PALMER STATION MONTHLY SCIENCE REPORT

NOVEMBER 2018

A large growler of clear ice floating in the waters off Torgersen Island, seen in the background. The Torgersen Island Adélie penguin colonies are to the right side of the island. *Image Credit: Marissa Goerke*

NEWS FROM THE LAB

Randy Jones, Summer Laboratory Supervisor

While sunny, windless days may have been relatively rare, overall the month of November has been busy. The small boating season started early, which meant grantee groups were regularly out on the water early in the month. The B-234-P (Young), C-020-P (Steinberg), and C-045-P (Ducklow) groups arrived in late October, and began their science in earnest. B-234-P (Young) grantees, Hannah Dawson and Susan Rundell, were successful in getting out to sample water from the local area and collect sea ice in Hero Inlet over their short sampling season. Steinberg and Ducklow grantees (Jack Conroy, Shawnee Traylor, Rebecca Trinh, and Leigh West) joined the Schofield scientists for both the bi-weekly sampling and collaborative projects, with field and experimental work spanning Stations B and E, Palmer Canyon, their incubation setups on the Aquarium Deck, and in the labs.

The LMG18-10SB port call brought the arrival of B-032-L (Van Mooy), C-013-P (Fraser), and W-219-P (Waters). Van Mooy grantees Henry Holm, Kharis Schrage, and Ben Van Mooy, and Ducklow grantee Rebecca Trinh departed Station for what concluded as a very productive cruise. A record number of samples were collected and they were able to attach several sediment traps to individual drifting ice floes to collect novel data on the fascinating ice ecosystem dynamics. Fraser grantees Darren Roberts, Megan Roberts, and Florence Yates were in the field for the second half of the month, tracking seabird and penguin nest status and population parameters. Also, April Waters joined Station for her artist residency and accompanied science groups in the

field, took small boats out to study local icebergs, and shot images from the various perspectives around Station.

NOVEMBER 2018 WEATHER
Marissa Goerke, Research Associate

Palmer Monthly Met summary for November, 2018

Temperature
Average: -0.2 °C / 31.6 °F
Maximum: 5.0 °C / 41.0 °F on 3 Nov 22:20
Minimum: -4.8 °C / 23.4 °F on 6 Nov 08:11
Air Pressure
Average: 973.5 mb
Maximum: 994.2 mb on 28 Nov 14:04
Minimum: 953.0 mb on 20 Nov 03:53
Wind
Average: 13.3 knots / 15.3 mph
Peak (5 Sec Gust): 64 knots / 74 mph on 3 Nov 13:55 from N (349 deg)
Prevailing Direction for Month: NNW
Surface
Total Rainfall: 77.2 mm / 3.04 in
Total Snowfall: 32 cm / 12.5 in
Greatest Depth at Snow Stake: 124.4 cm / 48.5 in
WMO Sea Ice Observation: Sea ice concentration are <3/10 with 1-5 ice bergs and bergy bits.
Average Sea Surface Temperature: -0.84 °C / 30.5 °F

Temperatures peaked at 41.0° F on 3 November and reached a low of 23.4° F on 6 November. The wind peaked at 74 mph on the 3rd and averaged 15.3 mph. The prevailing wind direction for the month was from the North-North-West. We had several storms move through bringing our monthly snow accumulation up to 12.5 inches and our total accumulation has only dropped two inches since last month. Sea ice conditions have been 3/10 at most and almost all fast ice in Hero Inlet has melted out. There are several large icebergs in the area.

B-032-P: PRODUCTION AND FATE OF OXYLIPINS IN WATERS OF THE WESTERN ANTARCTIC PENINSULA: LINKAGES BETWEEN UV RADIATION, LIPID PEROXIDATION, AND CARBON CYCLING

Dr. Benjamin Van Mooy, Principal Investigator, Woods Hole Oceanographic Institution

Personnel on Station: Henry Holm and Kharis Schrage

The Van Mooy group arrived in early November to study the lipid make-up of the planktonic community in the western Antarctic Peninsula (wAP). Our research questions are focused on oxylipin formation in diatoms via ultraviolet radiation (UVR), and the range of possible impacts on phytoplankton as well as the potential deleterious effects on grazers (such as krill) that consume them. While enzymatic formation of oxylipins in diatoms and their effects on grazers has been well characterized, intracellular formation of oxylipins via UVR-induced radical oxygen species is poorly understood. The combination of spring phytoplankton blooms and atmospheric ozone depletion over the wAP present theoretical conditions for oxylipin formation from this mechanism.

To understand both the formation and subsequent transport of these molecular species, we undertook five distinct sampling regimes this past month aboard the ARSV *Laurence M. Gould* on LMG18-10. Four of these were observational and one was experimental (Fig. 1). First we conducted CTDs paired with net tows throughout the Gerlache Strait, the surrounding bays, and Palmer Deep for observations of the water column. We collected samples to observe the phytoplankton's lipidome (the totality of lipids in a cell; including any oxylipins) and the lipids of the zooplankton community feeding in the region. Additionally, we deployed a series of net traps both tethered to ice flows as well as in open water to investigate sinking particulate matter. Krill fecal pellets, which were observed in almost every trap, are of interest for possible transport of oxylipins out of the food web. Our final sample collection consisted of ice cores from seasonal sea ice. We sectioned cores in order to gain a profile of the diatom community existing in seasonal ice to better understand their lipidome as well as possible differences in oxylipin levels between ice-adapted and open water diatoms.

