

# PALMER STATION MONTHLY SCIENCE REPORT



**Sunset colors with Bonaparte Point in the foreground.** *Image Credit: Randy Jones*

## **NEWS FROM THE LAB**

Randy Jones, Summer Laboratory Supervisor

As the summer season comes to a close, with dwindling daylight and increasingly stormy weather, it's time to reflect on the summer science season and the opportunities and challenges we encountered. The RHIBs, *Rigil* and *Hadar*, have proven to be transformative platforms for science operations and have allowed us to reach out beyond our standard boating areas, including the Palmer Canyon, thanks largely to our Marine Technicians (Jakob Bueche, Mike Burns, and Dave Moore).

In addition to supporting grantees and their science, Carly Quisenberry (Instrument Technician) and Marissa Goerke (Research Associate) have made excellent contributions to several large projects this month. The meteorological station, tower, and anchoring hardware at Gamage Point were removed (having been replaced by the Backyard Automated Weather Station or AWS). Planning and site visits have been completed for a new AWS to be installed in the Gossler Islands to support research activities in that region. And, the first phase of the replacement of the Instrument and Consumables Milvans was completed, with their contents being stored temporarily on the Manta Deck and in the BIO Lab spaces.

Many projects and operations were also not possible without the support of other departments across Station. Thank you to the Communications, IT&C, FEMC, Logistics, Galley, Admin, and Managers Departments for their professional support of the science groups.

This month also marked the 50<sup>th</sup> anniversary of the opening of Palmer Station. On the 20<sup>th</sup> of March, the community gathered to commemorate the past 50 years. We all feel special to have played a role here at Palmer Station and look forward to the upcoming 50 years of research!

Lastly, I would like to thank the scientists that the support staff and I have had the pleasure of working with over the course of the season. Your perseverance and dedication to your science is commendable. Best of luck as you return home!

## MARCH 2018 WEATHER

Marissa Goerke, Research Associate

<b>Temperature</b>
<b>Average:</b> 1.2 °C / 34.2 °F
<b>Maximum:</b> 5.7 °C / 42.26 °F on 30 Mar 17:36
<b>Minimum:</b> -5.7 °C / 21.74 °F on 18 Mar 10:32
<b>Air Pressure</b>
<b>Average:</b> 975.8 mb
<b>Maximum:</b> 992.3 mb on 11 Mar 22:31
<b>Minimum:</b> 946.2 mb on 21 Mar 22:53
<b>Wind</b>
<b>Average:</b> 13.7 knots / 15.8 mph
<b>Peak (5 Sec Gust):</b> 65 knots / 74 mph on 25 Mar 00:20 from NNE (32 deg)
<b>Prevailing Direction for Month:</b> ESE
<b>Surface</b>
<b>Total Rainfall:</b> 180.8 mm / 7.12 in
<b>Total Snowfall:</b> 29 cm / 11.3 in
<b>Greatest Depth at Snow Stake:</b> 9 cm / 3.5 in
<b>WMO Sea Ice Observation:</b> No sea ice in sight, 1-5 bergs with bergy bits and growlers.
<b>Average Sea Surface Temperature:</b> 0.86 °C / 33.5 °F

Winds peaked at 74 mph on the 25<sup>th</sup> and the average speed for the month was 15.8 mph. The prevailing wind direction for the month was from the east south-east. Temperatures peaked at 42°F and reached a low of 21.7°F. Snow has fallen several times but has not remained. 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

Personnel movements this month: Bill Baker and James McClintock departed with LMG18-02NB on 15 March.

