

PALMER STATION MONTHLY SCIENCE REPORT

JULY 2019



Research Associate W. Lance Roth wraps up a NOAA Carbon Cycle Greenhouse Gases air sample in the mid-morning light.

Image Credit: Hannah James

NEWS FROM THE LAB

Hannah James, Winter Laboratory Supervisor

The heart of winter was another successful month for the Palmer science community. The Bernard group was busy with their Time Point 2 experiment, laboratory staff was able to collect data at the Vieira borehole and replace an old battery, and the large task of wasting old chemicals around the labs began. Thanks to our Research Associate and IT department, 7-day and 24-hour waterwall datasets are now displayed under the “Weather” section of our local intranet page.

The Bernard group completed their Time Point 2 experiment and began the second phase of their long term feeding experiment. Towards the end of the month, the group hosted an open house for all staff on station. During this open house, small groups of people were showed three stations where different aspects of the experiments were explained and people got an up-close look at the krill in a small tank and under a microscope.

The weather was consistently inconsistent throughout the month, with calm, cold days followed by warm temperatures and winds gusting well over 100 miles per hour at times. All in all, it was a beautiful month with increased sunshine, ice bergs coming and going, and the slow return of wildlife. In addition to the frequently seen Cormorants, Kelp Gulls and Sheathbills, Snow Petrels became a common sight towards the end of the month. An increased number of juvenile Giant Petrels have been flying around Arthur Harbor for the last two weeks and three Gentoos were spotted swimming in Arthur Harbor mid-month. Crabeater and Fur Seals have been observed on land and on sea ice far in Hero Inlet, but Leopard Seals remained elusive throughout the month.

July 2019 WEATHER

W. Lance Roth, Research Associate

Temperature
Average: -4.2°C / 24.4°F
Maximum: 3.7°C / 38.66°F on 25 Jul 22:05
Minimum: -12.7°C / 9.14°F on 24 Jul 07:11
Air Pressure
Average: 997.2 mb
Maximum: 1018.3 mb on 11 Jul 23:56
Minimum: 962.8 mb on 27 Jul 04:03
Wind
Average: 13.5 knots / 15.6 mph
Peak (5 Sec Gust): 109 knots / 126 mph on 25 Jul 16:26 from ENE (61 deg)
Prevailing Direction for Month: NNE
Surface
Total Rainfall: 20.1 mm / 0.79 in
Total Snowfall: 27 cm / 10.5 in
Greatest Depth at Snow Stake: 49.4 cm / 19.3 in
WMO Sea Ice Observation: 6-10 icebergs with growlers and bergy bits
Average Sea Surface Temperature: -1.53°C / 29.2°F

July had a lot of variable weather with the winds reaching 126 mph on the 25th and averaging 16 mph. The prevailing wind direction was from the East-northeast. Temperatures reached a low of 9.1°F on the 24th and peaked at 38.7°F the following day, July 25th. We accumulated 10.5 more inches of snow raising our total to over 19 inches. There has been some new grease and frazil ice on occasion, but Arthur Harbor has been mostly ice-free with several large icebergs, growlers, and bergy bits.

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

We conducted the Time Point 2 suite of experiments in the second week of July and spent the rest of the month processing the resulting samples and data. We have made one notable change in our experimental approach between Time Points 1 and 2. Instead of conducting Assimilation

Efficiency experiments, as we did in Time Points 1 and Zero, we conducted Ingestion Rate experiments. We made this change because the Assimilation Efficiency results were highly variable, and we were concerned about their accuracy. Since we were measuring Assimilation Efficiency primarily to obtain estimates of Ingestion Rate, we decided it would be better to calculate Ingestion Rate directly.

Time Point 2 Experiments – Preliminary Results

1. Respiration Rates

The mean daily respiration rate standardized by krill dry weight has increased significantly since Time Point 1 (June) and Time Point Zero (May) ($p > 0.05$; Figure 1.A). There is still no significant difference in respiration rate between krill fed copepods and those fed diatoms, however ($p < 0.05$; Figure 1.B). The respiration rate values are now significantly higher (mean = $0.33 \mu\text{g O}_2 \text{ mg DW hour}^{-1}$) than those recorded for similar sized krill in August 2016 in the Bransfield Strait (mean = $0.25 \mu\text{g O}_2 \text{ mg DW hour}^{-1}$; Bernard et al. 2018).

