

PALMER STATION MONTHLY SCIENCE REPORT

August 2017



Gentoo penguins porpoise in front of Mt. William, seen from Palmer's RHIB, *Rigil*. Image Credit: Rachael Cunningham

NEWS FROM THE LAB

Emily Olson, Winter Laboratory Supervisor

We capped off our busy winter season in the Palmer Labs with one final fishing cruise and the completion of B-029-P (Postlethwait)'s notothenioid warming experiments. Despite the challenges of a condensed schedule for both fishing operations on the Gould and experiments conducted with the resulting specimens, B-029-P (Postlethwait) left Palmer with five full boxes of samples and a successful field season in the bag. Throughout the month station personnel continued *Rigil* operations in preparation for the summer season. We had a successful launch and retrieval of the RHIB while the Gould was docked at the pier, with the added complication of a power loss necessitating retrieval via line handling and winching back to its trailer. Towards the end of the month lab operations slowed down and, as B-029-P (Postlethwait) packed up, focus shifted to cleaning and staging for the summer science groups. The flowmeters in the aquarium finally fell to zero as B-029-P (Postlethwait) departed on August 29th, signaling the end of active science in the Palmer Labs for the 2017 winter season.

Palmer Monthly Met summary for August, 2017

Temperature
Average: -4.5 °C / 23.8 °F
Maximum: 4.2 °C / 39.56 °F on 13 Aug 15:59
Minimum: -14.2 °C / 6.44 °F on 29 Aug 11:57
Air Pressure
Average: 983.8 mb
Maximum: 1021.1 mb on 8 Aug 06:14
Minimum: 949.3 mb on 1 Aug 14:32
Wind
Average: 12.2 knots / 14.1 mph
Peak (5 Sec Gust): 56 knots / 65 mph on 23 Aug 04:22 from E (94 deg)
Prevailing Direction for Month: NNE
Surface
Total Rainfall: 17.8 mm / .7 in
Total Snowfall: 21 cm / 8.2 in
Greatest Depth at Snow Stake: 55 cm / 21.5 in
WMO Sea Ice Observation: Sea ice present <3/10, nilas or ice rinds, 1-5 bergs, with growlers and bergy bits.
Average Sea Surface Temperature: -1.67 °C / 29 °F

August was not as windy as July, but with wind speeds up to 65 mph on the 23rd and an average speed of 14.1 mph it made work outside difficult. Temperatures dropped down to 6 °F with an average of 24 °F. These cooler temperatures brought 8 inches of snow this month bringing our total snow accumulation up to 22 inches. Arthur Harbor and Hero Inlet have been developing some sea ice in the form of nilas and ice rinds. Over half of the area in front of Palmer Station is currently covered in sea ice, with plenty of bergs, growlers, and bergy bits in the area.

B-029 – IcemiRs: Control of Development and Physiology in Antarctic Fish by microRNAs

John Postlethwait, Principal Investigator, University of Oregon, H. William Detrich, Principal Investigator, Northeastern University, Thomas Desvignes, University of Oregon

Personnel on Station: Thomas Desvignes, Kristin Alligood, Rachael Cunningham, Leandro Marx-Albuquerque, and Natalie Mosqueda

Icefish live in frigid Antarctic seas and have unique traits including the absence of red blood cells and the inability to adapt to changes in environmental temperatures; a trait that would be harmful to animals in fluctuating environments. In mammals and fish inhabiting temperate waters, development and physiology is regulated by genes that encode specific proteins, but the rate of protein production is often modulated by short RNA molecules called microRNAs (miRNAs). miRNAs, which have not been studied in Antarctic fish, regulate the amount of protein cells make by binding to the RNA intermediate called messenger RNA (mRNA) and interrupting protein production. The B-029-P (Postlethwait) project aims at comparing miRNA regulation 1) in Antarctic fish vs. warm-water fish to learn how miRNAs regulate gene expression in constant cold and how their expression varies with elevation of temperature and 2) in Antarctic icefish with no red blood cells, enlarged hearts, and reduced bone density vs. closely related Antarctic fish containing red blood cells, normal hearts, and dense bones. The project will study the importance of miRNA gene regulation in Antarctic fish and will shed light on how these fish might respond to the warming of Antarctic waters.

After the departure of team members Postlethwait, Detrich, and Miller on July 29th, members Desvignes, Alligood, Cunningham, and Mosqueda remained at Palmer Station and continued conducting temperature challenges on target species and sampling control specimens.