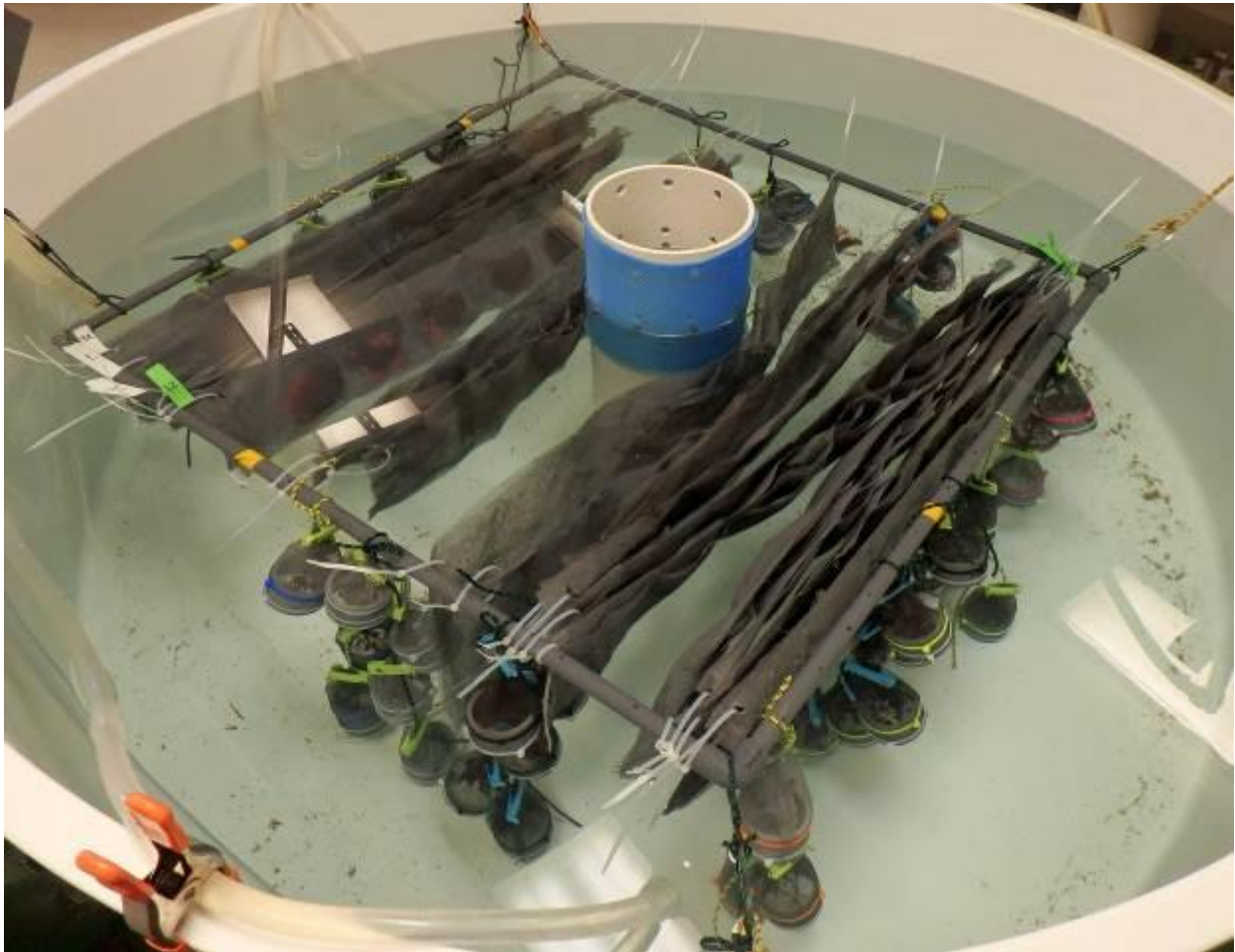
Overall, March was a very successful month in both the field and lab. We were able to make 46 dives to support our experimental studies *in situ* as well as in the lab and aquarium. Favorable conditions throughout much of the month allowed numerous collections of our focus organisms for this season's work: the red alga *Plocamium cartilagineum*, the amphipod *Paradexamine fissicauda* which commonly associates with *P. cartilagineum*, and the huge brown alga *Himantothallus grandifolius* with its associated gastropod fauna. A series of storms prevented us from diving away from station between 19 and 26 March and we only made a single dive at the pier during that interval. However, the weather forecasts for several days before the series of storms actually started had predicted a couple days of storms starting the following day, so each of those days we made dives to "stock up" on material to work on during the storm forecast to start the next day. For about three days, it seemed like a "little weather forecast that cried wolf" but then we got a whole pack of wolves. Those days of stocking up on collections allowed us to stay productive in the lab and aquarium throughout the unusually long block of nasty weather.

