

PALMER STATION MONTHLY SCIENCE REPORT

May 2011



Kristin O'Brien and Irina Mueller (B-036-P) transfer fish from the LMG to station aquaria

Image Credit: Reinhart Piuk

NEWS FROM THE LAB

By Melinda Piuk, Winter Assistant Supervisor of Lab Operations

May got off to a challenging start with the late arrival of the *ARSV Laurence M. Gould* (LMG) after a particularly rough week in the Drake Passage. A deploying member of the O'Brien group (B-036-P) was able to lead fishing operations on the way south, and fish were off-loaded upon arrival to keep science work on track. The returning members of the Cottrell group (B-026-P) were thrilled to step onto station after a rough crossing and continue their microbial work from January.

The LMG departed the following day for a fishing cruise with members of the O'Brien group (B-036-P) and two station volunteers. The ship returned early after a successful catch and left on the 13th to conduct research with Craig Smith and David Honig (C-246-N). The LMG returned a week later to gear up for another fishing cruise. It was an excellent month for fishing, and once again the ship returned to offload their catch earlier than expected. The LMG departed one last time on the 26th for a science expedition with the Smith group (C-246-N) and 5 station volunteers, and returned at the end of the month to stay at the pier for the remainder of the Palmer Station port call.

Amidst all of the hustle and bustle of a full Bio Lab and a busy pier, the Lee (B-256-P) and Amsler/Baker/McClintock (B-022-P) groups continued to be productive and conduct their research as the days grew darker and colder.

MAY 2011 WEATHER

By Neal Scheibe, Research Associate

May at Palmer Station had mostly gloomy skies, but calm winds once again allowed the science groups to carry out field work until near the end of the month. A particularly calm, unexpectedly sunny day on the 13th brought a sighting of humpback whales and Gentoo penguins. The windiest days seemed to coincide with the scheduled days off, which hampered outdoor activities but instead kept everyone curled around a warm drink inside.

The coldest day was the 11th at -7.9°C . The warmest temperature was on the 15th at 6.8°C . The average temperature for the month was -1.4°C , which is about the same as last year. Sea surface temperatures hovered near -0.4°C . Very little sea ice was seen this month, with no large icebergs in view. The glacier was heard calving several times during the warmer, rainy days.

There was 20 cm of snowfall throughout the month, often with snow being followed by rain to wipe out most accumulation around Palmer Station. A total of 49.5 mm melted precipitation fell during the month, with more than half of that coming during the last week, which left the station nearly bare of snow heading into June.

B-022-P: THE CHEMICAL ECOLOGY OF SHALLOW-WATER MARINE MACROALGAE AND INVERTEBRATES ON THE ANTARCTIC PENINSULA

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

Bill Baker, Principal Investigator, University of South Florida

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

Although the unseasonably wonderful weather of March and April was gone, May was another productive month for diving operations. We completed 42 research scuba dives during May. In addition to collections for a variety of laboratory projects, we were able to recover plants and concrete substrates from a growth experiment in Kristie Cove. Once each week we also recovered living and dead algal material that was placed in bags connected to the Bahia Paraiso anchor chain in late April. This is to determine how rapidly chemical defenses break down in dead plants, thereby making the tissue available to herbivores. In addition, we made a late season set of collections at five sites for a study of endophyte load effects on algal reproduction.

Our dive collections continued to allow us to stay very busy in the labs with feeding bioassays, reactive oxygen defense assays, and structural defense measurements. Diving collections also supported a variety of chemical extractions and preparations for experiments here and at our home institution.

We are grateful for the generous and professional assistance of numerous RPSC staff. Mindy Piuk, Christina Hammock, Tom Purcell, Eddie Quintanilla, and Neal Scheibe deserve special thanks for facilitating our laboratory and diving operations.

