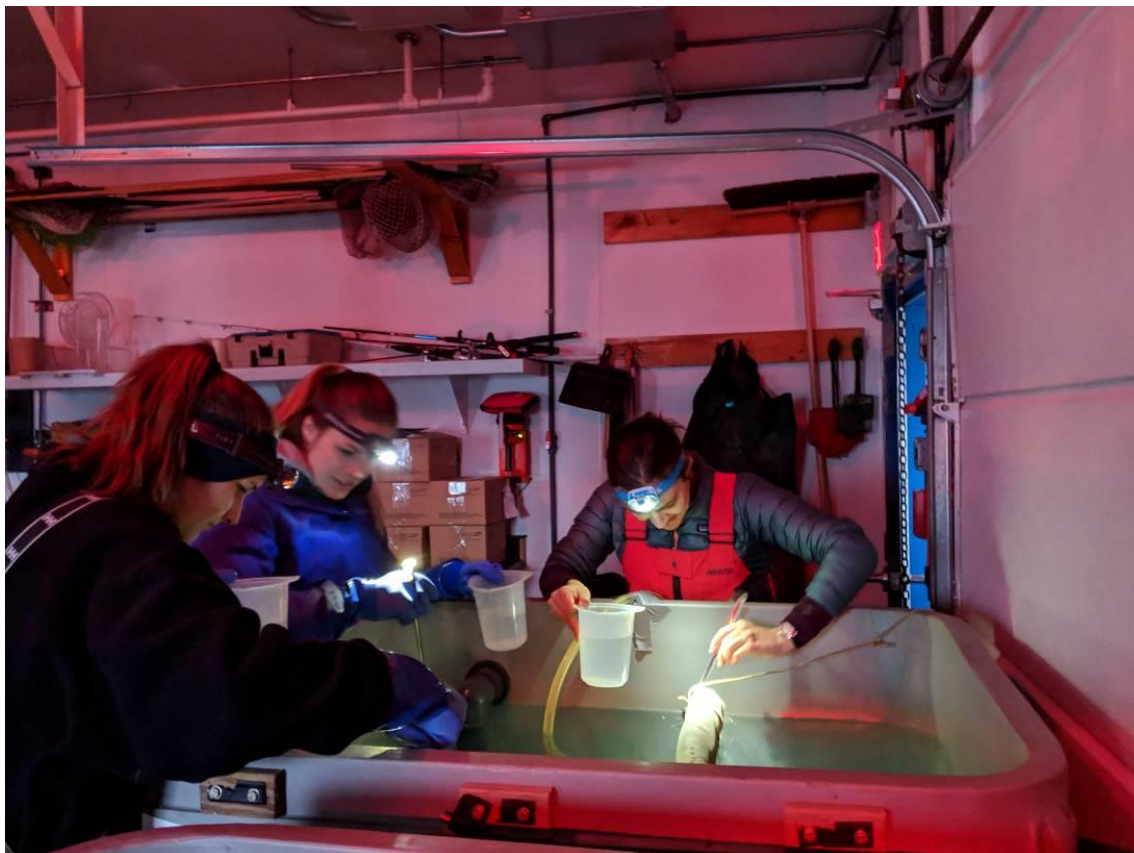


PALMER STATION MONTHLY SCIENCE REPORT

APRIL 2019



B-459-P (Bernard) group Julia Fontana, Kirsten Steinke, and Kim Bernard count and transfer krill from Xactic Tanks into the main aquarium tanks where they will remain throughout the 2019 winter season.

Image Credit: Hannah James

NEWS FROM THE LAB

Hannah James, Winter Laboratory Supervisor

The beginning of the month flew by as the station was focused on wrapping up summer science spaces and turning over roles to the winter crew. C-013 (Fraser), C-045 (Ducklow), C-019 (Schofield), and B-086 (Van Gestel) packed up samples and supplies and sailed north on the R/V Laurence M. Gould on April 5th. Jim Janoso was on site during the turnover port call to inspect and service a number of BioLab's microscopes. An annual inspection on all laboratory fume hoods was performed by Christopher Finn.

