

NBP 21-13: 15 Nov. 2021 – 22 Dec. 2021, PAL LTER Cruise #29

Weekly Science Report IV

(Dec. 5th to Dec 12th)

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

Overview (Carlos Moffat, Chief Scientist)

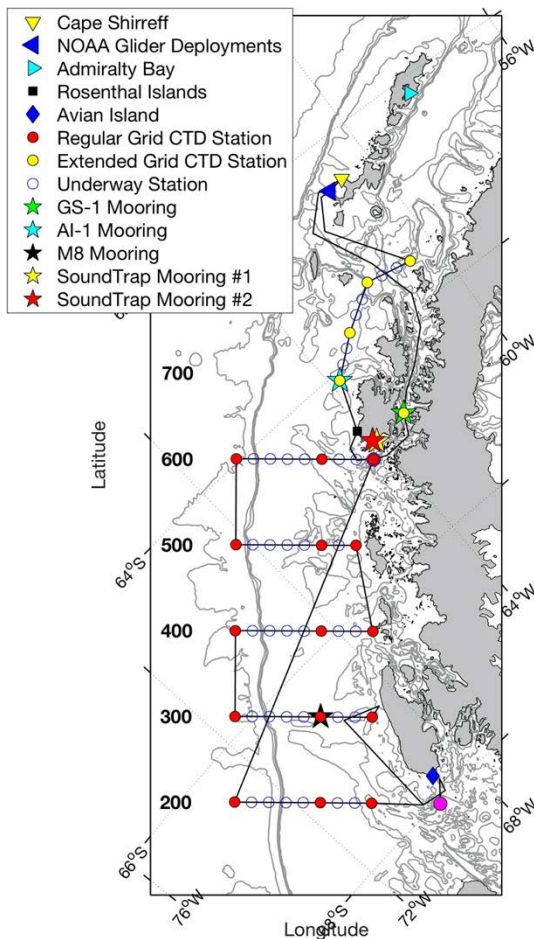


Figure 1: Cruise Plan. This week, we completed the first 4 stations (out of 5) of the extended grid, and the regular grid down to most of the 300 line.

During the third week of LTER science we finalized offshore zooplankton sampling using MOCNESS tows at the 300.200 station. We transited to the Palmer Station area and arrived on 12/8. During the following five days we conducted our process station at Palmer Deep, recovered two “SoundTrap” acoustic moorings and redeployed one, and finished censuses of a number of bird colonies in the Palmer area. The process station at Palmer Deep included full-depth CTD profiles, the deployment and recovery of drifting sediment traps, and conducting sub-diurnal (every 6 hours) water sampling to study diel variability.

For our final week of science activities before picking up our NOAA colleagues that have been working at Cape Shirreff, we are finalizing sampling along Gerlache Strait and recovering the two NOAA gliders we deployed during the first week of the cruise.

Group Reports

C-013 Seabirds (Megan Cimino, LTER PI, UCSC)

This week we were able to census Adelie and gentoo penguin populations and identify skua breeding pairs within the Palmer Station region, including Torgersen, Humble, Christine, Cormorant and Biscoe Islands. This is work that is typically conducted by the field team stationed at Palmer Station. At Biscoe, we outfitted penguins with geolocation dive recorders to monitor foraging behavior in lieu of Palmer Station based work. We processed diet samples in the lab and predator surveys continued to be conducted from the ship's bridge.

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C-024 Whales (Ross Nichols, Friedlaender Group, UCSC)

