

PALMER STATION MONTHLY SCIENCE REPORT

April 2012



Divers from B-027-P and dive tenders navigate the brash ice en route to a dive site.

Image Credit: Ryan Wallace

NEWS FROM THE LAB

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

Though daylight hours shortened during the month of April, members from B-027-P (McClintock/Amsler), B-037-P (Detrich), and B-256-P (Lee) sustained full days of science activity on station. Joining the busy labs in the middle of the month on LMG 12-04 were one member of B-029-P (Postlethwait) and one member of A-336-P (Gill), who both departed on the same cruise. Additionally, one member from B-038-L/P (Grimm) joined the team already on station and remained to conduct Antarctic icefish research.

Field science continued to successfully operate for most of the month, as weather permitted. Members of B-027-P (McClintock/Amsler) conducted weekly dives and one member from B-256-P (Lee) collected weekly soil samples from some of the local islands. Three fishing cruises were completed by B-037-P onboard the *ARSV Laurence M. Gould*. Station personnel continued to weigh giant petrel chicks for B-013-P (Fraser) approximately two times per week.

Visiting Grantees gave three science lectures in April. On 12 April, Dr. Bill Detrich described how his research team's studies of Antarctic fishes will help us understand the impact of oceanic warming on the marine biosphere and how comparison of red- and white-blooded fishes can lead to new genetic discoveries related to human diseases of blood (e.g., anemia). On 19 April Dr. Brian Eames (B-029-U) gave a talk on the evolution of skeletal development and demonstrated

that the evolution of the bone-making cell (the osteoblast) in Antarctic icefish may teach us new things about human skeletal conditions, such as osteoporosis. And on 26 April Kate Schoenrock (B-027-P) presented work on the effects of crustose coralline algae in tropical marine community dynamics from Kenya and the implications for the role of coralline algae in polar marine communities.

In early April, Palmer Station was visited by the *HMS Protector*. British hydrographers from the ship spent two days conducting bathymetric surveys in Arthur Harbor and Hero Inlet. Crew from the *HMS Protector* came ashore for station tours, and Palmer folks boarded the *HMS Protector* for ship tours. Because of inclement weather conditions the British Royal Navy departed sooner than expected on the evening of 3 April.

Palmer Station continued to observe seasonal changes, as the angle of sunlight gradually shifted and wildlife populations transitioned. Small groups of Adélie penguins continued to visit several islands within the local boating area, including Torgersen, Janus and Humble. On 15 April at least 200 Adélies were seen on Janus Island and in the nearby water. On 17 April approximately 18 Adélies were counted on the south-facing side of Humble Island, some busily transferring pebbles from one point to another. Small groups of gentoos were observed at Old Palmer and Dead Seal Island. Other bird populations observed during the month included blue-eyed shags, kelp gulls, snowy sheathbills, cape petrels, arctic terns, and giant petrels (adults and chicks). Marine mammals seen in the area included minke whales, humpback whales, fur seals, elephant seals and leopard seals.

APRIL 2012 WEATHER

By Neal Scheibe, Research Associate

Palmer Station saw a fairly tranquil April, though usually under dark skies. Winds reached a high peak gust of 62 knots on 11 April, but daily wind averages were in the single digits or low teens for most of the month. The last two weeks of the month were characterized by light, wispy winds primarily from the southeast, while the peninsula was engulfed in a high pressure system.

The average temperature for the month was a warm -0.8°C . The coldest temperature was on the 18th at -6.4°C and the warmest was on the 30th at 4.8°C . Sea surface temperatures stayed above zero for the first half of the month before passing below freezing by mid-month. The average sea surface temperature for the month was -0.05°C . Frequent glacier calvings yielded plenty of brash ice that quickly drifted out of the Palmer boating area. No large icebergs and few bergy bits have been seen around station.

April brought a good blanket of snow, but it was short-lived. The snow stake saw accumulation as high as 17cm of snow by the 17th, but at month's end there was only 5cm left. Palmer received 23 cm of total snowfall throughout the month and measured 23.9 mm of melted precipitation.