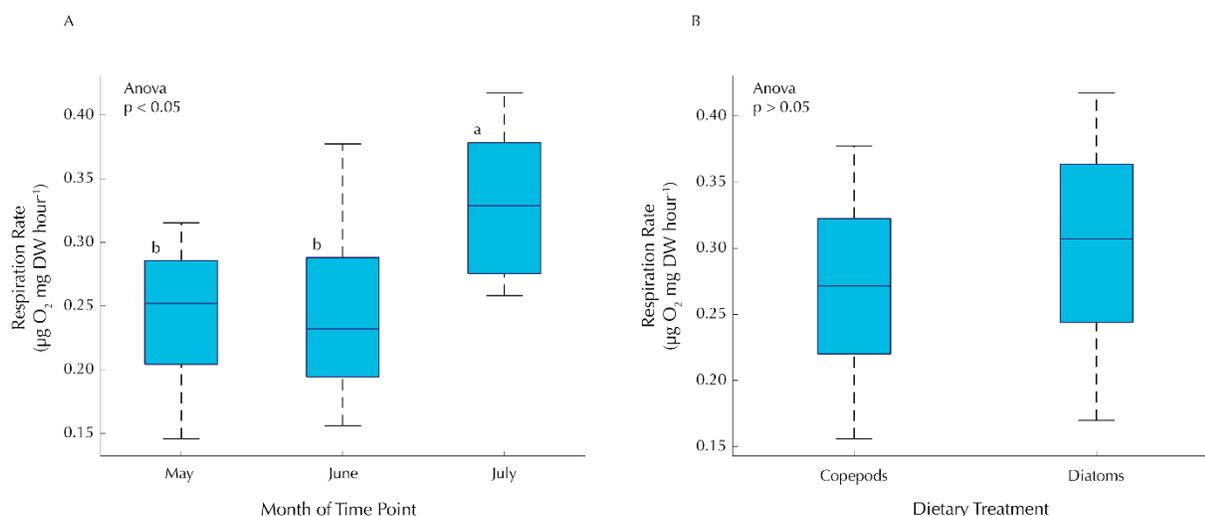


Figure 1. A. Mean respiration rates of krill measured at Time Point Zero (May), Time Point 1 (June) and Time Point 2 (July). Respiration rates in July were significantly higher than those in May or June. B. Mean respiration rates of krill fed a diet of copepods and diatoms (data from Time Points 1 and 2 only). Respiration rates were not significantly different.

2. Ingestion Rates

As mentioned above, we measured ingestion rates for the first time at Time Point 2 this month. Preliminary results indicate that juvenile krill used in our experiments ingested an average of $0.64 \mu\text{g Chl-}a \text{ individual}^{-1} \text{ day}^{-1}$. This ingestion rate equates to a clearance rate of approximately $1.56 \text{ mL (mg DW)}^{-1} \text{ hour}^{-1}$, which is slightly higher than that reported by Atkinson et al. (2002) in autumn in the Lazarev Sea ($\sim 1 \text{ mL (mg DW)}^{-1} \text{ hour}^{-1}$). Ingestion rates for krill fed the freeze-dried zooplankton mix cannot be assessed until we have measured the carbon contents of those samples, which will be done at our home institute.

3. Egestion Rates

There was a large amount of sediment (most likely glacial flour) in the seawater used in our experiments at this time point. As a result, fecal pellet samples produced in the Egestion Rate experiments also contained sediment causing our dry mass measurements to be erroneously high. For this reason, we have not reported them here. Since we only need to measure the organic

carbon content of the fecal pellets, the presence of sediment will not affect our final results as long as the sediment is inorganic. To assess this, we ashed a filtered sample of sediment in the muffle furnace (this destroys all organic matter) and found that 98% of the sediment was inorganic.

Experimental Treatment Conditions

After Time Point 2 was completed, the long-term feeding experiment moved into its second phase consisting of four separate dietary treatments. The table below shows the treatments in each tank.

Treatment	Phase 1 Diet	Phase 2 Diet
1	Freeze-dried zooplankton	Natural seawater
2	Freeze-dried zooplankton	Freeze-dried zooplankton
3	Diatom culture	Natural seawater
4	Diatom culture	Diatom culture

We continue to monitor the seawater temperature, salinity and dissolved oxygen twice daily in each of the four experimental treatment tanks. Temperatures have stabilized and have not dropped below -0.4 °C.

Open House – Science Talk Tuesday

We invited Palmer Station residents to participate in an Open House on Tuesday, July 30th (Figure 2). We set up three stations, with Kirsten, Julia and Kim running each. The attendees were divided into 3 groups and spent about 15 minutes at each of our stations. Kirsten demonstrated how to differentiate between a male and female krill and provided an opportunity for folks to look at krill under a dissecting microscope. Julia had her respiration experiment set-up in the Environmental Room and explained how the FireStingO2 oxygen sensor worked. Kim showed everyone the long-term feeding experiment set-up and explained how krill feed. The opportunity allowed folks on station to get up close to the krill and everyone who attended seemed to really enjoy it.

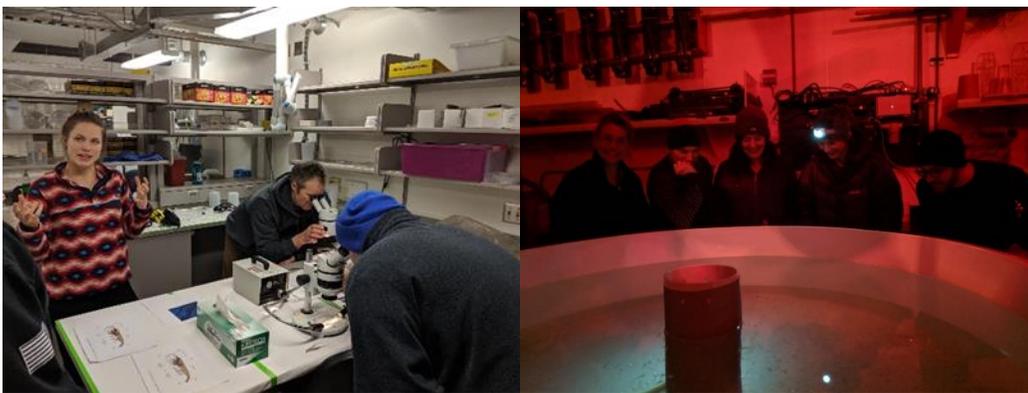


Figure 2. A. Kirsten explains her research while Kris and Dave take a closer look at krill under the dissecting scopes. B. Julia (with headlamp on) talks to Lisa, Ken, Holly, and Peter about krill. Photos: Hannah James

PALMER STATION
RESEARCH ASSOCIATE MONTHLY REPORT
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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 operated normally through 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 program cannot detect the computer time correctly, which may be due to a Windows 10 update. This issue has prevented the program from working properly this season.

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 inter-annual 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.

The system operated normally throughout the month, but something is causing the computer to lock up at times. 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.

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 has been 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.

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.

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/>.