As had been true for the last days of February, the major focus of our field and laboratory work at the beginning of the month was a transplant/common-garden experiment with the red alga *P. cartilagineum* that was initiated in May 2017. This consists of 14 concrete substrates positioned at three sites near Palmer. Each substrate has a rack containing individual pieces of *P. cartilagineum* (350 total pieces on 98 short ropes, seven ropes per rack) which were attached and left in place for the winter. In the first week of the month we finished recollecting, measuring, and sampling algae from the experiment in the lab, and then returned them to the concrete substrates to be recollected a final time this coming May.

Early in the month we began collecting gastropods (snails and a common limpet species) for a mesocosm experiment examining the impact of the gastropods on the ecologically dominant brown alga *H. grandifolius*. The mesocosms consist of 10 large aquaria plumbed on the deck outside the aquarium building to allow natural lighting. Five have gastropods at the same densities they occur on *H. grandifolius* in nature (determined based on samples collected last year) and the other five are gastropod-free controls. Each tank has three approximately 100-gram blade sections of different *H. grandifolius* individuals. The experiment was initiated on 24 March and will run for six to eight weeks.

The station gas chromatograph was in constant use throughout the month enabling us to determine which of 14 or more chemical groups (chemogroups) *P. cartilagineum* individuals belong to. With that knowledge, we have been establishing season-long experiments looking at the growth of *P. fissicauda* on the different chemogroups as well as the impact of the different chemogroups on the fecundity and embryonic development of *P. fissicauda*. These experiments

require *P. fissicauda* to be maintained in small containers with algae from an individual of known chemogroup. For this, we have constructed “amphipod hotels” out of rings of PVC pipe and window screening. Additional algae from the individuals used in the feeding need to be maintained throughout the experiment to replenish the food offered in the “hotels” and for this we constructed window screening curtains with individual pockets for the individual algae. The aquarium with both the hotels and curtains is shown below.



**“Amphipod hotels” and mesh curtains with individual *Plocamium cartilagineum* of known chemogroup maintained for the hotels and other experiments. Photo Credit: Chuck Amsler.**

Outreach activities continued throughout the month. We continued to post blogs to our UAB in Antarctica web site (<http://www.uab.edu/antarctica/>) three times per week. The site also features Twitter feeds from team members Sabrina Heiser and Jim McClintock. On 29 March, CJ Brothers, who will join the faculty of Walla Walla University in the fall, did a day-long “takeover” of the Walla Walla Snapchat account with thousands of views.

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, and Jakob Bueche 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, and Megan Roberts

Adélie penguin work concluded in March with the fledging of all chicks ending our presence/absence radio transmitter study on Humble Island. As per usual, gentoo penguin breeding was slightly behind Adélie penguins this year with work during early March focused on obtaining adult diet samples and chick fledging weights on Biscoe Island and in the Joubin Islands.

Brown skua work also concluded this month, with nest monitoring and growth measurements ending with the fledging of our last study chick. South polar skuas failed to fledge any chicks within our Shortcut Island study area, however scat collections and band observations continued throughout March.

Giant petrel chick banding on all local islands was completed in March while our intensive chick growth measurement study on Humble Island will continue through April. Foraging tracking of giant petrels via affixed satellite and GPS tags also concluded this month.



**C-013 Field Team Member Ben Cook removes GPS tag from Southern Giant Petrel's back as the petrel continues to sit on his rapidly growing chick. Photo Credit: Carrie McAtee**

Sediment trap contents were collected from Adélie colonies on Torgersen Island, gentoo colonies on Biscoe Island, and chinstrap colonies on Dream Island. These Palmer area sediment trap samples as well as Avian Island samples were processed for otoliths. Limpet trap contents were also collected from kelp gull colonies on four local islands.

On 15 March, the ARSV *Laurence M. Gould* departed Palmer Station with C-013-P team members Ben Cook, Shawn Farry, and Megan Roberts.

Labwork finished near the end of the month; all samples were stored and sent north. In addition, with the summer season at an end, project gear and supplies were cleaned, inventoried, and packed up; and project cargo passed off to Logistics to be sent north.