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: Kathryn Schoenrock and Julie Schram

The month of April was very productive for our science group. We began a six week long experiment which will investigate effects of decreased pH and increased sea water temperature on growth and physiology of two species of marine invertebrates (the marine snail *Margarella antarctica*, and limpet *Nacella concinna*) and two species of encrusting algae (*Clathromorphum obtectulum* and *Hildenbrandia sp.*). Daily water sampling and analysis allow us to monitor pH and alkalinity of these microcosms closely.

Time 0 sampling of non-experimental organisms were carried out after the start of this experiment to get a physiological baseline for these species. Measurements for the invertebrates include tissue sampling for whole animal biochemical composition, calcification, shell morphology, escape response from a predator, gene expression (with a collaborator), and wet weights. Photosynthetic health, thallus size, chlorophyll *a* content, calcification, and gene expression were measured for the algae.

April was also a productive dive month. With only two group members on station we were still able to make 12 dives with the help of dive tenders Neal Scheibe and Steve Sweet and a suite of volunteers. These dives allowed us to make collections and do field fluorometry measurements necessary for comparison with the microcosm experiments. We are extremely grateful to station staff for supporting us and our dive operations.

B-037-L/P PROTEIN FOLDING AND FUNCTION AT COLD TEMPERATURE: CO-EVOLUTION OF THE CHAPERONIN CCT AND TUBULINS FROM ANTARCTIC FISHES

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-L/P), Corey Allard (B-037-L/P), Jeffrey Grim (B-038-L/P), Irina Mueller (B-038-L/P), Mary Chamberlin (B-038-L/P), and Brian Eames (B-029-U)

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

As April began, we continued our efforts to produce embryos of *Notothenia coriiceps* and of *Chaenocephalus aceratus* by *in vitro* fertilization. We primed fish, both male and female, with a gonadotropin preparation to accelerate sexual maturation.

The ASRV *Laurence M. Gould* (LMG) returned to Palmer Station on April 12 (Cruise LMG12-04) at approximately 13:30 LT after a brief, but scientifically successful, crossing. En route to Palmer Station, the LMG conducted trawling operations near Low Island in support of projects B-029-U (John Postlethwait, PI), B-037-L/P (H. William Detrich, PI), and B-038-L/P (Jeffrey Grim, PI). Eight trawls yielded a substantial collection of fish, including 20 *Gobionotothen gibberifrons* and 37 *C. aceratus*, two of the three major target species required by the three projects. New team members Drs. Mary Chamberlin (B-038-L/P) and Brian Eames (B-029-U) arrived on this cruise. Supported by LMG and Palmer logistics personnel, we off-loaded our fish to the Palmer Station Aquarium.

The LMG then conducted two fishing cruises in support of our projects. The first cruise departed at 07:30 LT on April 14 northbound to fish at Low Island (southwest of ASPA 152) and at Dallmann Bay (ASPA 153) between April 14 and 17. Persistently harsh weather (30-50 knot winds out of the northeast, seas of 10-15 ft) prevented us from collecting at Low Island until near the end of the cruise. Instead, we trawled and trapped for fish in Dallmann Bay, which was protected from the prevailing weather by Brabant Island to the east. Fourteen trawls on April 15-16 yielded a modest collection of fish, including 9 *N. coriiceps*, 26 *G. gibberifrons*, and 3 *C. aceratus*, the three major target species required by the three projects. Two trap sets (4 x 4 trap strings; April 15-17) gave a complementary catch of 24 *N. coriiceps* and 9 *G. gibberifrons*. While the second set of traps was in the water at Dallmann Bay, we sailed for Low Island, arriving approximately 23:00 LT on April 16. Gradually the wind subsided and by 20:00 LT we were able to get the first of three trawls in the water. The third provided the bonanza: 67 fish mostly of the requisite species. At 23:30 LT on April 16, we sailed to retrieve the second trap set at Dallmann Bay, after which we set course for Palmer Station. We arrived at Palmer Station at 12:00 on April 17, and off-loaded the fish to the Palmer Station Aquarium with the support of the LMG and Palmer logistics personnel.

