

## PALMER STATION MONTHLY SCIENCE REPORT JUNE 2014



**E. Sheehan (B-037) monitors the embryo incubation system for *N.coriiceps***  
*(Image Credits: Nathalie Le François)*

### **NEWS FROM THE LAB**

Linnah Neidel, Winter Laboratory Supervisor

June was a relatively quiet month at Palmer Station with one science group on station. The two winter-over members of B-037 (Detrich) maintained their broodstock fish in the aquarium and collected gametes for controlled crossings with known parent fish. The crosses of *N.coriiceps* produced embryos that were hosted in the embryo incubation system in the environmental room, for elevated temperature studies.

ASC winter staff dug into our winter tasking, taking advantage of the quiet time between cruises. While keeping the labs and aquarium running, many projects small and large were tackled to maintain and improve the labs by both the facilities and lab personnel. The former photography darkroom was dismantled and transformed into a more useful working space. A project to replace some of the failing plumbing in the labs began. Evaluations of the instrument and chemical stores resulted in the purging of obsolete materials.

The days continued to shorten to a minimum of ~four hours of daylight as the winter solstice approached. Palmer Station paused for a welcomed break during the MidWinter Holiday on June 20, celebrating the Winter Solstice with the return of the Sun and the milestone of Mid-Season. During June, less and less animals were apparent. During a short period when the ocean began to freeze, the fur seals and elephant seals moved further away from station and closer to the edge of the ice. Giant petrels, cormorants, Antarctic terns, and gulls were viewed in the area. The six week period of isolation and quiet came to a close as the *ARSV Laurence M. Gould* (LMG) arrived on June 29<sup>th</sup> with B-010 (Cheng) and B-266 (Bilyk), who will be fishing locally and working from Palmer Station through mid-August.

## **JUNE 2014 WEATHER**

Graham Tilbury, Research Associate

During the first two weeks of the month a high pressure system settled over the peninsula with mostly overcast days with very low wind speeds and very little snow falling the entire time. Satellite images for the period showed an extensive band of cloud stretching from the west coast of South America across the entire Drake Strait and covering the Antarctic Peninsula. During this calm period, wind speeds averaged less than ten knots, blowing predominately from the North East.

The average temperature for the month was -2.9°C, making it a warmer than average month. The low of -7.2°C occurred towards the end of the calm period, almost half way through the month. The highest temperature was recorded on the last day, reaching a max of 2.4°C.

In contrast to the start of the month, a series of low pressure systems dominated the second half of June. The pressure dropped to its lowest value of 957.5 mb on the 20<sup>th</sup>, accompanied by strong North Easterly winds gusting to 54 knots. However, the peak wind gust for the month was recorded at 62 knots on the 30<sup>th</sup>, blowing again from the North East. Winds from this direction were recorded on 20 days of the month.

Precipitation for June was 33.5mm, an amount below the average of 42.8mm. The total snow fall of 27cm for the month was well below the 43.6cm average. Max snow stake depth of 29cm was recorded on the 24<sup>th</sup> of the month.

June's sea surface temperatures ranged from -1.3°C to -1.7°C, with no days above freezing. For a brief period of five days in the middle of the month, the cold temperatures enabled new sea ice to start forming, and large floes of pan cake ice filled Hero Inlet and parts of Arthur Harbor. Strong NE winds soon cleared these from the area, and by month's end there was no sea ice around the station. Relatively few large icebergs were seen during the month. The glacier front to the north of the station continued calving regularly throughout this time.

## **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 remarkable suite of characters, including the acquisition of macromolecular antifreezes by most species and the loss of red blood cells and hemoglobin by the icefish family, as the Southern Ocean (SO) cooled to the freezing point of seawater ( $-1.9^{\circ}\text{C}$ ) over the past 25-40 million years. Today, these cold-adapted stenotherms are threatened by rapid warming of the SO, the temperature of which is likely to increase by  $2-5^{\circ}\text{C}$  over the next two centuries. The long-term goals of my research program are to assess the molecular and organismal consequences of this warming by two experimental strategies: 1) characterization of the functional properties of the protein-folding machine, the chaperonin CCT, from the cold-adapted Antarctic notothenioid fishes at physiological and supra-physiological temperatures; and 2) analysis of the effects of elevated temperature regimes on gene expression by developing embryos of red- and white-blooded Antarctic notothenioids. Therefore, our field objectives are: 1) to purify CCT from testis tissue of the Humphead notothen, *Gobionotothen gibberifrons*, to support experimentation at the PI's home laboratory; and 2) to carry out long-term incubations of embryos from the Bullhead notothen, *Notothenia coriiceps*, and from the Blackfin icefish, *Chaenocephalus aceratus*, at control ( $-1^{\circ}\text{C}$ ) and experimental ( $+4^{\circ}\text{C}$ ) temperatures. Embryos sampled at intervals will be analyzed for potential perturbation of gene expression by high-throughput RNA sequencing (RNAseq).

