

PALMER STATION MONTHLY SCIENCE REPORT
March 2011



Emperor penguin at Hero Inlet.
Image Credit: Brian Nelson

NEWS FROM THE LAB

By Phil Spindler, Science Support Supervisor

The *RV Laurence M. Gould* (LMG) departed station at the beginning of March, wrapping up their cruise with the geology groups (MacPhee/G-170-E, Barbeau/G-432-E, and Kirschvink/G-436-E). A few folk from station field teams also went north with that ship. The groups that remained wound down their very successful seasons. Penguin colonies emptied out, the days quickly became shorter, and cooler stormier weather set in.

By the end of March, science groups prepared their last samples, packed up their lab work, and station personnel prepared to turn over to their incoming winter counterparts. Though most wildlife moved out of the area, we had a surprise visit by an emperor penguin. For many folk who have only worked at Palmer, this was indeed a rare and exciting opportunity.

The LMG returned to station at the end of the month for a week-long port call. The station received its resupply of fuel, food, and fresh support staff. All emergency teams turned over to winter staff. Jim Bockheim's group (G-239-E) arrived and got cracking on their four-week field season. They are deploying instruments in the area to study the active-layer dynamics, soil properties, and scope out a site for a future permafrost-monitoring bore hole. This will help complete the picture of west Antarctic Peninsula permafrost and active-layer changes.

MARCH WEATHER

By Brian Nelson, Research Associate

March was a series of calm, dry days that were bookended by gloomy systems that moved through at the beginning and end of the month. Average temperatures stayed above the freezing mark, with the low reading of -1.5C coming on the 22nd and the high of 8C on the 9th. Snowfall, at 6cm, is down sharply from a year ago where it came in at 34cm and from the average of 21cm.

The winds averaged only 7 knots for the month, allowing several continuous days of boating. The maximum gusts were on the first day of the month, blowing at 55 knots.

Sea conditions remain the same, with regular brash from glacier calvings and a few bergs in otherwise open water. The average sea surface temperature was 0.77C and stayed above 1C for most of the last week of the month.

B-013-P PALMER LONG TERM ECOLOGICAL RESEARCH (LTER): LOOKING BACK IN TIME THROUGH MARINE ECOSYSTEM SPACE, APEX PREDATOR COMPONENT

Dr. William R. Fraser, Principal Investigator, Polar Oceans Research Group, Sheridan, MT

Personnel on station: Jennifer Blum, Marc Travers

The Laurence M. Gould departed on March 7, and our field team decreased to two members as Kelsey Ducklow departed for the season. Weather conditions during March were much improved from February. We were able to complete all of our fieldwork in a timely manner with only minimal delays due to occasional precipitation or high winds.

Adélie work concluded this month, as the radio transmitter project on Humble Island came to a close. Equipment was removed from the island and data files processed. A telemetry scan was also performed to collect molted transmitters. Sediment trap contents were collected from gentoo colonies on Biscoe Island and chinstrap colonies on Dream Island. Sediment trap sample processing continued until the end of the month.

Skua work continued throughout the month with both brown and south polar skua chick growth monitoring. South polar skua scat and regurgitate collections also continued on Shortcut Island, and all chicks from our study were banded before the end of the month. Limpet trap contents were collected from kelp gull colonies on four local islands. Giant petrel chick banding was completed on all local islands. Growth measurements of giant petrel chicks continue on Humble Island. We commenced preparations and training for RPSC winter personnel who will be continuing some measurements for this project.

Marine mammal monitoring continued, and we noticed the return of the large breeding male elephant seals that have been mostly absent for the past couple of months. Lab work continued and finished up as our last box of samples was packed up and given to Logistics during the last week of March. Project gear and supplies were cleaned, inventoried and packed up; project cargo was sent north. Data analysis and organization projects, other end-of-season inventories,

and Lab/Polar Haven/boathouse organization/clean-up were also main activities. An end-of-season outbrief will occur via phone with our planning manager, Eric Pohlman.

RPSC continued to provide great support this month, and we'd like to thank everyone for their efforts and attitude throughout the entire summer. Special thanks to Phil Spindler for providing great support these last few months in the midst of covering two positions; Bob DeValentino for his efforts in assisting with our Canadian sample shipments; Kendall Barbery for jumping in and doing a great job as our boating coordinator, and to all folks who helped cover the boating coordinator position prior to Kendall's arrival.

B-019-P PALMER LONG TERM ECOLOGICAL RESEARCH (LTER): LOOKING BACK IN TIME THROUGH MARINE ECOSYSTEM SPACE, PHYTOPLANKTON COMPONENT

Principle Investigator: Oscar Schofield, Rutgers University and Matt Oliver, University of Delaware

Personnel on station: Kaycee Coleman and Mike Garzio

The group wrapped up their field season and departed station on April 4.

