

PALMER STATION MONTHLY SCIENCE REPORT

AUGUST 2013



Sean O'Neill and Madelyne Willis of B-228-P (Amaral-Zettler) retrieving a CTD at Station E.
(Image Credit: Ryan Wallace).

NEWS FROM THE LAB

By Janice O'Reilly, Assistant Supervisor of Laboratory Operations

During the month of August grantees and ASC staff dedicated long hours to winter science and work projects. Members from B-029-U (Postlethwait) and B-228-P (Amaral-Zettler) continued with their research, in the labs, environmental rooms, and on the water. The ASC team continued preparations for the upcoming summer science season: labs were cleaned and organized, equipment calibrations and PM's were conducted, linoleum floors were cleaned and polished, computers were upgraded, and science supplies were prepared for summer grantees.

A variety of weather conditions during August shaped a transitioning landscape, one that changed dynamically with lengthening daylight hours and periods of open water. On the 2nd and 7th of August, the early morning light, along with low stratospheric temperatures, created ideal conditions for displays of iridescent nacreous clouds. Dramatic sunsets created boldly-colored skies on several afternoons, providing some wonderful photography opportunities.

As the environment transitioned from winter to summer, small groups of birds appeared more frequently around the local Palmer Station area. On 18 August, 20 Adélie penguins were sighted on the south shore of Janus Island, and on the same day approximately six (unidentified) penguins were observed swimming along the backyard shore of Arthur Harbor. On 27 August, during the installation of the Automatic Weather Station on Bonaparte Point, ASC staff watched a group of approximately 12 gentoo penguins in the nearby water, plunging below the water's surface, perhaps feeding; the penguins porpoised into the Bonaparte Point channel and hopped onto the snow-covered shore, where they preened their feathers. On the same day, the water-sampling team, observed six gentoo penguins on Torgersen Island. Giant petrels, blue-eyed shags, snowy sheathbills, and kelp gulls were commonly seen throughout the month, especially during periods of open water. Other birds observed less frequently included snow petrels and cape petrels.

Few seals were seen during August. Boaters reported seeing one Weddell seal sleeping on the southwest shore of Amstler Island on 11 August. Two Weddell seals appeared periodically on the Hero Inlet sea ice, visiting for up to three days at a time. At least one of the Weddell seals appeared to be pregnant, and was usually seen alone. One crabeater seal was observed on 21 August, resting on the Hero Inlet sea ice. On 27 August, one Weddell seal was seen on the eastern shore of Torgersen Island. Wildlife sightings were mainly restricted to Palmer Station, the backyard, and Bonaparte because of limited boating opportunities.

AUGUST 2013 WEATHER

By Graham Tilbury, Research Associate

The month of August started out with the coldest temperature so far this winter. The first week was typical winter weather, with low temperatures and moderate winds from the south.

A change in the winds to a more northerly flow followed, and for the next ten days temperatures warmed considerably. Towards the middle of the month, a low pressure system settled over the area, and moderate easterly winds brought the heaviest snowfalls of the month. During the last week, a low pressure system caused wind speeds to drop considerably, stalling at zero knots on several occasions, and temperatures to remain pleasantly cool.

A strong northeast wind on 7 August peaked at 61 knots, the highest reading for the month. However, winds for the month were generally much lower, averaging 10 knots, only slightly higher than July's average.

The lowest temperature of -18.7°C occurred on the first day of the month. However, for the rest of the month, far warmer temperatures were the norm, with the warmest temperature of 1.3°C recorded on 26 August.

Snowfall for the month totaled 23 cm. This brought the annual total up to 242 cm, which is very close to the annual average for August at the station. The snow stake reached its highest level of 52cm on 12 August. By the end of the month it had fallen only slightly to a level of 41 cm.

The sea surface temperature averaged -1.8°C for most of the month. Sea ice formed on several occasions, only to be broken up by the warmer northerly winds. By the end of the month, with calmer winds and lower temperatures, the sea around the station was covered with a solid layer of predominantly thin first year ice.

B-029-P: DEVELOPMENTAL MECHANISMS FOR THE EVOLUTION OF BONE LOSS

Dr. John H. Postlethwait, Principal Investigator, Institute of Neuroscience, University of Oregon, Eugene, and Dr. H. William Detrich, Co-PI, Northeastern University

Personnel on station: Ashley Nelson, Urjeet Khanwalkar.

Our goal is to understand the molecular genetic mechanisms for the evolution of bone loss in the icefish lineage of Antarctic Notothenioid fish. To investigate the developmental origins of these differences, we made matings for several species Notothenioid species; currently only *N. coriiceps*, a robustly mineralized species, are still developing at Palmer.

