6), we have a normalized surface radiance spectrum with a peak centered around 476 nm (blue), and this agrees with our visual observations and the low fluorescence levels (1.1 mg/m<sup>3</sup>) at this location.



# LMG2301 HyperSAS Data Acquisition

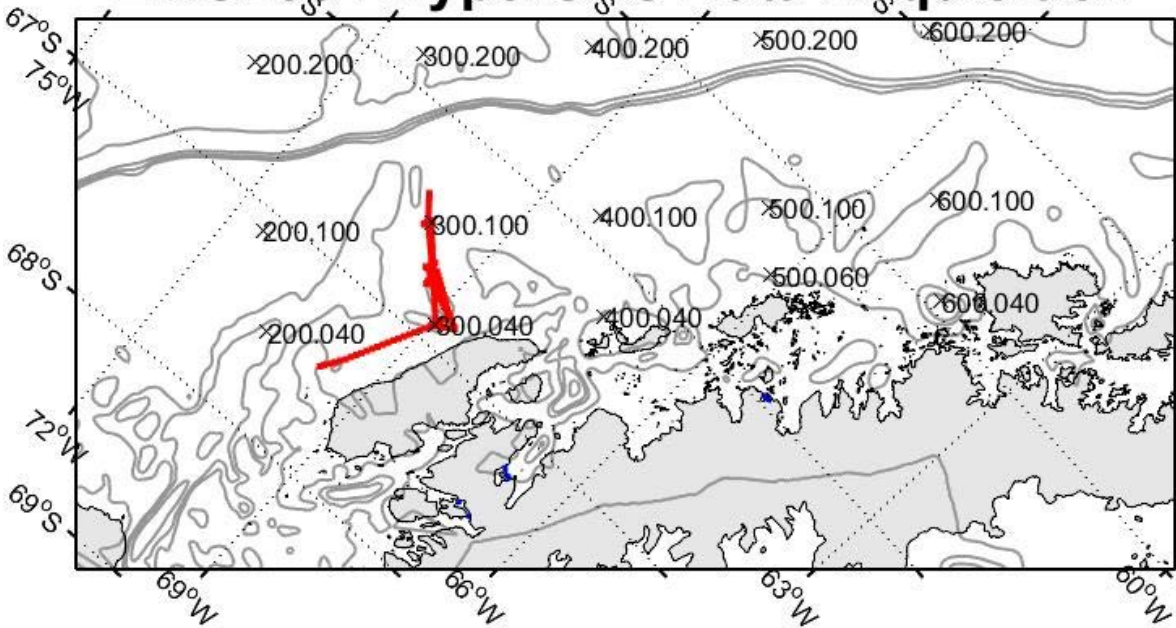


Figure 5: Map of HyperSAS measurements from 1/9 - 1/15.

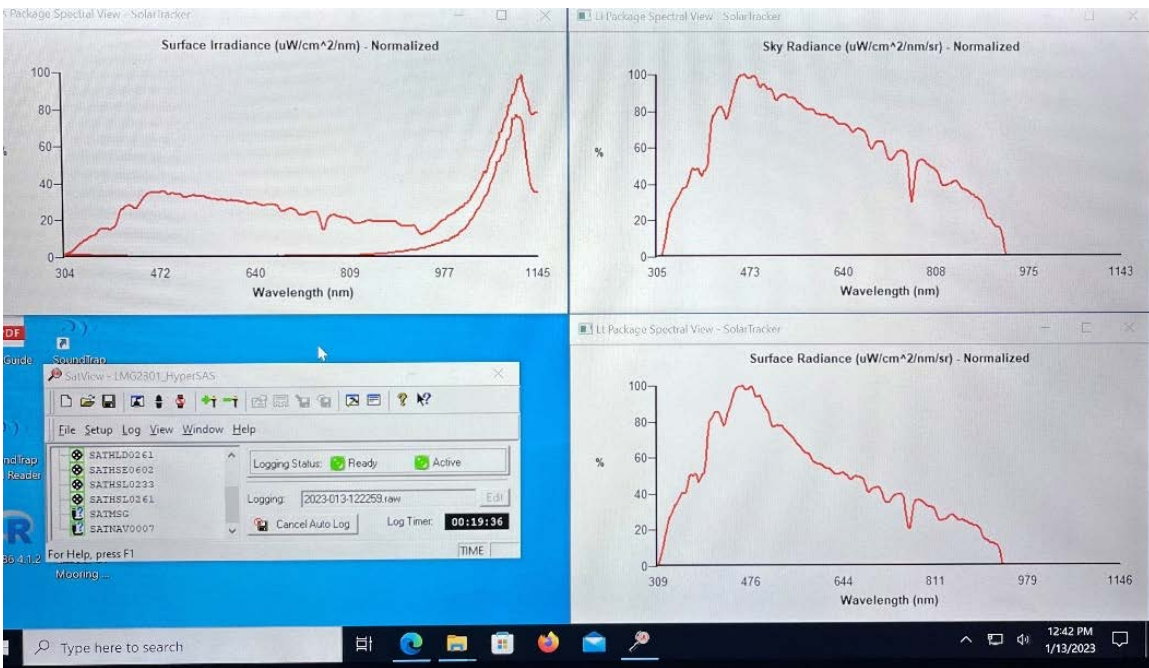


Figure 6: Real-time data from the HyperSAS.