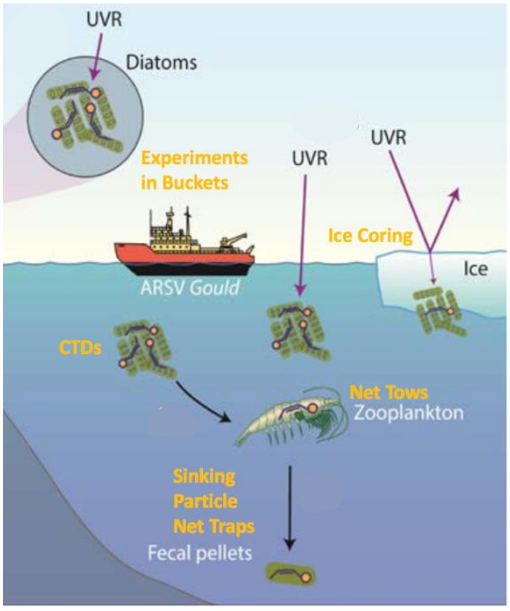
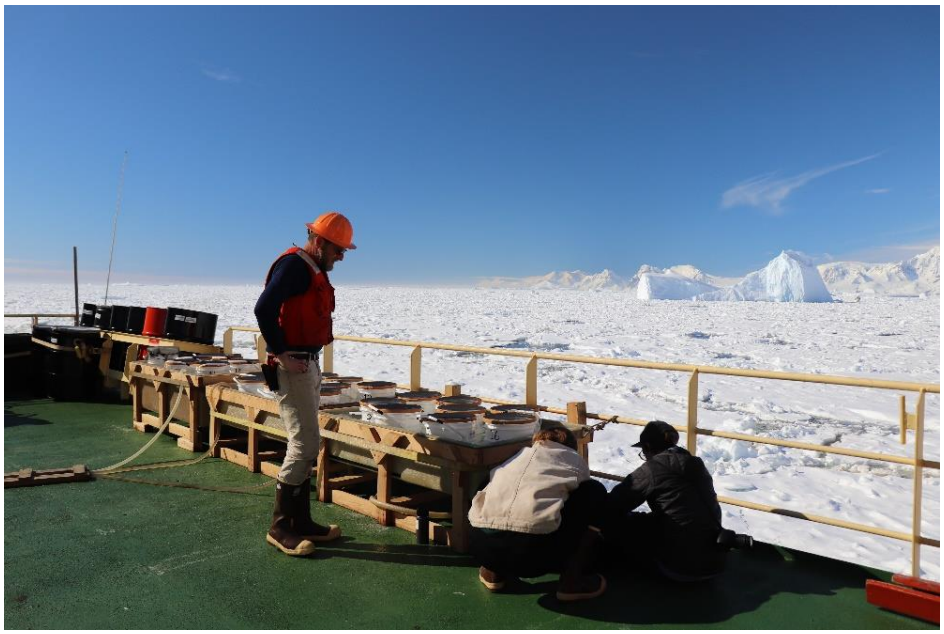


Fig. 1 – Schematic of sampling areas with methods used for sampling each area in orange.

Overall LMG18-10 sample collection was a massive success with the collection of quality samples from a range of geographic and environmental conditions across the area surrounding Palmer Station. Our sampling included 27 CTDs, 17 paired net tows, 8 sinking particle trap deployments, 15 ice core profiles, and over 600 samples. We believe we have assembled a sample set to truly examine the ranges and location of oxylipins in the surface waters as well as linkage between these distinct ecosystem sections.

Henry Holm ice coring during LMG18-10 (left). Josephine Patterson and Ben Van Mooy deploy a sediment trap off the stern of the *Gould*. *Image Credits: Van Mooy group*

Three major incubation experiments were also performed during LMG18-10 using environmental samples to test UV radiation effects on phytoplankton and krill grazers. Water collected from CTDs was put in buckets with either a UV filter or unfiltered for full light exposure. 24 hours later, krill were added and allowed to graze for 24 hours. Lipid samples of the phytoplankton were taken before UV radiation, before krill addition, and upon krill removal. Krill and their fecal pellets were also sampled for lipids. We attempted to recreate environmental conditions while manipulating the levels of UV light and possibly oxylipin levels. These incubations will allow us to directly measure oxylipin production under known conditions, as well as whether they effect krill feeding.



Van Mooy team members (Ben, Kharis, and Henry; L-R) setting up an incubation experiment. *Image Credit: Van Mooy group*

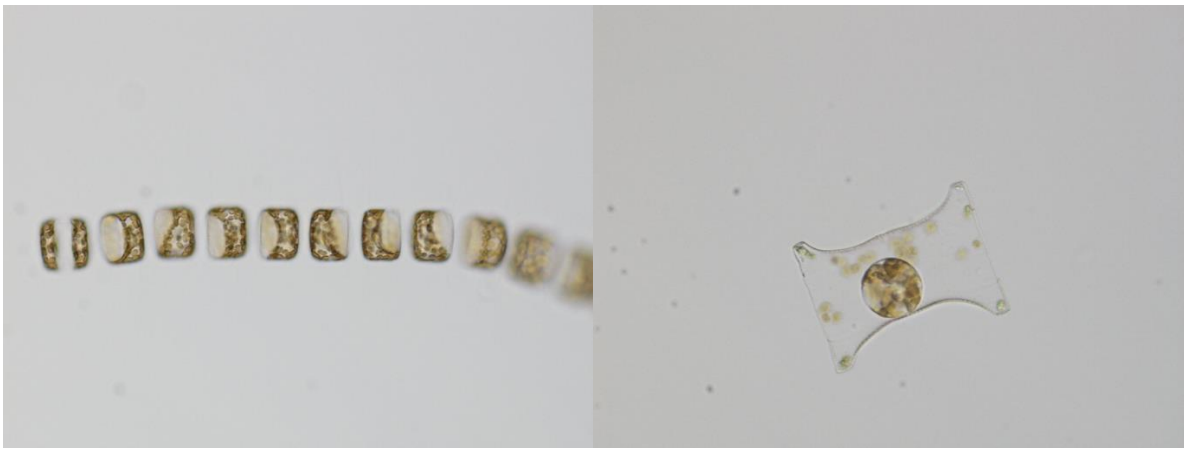
The past week on Station, we have continued incubations of ice-adapted diatoms found near Palmer to observe adaptions in their lipidome to various temperature and light conditions. We will continue experimental incubations involving open water diatoms and krill starting this week.

B-234-P: SPRING BLOOMS OF SEA-ICE ALGAE IN THE WESTERN ANTARCTIC PENINSULA: EFFECTS OF WARMING AND FRESHENING ON CELL PHYSIOLOGY AND BIOGEOCHEMICAL CYCLES

Dr. Jodi N. Young, Principal Investigator, University of Washington, School of Oceanography

Personnel on Station: Hannah Dawson and Susan Rundell

The month of November was a whirlwind for B-234-P (Young)! Early on, graduate students Hannah Dawson and Susan Rundell finished unpacking and setting up the lab for processing field samples and growing algal cultures in custom-made aquarium tanks. After getting operator training completed, they were able to sample seawater and ice slush seven times while at Palmer Station, mainly at Station B with the help of the Marine Technicians. Each of these sampling events were followed by intensive processing using the outdoor incubation tanks and the 2°C Environmental Room to keep the organisms as close to ambient conditions as possible. Using water from Station B, algal cultures were started in three aquarium tanks set to three different temperatures and salinities to mimic normal seawater, melt conditions, and freeze conditions. These cultures grew very well and showed early interesting differences. The details of these differences will be more fully understood once all samples are processed and analyzed back at the University of Washington this coming year! As an exciting finish to the season, B-234-P was able to sample a multi-day phytoplankton bloom that began during their last week of sampling. In addition to all the sampling and algal culturing B-234-P performed in November, Hannah and Susan packed up the lab to head back north at the end of the month.



The B-234-P (Young) group utilized the compound microscope on station to image the microscopic community in the seawater; above a chain of *Thalassiosira spp.* (left) and *Eucampia antarctica spp.* (right). *Image Credit: Young group*

B-234-P would like to thank everyone on Station who made us feel so welcome and helped us accomplish more science than we thought we'd have time for! Palmer Station was an amazing temporary home and lab for us to be a part of!