A second goal is to understand how embryos of Antarctic fish respond to increasing temperature. As the Southern Ocean begins to warm, what will happen to embryonic development of Antarctic fish? Any of several possibilities suggest themselves. 1) Embryos might just die, unable to cope with the increasing temperature. 2) Embryos will develop more rapidly and immediately hatch in the Austral winter or too early in the Spring before sufficient returning sunlight allows phytoplankton to proliferate to provide food for the larvae. 3) Embryos will develop more rapidly but will delay hatching until the lengthening photoperiod signals the historically normal time for hatching. To distinguish these possibilities, we are growing a group of animals at higher temperature, as described below.

August Summary

- From the *N. coriiceps* cross #7/8 (~2000 embryos), which occurred over the course of several days around June 7th, 2013, our oldest embryos were at approximately 80dpf (as of August 26th, 2013). These are currently being raised in a cascade tank in Environmental Room #1. The cascade tank in Environmental Room #1 continues to run well with little to no issues concerning flooding or mass embryo death.
- From *N. coriiceps* cross #12 (~300 embryos), which were fertilized on June 25th, 2013 (natural overnight spawning in the watch tank), embryos are currently at 62dpf (as of August 26th, 2013). They are currently being raised in two floating incubators in the indoor tank closest to the lab vestibule.
- To test the effect of temperature on embryonic growth, we set up an incubator in a laboratory refrigerator for a warm temperature ($+4^{\circ}\text{C}$) experiment using 300 embryos from *N. coriiceps* cross #7/8. Embryos were slowly acclimated to $+4^{\circ}\text{C}$ over 24 hours to avoid heat shock (an increase of approx. $+0.25^{\circ}\text{C}$ every hour). We perform a water change of 60% of the tank every 6 hours, and have dimmed the light to match that of Environmental Room #1, hoping to control as many variables as possible between the warm and control embryos. We take a sample of embryos (n=4) every 24 hours for morphology and for gene expression analysis.

- Final total samples for histology, gonadal-somatic index (GSI, a measure of reproductive readiness), and RAD-sex (population genetic analysis by massively parallel high throughput DNA sequencing) on expired or spawned out individuals has been completed.
 - FINAL totals for this season:
 - *C. aceratus* – 281
 - *C. gunnari* – 99
 - *C. rastrorpinosus* - 20
 - *P. georgianus* - 45
 - *N. rossii* – 46
 - *N. coriiceps* – 158
 - *G. gibberiformis* -120
 - *T. hansonii* – 4
 - *P. charcoti* – 2
 - *G. acuticeps* – 1
- Embryo fixations continue for RNA-seq, Bouin's, in situ (whole and sections), as well as alcian blue-alizarin red (ABAR) and von Kossa's staining for bone development.
 - Sampling is completed for unfertilized eggs, "sphere" stage, "shield" stage, 60-80% epiboly, 10-15 somites, and 60 dpf
 - Fixations for in situ hybridization experiments for gene expression analysis (whole embryos and histological sections), ABAR, and von Kossa's continue every 10 or 20 days, depending on the fixation protocol
 - Photos of the embryos continue to be taken under a dissecting scope every two to three days, depending on the rate of development
- Histology and RAD-sex samples (along with any full boxes of embryo samples) will be sent back to Oregon on the September cruise
 - A number of frozen fish heads will also be sent to Oregon
- The tray incubator and cylindrical incubators will be sent back to Punta Arenas for storage on the September cruise

B-228-P: COLLABORATIVE RESEARCH: MICROBIAL COMMUNITY ASSEMBLY IN COASTAL WATERS OF THE WESTERN ANTARCTIC PENINSULA

Linda Amaral-Zettler, Principal Investigator, Marine Biological Laboratory, Woods Hole, MA;
 Jeremy Rich, co-Principal Investigator, Brown University, Providence, RI

Personnel on station: Sean O'Neill and Madelyne Willis

August was an unpredictable but successful month for B-228. Given that many of our project's objectives are constituent upon weather and ice conditions, it's necessary that our plans remain flexible. Much of August was spent completing the first carboy experiment and, due to a lack of sea ice with visible microbial growth, we postponed the sea ice carboy experiment. Instead, we moved ahead with our second carboy experiment with seawater from the station intake pipe.

For this second carboy experiment we decided to alter the light cycle. In the July experiment we used an eight hours on/sixteen hours off light cycle and full spectrum lighting. For the second experiment we have set up the 50 L carboys under 24/7 ambient light in the environmental room, which is similar to the lighting conditions in a preliminary experiment. Samples are being collected from the carboys every other day and the experiment will continue to run through the first week of September.

In the past month we also had the opportunity to get back out to Station B to continue collecting samples of the microbial communities during the transition from winter to spring. The clement weather and calm water conditions on 27 August permitted us to get out to Station E where we were able to cast a conductivity, temperature, and depth profiler (CTD). We hope to have opportunities to include samples from Station E in our environmental sampling project before the end of the season.

The staff at Palmer station has continued to be flexible and understanding with the fluctuating needs of our project. A special thanks to Dan Nielsen for his help setting up the lighting and shelving for the carboy experiments. In the next month we will continue to look for opportunities to get out to Stations B and E, and to collect samples of sea ice. We are also looking forward to welcoming a new member to B-228, Monica Stegman, and beginning a third carboy experiment.

