

PALMER STATION MONTHLY SCIENCE REPORT

April 2013



Giant Antarctic petrel (GIPE) parents continued feeding their chicks during the month of April. This photo was taken on Humble Island on 25 April 2013.

Image Credit: Janice O'Reilly

NEWS FROM THE LAB

By Janice O'Reilly, Assistant Supervisor of Laboratory Operations

The beginning of April marked the end of a busy science season for several science groups at Palmer Station and ASC summer support staff. Members from B-003-P (Morel), B-013-P (Fraser), B-019-P (Schofield), B-252-P (Ducklow), and B-045-P (Ducklow) closed out their labs and departed station on 3 April. Two members from B-029-U (Postlethwait) and one member from B-027-P (Amsler-McClintock) also departed Palmer Station, while remaining members carried on their research.

Between port calls, ASC staff cleaned labs, prepared materials and set up equipment in preparation for the next surge of science activity. On 18 April the *ARSV Laurence M. Gould* (LMG) brought the B-036-P (O'Brien) group and two members from the B-029-P (Postlethwait) group. Arriving and departing on the same cruise were one member from A-336-P (Gill) and two members from A-109-P (Moore). The busy port call included offloading of live fish for B-036-P (O'Brien) and B-029-P (Postlethwait).

On 21 April the LMG traversed to Primavera to retrieve the Bockheim group (G-239-E) who had been conducting field work since 16 April. The group returned to Palmer Station on 22 April to complete work on local islands and in the labs.

A second fishing cruise to Dallmann Bay and Andvord Bay took place 25 April to 29 April. The LMG returned to Palmer Station with six tanks of fish for B-036-P (O'Brien) and B-029-P (Postlethwait).

Local field science continued to operate during the month of April, as weather permitted. Members of B-027-P (McClintock/Amsler) continued weekly dive operations within the local area, and ASC personnel conducted giant petrel chick weighings on Humble Island.

As the peninsula region entered the transition to winter, wildlife populations decreased. Small groups of up to approximately one dozen Adélie penguins were commonly observed on Torgersen and Janus Islands during April. Occasional sightings of one or two gentoos in the backyard were reported. Other bird populations observed during the month included blue-eyed shags, kelp gulls, snowy sheathbills, cape petrels, Antarctic terns, Wilson's storm petrels, snow petrels, and giant petrels (adults and chicks). Marine mammals observed in the local area include, fur, elephant, crabeater and leopard seals.

APRIL 2013 WEATHER

By Graham Tilbury, Research Associates

April's weather was typical of fall season conditions. Temperatures continued to drop slowly, and periods of relative calm were followed by days of strong, blustery winds, mainly from the North.

The average wind speed for April was 14 knots, almost double the previous month's value. A strong Northeasterly wind on 14 April peaked at 61 knots and brought with it 21 mm of rain, which quickly melted accumulated snow around the station. Again on 29 April, another strong Northeasterly wind precipitated 9 mm of rain, sufficient to melt away the local snow.

The average temperature for the month was 0.8C, just above freezing. A warm North wind on 10 April briefly raised the temperature to an unseasonal 7.5C. The lowest temperature for the month was -3.7C, recorded on the morning of 22 April.

April has been the wettest month so far this year. A total of 126.5 mm of melted precipitation was recorded at the gauge at Gamage Point. The maximum snow stake depth was 17cm, observed on 27 April.

Daily sea ice observations were performed during the month. Seawater temperature persisted above the freezing point, therefore no sea ice was observed. The glacier adjoining Arthur Harbor continued calving regularly which produced large amounts of brash ice that filled the harbor. Strong North to Northeasterly winds soon cleared the ice from the waters around the station.

A-209-P: ANTARCTIC EXTREMELY LOW FREQUENCY/VERY LOW FREQUENCY OBSERVATIONS OF LIGHTNING AND LIGHTNING-INDUCED ELECTRON PRECIPITATION (VLF)

Robert Moore, Principal Investigator, University of Florida

Personnel on station: Michael Mitchell and Daniel Kotovsky

While at Palmer, we accomplished the following. The antenna guy ropes were tightened and the preamp enclosure was replaced. Four posts were added on the glacier to help keep the instrument cable from freezing in to the ice and several sections were re-strung with rope. The two fallen junctions in the backyard have been righted and two connectors were replaced. The sea ground in Hero Inlet was raised, cleaned, fixed, and returned to the inlet. Several rounds of hum sniffing were conducted to help find a future antenna location. Electronics in Terra lab were reorganized and the Stanford data acquisition systems was retrograded. We also conducted two rounds of system calibration.

