PALMER STATION MONTHLY SCIENCE REPORT

FEBRUARY 2018

During the Laboratory Open House (1 Feb), Donna Patterson-Fraser explains the C-013-P Fraser group research efforts. *Image Credit: Randy Jones*

NEWS FROM THE LAB

Randy Jones, Summer Laboratory Supervisor

At the start of the month, Instrument Technician Carly Quisenberry hosted a Laboratory Open House for the Palmer community. Each of our grantee groups at Palmer Station gave short 5-10 minute presentations about their research work and field efforts so far this season. The presentations were well attended and provided community members a perspective into the day-to-day efforts of the grantees in the field and in the laboratory. Early February also marked the conclusion of the month-long LTER cruise aboard the ARSV *Laurence M. Gould*, which was very successful, and the departure of the B-256-P (Lee) group – whose members collected many *Belgica antarctica* for further studies upon return to Miami University in Ohio.

Educational outreach has been a theme throughout the season, but was especially active during February. Station members and scientists engaged with five tour ships that visited Palmer Station and one offshore lecture/Q&A session, in addition to a number of other yachts, sailboats, and military vessels. Grantees reached out to school groups about once per week using video chat to translate their work for a K-12 school audience.

Warmer temperatures and frequent glacier calving activity were typical for the month, which resulted in large quantities of brash ice and growlers in the harbor. Some periods even saw Hero

Inlet, Arthur Harbor, and the area between Palmer Station and Torgersen Island full of brash ice. By the end of the month, winter was not far off – February weather was generally overcast and/or stormy. Science groups prevailed to make it out in Zodiacs and aboard the RHIBs to complete their sampling objectives.

Near the end of the month, we welcomed the *Gould* back to Palmer bringing the B-022-P (Amsler/Baker/McClintock) group of chemical ecologists from the University of Alabama at Birmingham and University of South Florida. They quickly established the dive locker, aquarium, and laboratory setups, and began boating operations, dock diving, and small boat based diving within a week of arrival. The *Gould* departed Palmer to begin minke whale research efforts along the Antarctic Peninsula (C-024-L, Friedlaender), with a scheduled return in mid-March.

FEBRUARY 2018 WEATHER
Marissa Goerke, Research Associate

Palmer Monthly Met summary for February, 2018

Temperature
Average: 2.6 °C / 36.7 °F
Maximum: 9.7 °C / 49.5 °F on 21 Feb 22:26
Minimum: -2.5 °C / 27.5 °F on 19 Feb 09:51
Air Pressure
Average: 979.4 mb
Maximum: 996.4 mb on 19 Feb 14:14
Minimum: 959.7 mb on 14 Feb 02:26
Wind
Average: 9.9 knots / 11.4 mph
Peak (5 Sec Gust): 55 knots / 63 mph on 22 Feb 09:46 from NE (37 deg)
Prevailing Direction for Month: ESE
Surface
Total Rainfall: 35.1 mm / 1.38 in
Total Snowfall: 0 cm / 0 in
Greatest Depth at Snow Stake: 0 cm / 0 in
Sea Ice Observation: Only ice of land origin is visible, 1-5 bergs with growlers and bergy bits.
Average Sea Surface Temperature: 1.23 °C / 34.2 °F

Winds peaked at 63 mph on the 22nd and the average speed for the month was 11.4 mph. The prevailing wind direction for the month was from the east south east. Temperatures warmed to a peak of 49°F and reached a low of 27°F. No measurable snow has fallen. The glacier has been actively calving and only ice of land origin remains in the area.

B-022-P: THE CHEMICAL ECOLOGY OF SHALLOW-WATER MARINE MACROALGAE AND INVERTEBRATES ON THE ANTARCTIC PENINSULA

Drs. Charles Amsler and James McClintock, Principal Investigators, University of Alabama at Birmingham; Dr. Bill Baker, Principal Investigator, University of South Florida

Personnel on station: Charles Amsler, Margaret Amsler, Bill Baker, CJ Brothers, Michelle Curtis, Sabrina Heiser, James McClintock, Andrew Shilling

B-022-P arrived at Palmer on 20 February with LMG18-02. Initial efforts centered on setting up our lab space, dive locker, and our portion of the aquarium building as well as mandatory boat training.

Once we had completed boat training, weather prevented us getting from away from station until 25 February. However, our field efforts commenced with checkout dives at the pier on 22 February. The weather cleared on the 25th, allowing diving away from station each day the rest of the month and we completed 14 total dives in February.

The major focus of our field and laboratory work once we were able to get out revolved around a transplant/common-garden experiment that was initiated last May. In May, we deployed 14 concrete substrates (Fig. 1) at three different sites within the normal boating area. One of the

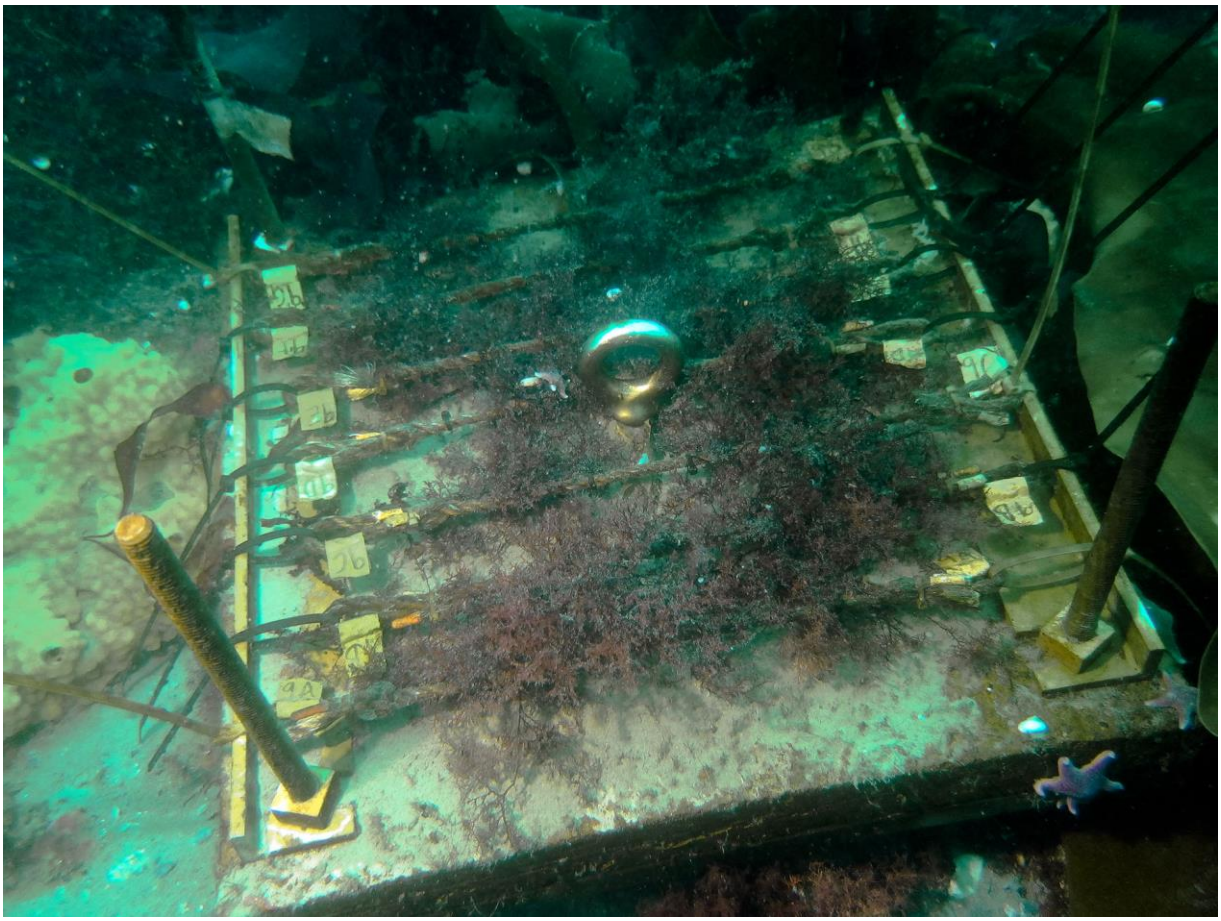


Fig. 1 – Concrete substrate and rack of ropes containing individuals of the red alga *Plocamium cartilagineum* that was outplanted in May 2017 by B-022-P as part of an experiment, as seen upon recovery in February 2018. (Photo Credit: Sabrina Heiser).