B-020-P: PALMER LONG TERM ECOLOGICAL RESEARCH (LTER): LOOKING BACK IN TIME THROUGH MARINE ECOSYSTEM SPACE, ZOOPLANKTON COMPONENT

Dr. Deborah K. Steinberg, Principal Investigator, Virginia Institute of Marine Science, VA

Personnel on station: Kim Bernard, Kate Ruck, Lori Price

Post-LTER cruise sample processing has continued and is now near complete. Only a few samples will be shipped back to our laboratory at VIMS.

Regular zodiac sampling trips are being carried out, weather permitting, using the DT-X echo sounder and the 1m ring net with the aim of catching zooplankton, specifically *Euphausia superba* and *Salpa thompsoni*. Zooplankton seem to have become more scarce than they were in February and we have not been able to catch as many as we'd hoped for. The echo sounder, however, has continued to detect large patches of krill in deep waters and close to the sea floor. Our preliminary results suggest that while diurnal tides may be influencing the introduction of krill patches from the Palmer Deep region (this has yet to be verified though), local bathymetry may be acting to entrain these patches in certain areas; in particular, the deep bowl and trench to the south of Cormorant Island, where we have found deep, near-benthic krill patches fairly consistently.

The few zooplankton caught during our sampling trips are being processed either for CHN (specifically the pteropod, *Limacina helicina*) or lipid analysis, which will be conducted back in the States at VIMS.

Three more dilution experiments (to determine feeding rates of microzooplankton) have been conducted, bringing the total number of on-station dilution experiments to seven. Further seawater samples have been collected for microzooplankton identification and enumeration. In addition, vertical net tows using a 64 μ m mesh net were conducted to collect the larger, less abundant microzooplankton groups.

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: Bill Baker, Charles Amsler, Margaret Amsler, Bill Dent, Ruth McDowell, Jackie Salm, Kate Schoenrock, Julie Schram

March was an outstanding month for diving operations. After enduring unseasonably bad weather for the first weeks after we arrived in mid-February, we were rewarded with unseasonably great weather all of March. This allowed us a string of 22 straight days of diving; weather prevented us from diving from boats on only three days all month. In addition to collections for a wide variety of laboratory projects, we were able to deploy a growth experiment on small concrete substrates in Kristie Cove early in the month and to recover/redeploy the plants for interim measurements after three weeks. We also deployed and recovered three short-term experiments looking at consumption of filamentous intertidal algae transplanted to the subtidal, and recovered a long-term sponge predation experiment that had been deployed at Norsel Point in late May and early June 2010. Support from the LMG's Tin Can landing craft made it relatively easy for us to recover the concrete parking lot bumpers these sponge outplants were anchored to.

Team member Julie Schram arrived on 27 March with LMG11-03, which also carried the Tin Can. We made several dives from the landing craft in March in addition to the bumper recovery dives. It is an excellent platform for diving operations and we are very grateful to Marine for making it available to us during the time the LMG was here.

The numerous collecting opportunities provided by the good weather also allowed 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 institutions.

We are grateful for the generous and professional assistance of numerous RPSC staff. Phil Spindler, Christina Hammock, and Brian Nelson deserve special thanks for facilitating our laboratory and diving operations. Kendall Barbery stepped in as boating coordinator for the month on very short notice and did an outstanding job. We are also very grateful to Chance Miller and the other LMG Marine Techs for generously supporting dive operations from the Tin Can for the last few days of the month (and first few of April).

B-045-P PALMER LONG TERM ECOLOGICAL RESEARCH (LTER): LOOKING BACK IN TIME THROUGH MARINE ECOSYSTEM SPACE, MICROBIAL ECOLOGY COMPONENT

Hugh Ducklow, Principal Investigator, Marine Biological Laboratory, Woods Hole Massachusetts

Personnel on station: Alice Alpert, Edgar Woznica

The summer season is coming to end and our group is glad to say we achieved our science goals. We were able to sample in unseasonably gorgeous weather and collect all the way through March. We have noticed that the bacteria have not yet returned to the winter baseline with end of March population numbers still several times above those of early October. Next year we are looking forward to building on an expanded data set by continuing to work with our flow cytometer and by sampling the water at seven depths instead of four. Alice left early to go visit graduate schools so Edgar finished up the season. The on-site personnel, Edgar and Alice, would like to thank the Raytheon Staff for excellent support and Hugh Ducklow and Matthew Erickson for a wonderful experience.