B-027-P: THE EFFECTS OF OCEAN ACIDIFICATION AND RISING SEA SURFACE TEMPERATURES ON SHALLOW-WATER BENTHIC ORGANISMS IN ANTARCTICA

James McClintock, Charles Amsler, and Robert Angus, Principal Investigators, University of Alabama at Birmingham

Personnel on station: Charles Amsler, Margaret Amsler, Kate Schoenrock, Julie Schram.

At the end of the first week of April we were able to initiate our second main experiment (“mesocosm experiment”). The experiment was delayed nearly a week while bad weather prevented us from collecting the organisms for it.

The bulk of our daily efforts throughout the month involved daily monitoring of water chemistry parameters, other maintenance activities for both our microcosm and mesocosm experiments, and photosynthetic measurements of macroalgae in the microcosms. Field measurements of macroalgal photosynthetic parameters for comparison to the microcosm experiment data were made when weather permitted diving operations.

Despite the weather, our laboratory experiments are going very well. The laboratory experiments are the central aspect of our project and so we are quite pleased with the season’s progress to date.

As noted, poor weather was a problem with field aspects of our work throughout the month and limited our diving operations more so than in any of the nine previous seasons one of our projects has been diving here during April. During the month we completed 23 dives to collect macroalgae and amphipods for laboratory studies, to collect fresh macroalgal food for experimental amphipods, and to perform field photosynthetic measurements. However, that total reflects the fact that we made multiple short dives at different locations on many of the days we were able to get off station. We had originally planned on having relatively limited diving

operations in May. Consequently we have flexibility and hope to be able to catch up on the comparative field-based measurements.

We are grateful for the generous and professional assistance of numerous ASC staff. Janice O'Reilly, Juliet Alla, Hannah Gray, and Graham Tilbury deserve special thanks for facilitating our laboratory and diving operations. Dan Nielsen also deserves special thanks for, along with Juliet and Graham, rapidly repairing a key piece of equipment that is critical for our microcosm experiment.

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: Thomas Desvignes, Nathalie R. Le François and Braedan McCluskey

Our group B-029-P, along with Kristin O'Brien's group B-036-P, planned, organized and actively participated in three experimental fishing expeditions on the LMG for *Caenocephalus aceratus*, *Notothenia coriiceps*, *N. rossii*, and *Pseudochaenichthyes georgianus* broodstock fish. Those fish were then transferred from the LMG to Palmer Station aquarium facilities and will be used for the production of embryos and newly-hatched larvae at the aquatic laboratories of Palmer Station.

Daily maintenance of captive fish populations consist of checking fish health and water temperature, feeding, and daily adjusting the photoperiod to the natural local environment. We monitor the maturation and development of our captive population of icefish and rockcod every 2 or 3 days to detect any sign of ovulation. Several maturing females and males of the yellow belly Rockcod *N. coriiceps* were tagged and injected with steroid hormones to stimulate the final steps of oogenesis and spermatogenesis respectively. This procedure will be extended to the South Georgia Icefish *P. georgianus*.

To be ready for any reproduction event, and with the terrific help of the Palmer I&O, we set up an incubation room in Environmental room #1. The temperature is now regulated at 1 to 2C, and the room will be set up with several different kinds of incubators to assess the best way to brood rockcod and icefish embryos. Specifically, two new models of upwelling incubators will be evaluated (upwelling incubators and Heath tray incubators) in parallel to the historically used type.

Our team would like to work with other teams to make a recommendation report to suggest some improvements and modifications to Palmer Station Aquatic facilities that should be implemented to improve animal health and to improve experimental outcomes. These recommendations concern the maintenance and improvement of stock tank management, LMG fishing activities, and transfer practices to increase survival rates in captivity of broodstock fish, as well as the success of in vitro fertilization, embryo incubation, and hatching of larvae. Some recommendations concern new proposed SOP (Standard Operating Procedures), some easy and inexpensive modifications, and some more profound adjustments of the sea water facilities.