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Graham Tilbury

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 during 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 antenna atop the glacier was damaged sometime around 14 August, During a week of prolonged bad weather, with wind gusts exceeding 50 knots. Upon inspection of the VLF antenna, the Research Associate confirmed that the antenna wire hoist rope had severed. The mast itself was secure. Various alternative repairs were discussed and on 28 August, during a day of calm weather, a team of six winter-overs was able to get up to the site and hoist a second pulley and haul rope into position. The antenna wires were then hoisted and secured close to their original position. On 29 August, UoF staff confirmed the system was operating at normal signal levels. It is hoped this repair will suffice until April next year, when the antenna is scheduled for relocation off the glacier.

A-132-P: FABRY-PEROT INTERFEROMETER (FPI)

Qian Wu, Principal Investigator, National Center for Atmospheric Research

The Fabry-Perot Interferometer observes mesospheric and thermospheric neutral winds and temperatures at Palmer Station by measuring the wind-induced Doppler shift in the air's nightglow emissions. The Research Associate operates and maintains on-site equipment for the project.

The system operated normally 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 operated normally throughout the month.

**O-204-P: A STUDY OF ATMOSPHERIC OXYGEN VARIABILITY IN RELATION TO
ANNUAL TO DECADEAL 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 both TerraLab and the VLF Building.

Air samples were collected as scheduled throughout the month.

A new wooden crate for transporting filled flasks was built by the station carpenter.

**O-264-P: COLLECTION OF ATMOSPHERIC AIR FOR THE NOAA/GMD
WORLDWIDE FLASK SAMPLING NETWORK**

James Butler, Principal Investigator, 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.

Carbon Cycle and Halocarbon sampling were completed as scheduled during the 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.

A problem with the internal 45watt calibration lamp was reported on 22 August, and a request made for the lamp to be replaced with one of the spare lamps on station. A replacement lamp was located and fitted in place the following day, 24 August. Subsequent calibration scans confirmed the original lamp was faulty.

Normal on-station calibration runs were performed as scheduled.

O-283-P: ANTARCTIC AUTOMATIC WEATHER STATIONS (AWS).

Mathew Lazzara, Principal Investigator, University of Wisconsin

AWS transmissions from Bonaparte Point are monitored using the TeraScan system and the Data Ingestor system. Data collected from this station is freely available from the University of Wisconsin's AMRC website. The Research Associate monitors data transmissions for the project and performs quarterly maintenance on the station at Bonaparte Point.

On the afternoon of 28 August, a lull in the weather enabled three ASC staff to boat across to Bonaparte Point and install the repaired AWS system. The sensors, antenna and control housing were all installed. Unfortunately, a crucial interconnecting power cable could not be located; therefore we were not able to power the system. The battery pack, solar panel and charge regulator were all checked and found to be fully operational. A power cable is to be sent down on the next available LMG port call, and will be installed as soon as conditions permit.

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 GPS station performed normally during 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.

Satellite passes were captured normally 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 through 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 operated normally throughout the month.
This project is no longer funded.

B-466-P: FLUORESCENCE INDUCTION AND RELAXATION (FIRe) FAST REPETITION RATE FLUOROMETRY (FRRF)

Deneb Karentz, Joe Grzyski, Co-Principal Investigators, University of San Francisco

The focus of this project is to identify and evaluate changes that occur in genomic expression and physiology of phytoplankton during the transition from winter to spring, i.e., cellular responses to increasing light and temperature. A Fast Repetition Rate Fluorometer (FRRF) with a FIRe (Fluorescence Induction and Relaxation) sensor is installed in the Palmer Aquarium. The Research Associate downloads data and cleans the instrument on a weekly basis.

Weekly cleaning of the instrument and data downloads were performed as scheduled.

T-998-P: INTERNATIONAL MONITORING STATION (IMS) FOR THE COMPREHENSIVE NUCLEAR TEST BAN TREATY ORG. (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 replacement cooler has been dispatched for shipment to the station and should arrive with the next LMG port call. The detector circuit remains off-line, but daily air filter sampling continues as normal.

TIDE GAGE

Tide height and seawater temperature are monitored on a continual basis by a gauge mounted at the Palmer Station pier. The Research Associate operates and maintains on-site equipment for the project.

A request for additional information on a suitable sensor mounting was requested by the supplier. The necessary information was emailed back the following day.

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 twice each 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 (PalMOS) and emailed to the NOAA for entry into the Global Telecommunications System (GTS).

The wind speed indicator sensor atop the tower failed during extended strong winds on the afternoon of 25 August. The following afternoon the winds dropped to a low enough speed to enable the Communications Technician to safely climb the tower. He was able to re-secure the detached head of the instrument. Wind speed data for the period 13/08/25 19:19:58 through 13/08/26 19:51:58 is therefore incorrectly recorded as zero.