On April 21st, the R/V Laurence M. Gould returned to station with the B-459-P (Bernard) group, who will remain through the winter season. On site for the LMG19-04 cruise is Bo Hosticka of T-998-P (CTBTO) to perform annual inspection and maintenance to his equipment in Terra Lab. Also on board were the 5,000 juvenile krill that the B-459-P (Bernard) group caught on the cruise to station. Due to the broken winch on the R/V Laurence M. Gould, the krill were transferred from the ship to the Landing Craft, picked with the SkyTrac from the pier, and finally pallet jacked from the deck into the Aquarium Room in BioLab. This process went very smoothly and the krill fared the trip well. The next week was spent setting up the Aquarium Room for B-459-P (Bernard)'s season, which is detailed below.

Though based on the R/V Laurence M. Gould, science groups B-236-P (Amsler) and B-303-L/N (Sanders) were active around station during the southbound port call picking up supplies and instrumentation needed for their cruise. The ship returned to station on April 25th to swap out CTDs for the Sanders group due to unrepairable electronic issues with the onboard CTD.

The weather conditions have shifted into wintery mixtures of snow and rain, with lots of wind and overcast days throughout the month. Brash ice has come and gone, and most snowfall was immediately washed away by following rainstorms. With the wind came a variety of birds usually not seen around station. Wilson Storm Petrels, Antarctic Terns, and Snow Petrels became a common sight, and fewer and fewer Skuas and Giant Petrels are observed. Crabeater and leopard seals have been observed from station, and occasionally Gentoo penguins come ashore around station. A colony of about 80 individuals have been sticking around Point 8.

April 2019 WEATHER

W. Lance Roth, Research Associate

Temperature
Average: -.4 °C / 31.3 °F
Maximum: 5.2 °C / 41.36 °F on 24 Apr 07:45
Minimum: -6.3 °C / 20.66 °F on 22 Apr 01:51
Air Pressure
Average: 980.9 mb
Maximum: 1002.6 mb on 9 Apr 02:31
Minimum: 948.6 mb on 13 Apr 18:02
Wind
Average: 24.5 knots / 28.2 mph
Peak (5 Sec Gust): 104 knots / 119 mph on 11 Apr 16:53 from NNW (344 deg)
Prevailing Direction for Month: NE
Surface
Total Rainfall: 160.5 mm / 6.32 in
Total Snowfall: 29 cm / 11.3 in
Greatest Depth at Snow Stake: 20.4 cm / 8 in
WMO Sea Ice Observation: No sea ice in sight with 1-5 ice bergs and bergy bits.
Average Sea Surface Temperature: .52 °C / 32.9 °F

April was a very windy month with the wind reaching 119 mph on the 11th and averaging 28.2 mph. The prevailing wind direction was from the North-East. Temperatures reached a low of 21.7° F on April 22nd and just two days later peaked at 41.4° F on April 24th. We accumulated 11 inches of snow and had six inches of rain fall. There has been brash ice in the area occasionally, as well as several large icebergs in the area.