B-239-P VIRAL CONTRIBUTIONS TO SUMMER BLOOM DYNAMICS IN THE WESTERN ANTARCTIC PENINSULA

Grieg Steward, Principal Investigator, University of Hawai`i at Manoa

Personnel on station: Jaclyn Mueller

The month of March brings our very successful, first season at Palmer Station to an end. Luckily, the weather improved drastically from the windy conditions of February, and core sampling at Station B and E continued without interruption. Alex Culley departed on the Laurence M. Gould on March 7th, leaving Jackie Mueller the only remaining personnel from our group on station. With outstanding assistance from other science groups and station personnel, she was able to continue sampling and pack up all of our gear without any problems. In addition to our own work, we were able to pack up and ship Jenn Brum's (B-319-P) equipment and samples to her.

The collaborative efforts of the Schofield (B-019-P) and Ducklow (B-045-P) groups resulted in truly synchronous sampling of microbial processes throughout the entire season. We thank Kaycee Coleman, Mike Garzio, and Edgar Woznica for their efforts this month in helping coordinate our biweekly sampling. The samples collected this month will allow us to determine total viral abundance, the frequency of infected cells, and the diversity of the viral community. We are particularly interested in incorporating these viral dynamics into the other microbial processes measured throughout the summer bloom.

The third ocean acidification experiment was successfully completed in the beginning of March. We were able to collect samples for the viral component at all the time points from each treatment of pre-industrial (180ppm), current (385ppm), and predicted future (750ppm) atmospheric CO₂ concentrations. These samples will allow us to determine how varying CO₂ levels influence viral abundance, viral diversity, and mortality of phytoplankton and prokaryote communities due to viral infection.

We are extremely grateful for the generous support provided by all of the RPSC staff throughout the season. In particular, we thank Christina Hammock and Phil Spindler for their continued hard work this month, Kendall Barbery for stepping up unexpectedly and supporting all of our boating needs, and Bob DeValentino and David Pettengill for leading such an organized logistics team.

B-256-P: ROLE OF DEHYDRATION AND PHOTOPERIODISM IN PREPARING AN ANTARCTIC INSECT 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, Nicholas Teets

Yuta Kawarasaki was the only person on station until March 27th when the Laurence M. Gould brought Nicholas Teets. With help from other science groups and station personnel, Yuta was able to carry out sampling of *Belgica antarctica* larvae from various islands during the month.

In addition to the field sampling, our focus was to set up laboratory experiments to further characterize cryoprotective dehydration, one of two plausible overwintering strategies for midge larvae. Larvae can potentially survive winter cold by tolerating the freezing of their body fluid. But, should they remain unfrozen by means of supercooling, the larvae will lose their body water to environmental ice, resulting in a more concentrated body fluid and a reduced chance of freezing. This latter strategy of cryoprotective dehydration has only been described in a handful of invertebrates. Previously we demonstrated that summer-collected larvae of *B. antarctica* can undergo cryoprotective dehydration.

We are grateful to station personnel for their support. Especially, we thank Phil Spindler, Carolyn Lipke, and Christina Hammock for their assistance in the laboratory. We also thank Kendall Barbery for the boating support and Christina Hammock, Nándor Kovats, Carolyn Lipke, Jeff Otten, David Pettengill, and Phil Spindler for helping with field collections. We also thank personnel from science groups B-013-P, B-020-P, and B-239-P for providing transportation between islands.

PALMER STATION
RESEARCH ASSOCIATE MONTHLY REPORT
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Brian Nelson

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. The roving unit was used to measure the glacier terminus.

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.

The focus mechanism in the Fabry-Perot Interferometer has been deemed faulty by the grantees. It has been set to a workable, but not ideal, position and de-powered. The group plans to replace the unit during their upcoming site visit.

**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. A two week data outage occurred due to failure of the TeraScan system. Please see the T-312-P section below for details.

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. Samples taken from TerraLab still have occasional high levels of CO₂. The system was leak checked to eliminate leaks as a possible contamination source. Discussion is underway to move the air sampling tower to the windward (east) side of the building, where the grantees originally suggested it should be.

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 was halted throughout 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 site visit is currently underway. The old antenna has been taken down and the cable moved back within the safe travel area on the glacier. The new antenna should be up this week, courtesy of the riggers. The system is still inoperable due to shorting problems, but they have been isolated to a section of the cable, and new supplies should allow repairs to be made. Also, the grounding cable in Hero Inlet was inspected and repaired this month.

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 computer failed catastrophically in mid-March, causing the loss of satellite imagery and Automated Weather Station data downloads. With much thanks to the Palmer IT department, the hard drive was cloned and inserted into another computer, along with the driver cards for the satellite dish control. This temporary fix was successful and replacement parts are currently being ordered for the original system.

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. 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.

The system operated normally throughout the month. A faulty UPS battery was discovered and removed from the system. The site visit is currently underway.

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. The site visit is currently underway.

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 and the R/V NATHANIEL B. PALMER.