ASC continued to provide great support this month and we would like to thank everyone on station for their efforts throughout the entire summer. Special thanks to Resident Marine Technicians Dave Moore, Jakob Bueche, and Mike Burns for keeping us on the water throughout the entire season. Also to birder assistants Mike Burns and K.C. Loosemore for assisting with end of season giant petrel monitoring and Chuck Kimball for continued communication support and help setting up the Humble Island penguin telemetry transmitter as well as tending to the weather stations and live penguin cam.

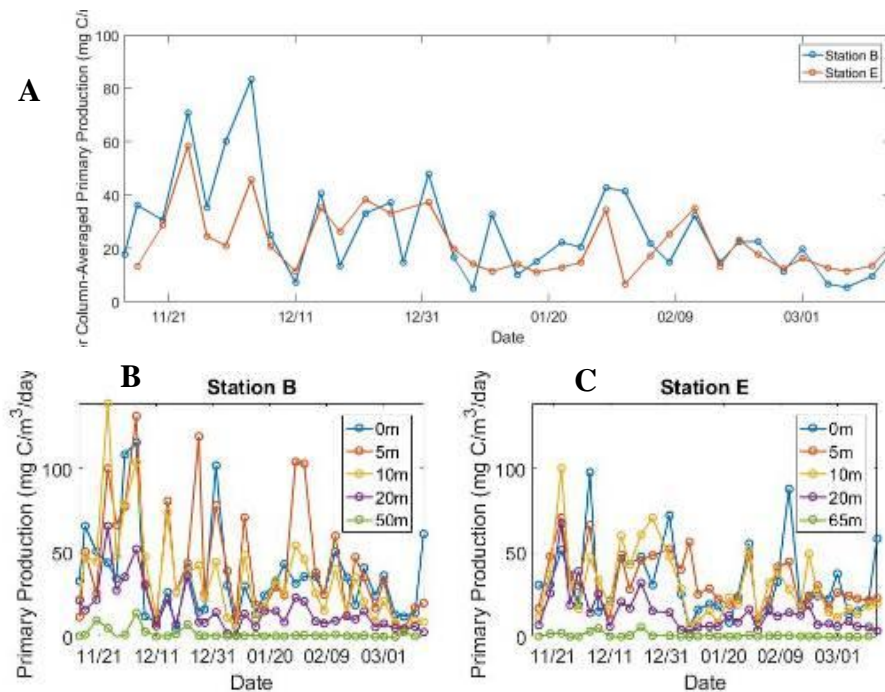
# C-019-P: PALMER, ANTARCTICA LONG TERM ECOLOGICAL RESEARCH (LTER): LAND-SHELF-OCEAN CONNECTIVITY, ECOSYSTEM RESILIENCE, AND TRANSFORMATION IN A SEA-ICE INFLUENCED PELAGIC ECOSYSTEM – PHYTOPLANKTON COMPONENT

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

March roared in like a lion, with the winds being higher than we've seen the entire season. Despite this, C-045-P (Ducklow) and C-019-P (Schofield) were successful at both Stations E and B to finish up our Palmer LTER sampling. We also finished our acoustic transects, using an echosounder to find variability in the offshore and inshore environments around our extended boating areas.

With all of our data processed (Fig. 1) and equipment packed away, we'd like to give one more big thank you to the supporting staff and coworkers at Palmer Station and on the ARSV *Laurence M. Gould*. This season at Palmer has been a transitional period with the additions of new technologies, and we've been exploring our limits in a beautiful place. Knowing that our science is a priority to station is appreciated, and knowing that we're a part of something bigger is invaluable. Thank you!



**Fig. 1** – Water column-integrated primary productivity (A;  $\text{mg C m}^{-2} \text{ day}^{-1}$ ), sampled biweekly at Station B (blue) and Station E (orange) from November 14th, 2017 to March 13th, 2018. Primary productivity ( $\text{mg C m}^{-3} \text{ day}^{-1}$ ), sampled biweekly at Station B (B) and Station E (C) from November 14th, 2017 to March 13th, 2018 at various depths.