In addition to fish maintenance and reproduction planning, this month our group finished sampling all biological replicates of various tissues and skeletal elements in all studied fish Antarctic species. These samples were preserved in Ethanol for DNA analysis, in RNALater for High Throughput DNA Sequencing, or frozen for cartilage and bone morphological studies. Samples were sent back to Eugene, OR, with Thomas Desvignes on LMG13-04NB. Samples will be prepared and analyzed at the University of Oregon and Northeastern University.

The B-029 group extends sincere thanks the dedicated LMG staff and crew, and the cheerful and skillful Palmer Station staff with special regards to the laboratory team for constant attention, I&O crew which spent considerable effort helping with various issues regarding the water system and the set up of incubators, and administrative support staff for their important contributions to sample shipment and making the science here possible, productive, and – especially – enjoyable!

B-036-P: REDOX BALANCE IN ANTARCTIC NOTOTHENIROID FISHES: DO ICE FISHES HAVE AN ADVANTAGE?

Kristin O'Brien, Principal Investigator, University of Alaska Fairbanks

Personnel on station: Kristin O'Brien, Elizabeth Crockett, Theresa Grove, Johanne Lewis, Corey Oldham and Amanda Reynolds.

Our field team, consisting of Dr. Elizabeth Crockett (Ohio University), Dr. Kristin O'Brien (University of Alaska Fairbanks), Dr. Theresa Grove (Valdosta State University), Dr. Johanne Lewis (Georgia Southern University), Corey Oldham (University of Alaska Fairbanks), and Amanda Reynolds (Georgia Southern University), arrived at Palmer Station on April 18, 2011. We had a successful fishing trip during our journey south (April 16-17) and arrived with an abundance of fishes to begin our research, including both icefishes and red-blooded notothenioids.

The aim of our research this season is to determine if there is physiological or biochemical advantage to being an icefish. We are testing the hypothesis that the presence of the iron-containing oxygen-binding proteins hemoglobin and myoglobin promotes the formation of free radicals, which damage biological macromolecules. We hypothesize that greater rates of protein oxidation in red-blooded notothenioids results in greater rates of protein turnover and higher rates of protein synthesis compared to icefishes. Thus far, we have measured rates of protein synthesis in hearts, pectoral adductor muscle and liver tissue of the icefishes *Chaenocephalus aceratus* and *Pseudochaenichthys georgianus*. We have also begun to measure the energetic costs of protein synthesis in hepatocytes of *Gobionotothen gibberifrons*, and levels of the antioxidant, ascorbate, in red- and white- blooded notothenioids.

Field team members Crockett, Oldham and Grove participated in a successful fishing trip on the *R/V Laurence M. Gould* from April 25 – April 29, capturing several species of red- and white-blooded notothenioids. Unfortunately, once on station we lost many fish when water flow to one of the outside tanks precipitously declined sometime between 9 pm on April 30 and 8:30 am on May 1. Ammonia levels increased in the tank from 0 ppm to 0.5 ppm and 16 animals died in the tank, mostly icefish and including 90% of the *Chaenocephalus aceratus* (7 of 8 animals). The cause of the decline in water flow has not been determined and obtaining adequate water flow to the aquarium tanks has been a great concern this season.

G-239-E: ANTARCTICA PERMAFROST AND ACTIVE-LAYER DYNAMICS

James Bockheim, Principal Investigator, University of Wisconsin Madison

Personnel on station: Kelly Wilhelm and Nicholas Haus

We stayed at Primavera Station (Argentina) April 16-22, 2013 and at Palmer Station from April 24 to May 2, 2013. Our team included Kelly Wilhelm and Nicolas Haus, both graduate students; and Capt. Fernando Gallardo and Pvt. Antonio (last name unknown), both Argentinian observers (Primavera only).

