

PALMER STATION MONTHLY SCIENCE REPORT

June 2012



A Weddell seal rests on the sea ice of Hero Inlet.

Image Credit: Janice O'Reilly

NEWS FROM THE LAB

By Janice O'Reilly, Winter Assistant Supervisor of Lab Operations

Palmer Station and the *ARSV Laurence M. Gould* (LMG) continued to support a busy month of science during June. One fishing cruise was completed on 13-16 June, the final catch for the season. Seven members from B-037-P (Detrich) and B-038-P (Grimm) continued their research in the labs for most of the month. After the departure of the LMG on 21 June two members from B-037-P (Detrich) and B-038-P (Grimm) remained on station to continue icefish experiments over the winter.

Visiting Grantees gave two science lectures during June. Dr. Irina Mueller from B-038-P discussed the role of mitochondria in the cell and explained why Antarctic fishes are a good system for understanding the relationship between mitochondrial structure and function. Bouvard Hosticka of T-998-P presented an overview of the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) and discussed the methods used for monitoring the presence of radionuclides. He gave an overview of the Radionuclide Aerosol Sampler and Analyzer (RASA) that currently operates at the Palmer Station TerraLab.

As seawater and air temperatures dropped at Palmer Station, fewer wildlife sightings were reported during June. The Adélie penguin population on Torgersen Island declined from over 100 last month, to only four on 24 June. Other birds identified in the Palmer area included blue-eyed shags, kelp gulls, snow petrels, snowy sheathbills, giant petrels, and Antarctic terns. On 11 June at least three whales were spotted from Palmer Station, surfacing and spouting along the brash ice edge near Bonaparte Point. On nearby islands fur seals were often observed challenging each other in small groups, and elephant seals were frequently seen napping in clusters. Leopard seals were commonly seen resting on floating ice around the Arthur Harbor area, sometimes as many as four different individuals observed at the same time. In Arthur Harbor near the pump house, a leopard seal fed on a seal over three consecutive afternoons. On 30 June a Weddell seal appeared on the sea ice layer of Hero Inlet, the first Weddell seal sighting in the Palmer Station area this winter.

JUNE 2012 WEATHER

By Neal Scheibe, Research Associate

June was a relatively clear month, with the exception of some snowy days both early and late in the month. A steady cooling trend continued through the first three weeks of June but was broken up by some low pressure systems just prior to mid-winter's day. The average temperature for this month was -5.0°C , with a low of -13.5°C on the 17th and a high of 2.0°C less than a week later. The peak wind gust for the month was recorded on the 5th at 62 knots and the average wind speed was 12 knots.

The melted precipitation for June was 32.5 mm and 231.0 mm for the year, above what we saw this time last year. There was 51 cm of snowfall recorded, though a lot of the early snowfall was swept away by heavy winds a few days later. The snow stake stood at 45cm at month's end and the year to date snowfall is 143cm, which is nearly double the mark at the same time a year ago.

June's average sea surface temperature was -1.3°C , with no days above freezing. Despite the cooler temperatures, very little sea ice was seen during the month. The back of Hero Inlet did freeze up and some pancake ice was forming in Arthur Harbor near the end of the month. A few bergs were seen floating throughout the boating area for most of the month.

B-037-P MICROTUBULE FUNCTION, PROTEIN FOLDING, AND EMBRYOGENESIS IN ANTARCTIC FISHES: AN INTEGRATIVE APPROACH

H. William Detrich, Principal Investigator, Depts. of Earth and Environmental Sciences and of Biology, Northeastern University, Boston, MA

Personnel on Station: H. William Detrich (B-037-P, B-029-U), Corey Allard (B-037-P), Leonardo Almeida (B-037-P), Sara Alvira (B-037-P), Lucia Quintana (B-037-P), Irina Mueller (B-038-P), and Mary Chamberlin (B-038-P)

N.B. Because B-029-U and B-038-P are projects affiliated with B-037-P, this report encompasses work by all three projects.