primary objectives of our NSF award focuses on the red alga, *Plocamium cartilagineum.* Individuals of *P. cartilagineum* have different combinations of defensive chemical compounds and we are trying to understand what drives this marked chemical diversity. Collections and subsequent chemical characterization using the station gas chromatograph last season indicated that variation in their chemical diversity is occurring at a relatively small spatial scale and we performed a spatially-intensive series of multiple transects at four locations. Chromatographic analyses from those collections informed our choice of a specific transect and depth at three of the sites (with two depths at one of the sites) for the common-garden/transplant experiment. After the 14 concrete substrates were positioned at these sites, racks containing 350 individual pieces of *P. cartilagineum* (attached to 98 short ropes, seven ropes per rack) were attached and left in place for the winter.

Relocating the substrates and determining if they had survived icebergs and storms during the winter was our top initial priority, and anticipation of what we might find was high. The joy of finding the first set completely intact is shown at the beginning of a video (https://youtu.be/vtbum6qkK5s) that is part of our project outreach this season (see new blogs every Monday, Wednesday, and Friday morning at http://www.uab.edu/antarctica/). All 14 substrates were ultimately found intact. By the end of February, a full set of racks/ropes with the *P. cartilagineum* from one site had been recollected, measured and sampled in the lab, and returned to the concrete substrates to be recollected a final time this coming May. A second set was recovered and initial lab processing begun on 28 February.

We are grateful for the generous and professional assistance of numerous ASC staff in assisting with our activities. Randy Jones, Carly Quisenberry, Dave Moore, Mike Burns, Jakob Bueche, and Bill Burns deserve special thanks for facilitating our laboratory and field efforts.

C-013-P: PALMER, ANTARCTICA LONG TERM ECOLOGICAL RESEARCH (LTER): LAND-SHELF-OCEAN CONNECTIVITY, ECOSYSTEM RESILIENCE, AND TRANSFORMATION IN A SEA-ICE INFLUENCED PELAGIC ECOSYSTEM – APEX PREDATOR COMPONENT

Dr. William R. Fraser, Principal Investigator, Polar Oceans Research Group, Sheridan, MT

Personnel on station: Ben Cook, Shawn Farry, Carrie McAtee, Donna Patterson-Fraser, Megan Roberts

On 6 February, the ARSV *Laurence M. Gould* made a brief return to Palmer Station with C-013-P/L team members Darren Roberts and Megan Roberts at the conclusion of a successful LTER cruise. In addition to ship based surveys and a week of intense data collection on Avian Island, the C-013-L cruise team also succeeded in conducting shore based penguin surveys on Hugo Island, Armstrong Reef, Prospect Point, and the Rosenthal Islands. On 8 February, the *Gould* departed Palmer Station with C-013-P/L team members Donna Patterson-Fraser and Darren Roberts.

Back in the Palmer Station area, Adélie penguin studies concluded this month with beach counts and measurements of Adélie fledglings. Adélie penguin foraging ecology studies were also concluded in February with the completion of our radio transmitter study on Humble Island.

Gentoo penguin satellite tag deployments, fledgling measurements, and diet studies on Biscoe Island and in the Joubin Islands were conducted in February and will continue into March.

Adélie penguin fledglings preparing to depart Humble Island. *Image Credit: Fraser Group*

Skua work continued through February with monitoring and banding of brown skua chicks on local islands as well as on Dream and Biscoe Islands. South polar skua reproductive monitoring on Shortcut Island continued throughout February as did the monitoring of the blue-eyed shag colony on Cormorant Island. Kelp Gull surveys and chick counts were also completed for local islands. Growth measurements of giant petrel chicks on Humble Island continued every other day during February and will continue until chick fledging in April.

As always, ASC provided outstanding science support this month. Special thanks to all the ASC and grantee field volunteers that assisted with Adélie fledgling measurements; to Lab Supervisor Randy Jones for coordinating the volunteer schedule; and a special thanks to Resident Marine Technicians Dave Moore, Mike Burns and Jakob Bueche for all the boating assistance.

C-019-P: PALMER, ANTARCTICA LONG TERM ECOLOGICAL RESEARCH (LTER): LAND-SHELF-OCEAN CONNECTIVITY, ECOSYSTEM RESILIENCE, AND TRANSFORMATION IN A SEA-ICE INFLUENCED PELAGIC ECOSYSTEM – PHYTOPLANKTON COMPONENT

Dr. Oscar Schofield, Principal Investigator, Rutgers University, Institute for Earth, Ocean, and Atmospheric Sciences, Department of Marine and Coastal Sciences

Personnel on station: Frank McQuarrie and Taylor Dodge

With a very successful February behind us, we look back proudly. The LTER cruise, aboard the ARSV *Laurence M. Gould*, came to an end and we said goodbye to Schuyler Nardelli, and welcomed Taylor Dodge to Station working as a Field Technician in our lab. The C-Ops radiometer is also back on station; the C-Ops is a deployable free-falling radiometer system used to track irradiance both downward and upward. Additionally the Imaging Flow Cytobot was moved back to Palmer at the end of the cruise.

Despite high winds and swells our biweekly sampling continued. Primary productivity has seen a few spikes over time with less of a downward trend than in most of January (Fig. 2).

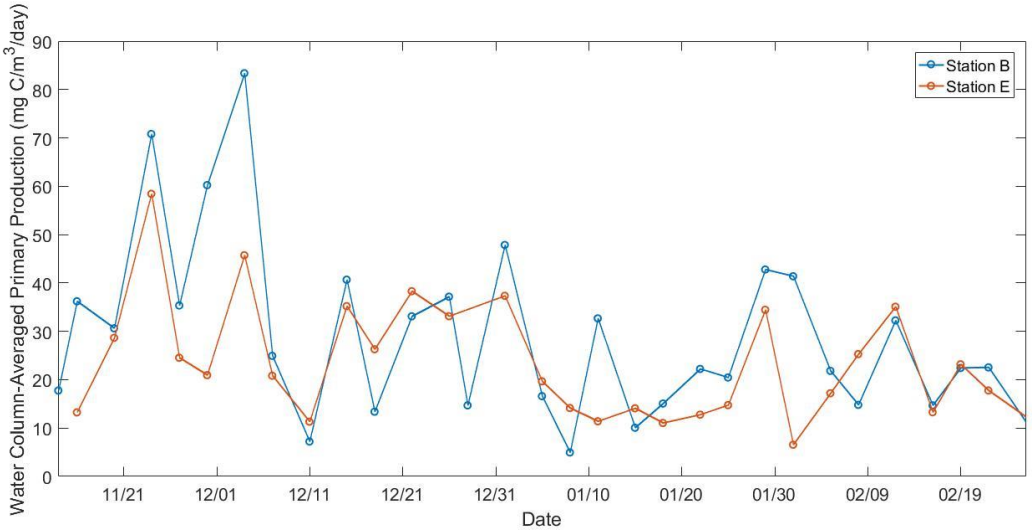


Fig. 2 – Water column-integrated primary productivity (mg C m^{-2} day^{-1}), sampled biweekly at Station B (blue) and Station E (orange) from November 14th, 2017 to March 1st, 2018.