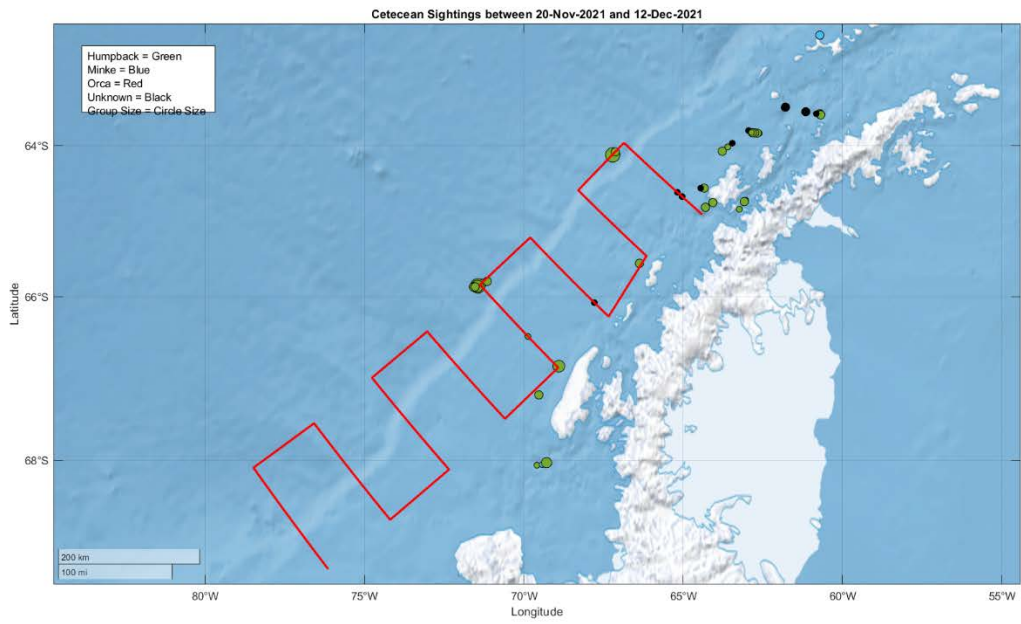
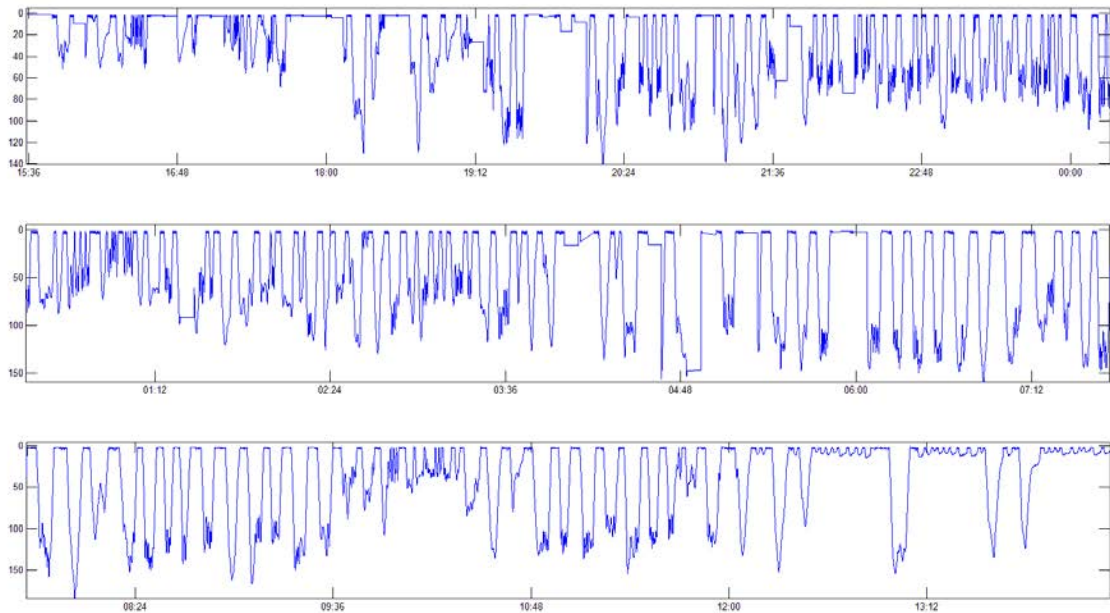
This week, the Whalers (Ross Nichols and Darren Roberts) continued to conduct bridge surveys of cetaceans and pinnipeds. This week, sighting totals for the LTER cruise total: three Antarctic Minke whales (Bb), ninety-four Humpback whales (Mn) and sixteen individuals of unknown cetacean species. Humpbacks sighted have continued to be found in an equal ratio of solo and groups of two individuals performing both travelling and foraging behaviors, although some groups of three and four have also been sighted. Thus far, no surface feeding or bubble netting has been observed. However, surfacing breaching has been sighted on now eight occasions. Photo identification data using fluke imagery has been collected on a total of six humpback whales.



In addition to surveys, the whalers collected 2 biopsies from humpback whales. We also deployed and recovered 1 CATS suction cup tag on an adult humpback whale (see photo). The tag was deployed in the Gerlache straight, west of Anvord Bay (-64.757637, -

63.069728) on 12/9/2021. The tag was recovered on 12/12/2021, on the continental shelf northwest of the deployment (-63.7832, -63.1506). The tag recorded motion (accelerometer, gyroscope, magnetometer), depth, GPS, temperature, light, audio as well as HD camera footage for select periods (Figure 2). The tag recorded data while on the animal for 22.5. The whalers have deployed using small boat operations multiple times thanks to the continued support of the ASC/ECO staff and crew, of which much of this work was made possible.

Finally, two moorings were recovered successfully by the whalers near the Palmer Station area. Each mooring was equipped with an acoustic release (Edgetech), an acoustic recorder (Soundtrap ST600) and a temperature probe (RBR solo). Some damage was observed between the two moorings: one of the acoustic recorders was unfortunately destroyed due to a possible leak and one acoustic release suffered minor but repairable damage. All other data was successfully acquired from the devices. One mooring was redeployed at -64.775833, -64.078612 with the same payload array as those that were recovered. A more detailed event report will be available in the final Cruise Report.