While on Station, B-234-P members Hannah Dawson and Susan Rundell collected a variety of sample types including seawater from Station B, ice slush during an algae bloom, and near-ice seawater in Hero Inlet (pictured above). *Image Credit: Young group*

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

Personnel on Station: Darren Roberts, Megan Roberts, and Florence Yates

C-013-P personnel arrived at Palmer Station on 11 November. Upon arrival, requisite trainings were completed and we were able to access our research study sites 16 out of the 19 remaining days in November.

Field work this month began with breeding chronology studies on a subset of Adélie nests on Torgersen and Humble Islands. A portion of these nests were sampled at the 1-egg stage to obtain adult body condition and egg morphometric data. Timing of a peak egg census was also determined and completed for Adélies on all local islands including Biscoe Point. Adélie peak egg census will be completed at Dream Island as soon as conditions allow. In addition to our Adélie monitoring, we also began monitoring Gentoo colonies on Biscoe Point.

Adélie penguins incubating eggs on Torgersen Island. *Image Credit: Florence Yates*

Brown skuas have arrived and we began their mark-recapture and breeding chronology studies, including leg band re-sights and monitoring nests in the local area, as well as at Biscoe Point. South polar skuas began arriving locally in the middle of the month and we began our band re-sighting and nest monitoring study of them on Shortcut Island. Satellite transmitter deployments on southern giant petrels have begun and will continue through February 2019. An early-season

census of giant petrel nests was completed on Shortcut and Humble Islands, with an extensive all-island census to begin in December. We also began monitoring the small blue-eyed shag colonies on Cormorant Island this month.

Blue-eyed shags with the peninsular mountains in the background. *Image credit: Megan Roberts*

Marine mammal censuses of seals and whales began this month. Seal sightings this month included Weddell, crabeater, leopard, and southern elephant seals. The most commonly occurring species in November were elephant seals. This included adults, weaned pups, and a few pups still nursing.

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

Personnel on Station: Anna Bashkirova and Marie Zahn

After the late October, harsh weather with sea ice encasing Palmer Station and winds gusting over 40kts, spring finally arrived! Our first bi-weekly sampling event occurred at Station B on November 2nd, marking the earliest field sampling we've had over the last several years. We were able to reach both Stations B and E for the remainder of the month and even went as far as Palmer Canyon, an Adélie foraging area about 3.5 miles away for our collaborative sampling efforts with the C-013-P (Fraser), C-020-P (Steinberg), C-024-P (Friedlaender), and C-045-P (Ducklow) labs to examine interactions between mixed layer depth, krill distributions, and penguin foraging patterns.

Typically foul weather conditions inhibit early season sampling, but this year's open water and manageable winds allowed us to capture the first spring phytoplankton bloom. Wind speed decreased after the first week of November (Fig. 2) and sea ice retreated, allowing sufficient sunlight and water column stratification for a bloom. Stratification was especially pronounced 15-19 November and best observable in salinity and density values from CTD profiles collected at Stations B and E (Fig. 3). This was accompanied by a steady rise in chlorophyll concentrations (Figs. 3 and 4), reaching a maximum on November 19. However, strong winds beginning 18 November soon mixed the water column, quenching the bloom (Figs. 2-4).

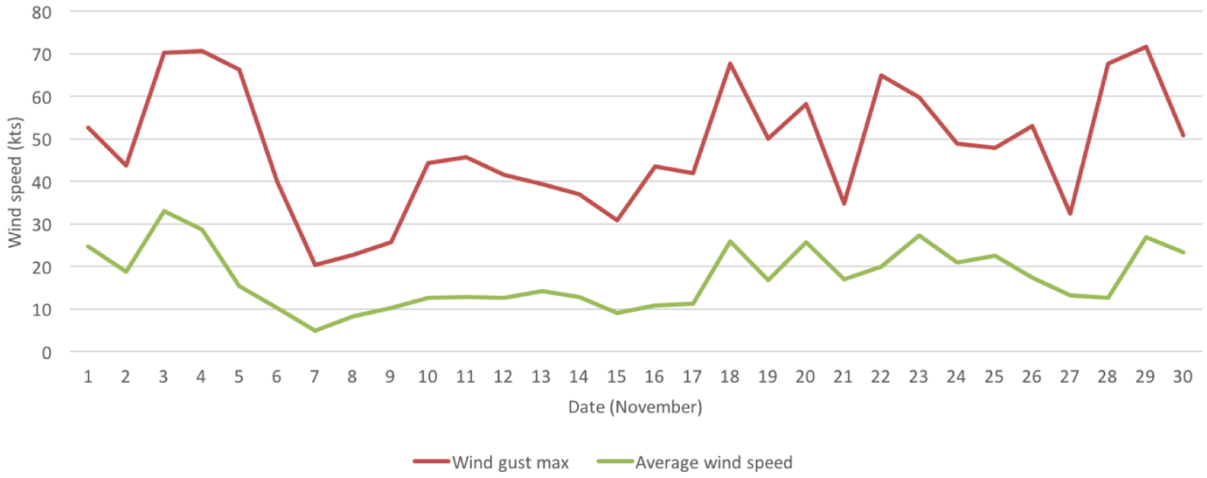


Fig. 2 – Average wind speed (green line; kts) and wind gust max (red line; kts) for the month of November 2018 (data and plot courtesy of Palmer Research Associate, Marissa Goerke).