The LTER transect studies were disjointed because of *Gould* arrivals and weather, but we did get two days' worth of acoustic and optical data along with our regular biological samples at depths inshore vs offshore. Another trip to Palmer Deep was also successful with the Steinberg zooplankton lab (C-020-P) and the Ducklow bacteria lab (C-045-P). On 17 February, we headed out on RHIB *Hadar* past our regular boating limits and gathered ecological data about the Palmer Canyon.

The cruise also brought us chlorophyll samples to analyze and have been spending much of our time in the red lights of the lab, having already analyzed 500 of the samples collected by several scientific projects on the *Gould*.

The ASC support staff are crucial to our lab's success and we are grateful for their work. The Marine Technicians and new RHIBs have changed our season for the better and we appreciate them working through any and all problems and requests that arrive; the Technicians are the definition of professional and flexible, both traits being essential when working in an environment like ours. Saying goodbye to the LTER cruise was bittersweet, but the science continues effectively and efficiently.

C-020-P: PALMER, ANTARCTICA LONG-TERM ECOLOGICAL RESEARCH (LTER): LAND-SHELF-OCEAN CONNECTIVITY, ECOSYSTEM RESILIENCE, AND TRANSFORMATION IN A SEA-ICE INFLUENCED PELAGIC ECOSYSTEM – ZOOPLANKTON COMPONENT

Dr. Deborah Steinberg, Principal Investigator, Virginia Institute of Marine Science, College of William & Mary

Field personnel: Jack Conroy and Kharis Schrage

The zooplankton community has shown interesting changes throughout the course of the season. We have found the Antarctic krill (*Euphausia superba)* and the pteropod *Limacina helicina* to be the dominant macrozooplankton species near Palmer Station this summer. However, both species have been scarce over recent weeks (Fig. 3a). When observed this month, *E. superba* individuals were larger than earlier in the season. Salps have been notably absent in our local net tows. We observed seasonal succession in the copepod community this year, with the herbivore *Calanoides acutus* declining in abundance while the omnivorous copepods from the family Clausocalanidae have grown more abundant (Fig. 3b). Recent tows have shown greater frequency of less abundant taxa that were more common early in the season. These groups include ostracods, chaetognaths, and the smaller krill species *Thysanoessa macrura*.

With the return of the C-019-P Imaging Flow Cytobot this month, we carried out two *E. superba* feeding selectivity experiments. It was valuable to obtain data on late season feeding as the phytoplankton biomass is lower than during earlier experiments, and the phytoplankton community structure has also evolved since mid-summer. Initial results suggest krill were grazing less efficiently on phytoplankton in the February experiments compared to mid-December and early January. A first pass through the data also hints at size-selective feeding.

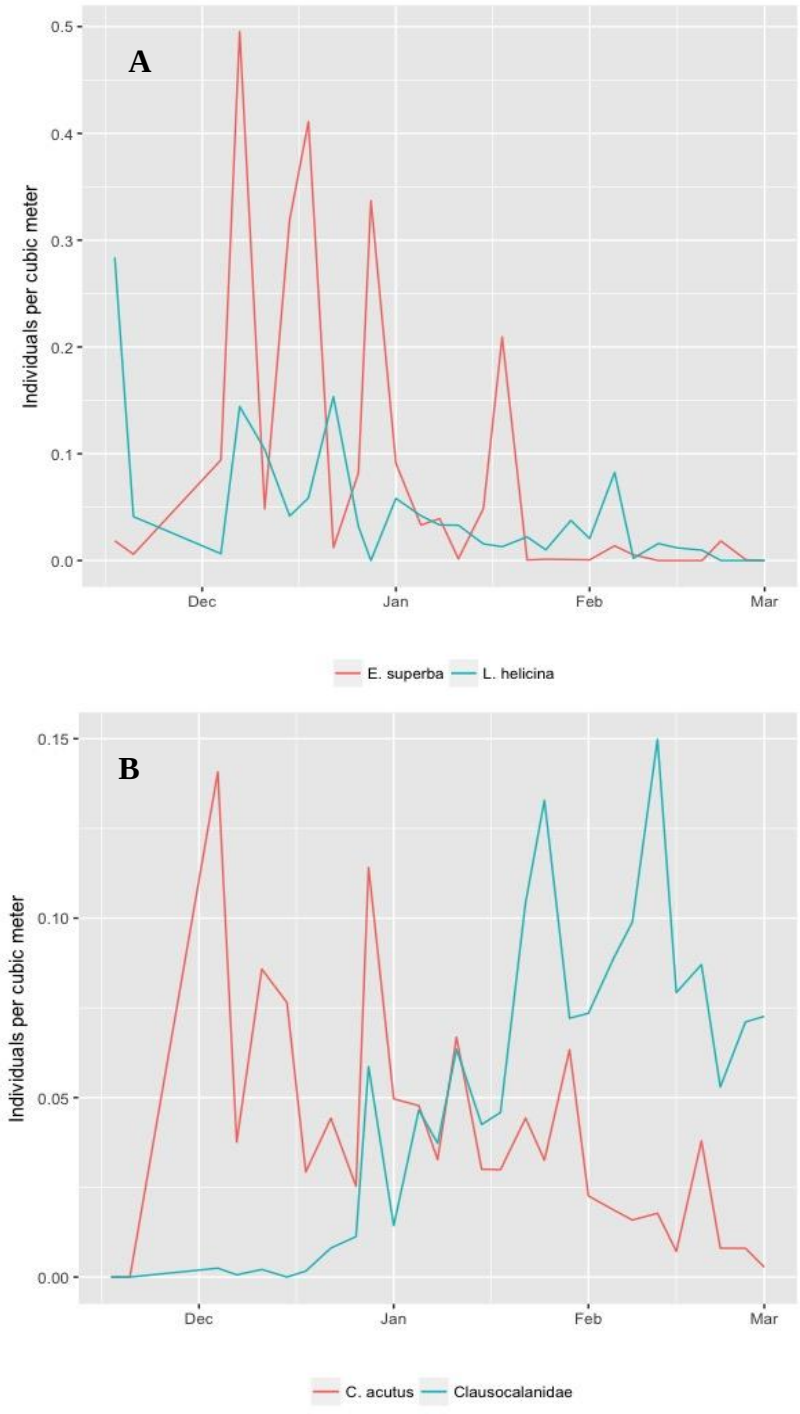


Fig. 3 – Average abundance of *Euphausia superba* (red, top), *Limacina helicina* (blue, top), *Calanoides acutus* (red, bottom), and Clausocalanidae (blue, bottom) from early December to late April.