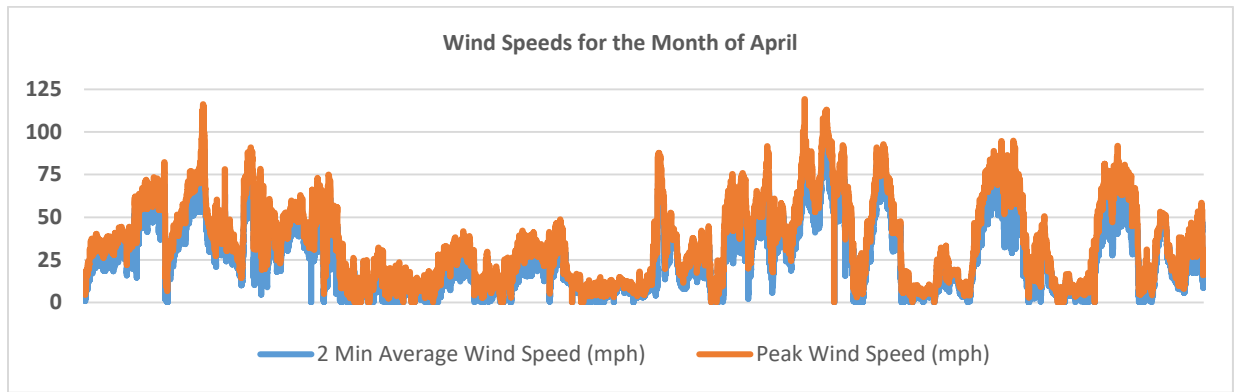


Fig. 1 – Two-minute average wind speed (blue line; mph) and peak wind speeds (orange line, mph) for the month of April 2019. Image Credit: W. Lance Roth.

B-459-P: CAREER: “THE OMNIVORE’S DILEMMA”: THE EFFECT OF AUTUMN DIET ON WINTER PHYSIOLOGY AND CONDITION OF JUVENILE ANTARCTIC KRILL

Dr. Kim Bernard, Principal Investigator, College of Earth, Ocean, and Atmospheric Sciences, Oregon State University

Personnel on Station: Kim Bernard, Kirsten Steinke and Julia Fontana

Collecting krill on the southbound

Our research began during the transit south on the *R/V Laurence M. Gould*. During the nights of April 17 and 18, we searched for and successfully collected ~5,000 juvenile Antarctic krill from the Croker Passage and Wilhelmina Bay (Figure 1). We maintained the krill in two large Xactic tanks that were plumbed with natural seawater. On April 21, we arrived at Palmer Station and the two Xactic tanks were immediately transferred via the Landing Craft to Palmer while the *R/V Laurence M. Gould* held station in Arthur Harbor. Despite this being a new means of transfer, it went off without a hitch and we are very grateful to everyone, both ship- and shore-side, who helped make this happen.



Figure 1. Picking out individual healthy juvenile krill using stainless steel sauce ladles. Photo credit: Julie Schram.



Figure 2. Xactic tanks with krill in the Palmer Aquarium Room. Photo credit: Kim Bernard.

difficulty in maintaining constant flow between all 16 tanks, (ii) overflow of tanks, and (iii) the presence of too many bubbles (which negatively affect the ability of the krill to remain submerged – i.e. bubbles attach to them and they float to the surface). After careful consideration, we decided that it would be better to have one large tank per treatment (rather than four smaller replicate tanks). This would minimize issues with inconsistent flow rates between many tanks, would reduce the chances of overflow, would also reduce the chances of the water freezing in the tanks, and would allow us to use many more krill (~660 instead of 60). Since Antarctic krill are a pelagic schooling species, it also made more sense to have them in larger volumes of seawater. In order to take replicate samples of krill from each tank, we must be able to prove that the environmental conditions in each treatment tank are not significantly different. We have been recording the seawater temperature, salinity and dissolved oxygen in each tank, twice a day, and are not seeing any significant differences, giving us confidence that this is the best approach for our study.

Time-point zero

We started our first series of time point experiments on April 29, running the full week. This series of experiments included measurements of (i) respiration rates (n=16 krill), (ii) egestion rates (n=4 replicates of 10 krill each), (iii) assimilation efficiency (n=4 replicates of 9 krill each), (iv) fatty acid absorption efficiency (n=4 replicates of 10 krill each), and (v) growth rates (n=212 krill). We will conduct this series of experiments (with the exception of growth rates, which will only be done again at the end of the season due to the need for large amounts of krill) four more times during our field season.

The Xactic tanks were quickly plumbed into the Palmer Station natural seawater (Figure 2) and the krill were assessed and found to be in good condition.