Later that week, the LMG departed Palmer Station at 08:45 LT on April 19 for the second fishing trip. The fishing success during previous trips provided the opportunity to conduct exploratory fishing in areas south of Anvers Island in search of alternative fishing locations. We arrived at the final approach to the Fish Islands at approximately 22:00 LT, where we intended to set fish traps, but significant ice cover made this impossible. The decision was made to steam south to sample the deepwater fish fauna (specifically dragonfishes) in the "Banana Trench" (~900 m). We arrived at the Banana Trench at approximately 00:00 and surveyed the bottom topography along prospective trawl headings. From 01:00-08:30 LT on April 20, we conducted three trawls. The catch was modest but included several species not readily available elsewhere, including Nototheniidae (*Trematomus spp.*) and Artedidraconidae (plunderfish). At 10:00 we deployed four 4-trap strings at 230-240 m on prospective fishing groups northeast of the Banana Trench with a planned retrieval the following morning. Following trap deployment, we steamed south for a potential trawling site near the Antarctic Circle. Upon arrival, we encountered abundant icebergs and brash ice that prohibited trawling. We next headed north to survey the bottom at Lewis Sound, which looked promising based on nautical charts. After surveying the bottom, we determined that trawling was not possible. Other exploratory fishing sites that we wished to survey were far north of the pot location, so we pulled the traps at 22:00 (April 20); the catch was zero. We set sail for proven fishing grounds near Renaud Island, arriving there at 07:00 LT on April 21. Trawling at this location yielded mostly juvenile fish, including five *C. aceratus*. We then transited to Hugo Island to explore sites west of the island. Four trawls at this location (depths 170-200 m) between 22:00 LT, April 21, and 02:00, April 22, yielded a modest number

of fish, including 11 medium-to-large *C. aceratus* and three *N. coriiceps*. At 03:00 the ship departed Hugo Island and arrived at Palmer Station at 10:00 LT to commence fish off-load.

At Palmer Station, members of all three science groups sampled tissues from a variety of notothenioid fishes, including the target species (*C. aceratus*, *G. gibberifrons*, and *N. coriiceps*), as well as *N. rossii*, *Lepidonotothen squamifrons*, *Champscephalus gunnari*, *Chionodraco rastrispinosus*, and *Pseudochaenichthys georgianus* to support research in our CONUS laboratories.

We have four major scientific Aims this season: 1) to examine the energetics and thermal optima of the folding of tubulin by the chaperonin CCT using proteins purified from *G. gibberifrons* (B-037-L/P); 2) to assess the effects of elevated temperature regimes on embryonic development of *N. coriiceps* with special attention to the rate of cleavage (B-037-L/P); 3) to determine the ontogeny of cartilage and bone formation by embryos of robustly ossified and poorly ossified Antarctic fishes (*N. coriiceps* and *C. aceratus*, respectively) (B-029-U); and 4) to explore the role of reactive oxygen species in the development of notothenioid embryos (B-038-L/P). Work on Aim 1 awaits the arrival of project personnel on LMG12-05. Experiments for Aims 2-4 await the production of embryos of the relevant species. By the end of April, adults of the species *C. aceratus*, *C. gunnari*, and *N. coriiceps* appeared to be nearly ready to spawn based on our observations of ovaries and testes during dissections. If these indications prove correct, our groups will be able to produce embryos and study their development over a period of ~5 months.

The *LMG* departed Palmer Station on April 24 en route to Punta Arenas, Chile. Dr. Brian Eames sailed northbound, while Detrich, Allard, Grim, Mueller, and Chamberlin remained on station to continue our research programs. We await the arrival of four team members, Leonardo Almeida, Juan Carlos Zabala, Lucia Quintana, and Sara Alvira (B-037-L/P) on Cruise LMG12-05. We thank the ship and station personnel for their excellent help in making our early field season a great success.