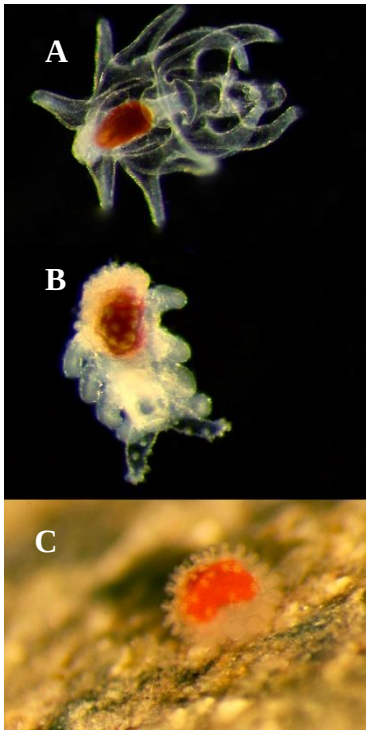


Figure 2. Sea star development: (A) larval brachiolaria stage, (B) metamorphosis into the juvenile stage, and (C) settlement.

We made our second sampling trip to the Palmer Canyon along with C-045-P and C-019-P. In mid-January there was a large krill swarm in the Canyon. However, in mid-February we found no large krill aggregations during our acoustic survey. In addition to plankton net tows we perform six CTD casts to 200m throughout the Canyon. This data will be valuable to understanding the physical dynamics that influence zooplankton and phytoplankton in coastal canyons, which serve as important predator foraging grounds and often exhibit elevated primary production along the western Antarctic Peninsula.

In mid-February, we collected about 50 sea star larvae in a net tow at LTER Station E. They are most likely *Odontaster validus*, the most common sea star in the waters around Palmer Station. Upon collection, they were in their last larval stage, brachiolaria (Fig. 4a). Kharis Schrage has been maintaining about thirty individuals in our laboratory. Last week these animals began metamorphosing into the juvenile stage (Fig. 4b). This process includes development of the rudiment (yellow part next to the red gut) and brachiolar arms (the bumpy arms at the bottom) while reabsorbing much of their body. Only those offered substrate (a rock covered with algae and biofilm from the intertidal zone) have completely settled and are developing pentaradial symmetry, the recognizable sea star body layout (Fig. 4c). We were excited to share this serendipitous finding with the benthic ecologists (B-022-P) who arrived at Palmer Station this month!

C-024-P: PALMER, ANTARCTICA LONG-TERM ECOLOGICAL RESEARCH (LTER): CLIMATE MIGRATION, ECOSYSTEM RESPONSE AND TELECONNECTIONS IN AN ICE-DOMINATED ENVIRONMENT, WHALE COMPONENT

Dr. Ari Friedlaender, Principal Investigator, Oregon State University, Newport, OR

Personnel on Station: Greg Larsen and Ross Nichols

For the month of February, the whale researchers (Greg Larsen and Ross Nichols) stationed at Palmer as part of the LTER project, have continued two primary projects that involve humpback and minke whale photo id/biopsy sampling and active acoustic prey mapping. Our work this month has been supplemented by one additional researcher on the LMG18-01 research cruise (Dr. Doug Nowacek) in the beginning of the month and a team of seven researchers on the LMG18-02 research cruise at the end of the month. These teams have been collecting complementary sets of sighting records, biopsy samples, unmanned aerial vehicle (UAV) photogrammetry, and active acoustic prey mapping transects. Following the LMG18-01 port call on 8 February, we were able to carry out necessary repairs/reconfiguration to our UAV platform in order to resume on-station operations. Now that we have thoroughly tested the repaired craft on land we have resumed on-the-water UAV field operations and we plan to collect our first UAV photogrammetry data in the coming week. Following the arrival of the LMG18-02 port call

on 20 February, we provided our echosounder equipment to the research cruise and have discontinued Palmer Station based prey mapping data until the next LMG18-02 port call on 16 March. Nevertheless, we continue to coordinate with project C-020-P to share prey mapping data between projects as they continue echosounder operations from the RHIB research platform.

This month we experienced a marked decline in weather conditions and sighted whales, with frequent high winds and several periods during which few whales and low amounts of krill were observed by our team and the other teams that regularly transit the boating area. We note, anecdotally, that most of the whales we have encountered during these 'low krill' periods have been mother-calf pairs transiting or feeding in shallow waters and adult whales transiting through the boating area, with very few adult whales actively foraging alone or with other adults. Since January we have spent a total of ~193 hours on the water surveying and collected 36 skin blubber biopsy samples, of which 35 are from humpback whales and 1 is from a minke whale. These samples will be used for genetic and hormone analyses to characterize and assess changes in baleen whale population demography. We have encountered a total of 147 whales this season, of which 132 were humpback whales, 7 were minke whales and 8 were killer whales.

Over the course of our 132 humpback whale encounters, we have been able to collect 104 high quality fluke photos that will be used to catalog individuals of this population and track them from year to year, as well as the 35 biopsy samples previously mentioned. These numbers can be compared to 59 fluke catalog entries and 72 biopsy samples that were collected at Palmer Station by this time last year. We note that our biopsy numbers are significantly lower this year because our team has been sharing our total permitted amount of biopsies with multiple other teams collecting samples for our project around the Antarctic Peninsula, so we deliberately forewent this sample collection for an entire month. Among our fluke photographs we have identified two humpback whales so far that have been seen previously in this area: these were identified as individuals Mn17_030A_P and Mn16_089D_P, respectively (Fig. 5), and skin and blubber

Mn17_030A-P

Mn18_008A_P

Mn16_089D_P

Mn18_035A_P

Fig. 5 – Resighted humpback whales seen and sampled in previous seasons (left) and resighted/resampled this year (right), identified using our fluke photo ID catalog. (Photo Credits: Friedlaender Group).

biopsy samples were obtained for each for cross-year comparison of hormone levels and skin microbiome.

Since our previous update, we have encountered 4 additional minke whales, bringing us to a season total of 7 minke whale sightings and 1 minke whale biopsy. We attribute this paucity of minke biopsy samples to the species' characteristically illusive and highly variable swimming behaviors, which makes encounters with minke whales typically brief to the degree that biopsy is difficult or impossible. Nevertheless, from our sightings we are able to record the temporal, spatial, and behavioral context of the whale, which can help us to characterize when, where, and how minke whales inhabit the waters around Palmer Station.

Our singular encounter with killer whales (Fig. 6) took place on 28 February when a pod of eight

Fig. 6 – Example photographs from our encounter with Gerlache killer whales on 28 February 2018. Rake-mark scars (top), eye patches (bottom), saddle patches, and dorsal fins (both images) are some of the individual-specific marking that can be used to identify individuals within a population. (Photo Credits: Friedlaender Group).

Whales (Gerlache/Type-B [small] ecotype) entered the southern boating area. We noted two bull males, one calf, and five juvenile and/or female killer whales in this group, and we were able to document some identifiable features on several individuals including eye-patches, saddle-patches, dorsal fins, errant coloration marks, and miscellaneous scars (Fig. 6). We are currently sorting these photographs and will send any potentially useful photographs with our sighting data to our colleague John Durban at NOAA's Southwest Fisheries Science Center, who is studying this population.

The whale team has performed 17 active acoustic surveys since arriving at Palmer Station, nine of which were performed in the month of February. High brash ice and inclement weather impacted our abilities to survey some areas throughout this month. We saw a large decline in krill abundance when compared to our January surveys in all locations. Krill patches in February were generally found in deeper water, smaller in size and less frequent at all four of our standard transects within the boating limits around Palmer Station. Both surface and deep water krill patches have shown a measured reduction in comparison to our measurements in January.

We have continued our supplementary efforts to catalog leopard seals as they are found hauled out in the boating area, but their occurrence is highly variable, depending on the amount of brash ice and the presence of suitably sized bergy bits. Although our sample size from this year will likely be too small to significantly advance our desired long-term results, they will undoubtedly be sufficient to allow us to design and populate a database for continued future efforts to characterize the leopard seal population around Palmer Station.