The over-wintering season began with the departure of four members (Detrich, Desvignes, Hu, Khanwalkar) of the B-037 research team from Palmer Station on board the *ARSV Laurence M. Gould* on the morning of May 15, en route to Punta Arenas, Chile. CCT experimentation was completed at this time. Le François and Sheehan remain on station to conduct the embryonic development activities until mid-October 2014.

Broodstock fish from *C. aceratus* and *N. coriiceps*, captured during the LMG14-04 fishing cruises, have been maintained and conditioned to produce gametes in order to obtain multiple biparental crosses to study the molecular and organismal consequences of warming temperatures on embryonic development. At Palmer, the purpose-built embryo incubation system (Aquamerik, Quebec, Canada) was installed in Environmental Room 1 of the Palmer Station Aquarium and test driven over a period of approximately one month (May-June).

Le François directed the operation and the testing of the embryo incubation system with the assistance of Sheehan and ASC personnel. The system is operating stably and delivers seawater at two temperatures ( $-1$  and  $+4^{\circ}\text{C}$ ;  $\pm 0.3^{\circ}\text{C}$ ). Embryos of the broadcast spawner *N. coriiceps* are to be incubated in upwelling cylindrical incubators, whereas those of the brooder *C. aceratus* will be maintained in Heath tray incubators.

Nine crosses of *N. coriiceps* were successfully obtained over a period of three weeks in June, and these have been introduced into the incubator at two different temperatures. We attempted a cross for *C. aceratus* in late May, but despite intensive monitoring and care, the fertilized eggs were not viable. Lacking an icefish cross, we will use the Heath trays as an alternate mode for raising *N. coriiceps* embryos.

Disinfection protocols are currently being assayed using spontaneous crosses collected directly in the tanks, in order to maximize the survival of our experimental developing embryos during their long incubation period (5-6 months). Additionally, Le François and Sheehan are looking at basic semen quality evaluation and doing some preliminary zootechnical work to develop a sperm cryopreservation technique that would facilitate future studies when fertile males and females are not captured synchronously.

In preparation for the arrival of the incoming B-010 (Cheng) and B-266 (Bilyk) groups (late June), our group with the support of the lab manager (Neidel) and instrument tech (Scott) consolidated our equipment and supplies from Lab 10 to half of Lab 1 and utilization of tanks was reduced by 75%.

We thank the station personnel for their exceptional help in making our ongoing field season a great success.

## **PALMER STATION RESEARCH ASSOCIATE MONTHLY REPORT JUNE 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 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 tower was inspected last week and looked secure. The receiver 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 through the month.

**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 O<sub>2</sub> (detected through changes in O<sub>2</sub>/N<sub>2</sub> 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 CO<sub>2</sub> 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.

**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 (N<sub>2</sub>O) 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.

### **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.

The system operated normally throughout the month of June.

### **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 primary GPS station collected data normally 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 satellite antenna tracker developed a problem early in the month. It was discovered that the elevation system had failed. A replacement tracking control unit was fitted and the system has operated normally since then. A scheduled data storage tape change was completed on the 24<sup>th</sup> June.

## **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.

## **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.

A fault in the Dspec unit was detected on the 16<sup>th</sup>. It was corrected by software instruction. The system continued operating 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.

The tide level, conductivity and sea water temperature monitoring system performed correctly the entire month. Data graphics will be incorporated into the new display screen.

## **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.

Apart from one wind direction freeze up during a cold spell, the system operated normally during the month. The development of the new display screen, incorporating images from six individual screens, continues.