After a delayed arrival due to inclement weather during the northbound transit of LMG17-06, the ARSV *Laurence M. Gould* departed Punta Arenas, Chile on August 11th en route to Palmer Station to initiate cruise LMG17-07. On board was one member of science project B-029-P (Postlethwait), Leandro Marx-Albuquerque, and nine ASC staff members. The crossing of the Drake Passage was good and the *Gould* arrived at Palmer Station on the morning of August 15th. Later that day, the Chief Scientist, the Captain of the *Gould*, and the MPC met to plan the four-day fishing trip scheduled to leave the morning of August 17th. During interim port-call operations, cargo was off-loaded to the station, including the eagerly awaited “freshies.”

On August 17th three members of B-029-P (Postlethwait) (Desvignes, Alligood, and Mosqueda) as well as Palmer’s Laboratory Supervisor Emily Olson and ASC personnel Jack Norray embarked the *Gould* and departed station at 8:30 LT (local time). The course was set for “Hugo Deep”, a deep fishing ground located on the northeast side of Hugo Island. Three trawls were done using both Blake and Otter trawls at about 600m to 700m depth. Fishing at Hugo Deep yielded a light catch, but some very interesting specimens of dragonfish were collected there. Dragonfish represent an evolutionary intermediate between the classically studied and abundant red-blooded notothenids and the white-blooded icefishes, making the stop worthwhile. Early on the morning of August 18th (01:00 LT) the *Gould* steamed for the main fishing ground located at the southwest corner of ASPA 152 (Western Bransfield Strait) near Low Island where eight Otter trawls were conducted from 19:00 to 07:00 LT during the night of August 18th – 19th. After a

successful night of fishing we had captured a good amount of fish of three of the four targeted species, the white-blooded Blackfin Icefish (*Chaenocephalus aceratus*), the red-blooded Bullhead Notothen (*Notothenia coriiceps*) and the Humped Notothen (*Gobionotothen gibberifrons*), in addition to other notothenioid species. Unfortunately we didn't have much luck catching Mackerel Icefishes (*Champscephalus gunnari*), the fourth targeted species of our experiments. We thus have only three temperature-challenged specimens for this species, while having at least five specimens for each of the other three species. After these trawls the *Gould* headed back to Palmer Station, conducting en route two additional Blake trawls at Hugo Deep. These two additional trawls turned out to be even more successful than the previous nights', yielding several more specimens of dragonfishes as well as some Deepwater Notothen (*Trematomus loennbergii*) and several specimens of two eelpout species, one of the two other lineages of fish inhabiting the frigid waters of the Southern Ocean.

While steaming back to Hugo Deep on the way to Palmer Station, the scientific team began to process collected specimens that had died overnight possibly due in part to capture stress but most likely due to the very low surface water temperature (~-1.8C), much colder than the bottom temperature that we recorded with a temperature probe attached to the net (~-0.6C). We think the cold sea surface temperature combined with the cold air temperature on the back deck is likely responsible for these mortalities because while we were dissecting those fish we found in most of them some ice in their intestines and abdominal cavity. These fish nevertheless provided samples for DNA and morphological analyses.

On August 20th at 8:30 LT, the *Gould* docked at Palmer Station, the fish were off-loaded immediately and placed in the Palmer Station aquaria, and the science passengers disembarked.

While remaining on station, team members Cunningham and Marx-Albuquerque continued performing heat-challenge experiments as well as sampling control fish.

With only eight days left on station and many new fish, the complete team worked hard to dissect more control specimens and perform twice as many heat-challenges per day. On Friday, August 25th, the last heat-challenges were run and the last control fish were sampled the following day. Meanwhile, thanks to the great help of the Logistics team, the Waste Management Specialist, the Instrument Technician, and Laboratory Supervisor, among others, samples were packed, shipment paperwork submitted and approved, laboratory equipment and consumables returned, and aquaria drained and cleaned. On Monday, August 28th, the day before departure, the laboratory and aquarium facilities were inspected and chemical inventory updated, and, finally, in the middle of the afternoon, the result of our deployment and the team's hard work— five full boxes of samples— were transferred to the *Gould* in order to be sent back to our respective institutes. Despite some difficulties getting some of the targeted species (i.e. the Mackerel Icefish, *Champscephalus gunnari*), the B-029-P (Postlethwait) succeeded in performing a sufficient amount of experiments needed for testing the hypotheses of both the implication of miRNAs in thermal adaptation in Antarctic Notothenioids, as well as their involvement in the peculiar icefish physiology.