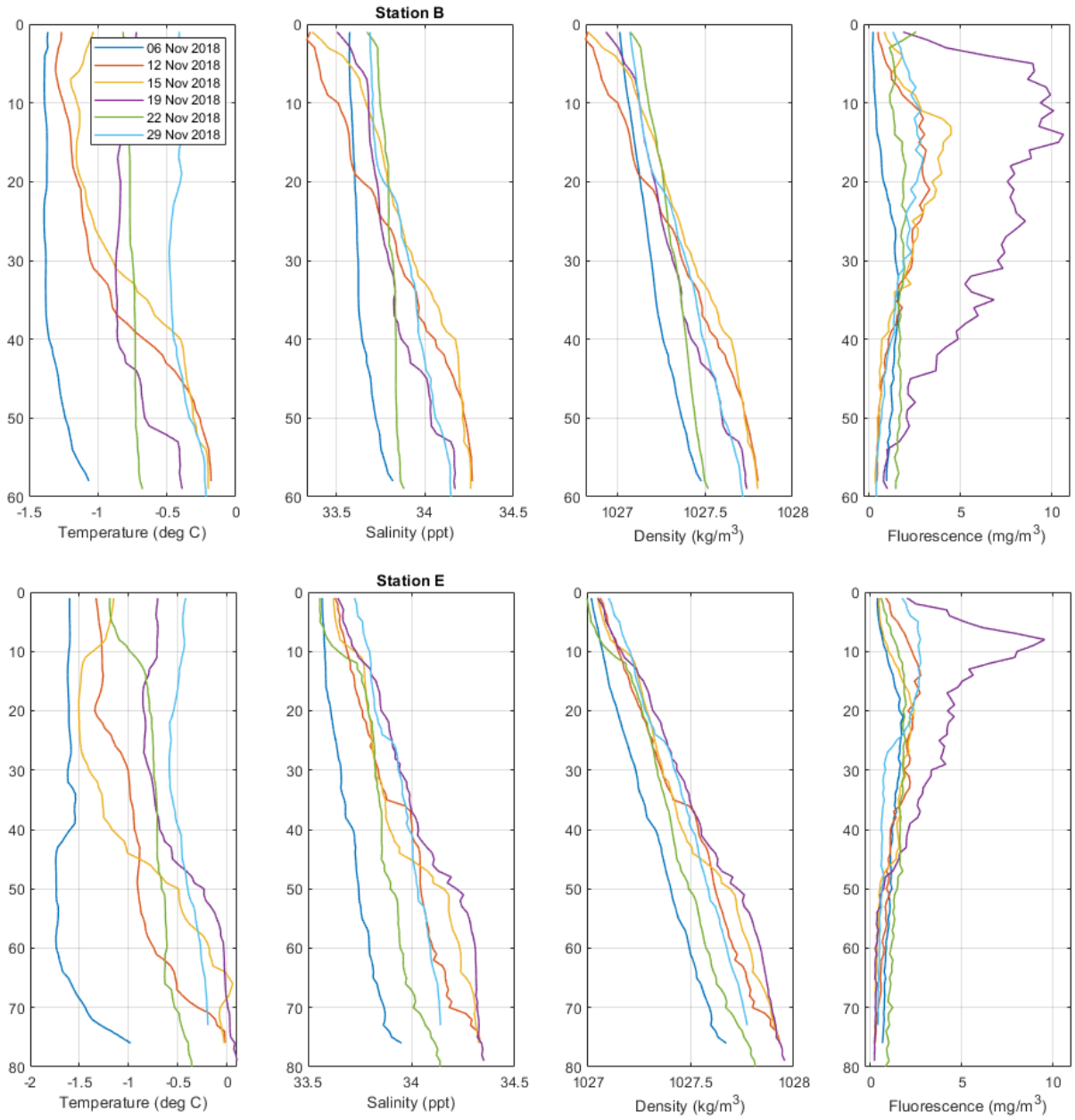


Fig. 3 – Temperature (°C), Salinity (ppt), Density (kg m^{-3}), and Fluorescence (mg m^{-3}) profiles against depth in meters (L-R) for November 2018 sampling events at Station B (top row) and Station E (bottom row).

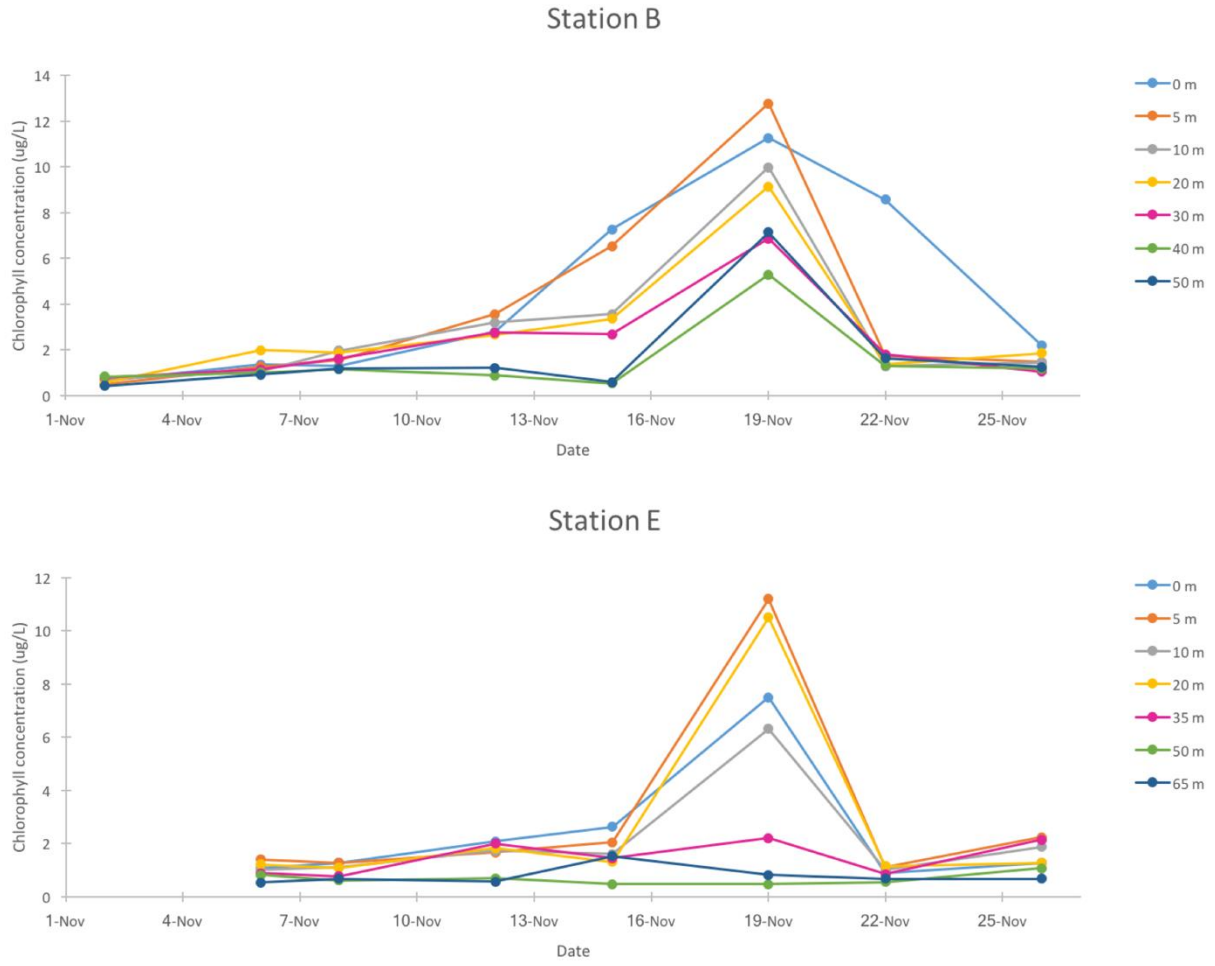


Fig. 4 – Chlorophyll concentrations (µg L^{-1}) for November 2018 sampling events across seven depths (various colors) at Station B (top) and Station E (bottom).