B-026-P: PHOTOHETEROTROPHIC MICROBES IN THE WEST ANTARCTIC PENINSULA MARINE ECOSYSTEM

Dr. Matthew T. Cottrell, Principal Investigator, School of Marine Science and Policy, University of Delaware, Lewes, Delaware

Personnel on station: Matt Cottrell, Mrina Nikrad and Jill Mikucki

The primary objective of this project is to explore the community structure and metabolism of microbes in the waters of the west Antarctic Peninsula, specifically those with a photoheterotrophic metabolism, which enables them to supplement their heterotrophic metabolism using energy harvested from sunlight. The purpose of our May 2011 deployment was to test the metabolism of photoheterotrophs in the winter with their metabolism in the summer, which we assessed in January 2011. We expect that seasonal variation in sunlight will be reflected in the fraction of the bacterial community harvesting sunlight to supplement the energy obtained from organic compound consumption. Collecting seawater successfully from Station E and Station B during the winter was just as challenging as we were told to expect. But breaks in the weather allowed us to collect all of the seawater that we needed for in situ rate measurements and to set up incubation experiments in the environmental chamber that can be sampled on days that we do not go out in the field. The experimental work focuses on the response of microbes to light and dark and organic material additions, which we expect will differ between photoheterotrophs and the rest of the microbial community. In addition to addressing important questions, the incubation experiments enable us to get as much out of the precious seawater that we are able to collect when the weather cooperates. We are looking forward to our next summer deployment that is just around the corner in January 2012.

We wish to thank the several volunteers who pitched in to help when we needed extra hands in the boat during inclement weather. We could not have gotten our work done without their assistance.

B-036-P: LINKAGES AMONG MITOCHONDRIAL FORM, FUNCTION AND THERMAL TOLERANCE OF ANTARCTIC NOTOTHENIOID FISHES

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

Personnel on station: Kristin O'Brien (UAF), Elizabeth Crockett (OU), Devin Devor (OU), Irina Mueller (UAF), Paula Dell (Polar TREC) and Jeff Grim (NEU).

We completed measurements of thermal tolerance in the red-blooded nototheniid, *Notothenia coriiceps* and the icefish, *Chaenocephalus aceratus* under normoxic and hyperoxic conditions. Animals were harvested at normal physiological temperature ($0^{\circ}\text{C} \pm 0.5$), 8°C and at the critical thermal maximum (CTMax). Arterial and venous blood were collected for measuring PO_2 , PCO_2 , lactate, pH, hematocrit (in red-blooded species) and serum osmolarity. Tissues were also collected for biochemical analyses at our home institution.

Experiments were completed to characterize differences in susceptibility to oxidative damage in mitochondria of red- and white-blooded notothenioids. Grim and Mueller measured the activity of the antioxidant superoxide dismutase in mitochondria isolated from *N. coriiceps* and *C. aceratus*.

During May we also had three successful fishing expeditions on board the Laurence M. Gould. Grim led fishing operations during the southbound leg of LMG 11-05, fishing at Low Island and Dallmann Bay, May 8-9. The second fishing trip was May 10-12 and the third and final trip was May 21-23. We greatly appreciate the assistance of Palmer Station support personnel during these fishing trips- Harry Snyder and Jeff Otten on our second trip, and Bamma Mellott and Bob Farrell on the third trip.

We ended science on Saturday, June 4 and packed our laboratory equipment on June 4 and 5. We gratefully acknowledge the outstanding support from Palmer Station throughout our entire field season, especially the station manager, Bob Farrell; lab manager, Mindy Piuk; instrument technician, Christina Hammock; and the crew in FEMC- Perri Barbour, Graham Colegrove, Rob Lyons, and Harry Snyder.

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

Most of this month focused on completing a number of experiments that were started in April. One of the experiments aimed to discern the physiological responses of Antarctic midge larvae following ecologically relevant, low-temperature exposure. Larvae can survive subzero exposure by tolerating the freezing of their body fluids or by losing their body water to environmental ice and, thereby, remaining unfrozen. Both strategies seem equally effective in surviving low temperature exposure. Follow-up analyses are planned to further investigate the differences in physiological parameters, focusing on the energetic costs of these strategies.

We are grateful to station personnel for their support. Especially, we thank Mindy Piuk and Christina Hammock for their assistance in the laboratory. We also thank Eddie Quintanilla and Tom Purcell for the boating support. Harry Snyder, Rob Lyons, and Mindy Piuk all assisted with fieldwork.