Finally, this month we participated in a variety of public outreach and science communication events. With the assistance of our LTER outreach coordinator and Palmer Station IT support, we hosted two video teleconferences for three classrooms around the country each time, with students ranging 9–13 years of age. These teleconferences lasted 40–50 minutes, during which time students presented 15–18 prepared questions that we answered conversationally through a webcam/teleconference setup. These events went very smoothly, and the coordinator and teachers all seemed very pleased with the outcomes. Additionally, we attended an outreach visit to the MS *Prinsendam* cruise ship, where we participated in two question-and-answer panels with cruise ship passengers on behalf of the scientific research effort of the Palmer LTER. We have also attended several 'meet and greet' events on station when cruise ships and yachts have made port calls at Palmer Station and we have not been immediately engaged in field operations. During these events we have fielded questions from guests on station in a casual, conversational setting, once again representing the scientific research effort of the Palmer LTER. On one such visit, we also gave a brief tour of Palmer Station to staff from a visiting cruise.

C-045-P: PALMER, ANTARCTICA LONG-TERM ECOLOGICAL RESEARCH (LTER): LAND-SHELF-OCEAN CONNECTIVITY, ECOSYSTEM RESILIENCE, AND TRANSFORMATION IN A SEA-ICE INFLUENCED PELAGIC ECOSYSTEM – MICROBIAL / BIOGEOCHEMICAL COMPONENT

Dr. Hugh Ducklow, Principal Investigator, Columbia University, Lamont Doherty Earth Observatory

Personnel on Station: Rebecca Trinh and Marie Zahn

February proved to be a full month with many different projects taking place. We continue to measure bacterial production using radiolabeled leucine with our usual Monday/Thursday sampling. February marked some of the lowest rates we have seen this year. Figure 7 shows depth integrated leucine incorporation rates at Station E for December (green), January (orange), February (blue), and our first sample point in March (purple). Bacterial production steadily rises from December 2017 to January 2018 (Fig. 7). Figure 8 shows the expected decrease in

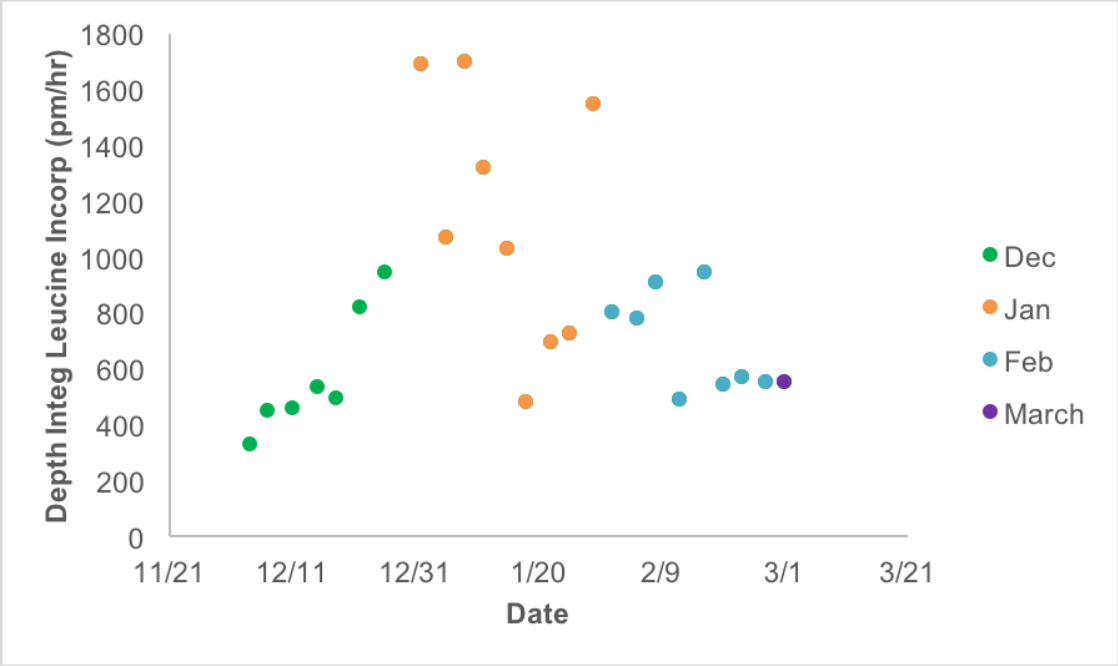


Fig. 7 – Graph depicting depth integrated bacterial production rates (pm hr^{-1}) for Station E from December 2017 to 1 March, 2018.

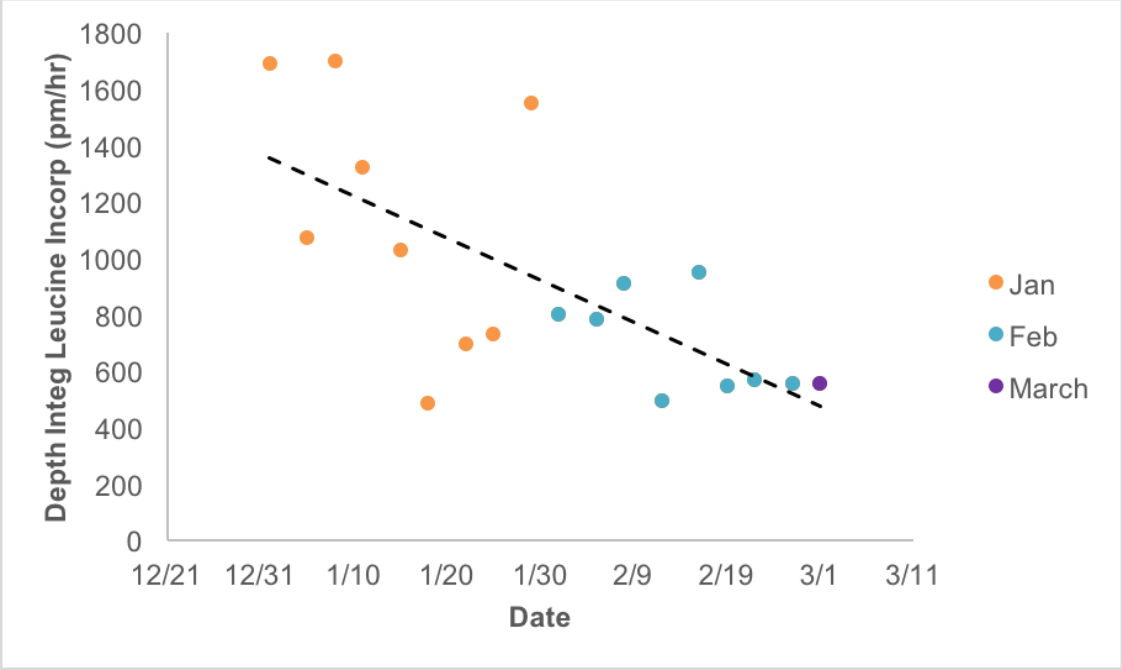


Fig. 8 – Graph depicting depth integrated bacterial production rates (pm hr^{-1}) for Station E from January 2018 to 1 March, 2018.

bacterial production from January to March as we move away from the austral summer season into winter. Station B data, although not graphically depicted here, showed a similar progression over the season.