We were also able to capture images and ID phytoplankton that dominated the spring bloom with our imaging flow cytobot (IFCB). We observed an increase in the total counts of phytoplankton organisms in our samples and saw a prevalence of *Phaeocystis* spp., *Corethron* spp., and chain-forming diatoms (*Thalassiosira* spp.; Fig. 5).

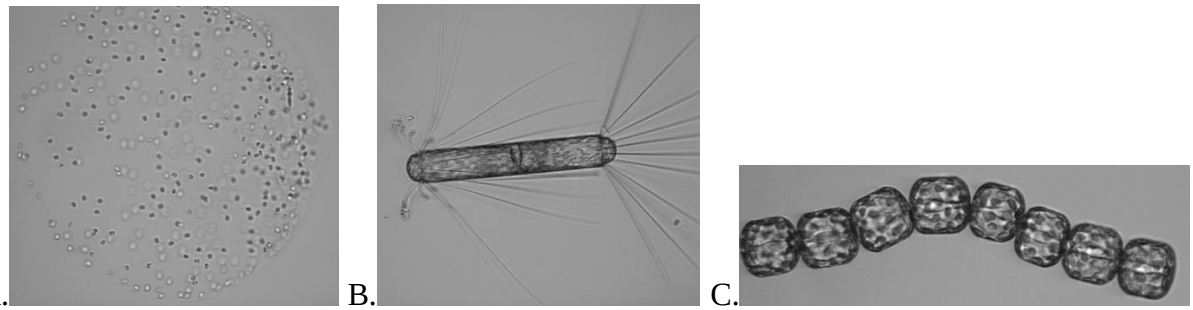


Fig. 5 – Images taken by our imaging flow cytobot of (A) *Phaeocystis antarctica*, (B) *Corethron* spp., and (C) *Thalassiosira* spp. from 19 November 2018.

November proved to be a very successful and productive start to our season! We want to thank the Marine Technicians, Michael Burns and Dave Moore, for helping us reach to our sampling locations, Lab Supervisor Randy Jones and Instrument Technician Carolyn Lipke for ensuring

that all of our lab needs are met, and Satcom Engineer PJ Charpentier and Research Associate Marissa Goerke for repairing the weather stations to enable our extended boating operations.

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, College of William & Mary, Virginia Institute of Marine Science

Personnel on Station: Jack Conroy and Leigh West

Jack Conroy, a third-year PhD student at the Virginia Institute of Marine Science, and Leigh West, a research technician in Dr. Debbie Steinberg's Zooplankton Ecology Lab, arrived at Palmer Station in late October. This is their second summer studying zooplankton seasonal succession and grazing impact near Anvers Island. This work is a key component of the Palmer Long Term Ecological Research (LTER) program's goal to understand marine ecology and biogeochemistry along the changing western Antarctic Peninsula.

LTER sampling began on 6 November, almost two weeks earlier than last summer due to sea ice conditions. We had twelve successful sampling days in November, with a total of 67 plankton tows (Fig. 6). Early sampling opportunities are particularly valuable, because there is limited previous zooplankton sampling in the Antarctic spring. Additionally, a key goal of this project is to compare heavy and light sea ice years.

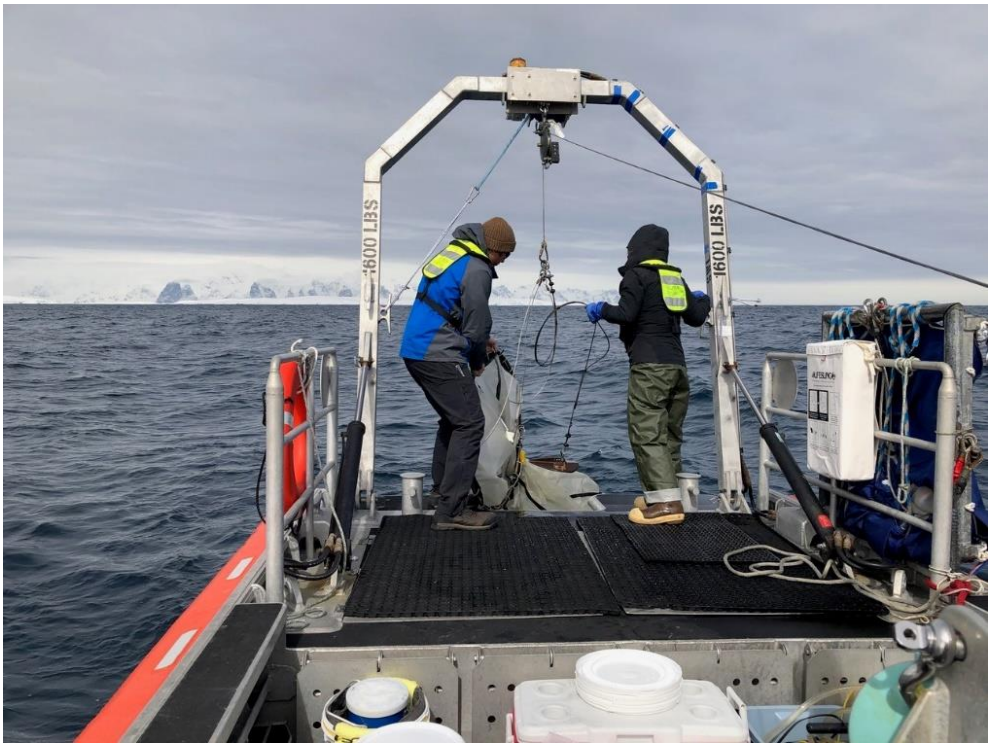


Fig. 6 – Marine Technician Dave Moore and Research Technician Leigh West deploy a plankton net from RHIB *Hadar*.

The Antarctic krill (*Euphausia superba*) has dominated macrozooplankton abundance and biomass thus far. Krill are particularly patchy, but we have observed in higher abundances than last season. The krill population sampled this year has included both juveniles and adults, while last summer we sampled almost exclusively juveniles. Larval fishes and carnivorous chaetognaths were also prominent in the November zooplankton assemblage.

Calanoid copepods are a numerically important zooplankton near Anvers Island. The herbivorous calanoids, *Rhincalanus gigas* and *Calanoides acutus*, were the most abundant species in November. This finding follows the pattern of seasonal succession first observed last year. Herbivorous copepod abundance is expected to decline through summer while omnivore abundance increases.

A brief phytoplankton bloom presented a great opportunity to conduct our first krill feeding selectivity experiment (Fig. 7). Chlorophyll measurements showed that juvenile krill grazing substantially knocked down phytoplankton accumulation in the 24-hour experiment. Anecdotally, the phytoplankton community during this bloom included large pennate diatoms (e.g., *Corethron* spp.) and the colonial haptophyte *Phaeocystis antarctica*. These experiments are a collaboration with our LTER colleagues in Dr. Oscar Schofield's phytoplankton research group. Samples processed on their Imaging Flow Cytobot are expected to reveal top-down changes in phytoplankton community composition.

