

PALMER STATION MONTHLY SCIENCE REPORT
January, 2010



The ARSV *Laurence M Gould* departs Palmer Station for the LTER cruise on January 5, 2009.
Image Credit: Rebecca Shoop

NEWS FROM THE LAB

Phil Spindler, Assistant Supervisor of Laboratory Operations

January started off with a busy port call with the ARSV *Laurence M Gould* (LMG). Science groups prepared for their month-long LTER cruise, and Palmer Station welcomed three more groups to station- Jon Cohen with the LTER zooplankton component (Deborah Steinberg/B-020-P), the polar entomologists (Rick Lee/B-256-P) and the underwater photographers (Norbert Wu/Y-608-P). The station's population was maxed out at forty-five for most of January.

The weather was very cooperative, and the science was most successful in the field. Many tour ships visited station over the month as well. Peter Rejcek from the Antarctic Sun (the USAP newspaper) was on station and reported on many facets of Palmer Station science, life, and operations. The RVIB *Nathaniel B Palmer* also stopped by during the LARISSA cruise for needed supplies.

From Palmer Station, we wish you the best in this New Year.

WEATHER SUMMARY

January, 2010

This season's atypical weather continued into January. Precipitation was minimal at only 11.9mm melted, one fifth of the January average. Though much of this was snow, no accumulation occurred. Wind was predominantly out of the north, shifting equally to the east and west. These consistent northerlies have been bad news for the LARISSA cruise of the RVIB Nathaniel B. Palmer, as the pack ice in the Weddell Sea has remained intact and blocked passage south to the Larsen Ice Shelf area.

Temperatures were reasonably steady this month at an average of 1.8 °C, with maximum temperature at 6.8 °C and minimum at -2.2 °C. These temps are very near average for January. Wind speeds were generally low, averaging only 7 knots.

Brash ice has been regularly washing out from glacier calvings in Arthur Harbor, as well as blowing in through Lover's Lane when the wind is from the northwest. There have usually been only a couple modest icebergs at a time within the boating limits, and a few larger bergs visible on the horizon. Sea surface temperatures rose quickly from 0.0°C to 2.5°C in early January, then rolled back off to below 1.0 °C.

THE FOLLOWING PROJECTS CONDUCTED RESEARCH AT PALMER STATION:

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, Shawn Farry, Kristen Gorman, Donna Patterson-Fraser, Rick Smaniotto, Kirstie Yeager

The arrival of the Laurence M. Gould on January 3rd increased our personnel to six people. Kristen Gorman and Shawn Farry departed on the annual LTER cruise on January 5th. Weather conditions were mostly favorable for the month of January except for a couple of short stretches characterized by periods of high winds and/or precipitation that postponed field operations and prevented access to our farther-ranging field sites.

Monitoring of Adelie penguin reproduction continued this month, as we obtained crèche dates, continued indicator counts, and completed an all-colony chick census on local islands as well as on Dream and Biscoe Islands. A Gentoo chick census was completed on Biscoe Island, and a chinstrap chick census was completed on Dream Island. A census of Adelie, chinstrap, and Gentoo penguin chicks was completed on the known penguin-breeding islands in the Joubins. Breeding chronology monitoring and sampling continued for our selected Adelie, chinstrap, and Gentoo nests. Adelie foraging ecology studies began this month, which include diet sampling as well as deployment of presence/absence radio transmitters and satellite transmitters/dive depth recorders. The receiver and data link system installed a few seasons ago for this transmitter work was utilized again; no difficulties were experienced with the data transfer this season. Samples continue to be salvaged for further analysis and collaborations.

Skua work continued this month, as we started observing hatches and monitoring chick growth of brown skuas on local islands as well as on Dream and Biscoe Islands. Similar nest monitoring

as well as scat collections continue on Shortcut Island for south polar skuas. Another all-island census of kelp gulls was completed this month to determine breeding success. Monitoring of the blue-eyed shag colony on Cormorant Island continued. Satellite transmitters continue to be deployed on giant petrels, and our all-island giant petrel census that began in mid-December was completed. The giant petrel study on Humble Island continues with chick growth measurements.

Monitoring of marine mammals has continued this month and was highlighted by numerous sightings of humpback whales throughout the month; near the end of January a number of humpback whales were observed feeding close to station. Fur seals have also been seen in increasing number on local islands. Lab work continued with Adelie diet sample processing and sample preparation.

Thanks to IT for providing some extra assistance to a couple of our field team members early in January; to John Fonseca for his outstanding boat support as he finished up his contract this month and to Ryan Wallace as he fluidly stepped back into the boating coordinator position again; and to Phil Spindler for his positive attitude and detail-oriented support of our project.