PALMER STATION
RESEARCH ASSOCIATE MONTHLY REPORT
May 2011
Neal Scheibe

G-295-P GPS CONTINUOUSLY OPERATING REFERENCE STATION.

Bjorn Johns, Principal Investigator, UNAVCO

The Research Associate operates and maintains on-site equipment for the project. Throughout the month, 15-second epoch interval GPS data files were collected continually at station PALM, compressed, and transmitted to the NASA-JPL in Pasadena, CA.

The GPS operated normally for the duration of the month.

G-090-P GLOBAL SEISMOGRAPH NETWORK (GSN) SITE AT PALMER STATION.

Kent Anderson, Principal Investigator, Incorporated Research Institutions for Seismology (IRIS)

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

Data collection occurred normally during the month.

A-132-P FABRY-PEROT INTERFEROMETER

Qian Wu, Principal Investigator, National Center for Atmospheric Research

The Research Associate operates and maintains on-site equipment for the project. The Fabry-Perot Interferometer observes mesospheric and thermospheric neutral winds and temperatures at Palmer Station.

On May 5, the control software was not responding. All connections were checked among the power supplies, the instruments, and computer. A loose connection was found on the power supply, which was tightened, restoring normal functionality. Otherwise, the Fabry-Perot Interferometer ran normally throughout the month.

**O-202-P ANTARCTIC METEOROLOGICAL RESEARCH CENTER (AMRC)
SATELLITE DATA INGESTOR.**

Mathew Lazzara, Principal Investigator, University of Wisconsin

The Research Associate operates and maintains on-site equipment for the project. The AMRC SDI 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 ingestor operated normally for the duration of 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 aid in determining rates of marine biological productivity and ocean mixing. The results are also used to help determine the 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. Palmer Station is especially well situated for resolving signals of carbon cycling in the Southern Ocean.

The Research Associate collects samples fortnightly from both TerraLab and the VLF Building. A goal is that all sampling will eventually be moved to TerraLab. Samples taken from the station are sent to Scripps where the analysis of O₂ and CO₂ content takes place.

Sampling equipment and operations were per plan throughout the month.

O-264-P: COLLECTION OF ATMOSPHERIC AIR FOR THE NOAA/GMD WORLDWIDE FLASK SAMPLING NETWORK

James Butler (Principle 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.

Palmer Station is one of many sites around the world providing data to support these projects. The Research Associate collects weekly air samples for Carbon Cycle Greenhouse Gases Group and fortnightly samples for Halocarbons & other Atmospheric Trace Species Group.

Carbon Cycle and Halocarbon sampling occurred normally during the month.

O-283-P ANTARCTIC AUTOMATIC WEATHER STATIONS (AWS).

Mathew Lazzara, Principal Investigator, University of Wisconsin

The Research Associate monitors data transmissions for the project and performs quarterly maintenance on the station at Bonaparte Point. 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 weather station ran normally during the month.

A-109-P ANTARCTIC EXTREMELY LOW FREQUENCY/VERY LOW FREQUENCY OBSERVATIONS OF LIGHTNING AND LIGHTNING-INDUCED ELECTRON PRECIPITATION.

Robert Moore, Principal Investigator, University of Florida

Extremely Low Frequency/Very Low Frequency (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. Lightning source currents are estimated or directly measured by experimental observations of individual natural and rocket-triggered lightning flashes in North America. Together, the North American and Antarctic data sets are used to experimentally identify and analyze the components of lightning and the effects of lightning, such as lightning-induced electron precipitation, that are observed in the Antarctic, more than 10,000 km distant.

Data collection resumed near the end of the month. See A-306-P below for more details.

A-306-P GLOBAL THUNDERSTORM ACTIVITY AND ITS EFFECTS ON THE RADIATION BELTS AND THE LOWER IONOSPHERE.

Umran Inan, 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 (uppermost layer of the atmosphere ionized by solar radiation) and magnetosphere (the area surrounding the earth dominated by the Earth's magnetic field and particles trapped by it). Many of these studies relate to the energetic releases associated with lightning. For example, Palmer Station's unique location enables it to pick up small bits of radiation from lightning strikes as far away as Africa, the USA, or the Pacific Ocean.