Fig. 7 – Leigh West and graduate student Jack Conroy prepare their first krill feeding selectivity experiment.

Fair weather in late November allowed our first sampling trip to the head of the Palmer Deep Canyon. This is a truly collaborative component of the LTER program. The goal is to determine how physical mixing impacts phytoplankton and krill distribution, which in turn drive seabird foraging behavior.

November was a fruitful start to our summer. The skill and dedication of Palmer Station staff allowed us to hit the ground running. In particular, we thank the following laboratory and marine staff: Mike Burns, Randy Jones, Carolyn Lipke, and Dave Moore.

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: Shawnee Traylor and Rebecca Trinh

We arrived at the end of October to relatively low sea ice conditions for this time of year. There was a push to get out as soon as possible, and we rushed to set up the lab. Weather and boat trouble limited us for the first week or so, but we managed to get our first samples on 2 November, at Station B. This is the earliest sampling the LTER has had since 2012. Since then, we have managed to get out twice a week for sampling at both stations. We have continued to include sample preparation for dissolved iodine at all depths at Station B, on Mondays. We have also added a new DNA assay in conjunction with that of years past.

Thanks to this early consistent sampling, we have captured the spring bloom in several different assays. Filtration for particulate organic carbon (POC) has visually demonstrated the dramatic change in the water column, and we nearly halved the volume of water filtered for layers in the photic zone (Fig. 8A).

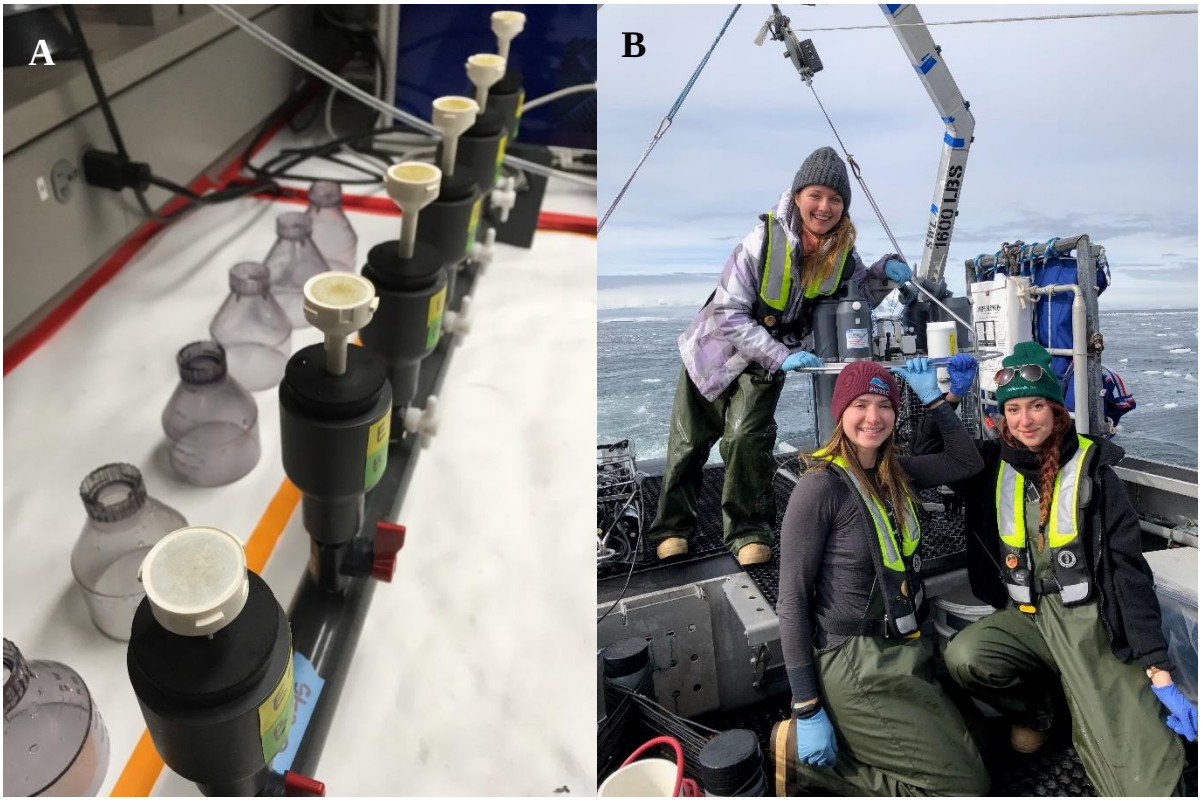


Fig. 8 – (A) POC filters showing increasing amounts of colored particulate matter, indicative of increased phytoplankton biomass in the water column. (B) Photo of the Schofield and Ducklow group sampling on RHIB *Hadar*.

This heightened activity has also been echoed in experiments using tritiated leucine incubations to quantify heterotrophic bacterial growth rates via incorporation of the radioactive tracer (Fig. 9).

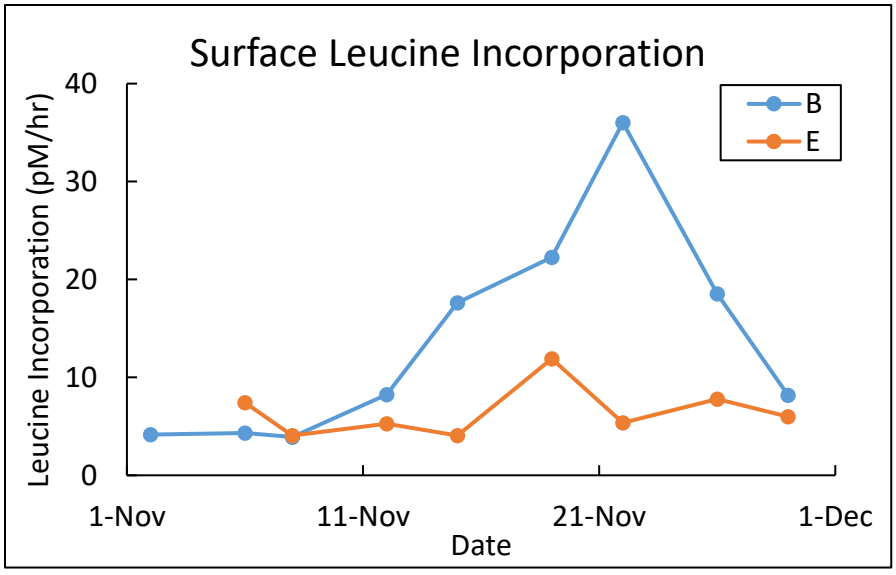


Fig. 9 – Surface water bacterial production rates (pM hr^{-1}) from 2 Nov through 29 Nov, showing an increase in activity around 16-21 November at Station B (blue line) and E (orange line).