Our projects this field season encompassed four major Specific Aims: 1) to assess the effects of elevated temperature regimes on embryonic development of Antarctic fishes (B-037-P); 2) to determine the ontogeny of cartilage and bone formation by embryos of robustly ossified and poorly ossified Antarctic fishes (B-029-U); 3) to explore the role of reactive oxygen species (ROS) in the development of notothenioid embryos (B-038-P); and 4) to examine the energetics and thermal optima of the folding of tubulin by the chaperonin CCT from Antarctic fishes (B-037-P).

During June, we continued our acclimation and heat shock experiments to determine the thermal sensitivity/resilience of embryonic development in the white-blooded icefishes and the red-blooded nototheniids (Aim 1). We monitored and sampled embryos from the long-term acclimation and short-term heat shock experiments begun in May using embryos of the Mackerel icefish *Champscephalus gunnari*, the Blackfin icefish *Chaenocephalus aceratus*, and of the Bullhead notothen *Notothenia coriiceps*. Embryos have also been collected from these crosses to address Aims 2 and 3. Some of the embryos are preserved in RNAlater for high-throughput analysis of embryonic gene expression at defined developmental stages in our CONUS laboratories. Others were collected in buffers appropriate for subsequent experimentation. We also produced two additional crosses of *N. coriiceps* to support further experiments throughout the winter.

To address the role of ROS in notothenioid embryo development (Aim 3), we trouble-shot assays for total antioxidant potential and enzymes involved in the production of ROS using adult tissues and individual embryos. These assays are now being used on embryos by winter-over personnel Dr. Irina Mueller and Mr. Corey Allard.

Our studies of protein folding at low temperature continued with the preparation of the chaperonin CCT and three heat-shock proteins, Hsp70, Hsp90 and Hsp96, from testis tissue from the Humphead notothen *Gobionotothen gibberifrons*. “Heat shock protein” is a misnomer in the case of Antarctic fishes, which have lost the capacity to induce synthesis of these proteins in response to acute thermal challenge. Rather, they are expressed constitutively at low temperature along with the normal cellular chaperones that assist the folding of ~10% of cellular proteins. When the CCT and Hsp preparations are returned to our laboratories in the US and Spain, we will use them to examine the kinetics of protein folding at low temperature and to evaluate their network of interactions during the assisted folding process.

Finally, we also continued to sample tissues from the diversity of notothenioid fishes caught during the month to support research in our CONUS laboratories.

The ASRV *Laurence M. Gould* (LMG) returned to Palmer Station on June 11, 2012 (Cruise LMG12-06) after a difficult crossing of the Drake Passage. Between June 13 and 16, the LMG conducted trawling and trapping operations near Low Island and in Anvord Bay in support of projects B-029-U, B-037-P, and B-038-P. Thirteen trawls and one trap string (16 pots) yielded ~80 icefishes of several species, but two of our target species, *G. gibberifrons* (3) and *N. coriiceps* (5) were not abundant. Supported by the LMG and Palmer logistics personnel, we off-loaded our fish to the Palmer Station Aquarium on June 16.

The LMG departed Palmer Station on June 21 en route to Punta Arenas, Chile. Drs. William Detrich and Mary Chamberlin, Ms. Sara Alvira, Mr. Leonardo Almeida, and Ms. Lucia Quintana sailed northbound, while Dr. Irina Mueller and Mr. Corey Allard remained on station to continue our research programs through the winter.

We thank the Captain, crew, and ASC personnel of the LMG and ASC Palmer Station personnel for their excellent help in making our continuing field season very successful.

Apologia: I regret that the B-037-P Science SITREPS that I filed for March, April, and May of 2012 used the title of my prior NSF OPP award. Mea culpa.