B-256-P: ROLE OF DEHYDRATION AND PHOTOPERIODISM IN PREPARING AN ANTARCTIC MIDGE FOR THE POLAR NIGHT

Richard E. Lee, Jr. and David L. Denlinger, Principal Investigators, Miami University, Oxford, Ohio and Ohio State University, Columbus, Ohio

Personnel on station: Yuta Kawarasaki

This month of April brought a drastic change in the habitats occupied by larvae of *Belgica antarctica*. Snow accumulated on the ground and the underlying substrate froze. This condition seems likely to persist throughout the winter.

One of the main goals for this year is to investigate changes in the midge's physiological state during the seasonal transition from summer to winter. Because the accumulated snow and the frozen ground pose a great challenge for collecting midge samples, in February we placed a tub containing larvae in their natural substrate in the backyard, where larvae were allowed to acclimatize in this semi-natural environment. This tub was brought into the laboratory to determine water content, temperature of crystallization, body composition, cold tolerance, and metabolic activity of winter-acclimatized larvae. These data will be compared to values from

larvae that were periodically collected from the field to investigate larval preparation for the winter; for example, winter larvae had increased cold tolerance compared to ones collected in March.

We are grateful to station personnel for their support. Especially, we thank Janice O'Reilly and Ken Keenan for coordinating science support. We also thank Lily Glass for assistance in the laboratory. The field sampling would not have been possible without boating support by Ryan Wallace and Sean Bonnette. Kerry Kells and Bill Burns helped with field collection of midge samples.

PALMER STATION
RESEARCH ASSOCIATE MONTHLY REPORT
April 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.

There was a loss of communication with the Falcon receiver in the seismic vault. The Falcon was no longer in contact with the router. The Falcon was power cycled and was soon returned to normal operation.

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. Large amounts of data were archived to hard drives and shipped to the University of Florida.

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 with no issues to report.

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. Power has been returned to the clean air building after being off for most of the month due to fire system maintenance.

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. Power was turned off during the previous month in the Clean Air building for fire system maintenance. At the time the NOAA air flasks were moved into TerraLab to avoid freezing. The flasks are remaining in TerraLab even though power has returned to the clean air building.

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. It was discovered that one of the calibration lamps, M-765, has become misaligned within its holding bracket. The lamp is still useable going forward, but the misalignment must be factored into previous and future calibration results.

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.

There was a visit during the month by a representative from Stanford University and by the USAP rigger group. During the site visit, the antenna on the glacier was shored up after the ice became severely melted out during the summer months. The old 4x4 posts were placed back into use after it was decided that the bamboo that was being used to hold the signal cable off the glacier were inadequate. Much of the bamboo is still frozen into the glacier. Alternate methods of attaching the cable to the posts are being examined, including carabiners, zip ties, and copper wire wraps.

The Stanford representative also installed new cards into the preamp at the base of the antenna. This is the second iteration of these preamp cards put into use, the previous versions resulted in too much noise. The new cards worked well and were left in operation.

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.

The system collected data normally during the month.

B-390-P: THERMO-SALINOGRAPH

Vernon Asper, Principal Investigator, University of Southern Mississippi

Sea water 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.

No ground points were collected during the month.

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

Deneb Karentz, Joe Grzymiski, 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. The FRRF collected no data for several days near the end of the month. When the data was downloaded on the scheduled day, the dataset was empty. Checks during the week did not indicate that there was a problem, so it is likely that the software was not restarted properly. It is not possible to look at the data *in situ*, while it is being collected, so any time the data is checked it leaves open the possibility that data collection will not be properly restarted. The data checked since that incident have been normal.

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. New batteries arrived and were installed into the UPS, bringing the battery backup capacity from two batteries to the maximum of five, with two more batteries left in reserve. The total projected battery backup capability of the UPS now stands at about two and a half hours.

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*.