B-019-P: Palmer Long Term Ecological Research (LTER): Looking back in time through marine ecosystem space, phytoplankton component.

Oscar Schofield, Principal Investigator, Institute of Marine and Coastal Sciences, Rutgers University

Personnel on station: Brian Gaas, Institute of Marine and Coastal Sciences, Rutgers University

The science kept on even after the L.M. Gould left with the other two Rutgers personnel in early January. The profiling bio-optical instruments went on the Gould, so we have unfortunately been lacking these data. However, twice-weekly profiling continues at stations B and E with B-045, with chlorophyll fluorescence, pigments, and POC samples acquired at 5 depths. With the help of RPSC IT, we got a second CTD working and inter-calibrated with the one taken on the Gould. CTD casts, along with fluorescence and transmittance, are taken at the same time as our discrete water samples.

The RPSC Instrument Tech was a big help in getting the HPLC up and running. After a short learning curve, the ~20 standards used for determining phytoplankton pigments have been successfully run and saved in a spectral library. We're in good position to run all of the pigment samples that have been accumulating through the rest of the season, and a full month ahead of last year's schedule. This comes despite a bit of organized chaos from changing and sharing lab spaces with a transient group.

Close coordination with the RPSC Instrument Tech and Lab Manager helped secure and set-up a set of incubators for a 10-week phytoplankton mixing experiment. The first of five permutations have been run, and halfway through the second set, it appears the cultures are continuing to enjoy their new home in Incubator #2. Now, we wait until the flow cytometer arrives with the Gould to start processing those samples...

The PIs of B-019 and B-045 decided to continue carbon uptake experiments until the end of the season. This required coordination with B-019, Rutgers University Health and Safety, and the RPSC Lab Manager to transfer radioisotope use permissions to B-019 members who were

staying on station. All went well, and the incubators will be set up once the Gould returns to port in early February.

Although not part of the original science plan, we have been working on a satellite remote sensing project involving some of the optics data we have collected. The Birders (B-013) have been instrumental in getting us samples from outside the limit we (B-019) can access. The RPSC Lab Manager organized a well-attended science lecture we presented on the subject; the question and answer period proved very fruitful for improving our experimental design. RPSC IT helped out again in getting the large program download scheduled and installed, and the Research Associate was happy to get the first few sets of satellite telemetry for us until we could access the NASA database personally.

B-020-P: Palmer Long Term Ecological Research (LTER): Looking back in time through marine ecosystem space, zooplankton component.

Deborah Steinberg, Principal Investigator, Virginia Institute of Marine Science, Gloucester Point, VA

Personnel on station: Jonathan Cohen

During the month of January, B-020-P conducted electrophysiological studies on the visual system of two krill species, *Thysanoessa macrura* (big-eye krill) and *Euphausia superba* (Antarctic krill). Specimens were collected throughout the month by net tows (500 μ m, 1 m dia.) from zodiac. Successful towing sites were Arthur Harbor, Station B, and Janus Island. Specimens were held in a cascade tank in the aquarium room prior to experiments. Specimens of both species were preserved for microscopy to characterize photoreceptor structure, with *E. superba* held for 5 days under light:dark, light:light, and dark:dark treatments prior to fixation. Visual spectral sensitivity experiments were only conducted on *T. macrura* as these data already exist for *E. superba*. Data collected on *T. macrura* suggest this species possesses different visual pigments in the upper and lower lobes of its bi-lobed eye. This is novel as all euphausiid species with bi-lobed eyes studied to date (4 deep-sea species) have a common visual pigment in both eye lobes. Data will be modeled to investigate how *T. macrura* uses its bi-lobed, dichromatic visual system to find food and avoid predators in its pelagic habitat. Temporal resolution experiments were successfully conducted on light- and dark-adapted specimens of *T. macrura* and *E. superba* at 0.7 and 4 °C to assess the speed of visual processing in these krill species. The goal of these experiments is to investigate functional changes in visual physiology of krill, and in turn their predator avoidance and foraging capability, in warming polar waters. Data on visual function in these Antarctic euphausiid species will also be compared to deep-sea species which inhabit slightly warmer water without dramatic seasonal changes in the light:dark cycle.

An experiment of opportunity was done in collaboration with B-256-P (the Buggers), and a visual spectral sensitivity curve for *Belgica antarctica* was determined. It showed peak sensitivity in the near-UV.

Many thanks are due to all RPSC support personnel on station for their assistance with this research, and good humor during several lean days of krilling. Special thanks are due to Ryan Wallace, who suggested and rigged the Furuno fishfinder on the zodiac, and John Fonseca who devised an excellent towing bridle. Without these, krill collection and all subsequent experiments would not have been possible.