Our accomplishments at Primavera were as follows:

1. Repaired snow stakes that had fallen over the past year
2. Downloaded pictures from timelapse camera from between March 10, 2013 and April 17, 2013. Reprogrammed timelapse camera to take 4 pictures per day, facing 6 snow stakes and Cierva Cove.
3. Serviced soil climate station and extracted data from weather station datalogger, collecting data from between March 9, 2012 and April 17, 2013
4. Replaced all temperature sensors in the deep borehole (15m), 11 shallow boreholes (1-4m), 9 surface plates (1cm), 9 air towers (1.3m above surface), and 4 snow stakes. Downloaded data from extracted sensors (iButtons) for between March 11, 2012 and April 18, 2013

Our accomplishments at Palmer were as follows:

1. Repaired two air temperature poles, which had been destroyed by seal activity
2. Repaired snow stakes that had fallen over the past year
3. Reprogrammed timelapse camera to take 6 pictures per day, facing 6 snow stakes and Lovers Lane (No pictures extracted due to previous programming error)
4. Serviced soil climate station and extracted data from weather station datalogger, collecting data from between March 3, 2012 and April 30, 2013
5. Replaced all temperature sensors in the deep borehole (15m), 11 shallow boreholes (1-2m), 8 surface plates (1cm), 10 air towers (1.3m above surface), and 4 snow stakes. Downloaded data from extracted sensors (iButtons) for between February 25, 2012 and April 30, 2013
6. Collected 3 bulk density soil samples from 6 geomorphic sites throughout Amsler Island and Palmer Station Backyard (Solifluction lobe, Glacial moraine, Seal wallow, 2 Outwash plain, Basin accumulation). These samples will be tested in the lab for frozen and thawed thermal conductivity, heat capacity, soil moisture content and bulk density.
7. Participated in outreach activities (Skype video meeting) with a group of 3rd and 4th grade students from Belmond-Klemme School District, Iowa.

Our provisional results are as follows:

1. Based on the data extracted from the 15m boreholes, it was tentatively determined that permafrost at Cierva was at approximately 5.5m, 1.5m shallower than thought from the previous year's data. At Palmer no permafrost was observed in 2012; however, after residual heat from drilling dissipated, permafrost was apparent just above 14m.
2. Our soil climate stations are providing valuable meteorological data for Old Palmer and Cierva Point where such data have been lacking. In addition, the stations are providing data on soil moisture, soil temperature, and soil salinity, which exist to a limited extent along the western Antarctic Peninsula. This data will be essential for the future calculation of soil climate and behavior in both regions.

**PALMER STATION
RESEARCH ASSOCIATE MONTHLY REPORT**

April 2013

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.

Grantees from UF (A-109-P) group performed on site repairs to the equipment and VLF antenna. The temporary repairs to the cable, reported earlier, were soldered and a new support post was installed to hold the junction box above the snow level. The equipment racks were optimized and a new hard drive enclosure fitted.

The special grounding cable for the antenna system was inspected and the end terminator retrieved from Hero Inlet and refurbished. A site survey was conducted pending the proposed move of the VLF antenna 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 required a manual restart to clear a software glitch. Other than that, it operated normally for 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 for the month. The data transfer system was converted to the SFTP format to comply with current data transfer security requirements.

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.

**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 was completed as scheduled for 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.

The UV monitor collected data normally throughout the month.
Absolute scans 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.

The Bonaparte Point automated weather station has been refurbished and is awaiting shipment to the station.

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 new GPS receiver, installed by the UNAVCO representative, is performing correctly.

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.

The VLF antenna and cable required attention on several occasions during the month. The warm temperatures experienced caused the signal cable and its support posts to loosen in the soft snow. The antenna base was realigned and secured in position. Most of the mast support stay wires were tightened and the rope lashings properly secured. The antenna loops also required tightening. The computer was rebooted several times to correct data transfer errors. The Stanford component of the VLF program (A-336-P) terminated at the end of April.

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. The problem of some orbital elements not updating is being attended to. A problem with the FTP process for transferring images from the receiver system to the station weather office was resolved.

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.

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.

The FRRF was cleaned Wednesday of each week, and the latest data set emailed to the relevant 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.

A serial I/O error on the RASA was corrected twice during the month. Other than that, all operations were 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.

The system collected data throughout the month, requiring one restart after a software update. A possible intermittent problem is 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 NOAA for entry into the Global Telecommunications System (GTS).

A problem with the MATLAB software that generates the wind speed and direction plots was diagnosed and required a reset to correct. Other than that, the system operated normally during the month.