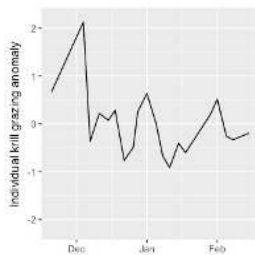
## **C-020-P: PALMER, ANTARCTICA LONG-TERM ECOLOGICAL RESEARCH (LTER): LAND-SHELF-OCEAN CONNECTIVITY, ECOSYSTEM RESILIENCE, AND TRANSFORMATION IN A SEA-ICE INFLUENCED PELAGIC ECOSYSTEM – ZOOPLANKTON COMPONENT**

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

Field personnel: Jack Conroy and Kharis Schrage

The beginning of March brought the end of our 2017-2018 field season. We conducted our final sampling trips to PAL LTER Stations B and E on 12 March, bringing our total count of net tows to 315 this season.

Our efforts focused on processing frozen samples during the final weeks at Palmer Station. We measured wet and dry masses for ~250 size-fractionated zooplankton samples in the laboratory. We also determined the gut chlorophyll contents for ~250 corresponding samples to calculate community grazing rate. An additional ~450 gut fluorescence samples were processed for individuals of the dominant macrozooplankton species *Euphausia superba* and *Limacina helicina* (Fig. 2). These data sets will be used in combination with phytoplankton data collected by C-019-P (Schofield) to determine how seasonal succession in the plankton community impacts food web carbon fluxes.



**Fig. 2** – Temporal variation in individual krill grazing rate during 2017-2018 field season. Zero on the y-axis represents the mean grazing rate for the season.

We accomplished all of our goals for this field season. We are leaving Palmer with zooplankton community composition, biomass, and grazing data sets that span spring to early autumn. We conducted seven krill feeding experiments, including two in collaboration with Dr. Ben Van Mooy to investigate the food web impacts of ultraviolet radiation-induced lipid oxidation. We also carried out four krill aggregation surveys with C-019-P (Schofield) to determine impacts on the phytoplankton community. Two of these cruises extended beyond the traditional Palmer Station boating limits to the nearby submarine canyon. Finally, collaboration with C-045-P (Ducklow) allowed for multiple experiments examining the bacterial diversity on krill fecal pellets and resultant rates of remineralization.

We are tremendously grateful to Palmer Station support staff for making our first season a success. The enthusiasm and expertise of marine technicians Dave Moore, Jakob Bueche, and Mike Burns allowed for many fun and fruitful sampling days on the RHIBs. Laboratory Supervisor Randy Jones and Instrument Technician Carly Quisenberry's commitment and adaptability throughout the season enabled smooth and productive operations.



**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 March, the whale researchers (Greg Larsen and Ross Nichols) stationed at Palmer as part of the LTER, project C-024-P, have continued our 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 a team of seven researchers on the ARSV *Laurence M. Gould* 18-02 research cruise during the first half of the month. This team collected complementary sets of sighting records, biopsy samples, uncrewed aerial vehicle (UAV) photogrammetry, and active acoustic prey mapping transects with humpback, minke, and killer whales during a research cruise along the western Antarctic Peninsula. During the first half of March, our operations at Palmer were limited to whale photo ID and biopsy sampling because our echosounder equipment was in use with the LMG18-02 research team and our UAV platform was exhibiting new irregularities in its flight behavior. Following the LMG18-02 port call on 16 March, we received a different UAV platform to replace our initial craft, and we were able at last to collect UAV photogrammetry data of whales transiting near Palmer Station (Fig. 3), the first such UAV operations and data to be collected by a team based at Palmer Station. Following the



**Fig. 3** – UAV imagery of a mother (top) and calf (bottom) pair of humpback whales encountered while transiting through the Palmer Station boating area on 17 March, 2018. Using photos such as these, we can calculate the basic dimensions of each whale, giving us an indication of each animal's life history and health status.