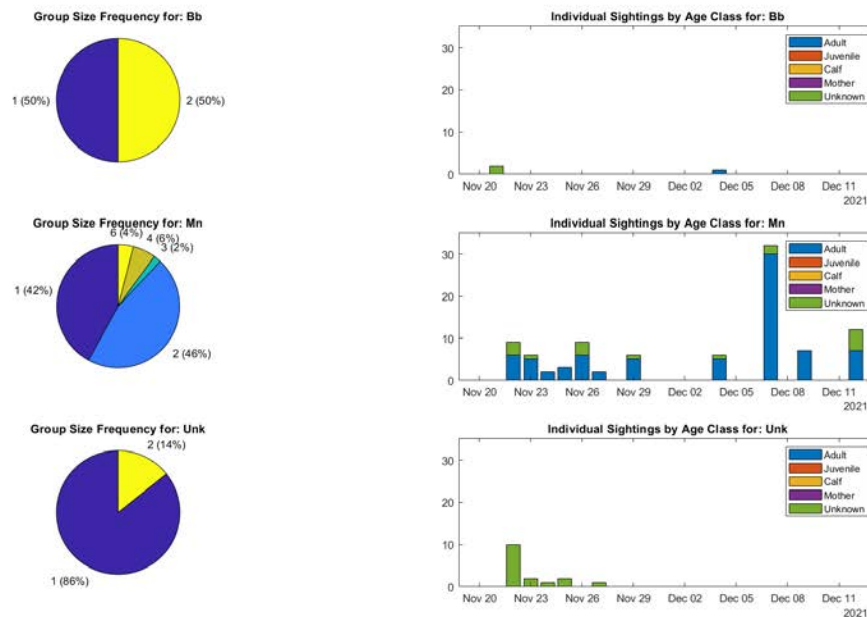


Figure 2: The dive profile for the duration of the entire CATS tag deployment (top). A map of cetacean sightings (middle) using bridge and small boat surveys in reference to the LTER grid. A sightings summary (bottom) of group size and species demographics, separated by species.

C-019 Phytoplankton (Jessie Taylor, Schofield Group, UCONN/Rutgers)

As of December 12, 2021, the phytoplankton team has sampled the LTER grid and two process stations. At the last LTER grid station 300.100, relatively diverse phytoplankton were captured with the Imaging Flow CytoBot (Figure 3). Radiometry measurements were taken on the bow during maximum daylight hours within 3-4 hours of solar noon. Two to four full CTD water collections were carried out at each process station, including stations 200.-040 near Avian Island and 300.040 at Palmer Deep. Full CTD water collection for each cast included filtration for chlorophyll-a, high performance liquid chromatography (HPLC), DNA, and phytoplankton absorption, Imaging Flow CytoBot analysis, and fluorometer measurements in the FiRe and PicoLiF instruments. At the end of the Palmer Deep process station, additional sampling of opportunity was conducted at three stations total in the East and West Bismark CTD sections, with water collection at surface depths and the depth of the maximum chlorophyll concentration. Filters were saved for HPLC and phytoplankton absorption spectra to pair with concurrent radiometry measurements taken on the bow.

Graduate student Quintin Diou-Cass carried out multiple light incubation experiments in the past week to study how phytoplankton respond to light conditions (Figure 4). His experiments included 1) a seven-day outdoor experiment, 2) a 24-hour outdoor experiment, and 3) an indoor incubator experiment that is ongoing. The first two experiments took place outside on the Helo deck of the NBP (Figure 2). All experiments involved low-light and high-light treatments using light-blocking mesh around bottles for low-light.