On 17 February, LTER groups C-045-P, C-019-P, and C-020-P were able to sample from Palmer Canyon for a second time in search for krill swarms. Unfortunately, no substantial swarms were found using the EK80 echosounder, but we were able to map the region again and sample from two transects, named "Line 1" and "Line 2." For each line, we conducted three deep CTD casts to 200m (a total of six casts), one on the north wall (~500m deep), one in the middle (~1000m deep), and one on the south wall (~500m deep) of the canyon. We drew water at 5m and 20m at all six locations, as well as 200m for the middle (deep) canyon locations. Bacterial production data showed higher rates on the north wall locations for both Line 1 and 2 when compared to the south wall, and as expected, surface water was more productive than deep water (Fig. 9).

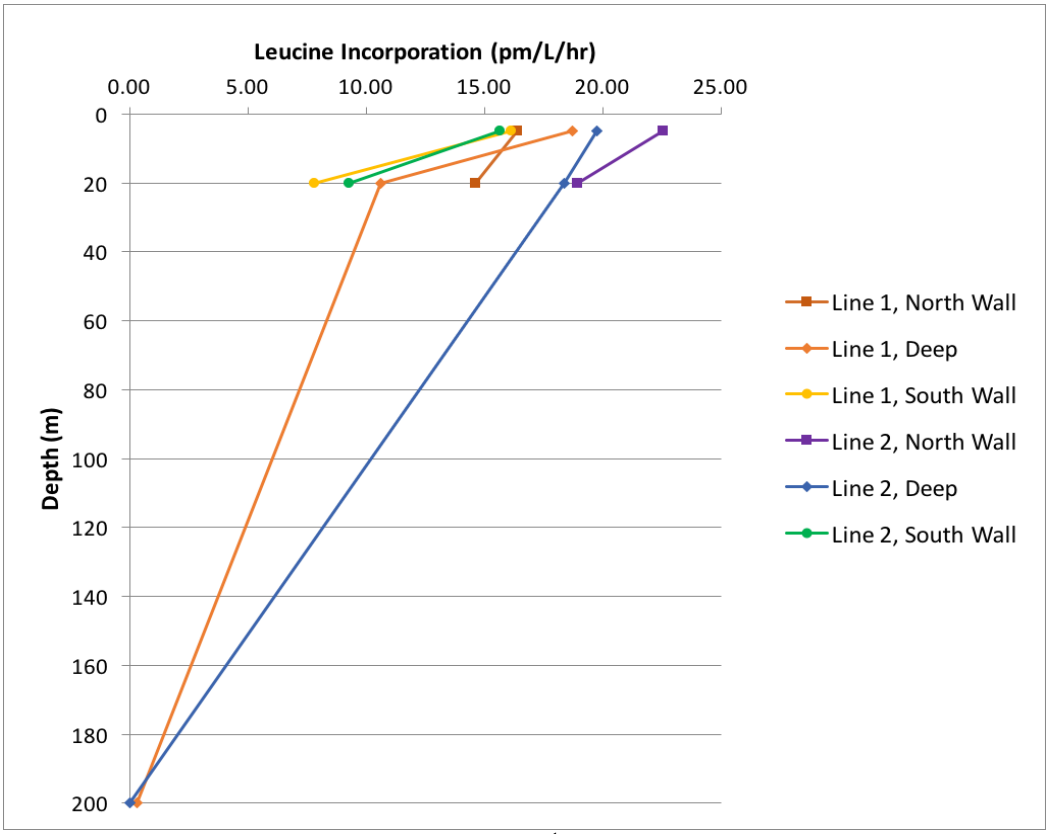


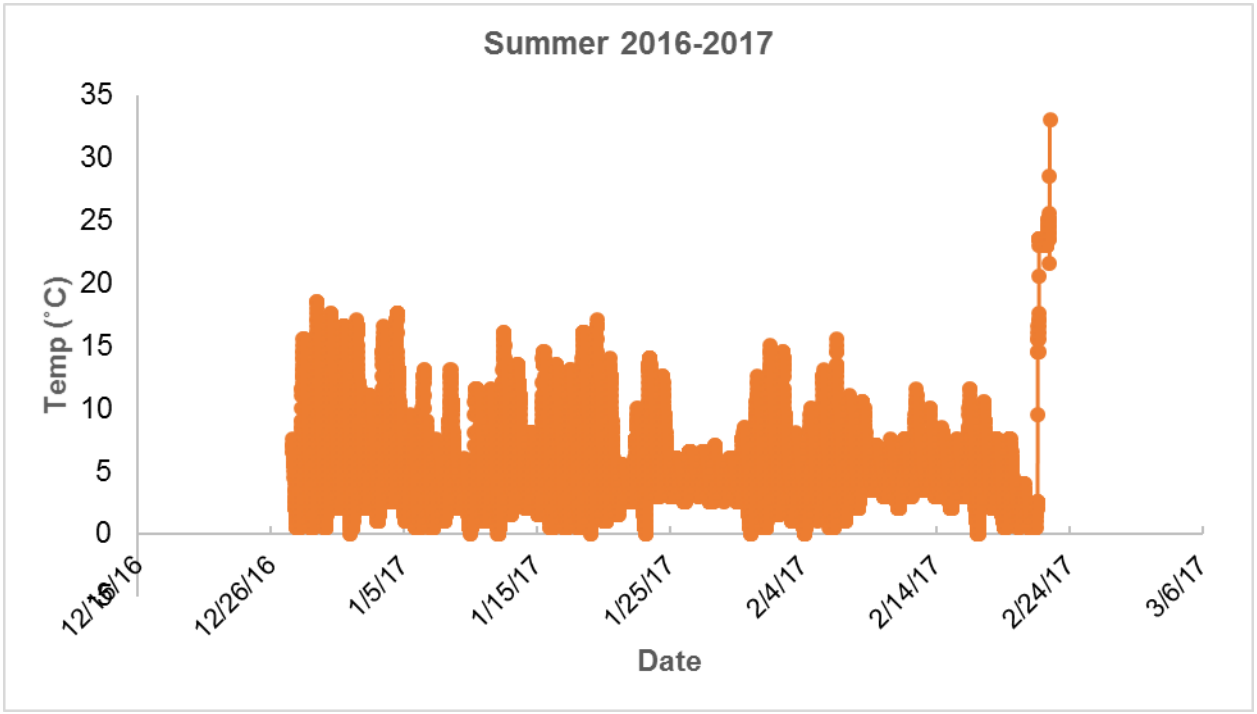
Fig. 9 – Graph of bacterial production rates (pm hr^{-1}) for two Palmer Canyon transects (Line 1 and 2) with three casts each (North, Deep, and South Wall).

In addition to our standard biweekly sampling this month, we ventured into the Palmer Backyard and retrieved ten soil temperature loggers that were buried last year (Fig. 10). They were first deployed in 2014 at five locations in a transect 0, 75, 150, 225, and 300 meters away from the

Fig. 10 – Rebecca (left) and Marie (right) recovering temperature loggers in the backyard. (Photo Credit: Ducklow Group).

base of the glacier towards station. Temperature data from the end of December 2016 to the end of February 2017 rarely dipped below freezing, ranging from 0 to 18˚C (Fig. 11A). This past year's data is more complete, showing a gradual drop in temperature during the winter from late March 2017 to the end of September 2017, reaching a low of -11˚C. Throughout October to December 2017, the temperatures rose again and remained steady (0-16˚C) up until our recovery of the loggers on 15 February 2018 (Figure 5B). The high temperatures at the end and beginning of each dataset are due to deploying and recovery of temperature sensors from the soil.

A.