The Equilibrator Inlet Mass Spectrometer (EIMS) was set up in conjunction with an Aanderaa optode (optical oxygen sensor) on a flow-through system from the seawater intake. This is being used to measure net community production (NCP) in real time, through the ratio of oxygen to

argon. By normalizing the oxygen values to that of an unreactive gas, we are able to isolate changes in concentration that result from biological activity from changes due to temperature and physical mixing. Times of high O_2/Ar ratios indicate increased NCP, while lower ratios show enhanced respiration. While a diel trend is evident, this monitoring also beautifully captured the productivity of the spring bloom with consistently higher levels of O_2/Ar. Oxygen saturation in Arthur Harbor increased and remained high for several days, before falling dramatically with the die off of the bloom (Fig. 10).

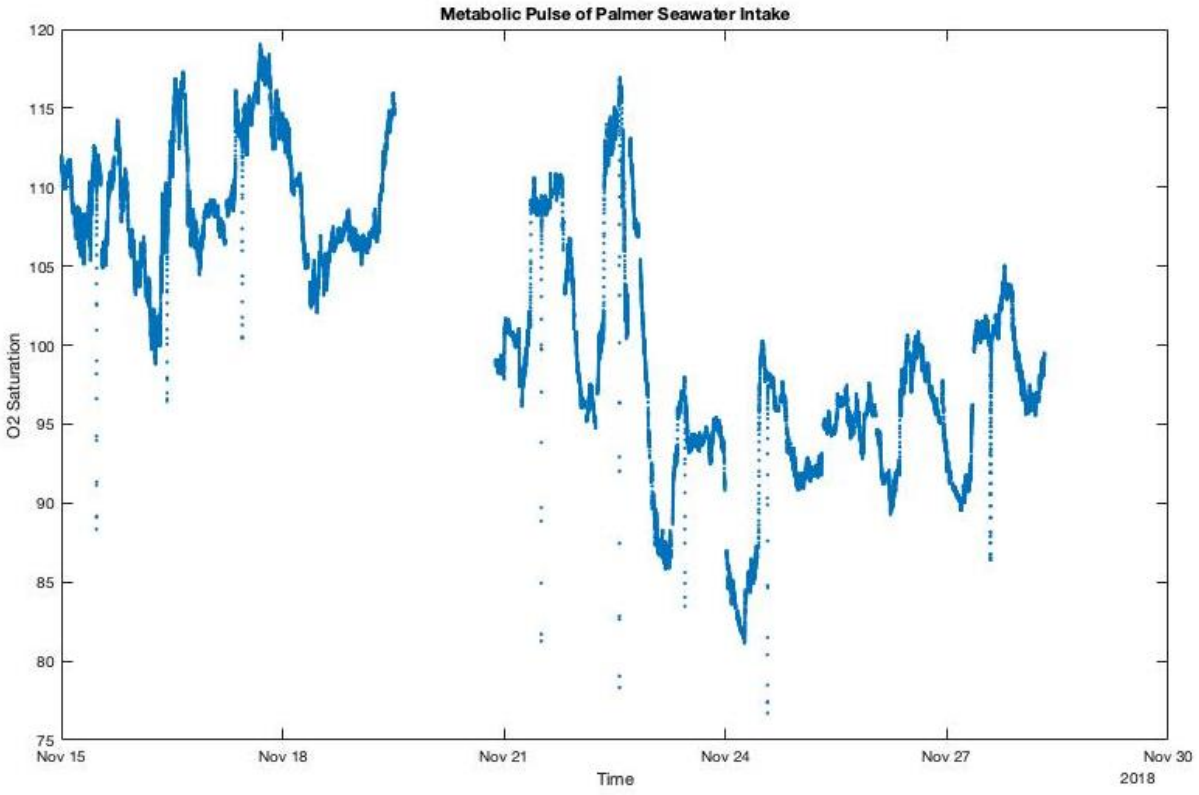


Fig. 10 – Oxygen saturation (%) time series (15-29 November) from the EIMS showing increased oxygen saturation during the spring bloom.

Additionally, during the month of November graduate student Rebecca Trinh was able to collaborate with Dr. Ben Van Mooy and his group from WHOI during their two-week cruise on the *Gould*. The goal of the cruise was to quantify the effects of oxidized phytoplankton lipids on the water column community, mainly krill and heterotrophic bacteria. We conducted several experiments where we exposed water column phytoplankton to UV-light to produce oxidized lipids and measured their effects on krill, water column heterotrophic bacteria, and particle associated bacteria on the fecal pellets the krill produced. Figure 11 shows how the water column bacteria responded to various amounts of UV light and krill over three days. In some instances, the UV radiation and increase in oxidized lipids decreased bacterial production; in other cases, it increased bacterial activity. In many cases, the addition of krill also increased bacterial production.

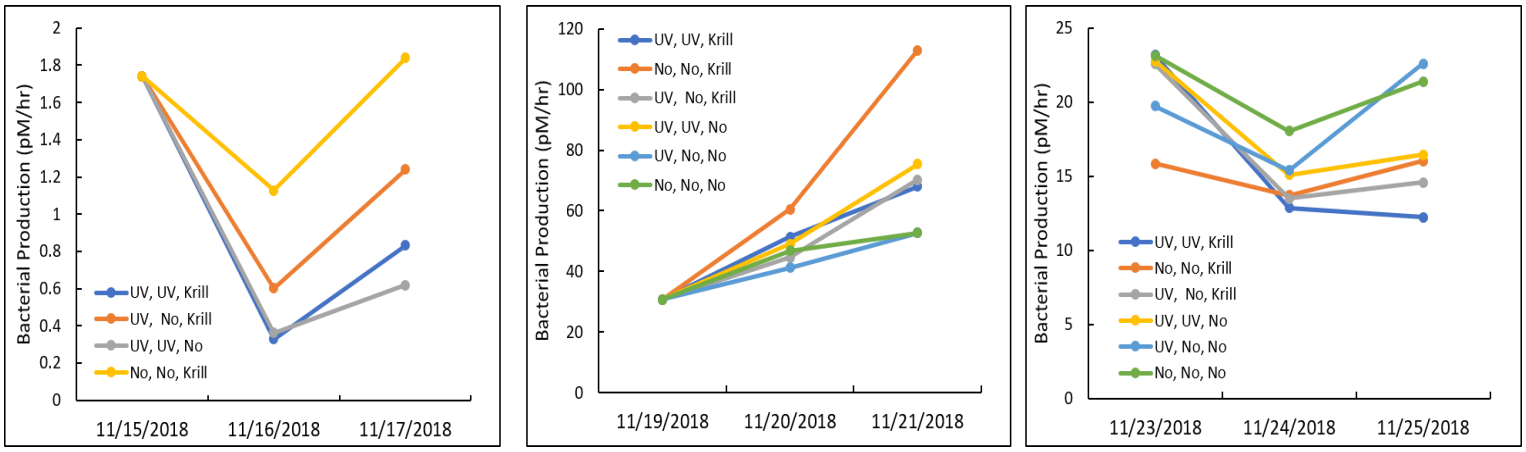


Fig. 11 – Water column bacterial production rates (pM hr^{-1}) in three different UV/krill experiments (15-17 November, 19-21 November, and 23-25 November) to understand how bacteria respond to the production of oxidized lipids in the presence or absence of grazers like krill.