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

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

During our second week of research, we completed plankton tows along grid lines 600, 500, 400, and 300. Previously, we predicted that salps would dominate the catch due to the low sea ice conditions. While abundant, they were not more abundant in the core grid than historical catches. However, the shelled pteropod, *Limacina*, was found in high numbers across the grid. Many mature female Antarctic krill, *Euphausia superba*, were also caught. Most of the mature females were with eggs. Mature females (Figure 7) can be recognized by a red dot on the belly (thelycum), while the presence of eggs is noted by a swelling of the carapace. The proportion of mature females increased with increasing distance from shore.

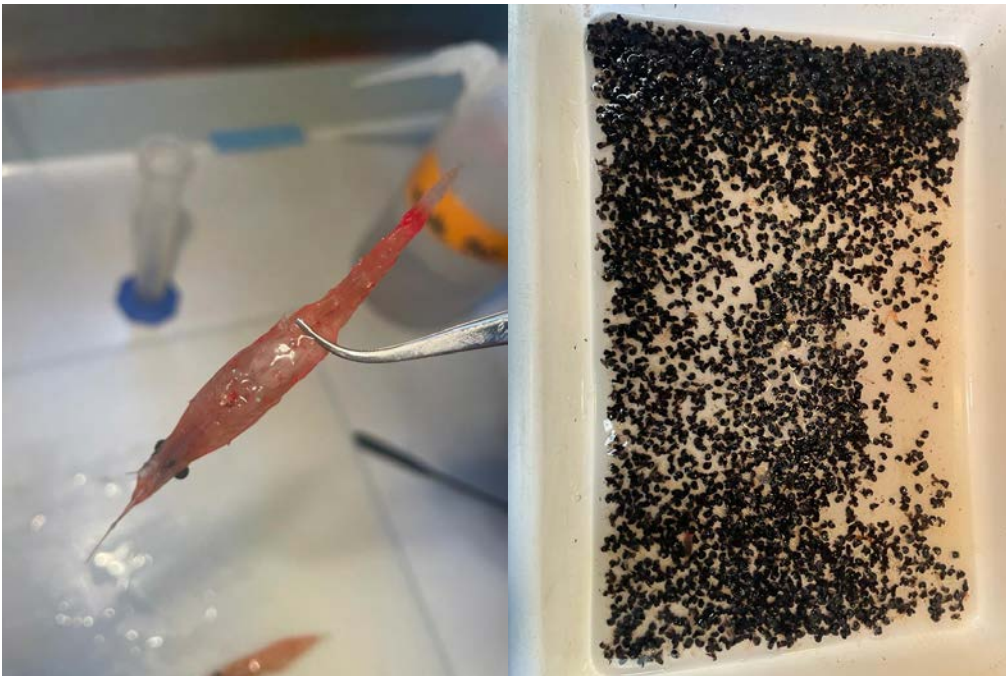


Figure 7: A mature female krill with eggs (left); A tray full of *Limacina* (right). Photo credit: Maya Thomas.

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

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

This week on the LMG the Van Mooy group continued sampling from the grid, completing the rest of the 600 line, as well as the 500, 400, and 300 lines. Samples from both underways and full CTD profiles (11 in total) were collected for our standard suite of samples for these stations, which include: lipids, carbs, particulate organic carbon (POC), nutrients, DIC/Alkalinity, oxygen

isotopes, and flow cytometry. This suite of measurements will help allow us to understand both carbon and energy cycling along the WAP, and comparisons with the long-term dataset will allow for parameterization of how biogeochemistry in the area is changing with climatic forcing in the area. Preparations are firmly underway for the next set of process station studies, which will include another set of PIT trap deployments, as well as diel CTD sampling of the euphotic zone. Although we are in a period of near constant daylight, we are sampling to see whether or not diel signals are maintained during this period. This sampling will complement studies undertaken during the LTER cruise last year, as well as day/night studies conducted at Palmer Station both this year and from 2020.

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

In our second week of the cruise, two additional grazing experiments were successfully completed at an offshore (500.200) and a shelf station (400.100). 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, 11 CTD casts were undertaken, most of which were in the Northern section of the LTER sampling grid (600, 500, 400 lines) and three of which were in the Southern section of the LTER grid (300 line).