Setting up the long-term feeding experiment

During the days that followed our arrival, we set up the sixteen 200-L tanks that we had originally planned on using for our long-term feeding experiment (Figure 3). However, a number of unforeseen issues arose that resulted in us switching to the large circular indoor tanks. These issues included (i) irregular flow rates and

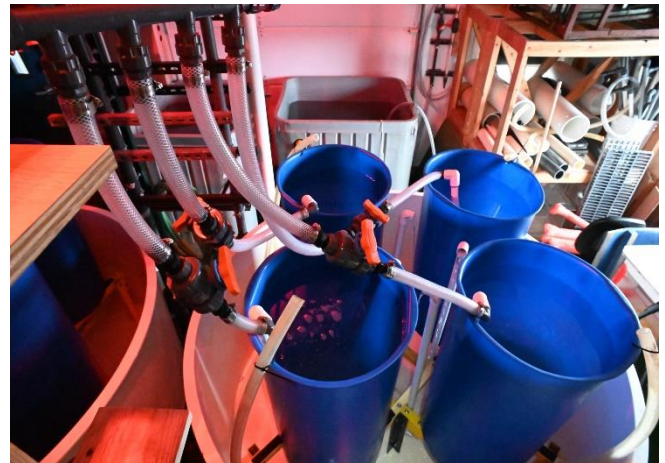


Figure 3. One set of four 200-L tanks set up inside a large circular aquarium tank. Photo credit: Kim Bernard

Trouble-shooting

We had a few minor issues arise within our first week at Palmer, but we feel that we have overcome these now. First, the diatom culture that had been started by the Young group over the

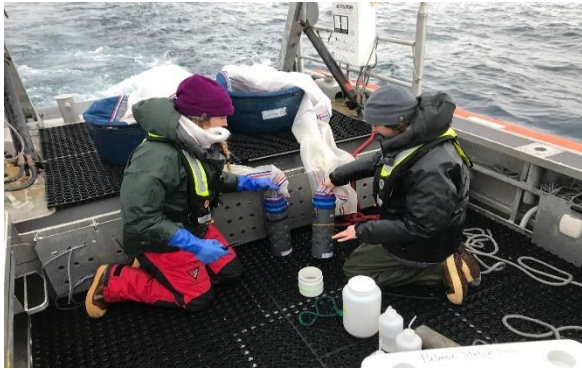


Figure 4. Kirsten Steinke (left) and Julia Fontana (right) prepare to empty the cod-ends of the Bongo net. Photo credit: Julia Fontana.

summer (and maintained by the Steinberg and then Schofield groups) was compromised during a power outage when the incubator temperature increased to 16°C. Despite being exposed to this high temperature, the culture has bounced back and now appears to be growing very well.

Second, collecting enough copepods to feed the krill proved challenging. Station B sampling did not yield enough copepods, but when conditions improved, Kirsten and Julia were able to get out to Station E with Marine Technicians, Andrew and Ken. After several net tows with the new Bongo net, they were able to harvest enough copepods to last a few months (Figure 4).

Looking ahead

Over the next four weeks, we will continue to grow the diatom culture to feed the krill in two of our four treatment tanks. We will also continue to collect copepods (weather and sea ice permitting) to feed the krill in the other two treatment tanks. In addition, we will process the samples that we can on station (e.g. weighing samples, measuring protein content, etc.) and will begin analyzing data.

PALMER STATION RESEARCH ASSOCIATE MONTHLY REPORT

April 2019

W. Lance Roth

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.

Both the ELF/VLF software terminated do to full hard drives. The drives were swapped and the software was restarted. Four unplanned power outages happened, but the system came back online and operated normally through the rest of 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 system was turned back on with the return of darkness. The system is still experiencing some issues with Windows 10.

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 O₂ (detected through changes in O₂/N₂ 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 CO₂ 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.

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 during favorable winds and HATS Air samples were taken every other week.

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.

Patrick Disterhoft made a site visit and installed Windows 10. The system operated normally throughout the month. Bi-weekly absolute scans were completed as necessary. The five lamp calibration was completed Patrick's site visit with a new black barrel.

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.

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. The glacier terminus was surveyed but has not been processed due to issues with Windows 10.

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.

Bouvard Hosticka is here for the annual site visit. The system operated normally through four unplanned power outages and returned to normal operation smoothly.

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 while the tide gauge lost connection with the host computer. Several days went by before the connection was made. Issues with the SQL Data Logger are still under being worked out.

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. Observations are archived on the AMRC website: <ftp://amrc.ssec.wisc.edu/pub/palmer/>