Figure 12A shows bacterial production rates in the water column and on krill fecal pellets that were not UV-radiated to produce oxidized lipids. Figure 12B shows bacterial production rates in the water and on krill fecal pellets that have been UV-radiated to produce oxidized lipids. In the absence of oxidized lipids, krill fecal pellets have similar rates of bacterial production compared to the water column initially, and then bacterial production increases over time on the fecal pellets while the water column bacteria stay relatively stable. Conversely, in the presence of oxidized lipids, the water column bacteria are much more productive than the fecal pellet bacteria initially. After about 24 hours, the fecal pellet bacteria become more active than the water column bacteria.

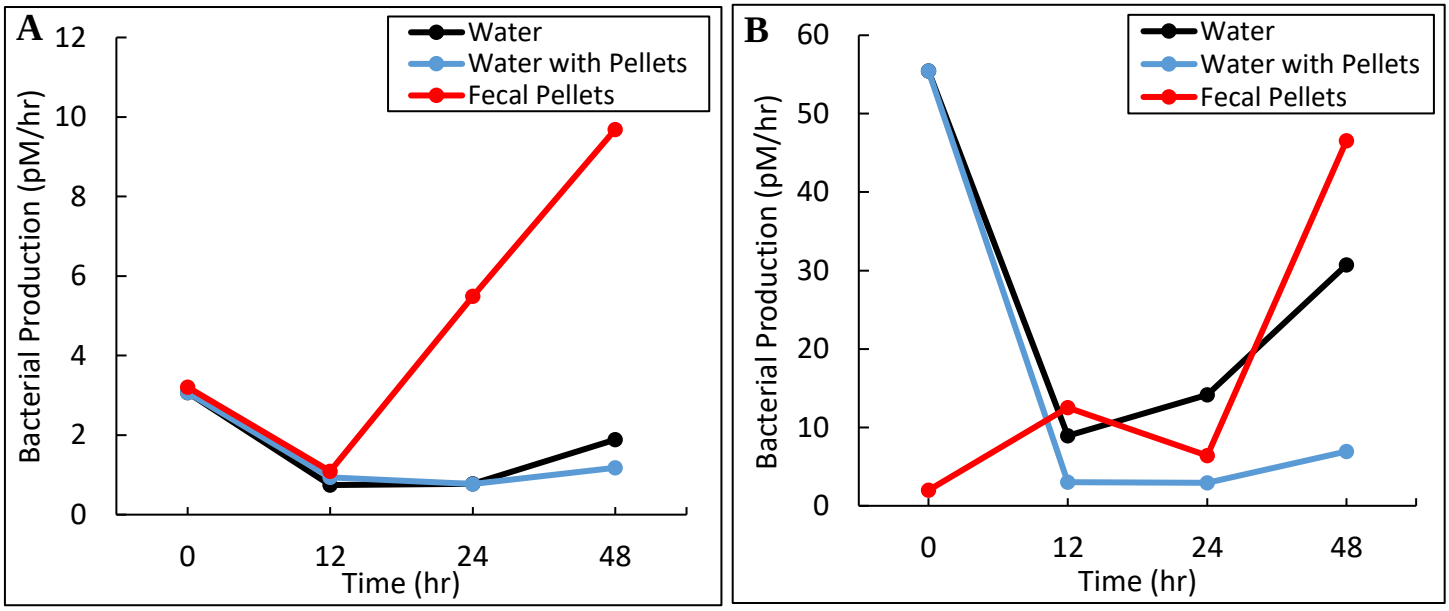


Fig. 12 – (A) Bacterial production rates (pM hr^{-1}) in the water column and on krill fecal pellets that not have been UV-radiated to produce oxidized lipids. (B) Bacterial production rates (pM hr^{-1}) in the water and on krill fecal pellets that have been UV-radiated to produce oxidized lipids.

W-219-P: WATER-ICE-SKY

Ms. April Waters, Principal Investigator, Salem, OR

Personnel on Station: April Waters

April Waters painting near Station. *Image credit: April Waters*

During my stay at Palmer, I painted, drew, and photographed the area around the Station, the glacier, and at multiple islands and coves. I went out with the scientists on small boats and RHIBs as they performed their science and gathered samples. I talked with a number of scientists so that information about their research work can be included in my future exhibitions. For one of the weekly science lectures, I gave a presentation about my work, and also participated in "Art in the Bar". I am honored by the opportunity to be at Palmer Station and look forward to starting on the body of work (Water-Ice-Sky) that will result from this experience.

Navigating around the boating area on a Rec Boat. *Image credit: April Waters*

Waters' painting space in BIO Lab 1. *Image credit: April Waters*

PALMER STATION
RESEARCH ASSOCIATE MONTHLY REPORT
November 2018
Marissa Goerke

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

Mr. 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

Dr. 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.

A-111-P grantee Hunter Burch arrived on station for a two week site visit. Hunter Burch and Research Associate Marissa Goerke worked together to calibrate and perform maintenance on both the VLF and ELF systems. The sea ground was inspected and cleaned.

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

Dr. 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 system operated normally throughout the month and was shut down for the summer as scheduled on 7 November 2018. A season of data was shipped north on a hard drive.

A-373-P: TROPOSPHERE-IONOSPHERE COUPLING VIA ATMOSPHERIC GRAVITY WAVES
Dr. 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
Dr. 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. Several shipments of empty flasks were received.

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

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 during favorable winds and HATS Air samples were taken every other week. Several shipments of empty flasks were received.

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

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 absolute scans were completed as necessary.

R-938-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-295-P: GPS CONTINUOUSLY OPERATING REFERENCE STATION.
Mr. 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-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 has operated normally throughout the month. Filters were prepared and one command request filter shipment was processed and mailed north.

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 has operated normally throughout the mouth.

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 AWS went down; battery failure is suspected. The Wauwermans AWS was visited, all systems were checked and the battery was swapped for the first time since install. Observations are archived on the AMRC website: ftp://amrc.ssec.wisc.edu/pub/palmer/.