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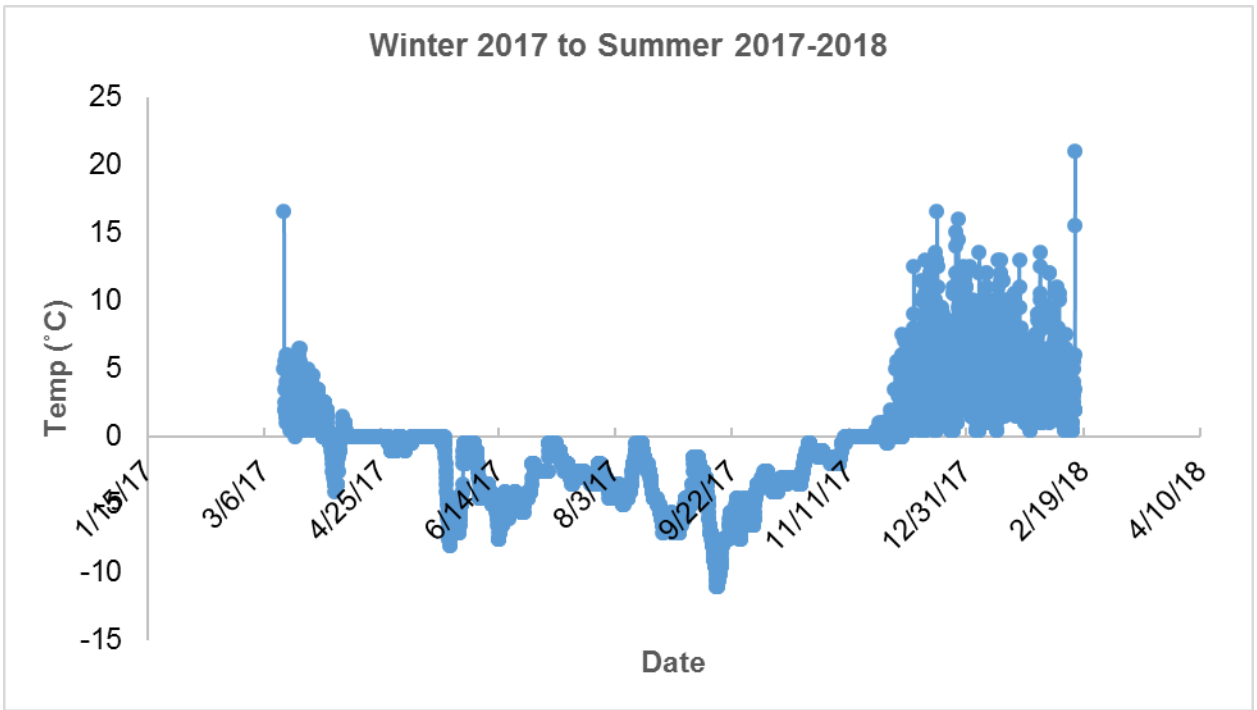

Fig. 11 – Graphs showing soil temperatures (˚C) for (A) December 2016 to February 2017, and (B) March 2017 to February 2018.

This month Rebecca returned from the month-long LTER cruise and began setting up her experiments at Palmer. Along with C-045-P Monday/Thursday sampling, Rebecca and Jack Conroy have been able to go out the past three Tuesdays to collect krill for her fecal pellet experiments. She has been measuring bacterial production rates associated with the krill fecal

pellets, as well as bacterial respiration rates. Below is a figure that demonstrates the bacterial draw down of oxygen in the presence of fecal pellets over two days (Fig. 12). It is expected that the respiration rate of bacteria in the presence of fecal pellets will be much higher than for bacteria with no fecal pellets. Additionally, she has begun extracting bacterial DNA from the krill fecal pellets and from whole-water samples taken from the CTD.

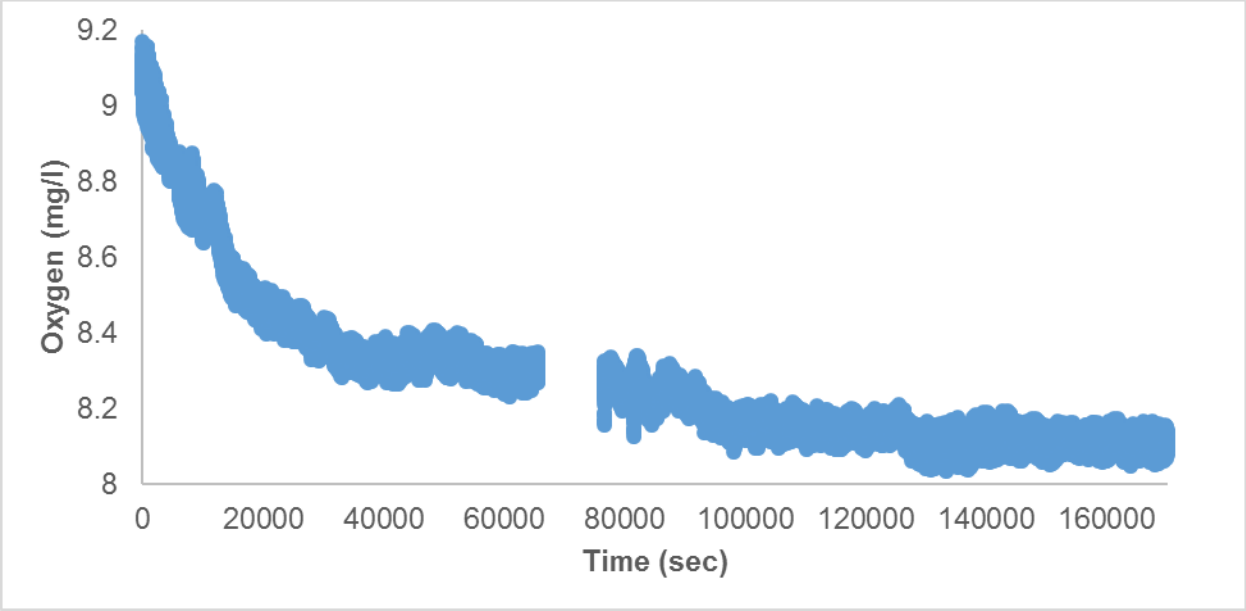

Fig. 12 – Graph showing bacterial respiration in the presence of fecal pellets measured by oxygen decrease (mg L^{-1}) over two days.

Finally, as the summer season nears its end, we began organizing and making plans to pack up our lab and send instruments and samples back to New York. Marie will be leaving station on 16 March, and Rebecca will stay until LMG18-03, which departs Station 5 April. This season's sampling efforts have been exceptionally complete with only two days where we could only safely sample from Station B out of a total of 32 sampling days to date and two additional Palmer Canyon visits. Only a few more weeks remain, but this season is expected to reach record numbers for samples obtained.

PALMER STATION
RESEARCH ASSOCIATE MONTHLY REPORT
February 2018
Marissa Goerke

G-090-P: GLOBAL SEISMOGRAPH NETWORK (GSN) SITE AT PALMER STATION

Kent Anderson, Principal Investigator, Incorporated Research Institutions for Seismology (IRIS)

Station PMSA is one of more than 150+ sites in the GSN, monitoring seismic waves produced by events worldwide. Real-time telemetry data is sent to the U.S. Geological Survey (USGS). The Research Associate operates and maintains on-site equipment for the project.

The system operated normally throughout the month.