The system was non-operational at the onset of the month. Suspected faulty cabling was replaced with a refurbished section of signal cable to the antenna in the prior month and this process was repeated with a different section of cable in May. Initially, the replaced cable showed no improvement on functionality. After minor adjustments were made to the connections and allowing the entire length of the cable to hold voltage overnight, the system began to function again. It is suspected that the voltage across the entire cable caused certain corroded areas to warm up and dry out, which then led to good data reception from the antenna. The system has been functional non-stop since May 25.

T-312-P TERASCAN SATELLITE IMAGING SYSTEM.

The Research Associate operates and maintains on-site equipment for the project. Throughout the month, the TeraScan system collected, archived, and processed DMSP and NOAA satellite telemetry, capturing approximately 25-30 passes per day. A weekly 85GHz SSM/I ice concentration image was produced and transferred to UCSB for B-032-P (Smith).

The system collected data normally during the month. The cloned system that was running for the prior few weeks was replaced at the beginning of the month with the old system containing a new motherboard.

On May 11, a station-wide power outage caused the system to lose functionality briefly, with no loss of data. The system was not on uninterruptible power supply (UPS) backup due to old batteries that were scheduled to be replaced with newly-arrived units. The new UPS was installed after the power outage and now protects the system from future outages.

Near the end of the month the system stopped delivering data to McMurdo forecasters. The transmissions have been reinstated, but troubleshooting continues into the cause of the issue..

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 though 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. Palmer's magnetometer is also a conjugate to the Canadian Poste de la Baleine station, allowing the study of conjugate differences in geomagnetic substorms and general auroral activity. The station 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 real-time data, including graphs and web camera images of the ocean in the vicinity of Palmer Station, are compiled by a local server into web page format and relayed to a mirror site at Woods Hole Oceanographic Institute, which is a collaborator in the project. The URL for the WHOI mirror site is <http://4dgeo.whoi.edu/tsg/>.

The thermosalinograph operated normally during the month.

T-998-P: IMS RADIONUCLIDE MONITORING

Managed by General Dynamics

The International Monitoring System (IMS) radionuclide sampler is part of the Comprehensive Test Ban Treaty (CTBT) verification regime. The automated Radionuclide Aerosol Sampler and Analyzer (RASA) unit pumps air continuously through a filter for 24 hour periods, collecting particulates in the .2-10 micron range. The filter is then tested for particulates with radioisotope signatures indicative of a nuclear weapons test. The station Research Associate operates and maintains the instrument.

A station-wide power outage on May 11 in the morning caused a temporary outage for this project. The system was not on battery backup due to a failure of the uninterruptible power supply (UPS) in the previous month. The UPS was scheduled to be replaced that very day, in the afternoon. The new UPS was installed into the system and activated during the power outage, but data for that day was compromised. Later in the month, a battery failed and was removed from the UPS, but it had no adverse effect on data collection. New batteries are on order. Data collection was normal for the rest of May.

ULTRAVIOLET (UV) SPECTRAL IRRADIANCE MONITORING NETWORK (UVSIMN)

A 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, while the sun is above the horizon. A BSI GUV-511 filter radiometer, which has four channels in the UV and one channel in the visible for measuring Photosynthetically Active Radiation (PAR), is located next to the SUV-100.

The UV monitor collected data normally for the month and all scheduled calibrations were carried out.

TIDE GAGE

The Research Associate operates and maintains on-site equipment for the project. Tide height and seawater temperature are monitored on a continual basis by a gauge mounted at the Palmer Station pier. Although salinity (conductivity) is also recorded by the tide gauge, the measurements are incorrect and should not be used. Correct salinity data can be found on the TSG system.

The tide gauge operated normally during the month.

METEOROLOGY

The Research Associate acts as chief weather observer, and compiles and distributes meteorological data. At the end of the month a summary report is prepared and sent to interested parties. 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).

Scheduled inspections were carried out at the Gamage Point tower. Weather updates and satellite imagery were forwarded to the R/V LAURENCE M. GOULD.