PALMER STATION
RESEARCH ASSOCIATE MONTHLY REPORT
June 2012
Neal Scheibe

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 143 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 old STS-2.5 seismometer was packaged and shipped back to the manufacturer. The system ran normally for 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.

Data collection went as planned for the month.

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. The Research Associate operates and maintains on-site equipment for the project.

The instrument ran well during the month. The computer was locked up on the 22nd, requiring reboot.

**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 for 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.

Sampling occurred regularly throughout the month.

**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 occurred normally 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. Also collecting light spectra is a BSI GUV-511 filter radiometer, an Eppley PSP pyranometer, and an Eppley TUVR radiometer. The Research Associate operates and maintains on-site equipment for the project.

The UV monitor collected data normally for the month. The quarterly calibration was carried out at month's end.

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.

The weather station ran normally during 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 GPS operated normally for the duration of the month.

A-336-P: ELF/VLF OBSERVATION OF LIGHTNING DISCHARGE, WHISTLER-MODE WAVES AND ELECTRON PRECIPITATION AT PALMER STATION.

John Gill, Principal Investigator, Stanford University

Stanford University has been operating a Very Low Frequency (VLF) receiver antenna at Palmer Station since the 1970's. By receiving naturally and manmade signals between 1 and 40 kHz, the Stanford VLF group is able to study a wide variety of electromagnetic phenomenon in the ionosphere and magnetosphere. The Research Associate operates and maintains on-site equipment for the project.

Data was collected normally during the month. During a station visit earlier in the season, a representative from Stanford University changed data handling cards in the pre-amplifier. This change was to make the hardware match up better with the setup used at other sites. The new cards resulted in noisier data, so the filter was changed to compensate for this. This required a calibration, which was carried out early in the month with good results. During the calibration, the pre-amplifier box at the base of the antenna was opened. The act of opening the box caused the hinges to fall apart. The door to the box was refastened with rope and bungee cord, with notice sent to the PI that a replacement box needs to be shipped down.

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 system operated normally for 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.

It was discovered that the global positioning system (GPS) was not functioning properly. This meant that the data being collected by the magnetometer were not time-stamped and of little value. A new GPS was shipped down, but did not make it onto the final boat of the season. To avoid losing data collection for the full winter season, the suspected bad surge protector connected to the GPS was removed from the system. This allowed the GPS, and the magnetometer, to resume normal operation. There is now no surge protection in the unlikely event of a lightning strike. When the new system arrives, it will be installed and the old GPS kept as a backup.

B-390-P: THERMO-SALINOGRAPH

Vernon Asper, Principal Investigator, University of Southern Mississippi

Seawater is pumped continuously through a thermosalinograph (TSG) sampling system, recording the temperature, conductivity, salinity, and fluorescence. The data and webcam images are sent to a mirror site (<http://4dgeo.who.edu/tsg/>) at Woods Hole Oceanographic Institute, which is a collaborator on the project.

The TSG operated normally during the month.

T-434-M/P: POLAR GEOSPACIAL CENTER

Paul Morin, Principal Investigator, University of Minnesota

The Polar Geospatial Center provides geospatial support (in the form of mapping, data delivery, and GIS analysis) to science and logistics communities of the U.S. Arctic and Antarctic programs. The Research Associate has been requested to collect ground control points in the Palmer area throughout the 2011-2012 season.

All data points are collected and being processed by the Polar Geospatial Center.

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 was installed in the Palmer Aquarium. The Research Associate downloads data and cleans the instrument on a weekly basis.

The FRRF was cleaned weekly and data were sent to the PIs.

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 RASA operated normally for the duration of the month. There was a site visit by Bouvard Hosticka from the University of Virginia to perform annual maintenance and install a new computer for the RASA machine as well as a new station personal computer.

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.

The tide gauge operated normally during the month.

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 weather station operated normally throughout the month. Scheduled inspections were carried out at the Gamage Point tower. Weather updates and satellite imagery were forwarded to the *ARSV Laurence M. Gould*.