LMG18-02 port call on 16 March, we also received our echosounder equipment back from the LMG18-02 research team, and we resumed Palmer Station based prey mapping operations. Despite our restored complement of field equipment and the high level of proficiency that our research team has achieved at this late point in the field season, all operations have been severely limited by high winds and inclement weather that have prevented boat-based research operations for most of the latter half of this month. Additionally, on 29 March, we experienced an as-yet unexplained incident with our UAV in which the craft rapidly descended into the ocean shortly after lift-off and was not recoverable. Analysis of the incident and all possible scenarios that could have precipitated it are underway, but in any case this marked the conclusion of UAV operations at Palmer Station this season.

This month we experienced a continuing decline in research conditions that was foreshadowed in the month of February. Frequent high winds limited boat operations, keeping us from conducting data collection for multiple days at a time during the last weeks of March. Generally when we were on the water we observed few whales and low amounts of krill, with a continuing pattern that was observed last month wherein most of whales we encountered have been mother-calf pairs transiting through shallow waters and few, but occasional, adult whales also transiting through the boating area. On 29 March, we observed a notable exception to this trend, with four adult whales moving eastward and generally displaying social behaviors in the southern boating area, but we have had too little time in the field of late to substantiate whether this is a late season trend or an exception to the trend we have otherwise observed.

This season we spent a total of 260 hours on the water surveying and collected 67 skin blubber biopsy samples, of which 65 are from humpback whales and 2 are from minke whales. 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 200 whales this season, of which 183 were humpback whales, 9 were minke whales and 8 were killer whales.

Over the course of our 183 humpback whale encounters, we have been able to collect 141 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 65 biopsy samples previously mentioned. This last number can be compared to 92 biopsy samples that were collected at Palmer Station by this time last year. We note that count of biopsy samples is considerably lower than it could have been 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, and we therefore deliberately forewent biopsy sample collection for one entire month of our team's field season. Although we do not have a precise number for comparison, teammates from previous years indicate that we have collected significantly more fluke ID photographs this year than in previous years. Among our fluke photographs we have identified two more humpback whales that we sampled since our last report that were seen and sampled previously in this area: these were identified as individuals Mn16\_073F\_P and Mn16\_073C\_P, respectively (Fig. 4), and skin and blubber biopsy samples were obtained for each for cross-year comparison of hormone levels and skin microbiome. It is possible that we resighted more whales from previous years, but we have not yet undertaken a comprehensive comparison between this year's catalog IDs and those of past years. Such an effort will take place away from Palmer during the off-season.

Since our previous update, we have encountered two additional minke whales, bringing us to a season total of nine minke whale sightings and two minke whale biopsies. We attribute this paucity of minke biopsy samples to the species' characteristically illusive and highly variable



Mn16\_073F\_P



Mn18\_064C\_P



Mn16\_073C\_P



Mn18\_088A\_P

**Fig. 4** – Resighted humpback whales seen and sampled in previous seasons (left) and resighted/resampled this month (right), identified using our fluke photo ID catalog. Both whales were seen on March 13, 2016, and were seen again on different days this month.

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.

The whale team performed 21 active acoustic surveys over the course of the 2017-2018 field season at Palmer, three of which were performed in the month of March. This month's surveys included a 38 kHz transducer, in addition to our 120 kHz transducer, to allow for higher resolution of krill patches. Using dual-frequency sonar, we measured low and high dense swarms more accurately than we could with a single frequency. High swell and inclement weather impacted our abilities to survey some areas throughout this month. We saw similar results as the month of February at all surveys locations: krill patches in March were sparse, with krill patches being low in density and overall distribution. When krill patches were found, they were typically found in water shallower than 70 meters, positioned in the water column between 15 and 40 meters.