A-111-P: THE NEXT GENERATION OF GEOSPACE RESEARCH FACILITIES AT PALMER STATION

Andrew Gerrard, Principal Investigator, New Jersey Institute of Technology

The ionosphere-thermosphere-magnetosphere (ITM) region of Earth's atmosphere, which is part of the larger geospace environment, is the portal through which the solar wind can enter and impact our planetary system. Though space weather research over the past decades has greatly increased our understanding of a wide variety of phenomena associated with ITM physics, the sum of these individual processes occurring in the geospace environment does not replicate the rich diversity and scope of this complex region. Thus, a more holistic approach to ITM research is necessary, one that integrates clustered instrumentation at multiple locations to simultaneously look at the interactions within the entire system. Using coordinated and collaborative instrumentation currently installed in Antarctica, researchers will study interrelated ITM phenomena observed at high latitudes. The goal of this research effort is a better understanding of the energy transfer and modulation of the geospace system.

The system operated normally throughout the month.

A-119-P: CONTINENTAL-SCALE STUDIES OF MESOSPHERIC DYNAMICS USING THE ANTARCTIC GRAVITY WAVE INSTRUMENT NETWORK (ANGWIN)

Michael Taylor, Principal Investigator, Utah State University

The Antarctic Gravity Wave Imaging Network (ANGWIN) is a cooperative effort of six international Antarctic programs to collect continent-wide gravity wave measurements. This network capitalizes on existing optical and radar measurement capabilities at McMurdo, Palmer, South Pole, and six other research stations: Halley (UK), Syowa (Japan), Davis (Australia), Rothera (UK), and Ferraz (Brazil). Infrared (IR) all-sky mesospheric OH (hydroxyl) imagers are installed at Davis, McMurdo, and Halley stations. The network quantifies the properties, variability, and momentum fluxes of short-period (less than one hour) mesospheric gravity waves and their dominant sources and effects over the Antarctic continent. An all-sky near-IR imager is also installed at Palmer Station to augment the existing instrumentation and create a capability for studying gravity wave properties at each site.

The IR camera has been turned back on and set up for the winter season. The camera has operated normally since data acquisition began.

A-373-P: TROPOSPHERE-IONOSPHERE COUPLING VIA ATMOSPHERIC GRAVITY WAVES
Vadym Paznukhov, Principal Investigator, Boston College

The goal of this project is to enhance the comprehensive research understanding of troposphere-ionosphere coupling via Atmospheric Gravity Waves (AGWs) in the Antarctic region. Both experimental and modeling efforts will be used on the Antarctic Peninsula to investigate the efficiency and main characteristics of such coupling and will address several questions remaining in the current understanding of this coupling process.

The system operated well throughout the month.

O-202-P: ANTARCTIC METEOROLOGICAL RESEARCH CENTER (AMRC) SATELLITE DATA INGESTOR
Mathew Lazzara, Principal Investigator, University of Wisconsin

The AMRC computer processes satellite telemetry received by the Palmer Station TeraScan system, extracting Automated Weather Station information and low-resolution infrared imagery and sending the results to AMRC headquarters in Madison, WI. The Research Associate operates and maintains on-site equipment for the project.

The data ingestor computer system operated normally until November 22, 2017 when the TeraScan system was upgraded and the two systems became incompatible. The AMRC data ingestor will remain down until further notice.

O-264-P: A STUDY OF ATMOSPHERIC OXYGEN VARIABILITY IN RELATION TO ANNUAL DECADAL VARIATIONS IN TERRESTRIAL AND MARINE ECOSYSTEMS
Ralph Keeling, Principal Investigator, Scripps Institution of Oceanography

The goal of this project is to resolve seasonal and interannual variations in atmospheric O_2 (detected through changes in O_2/N_2 ratio), which can help to determine rates of marine biological productivity and ocean mixing as well as terrestrial and oceanic distribution of the global anthropogenic CO_2 sink. The program involves air sampling at a network of sites in both the Northern and Southern Hemispheres. The Research Associate collects samples fortnightly from Terra Lab.

Air samples were taken twice this month. Four boxes of flasks were received.

O-264-P: COLLECTION OF ATMOSPHERIC AIR FOR THE NOAA/GMD WORLDWIDE FLASK SAMPLING NETWORK
Don Neff and Steve Montzka, Principal Investigators, National Oceanic and Atmospheric Administration / Global Monitoring Division; Boulder, CO

The NOAA ESRL Carbon Cycle Greenhouse Gases (CCGG) group makes ongoing discrete measurements to document the spatial and temporal distributions of carbon-cycle gases and provide essential constraints to our understanding of the global carbon cycle. The Halocarbons and other Atmospheric Trace Species (HATS) group quantifies the distributions and magnitudes of the sources and sinks for atmospheric nitrous oxide (N2O) and halogen containing compounds. The Research Associate collects weekly air samples for the CCGG group and fortnightly samples for the HATS group.

CCGG samples were taken once a week in favorable winds and HATS Air samples were taken every other week.

A giant petrel chick on Humble Island. *Image Credit: Randy Jones*

O-264-P: ULTRAVIOLET (UV) SPECTRAL IRRADIANCE MONITORING NETWORK
James Butler, Principal Investigator, National Oceanic and Atmospheric Administration / Global Monitoring Division; Boulder, CO

A Biospherical Instruments (BSI) SUV-100 UV spectroradiometer produces full sky irradiance spectra ranging from the atmospheric UV cutoff near 290nm up to 605nm, four times per hour. A BSI GUV-511 filter radiometer, an Eppley PSP Pyranometer, and an Eppley TUVR radiometer also continuously measure hemispheric solar flux within various spectral ranges. The Research Associate operates and maintains on-site equipment for the project.

The system operated normally throughout the month. Bi-weekly calibrations were completed as necessary.

T-295-P: GPS CONTINUOUSLY OPERATING REFERENCE STATION
Joe Pettit, Principal Investigator, UNAVCO

Continuous 15-second epoch interval GPS data files are collected at station PALM, compressed, and transmitted to the NASA-JPL in Pasadena, CA. The Research Associate operates and maintains on-site equipment for the project.

The system operated normally throughout the month.

T-312-P: TERASCAN SATELLITE IMAGING SYSTEM

The TeraScan system collects, processes, and archives DMSP and NOAA satellite telemetry, capturing approximately 25-30 passes per day. The Research Associate operates and maintains on-site equipment for the project. The TeraScan weather and ice imagery is used for both research and station operations.

The system operated normally throughout the month.

T-998-P: INTERNATIONAL MONITORING STATION (IMS) FOR THE COMPREHENSIVE NUCLEAR TEST BAN TREATY ORGANIZATION (CTBTO)
Managed by General Dynamics

The IMS Radionuclide Aerosol Sampler and Analyzer (RASA) is part of the CTBTO verification regime. The automated RASA continually filters ambient air and tests for particulates with radioisotope signatures indicative of a nuclear weapons test. The Research Associate operates and maintains the instrument.

The system operated normally throughout the month.

OCEANOGRAPHY
Daily observations of sea ice extent and growth stage are also recorded, along with continuous tidal height, ocean temperature, and conductivity at Palmer's pier.

Observations of sea ice around station were made daily and the tide gauge worked well throughout the month.

METEOROLOGY
The Research Associate acts as chief weather observer, and compiles and distributes meteorological data. Weather data collected using the automated electronic system is archived locally and forwarded once per month to the University of Wisconsin for archiving and further

distribution. Synoptic reports are automatically generated every three hours by the Palmer Meteorological Observing System and emailed to the National Weather Service for entry into the Global Telecommunications System.

The local weather station (PAWS) is working well. The Joubins temperature sensor has been fixed and reinstalled. The removal of the old system (Palmos) from Gamage Point is complete. Observations are archived on the AMRC website: ftp://amrc.ssec.wisc.edu/pub/palmer/.