

PALMER STATION MONTHLY SCIENCE REPORT

SEPTEMBER 2014



The 2014 Winter Palmer Station crew depart on the *ARSV Laurence M. Gould*.
(Image Credit: Steve Wickins)

NEWS FROM THE LAB

Carolyn Lipke, Summer Laboratory Supervisor

The winter season wrapped up this month at Palmer Station, during which the pace of science and station work never really slowed. The Bio Lab was continually inhabited by science groups all winter long and two groups rotated through the Terra Lab. ASC staff completed many station improvement projects over the winter, including the new boat ramp and zodiac parking deck.

The *ARSV Laurence M. Gould* returned to Palmer Station mid-month for the winter-summer ASC staff turnover. Several NSF and ASC program staff were also able to visit station during that port call. The winter staff departed after a busy week. We wish them well.

As we transition into the summer season fish embryos continue developing in the aquarium under the watchful eyes of the Detrich group's winter over field team members (B-037-P), and lab staff are preparing for the arrival of summer science groups in early October. Fur seals were frequently seen in the Palmer backyard and on Bonaparte point, somewhat of an unusual sighting for this time of year.

SEPTEMBER 2014 WEATHER

Graham Tilbury, Research Associate

A large high pressure system settled over the peninsular area during the first ten days of the month and on several of these the mountain range to the SE of the station was clearly visible, out to a distance of over 100 miles. Winds remained below ten knots during the first half of the month, resulting in the average wind speed being a low 8 knots. A peak wind speed of 68 knots was measured during a brief, strong blow on the 15th. Snowfall was just below average, at 22cm, bringing the year-to-date snowfall to 231cm, only 20 cm lower than this time last year. Melted precipitation for the month was only 265mm, making it an unseasonably dry month.

Temperatures for the month occasionally rose above freezing, reaching a high of 3.0°C, on the 9th. However, they stayed below freezing for the entire last week. The average temperature for September was a moderate -3.6°C, with a minimum of -12.6°C recorded on the very first day of the month.

Sea surface temperatures remained consistently below freezing, around -1.7°C, throughout the month. After several days of strong, warm NE winds, the sea ice, that had persisted throughout the boating limits for several weeks, suddenly gave way to partly open water on the 17th, just at the time of the *ARSV Laurence M. Gould's* arrival. Variable wind directions during the second half of the month ensured that days of fairly open water were followed by periods of solidly packed sea ice.

B-037-P: PROTEIN FOLDING AND EMBRYOGENESIS IN ANTARCTIC FISHES: A COMPARATIVE APPROACH TO ENVIRONMENTAL STRESS

H. William Detrich, Principal Investigator, Marine Science Center, Northeastern University

Personnel on Station: Nathalie R. Le François and Eileen Sheehan

Antarctic notothenioid fishes have evolved a suite of characters that makes them well adapted to their Southern Ocean (SO) habitat, which cooled to the freezing point of seawater (-1.9°C) by ~8-10 million years ago and has remained at this temperature to the present. However, these cold-adapted stenotherms are now threatened by rapid warming of the SO, the temperature of which is likely to increase by 2-5°C over the next two centuries. We are investigating the impact of this projected warming on development of the embryos of notothenioid fishes to determine whether they have the capacity to recruit to adult populations under this climate change scenario.

During the current winter season, Le François and Sheehan have been carrying out longterm incubations of embryos from the Bullhead notothen, *Notothenia coriiceps*, at control (-1°C) and experimental ($+4^{\circ}\text{C}$) temperatures. Using *N. coriiceps* broodstock captured earlier in the season, Le François and Sheehan obtained nine biparental crosses by *in vitro* fertilization for the thermal perturbation experiment. These crosses have been maintained in our purpose-built embryo incubation system (Aquamerik, Quebec, Canada) located in Environmental Room 1 of the Palmer Station Aquarium. Although two crosses were lost to a freezing incident in August and others have been sampled to completion, Le François and Sheehan continued to collect embryos in September.

The oldest of the clutches have now obtained 120+ days postfertilization. Embryos at -1°C and $+4^{\circ}\text{C}$ are being monitored daily by microscopy to ensure that we sample embryos at comparable stages for the two temperature treatments, and image banks of key developmental stages are being generated.

Le François and Sheehan have also begun dismantling the incubation system. As they prepare for their ship home in October, they have been consolidating and packing all of the science samples and filling out paperwork to prepare them for shipment. Le François and Sheehan have also been busy with organizing their data and writing manuscripts for future publications.

At the end of September, Le François and Sheehan gave a Science Talk to the new summer crew on station. They have also been writing blog posts for their home institutions (Biodôme de Montréal and Northeastern University, respectively; <http://blogue.espacepouurlavie.ca/author/uleftna>; <http://www.northeastern.edu/news/2014/09/antarctic-reflection>). A last online community outreach session was conducted with the Centre de la Biodiversité located in Montréal, Québec. The center is a member of Espaces pour la vie natural museums with which Dr. Le François is associated (see espacepouurlavie.ca/en).

We thank the ASC Palmer Station personnel, both summer and winter, and the Captain, crew, and ASC personnel of the *ARSV Laurence M. Gould* for their excellent support of our research program.

PALMER STATION RESEARCH ASSOCIATE MONTHLY REPORT SEPTEMBER 2014

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 seismograph station operated without any problems for the entire 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 tower was inspected again this month. The four lower antenna feed lines are still covered with snow drifts. A data overflow, caused by a number of days of very active signal, filled the hard drive storage system and resulted in the system locking up. With the help of the PI staff, the problem was eventually resolved and the system is now operating correctly.

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. The FTP of data files, conducted bi-weekly, was successfully completed.

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

Air samples were collected every two weeks, as scheduled.

**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 air samples were collected as scheduled.

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 bi-weekly absolute calibration scans were completed as scheduled. The latest scans involved running all three calibration lamps for inter comparison tests. A marked increase in UV levels, caused by sections of the Ozone Hole moving over the area, was observed during the last few days of the month. The levels, however, were well within the safe exposure range.

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 University of Wisconsin's 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.

Daily quality checks of the downloaded data were performed as scheduled. 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.

A new GPS JAVAD Receiver was installed towards the end of the month. Tests confirmed the system continues to run successfully.

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.

All scheduled daily passes were successfully downloaded and the system continues to perform correctly.

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.

Daily instrument checks, weekly cleaning and data downloads were performed as scheduled.

This project is no longer funded, but will remain active as long as the equipment is functional. The Research Associate will not perform any upgrades or repairs to this system.

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.

Daily filter samples were processed and packaged for shipping. The system continued operating normally throughout the month. Two sets of samples were requested during the month. Each was inspected and processed for shipping to analysis laboratories in Canada and Austria.

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.

The tide level, conductivity and sea water temperature monitoring system performed adequately for the first few weeks of the month. A possible intermittent problem with the pressure sensor is being addressed. A communication problem with the Logger remains unresolved. Hardware tests confirm all cables and connectors are secure. Software issues are being investigated.

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 National Weather Service for entry into the Global Telecommunications System.

The system operated normally during the month. Scheduled sensor inspection and cleaning was performed on the weather station. The new integrated display screen, incorporating individual weather data plots, is running successfully.