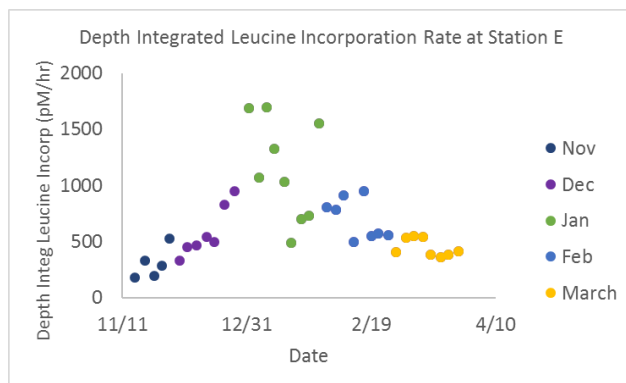
This month, in part owing to our reduced amount of time on the water and in part owing to a general lack of sea ice, we had very few opportunities to catalog leopard seals near station. A preliminary review of images collected over the course of the season, however, has identified 15 different individuals with no resights. We look forward to continuing this catalog effort more consistently throughout future seasons, and potentially expanding the effort to include Weddell seals, of which a few individuals are frequently seen hauling out in specific locations near Palmer. This month we also had few opportunities for public outreach, as we had no more teleconferences scheduled. We did, however, interact with a few tour groups from visiting cruises. We also had an opportunity to connect with researchers from Vernadsky Station who were in port aboard the LMG18-03 cruise during station turnover, and we hope to explore the possibility of future collaborations with them.

**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**

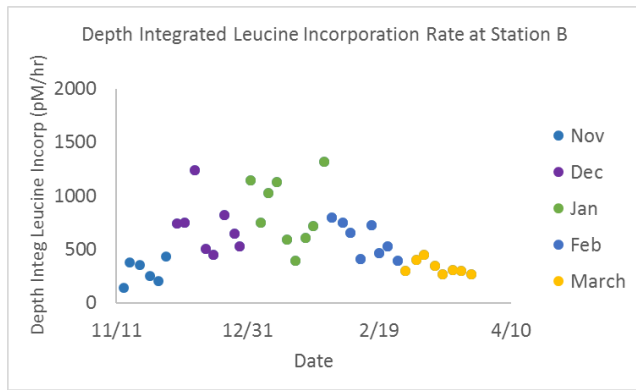
Dr. Hugh Ducklow, Principal Investigator, Columbia University, Lamont Doherty Earth Observatory

Personnel on Station: Rebecca Trinh and Marie Zahn

March marks the end of our field season here at Palmer Station. Our last field sampling day was on 26 March, 2018. Since the start of the season in November, we collected a record number of 573 individual water samples from Stations E and B, and Palmer Deep. This was made possible in part due to the addition of the two new RHIBs to Palmer Station. The RHIBs allow us to get out and sample on windy days that were previously over the safe boating limit and have allowed us to sample remote locations like Palmer Deep. On 15 March, Marie Zahn headed back north on the ARSV *Laurence M. Gould*. And on 5 April, Rebecca Trinh will be heading north as well, marking the end of our season at Palmer Station. As winter sets in, we have seen a noticeable drop in temperatures and an increase in storms. Below are updated graphs of bacterial production at Station E (Fig. 5) and Station B (Fig. 6) from the beginning of season in November, through 26 March. Both stations show a seasonal increase in bacterial production, peaking in January during the height of summer, and decreasing steadily as winter approaches. Winter has also brought a reduction in krill abundance around Palmer Station, making it difficult to collect krill for fecal pellet experiments. Rebecca Trinh gave the weekly science talk on 20 March about her krill fecal pellet experiments and other fecal science. C-045-P would like to thank everyone at Palmer Station for their continued support of our science and a successful field season.



**Fig. 5** – Depth-integrated bacterial production leucine incorporation rate ( $\text{pM hr}^{-1}$ ) at Station E from Nov. 2017 – March 2018.



**Fig. 6** – Depth-integrated bacterial production leucine incorporation rate ( $\text{pM hr}^{-1}$ ) at Station B from Nov. 2017 – March 2018.

**PALMER STATION**  
**RESEARCH ASSOCIATE MONTHLY REPORT**  
**March 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 operated normally throughout the month.

**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-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<sub>2</sub> (detected through changes in O<sub>2</sub>/N<sub>2</sub> 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<sub>2</sub> 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. Two 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 (N<sub>2</sub>O) 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 new HATS sampler pump has arrived.

### **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. Glacier terminus measurements were made and added to the archive of glacier mapping.

### **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. A command request for an example sample was completed and mailed out.



## **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 dropped offline on 29 March, presumably from the lack of sun in the past two weeks. Observations are archived on the AMRC website: <ftp://amrc.ssec.wisc.edu/pub/palmer/>.