On August 29th, at 8:30 LT, the *Gould* departed Palmer Station to Punta Arenas, Chile, with all B-029-P (Postlethwait) project members (Desvignes, Alligood, Cunningham, Marx-Albuquerque, and Mosqueda).

As of today, September 1st, the *Gould* has finished the northbound crossing of the Drake Passage and is sailing along the Argentinian coast of Patagonia to Punta Arenas where she should arrive early in the afternoon of September 2nd. The cruise got a little delayed due to a very large amount of pancake ice that had formed all along the peninsula and even until almost one third into the Drake Passage due to very low sea-surface temperatures (<-1.8C).

We express our sincere gratitude to the USAP staff in the US and Punta Arenas, and to the *Gould* and Palmer Station personnel for their exceptional help in making the month of August, and our entire season, a scientific success despite many changes of plan and revised schedules over the two cruises.



B-029-P (Postlethwait) principal investigator Thomas Desvignes does his best impression of the icefish *Champscephalus gunnari* caught on a fishing cruise aboard the *Laurence M. Gould*.

Image Credit: Kristin Alligood

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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-109-P: ANTARCTIC EXTREMELY LOW FREQUENCY/VERY LOW FREQUENCY (ELF/VLF) OBSERVATIONS OF LIGHTNING AND LIGHTNING-INDUCED ELECTRON PRECIPITATION (LEP).

Robert Moore, Principal Investigator, University of Florida

ELF/VLF radio wave observations at Palmer Station are used to provide a deeper understanding of lightning and its effects on the Earth's inner radiation belt. The Research Associate operates and maintains on-site equipment for the project.

The VLF/ELF system has operated well throughout the month.

A-119-P: DEVELOPMENT OF ANTARCTIC GRAVITY WAVE IMAGER.

Michael Taylor, Principal Investigator, Utah State University

The Gravity Wave Imager takes images of the night sky in the near infrared, observing the dynamics of the upper atmosphere. The camera takes one 20-s exposure image every 30s of a very faint emission originating from a layer located at ~55 miles of altitude.

The IR camera has operated well throughout the month.

A-357-P: EXTENDING THE SOUTH AMERICAN MERIDIONAL B-FIELD ARRAY (SAMBA) TO AURORAL LATITUDES IN ANTARCTICA

Eftyhia Zesta, Principal Investigator, University of California Los Angeles

The three-axis fluxgate magnetometer is one in a chain of longitudinal, ground-based magnetometers extending down though South America and into Antarctica. The primary scientific goals are the study of ULF (Ultra Low Frequency) waves and the remote sensing of mass density in the inner magnetosphere during geomagnetically active periods. The Research Associate maintains the on-site system.

The magnetometer was operational all month. It is still not on the Network and awaiting a new RSP.

A-373-P: TROPOSPHERE-IONOSPHERE COUPLING VIA ATMOSPHERIC GRAVITY WAVES

Vadym Paznukhov, Principal Investigator, Boston College

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

The system operated well throughout the month.

O-202-P: ANTARCTIC METEOROLOGICAL RESEARCH CENTER (AMRC) SATELLITE DATA INGESTOR.

Mathew Lazzara, Principal Investigator, University of Wisconsin

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

The data ingestor computer system has been operating normally all 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 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 when the winds were favorable and HATS Air samples were taken twice this month.

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. The aspirating fan on the PSP was fixed by replacing a fuse.

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 well throughout the month.

T-312-P: TERASCAN SATELLITE IMAGING SYSTEM

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

The Orbital Elements were updated again on the Terascan system. More maintenance was done on the antenna. The imagery is still dropping out during certain passes.

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

Managed by General Dynamics

The IMS Radionuclide Aerosol Sampler and Analyzer (RASA) is part of the CTBTO verification regime. The automated RASA continually filters ambient air and tests for

particulates with radioisotope signatures indicative of a nuclear weapons test. The Research Associate operates and maintains the instrument.

The system operated normally throughout the month.

OCEANOGRAPHY

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

Observations of sea ice around station were made daily and the tidegauge worked well throughout the month. The observations and tide data are archived on the AMRC website: <ftp://amrc.ssec.wisc.edu/pub/palmer/>

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 Joubin and Wauwerman sites are beginning to come back online as the sun rises higher in the sky. The observations are archived on the AMRC website: <ftp://amrc.ssec.wisc.edu/pub/palmer/>



A leopard seal lounges on a piece of sea ice in front of a fog bow. Image Credit: Emily Olson