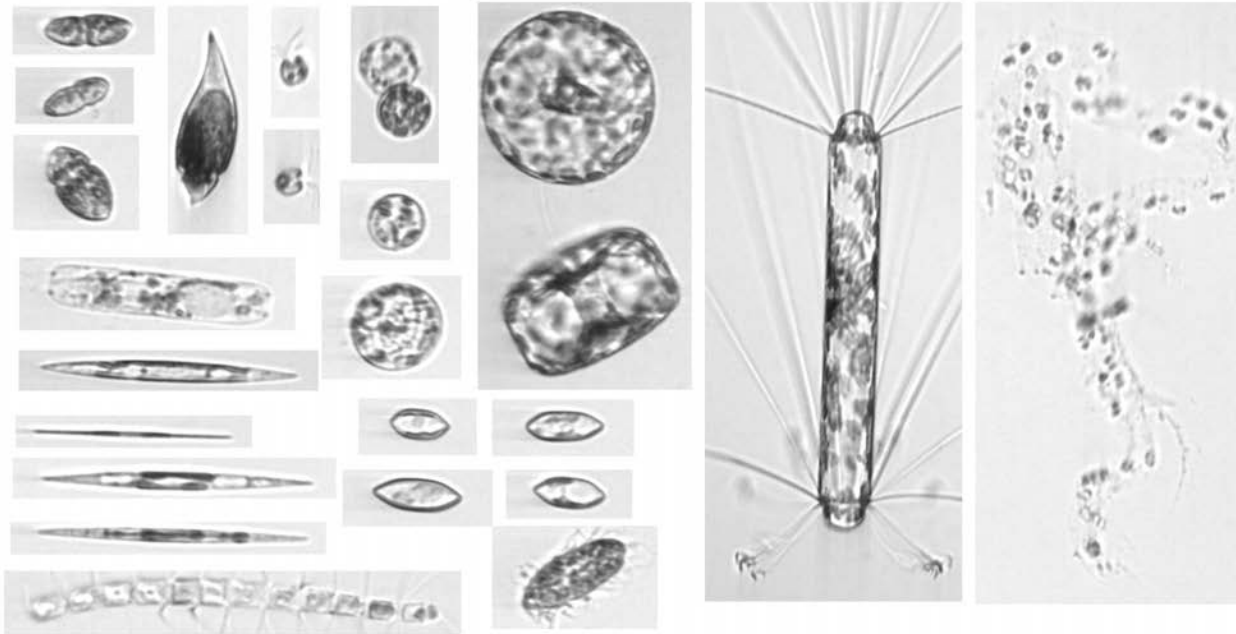


Figure 3. Imaging Flow CytoBot images collected at the last LTER grid station sampled, station 300.100, on December 6, 2021, including mixed flagellates, pennate and centric diatoms, ciliates, chain-forming diatoms, *Corethron sp.* diatoms, and *Phaeocystis sp.* haptophytes.



Figure 4. Incubation tanks on the Helo deck of the NBP used for the 24-hour outdoor light incubation experiment.

C-021 Physical Oceanography (Carlos Moffat, LTER PI, U. Delaware)

The glider deployed on November 25th in collaboration with NOAA made good progress and made two crossings of the Southern Bransfield Front (SBF), completing the goal of this mission. We expect to recover the glider this week.

We also completed a series of CTD sections around Palmer Deep. Exchange between this region and the surrounding shelf through Palmer Canyon and Gerlache Strait is poorly understood but critical to our efforts of understanding along-shore connectivity and the evolution of properties in this key biological hotspot. We collected hydrographic data along four high-resolution sections on the east (to Gerlache) and west (to Palmer canyon) access points to Palmer Deep. This week, we will be complementing these data with additional data along Gerlache Strait.

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

The Van Mooy group had an eventful week. We finished our iron and B₁₂ co-limitation trace metal clean incubation. Sampling for chlorophyll levels (100 mL onto 25 mm GF/Fs) occurred every other day, with the remaining volume being filtered at the end of the week.

During the process station at 600.040, a shallow CTD (100 meters) was conducted approximately every six hours. Sampling for lipids, carbohydrates, and RNA (in triplicate), as well as particulate organic carbon (POC), was conducted. We aim to determine if a diel cycle is maintained during the austral summer despite nearly constant daylight. We plan to look at both expression (RNA), and the standing stock of different energy storage pools (lipids and carbohydrates).

In addition to the diel study, we deployed two net traps. One was successfully recovered (from 50 meters depth after approximately 18 hours), while the other was torn during recovery and particles were not able to be recovered. Particles from the 50 meter nets appeared to be mainly fecal pellets, there was no marine snow observed. Degradation incubations have begun in the TBOD, which measures oxygen levels over time. Bottles will be sacrificed during the next three days to measure which lipids are degraded over time. We plan to calculate the turnover time of POC as well as specific groups of lipids that are biologically important (such as triacylglycerols, which are long term energy storage molecules). All experiments and filtering will be concluded by the end of the day on December 14th.

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

After leaving the southernmost portion of the LTER grid, we returned to 300.100 to complete our sampling of a shelf station along that line. A day/night pair of MOCNESS tows to 1000m was taken at 300.200. Along with the previous pair, we have a coastal and offshore set of tows for comparison in the southern grid. We finished the week with tows at several locations in the Palmer Deep area. Seven thermal tolerance experiments were conducted on nototheniid fish and icefish. Fecal pellet production experiments were completed on salps and Antarctic krill. Select animals were frozen at -80°C for gut fluorescence and other measurements. We wish to

thank the ASC/ECO staff and crew for their support and hard work that made this cruise a success.