B-045-P: Palmer Long Term Ecological Research (LTER): Looking back in time through marine ecosystem space, microbial ecology component.

Dr. Hugh Ducklow, Principal Investigator, The Ecosystems Center, Marine Biological Laboratory, Woods Hole, MA

Personnel on station: Alice Alpert and Amanda Keledjian

The month of January brought the annual LTER cruise to Palmer Station. Since Maggie and Dan left Palmer to join Hugh Ducklow, Matthew Erickson and Mirko Lunau on the L.M. Gould, two new members of B-045 arrived at Palmer to continue sampling in our stead. Alice Alpert and Amanda Keledjian maintained the sampling schedule at stations B and E, collecting water to measure bacterial abundance, productivity, dissolved organic carbon and nutrients. They also completed two more of the dilution experiments we have been conducting to assess the growth rates of different components of the microbial assemblage. Amanda and Alice will finish their work at Palmer when Maggie Waldron and Dan Whiteley return to station in early February, following the conclusion of the LTER research cruise.

We wish to thank the RPSC support personnel, particularly Phil Spindler, John Fonseca and Ryan Wallace, for ensuring a smooth turnover among B-045 personnel. Ted McKinley deserves special thanks for his time spent constructing the incubators we requested for the LTER cruise.

B-256-P: PALMER, Role of Dehydration and Photoperiodism in Preparing an Antarctic Insect for the Polar Night

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

Personnel on station: Richard Lee, David Denlinger, Nick Teets, Yuta Kawarasaki, Juanita Constible

Due to the efficient support system at Palmer Station we were able to begin field collection and laboratory studies shortly after our arrival. This year we found unusually large number of adults as well as larvae of the wingless fly (*Belgica antarctica*), whose exceptional tolerance to a variety of environmental stresses comprises the focus of our research. Large numbers of adult midges were observed at every field site, we visited during the first two weeks of January, including Norsel Point, Torgersen Island, Humble Island, Christine Island and Cormorant Island. Fly larvae were found in diverse microhabitats ranging from moss beds to mats of terrestrial algae to guano-rich sites adjacent to penguin rookeries.

Winter survival for many polar organisms depends on a coordinated transition from feeding, growth and reproduction during short summers, to an energy-conserving dormancy coupled with enhanced resistance to environmental extremes during long winters. Many temperate species rely on photoperiodic cues to trigger physiologic retooling in advance of winter. Since few studies have specifically addressed the role of photoperiodic timers in polar animals, we will determine whether larvae use these cues to trigger anticipatory preparations for enhanced resistance to desiccation and cold in winter. This summer we are collecting larvae to study the expression of the major clock genes and the proteins they encode. Other experiments investigate the effect of temperature acclimation on ATP synthesis and multiple bouts of freeze-thaw cycles. Additional larvae are being collected for a population genetics study that will estimate gene flow between populations on different islands, as well

as for a project designed to define the genome of this midge and to evaluate large scale changes in gene expression resulting from environmental stress.

A major objective of our project is to engage K-12 educators and their students in polar discovery. Our outreach efforts seek to connect the science activities of our team and other research projects on station with teachers and their students. Our website (<http://www.units.muohio.edu/cryolab/>), at Miami University, provides K-12 classroom activities that are based on national and state standards. Prior to our deployment, members of our team visited classrooms in Ohio and Virginia. We are interacting with these classes, and other students and teachers, through our blog (<http://frozenfly.edublogs.org/>). We will visit these classes again when we return home. In addition, we are developing a lesson plan on ecosystems that will engage students by using large panoramic pictures produced with GigaPan technology.

We are grateful to station personnel for their support and helpfulness during our first field season of this project. Phil Spindler, Lily Glass and Dianne Smith provided efficient and prompt assistance that allowed us to quickly set-up our laboratory and begin research. We thank John Fonseca and Ryan Wallace for boating support.

Y-608-P IPY: Poles Apart: Visual documentation of the marine ecosystems of the polar regions

Norbert Wu, Principal Investigator, Artist and Writers Program, Pacific Grove, CA

Personnel on Station: Norbert Wu, Ryan Caldwell, Andrew Day, Martin Schuster

We arrived at Palmer Station on January 3. Since that time, our team has conducted numerous dives at both known and unknown sites. Underwater visibility has been unusually bad this season due to plankton blooms, but nevertheless, the team has found two new dive sites off Cormorant Island that are visually and biologically outstanding.

We've collected marine life for Palmer Station's aquariums (to show to cruise ships, at the request of the lab manager) and documented those and other subjects for the Palmer marine life field guide (in progress). We've helped collect krill for Dr. Jonathan Cohen, and photographed and filmed individual krill as well for the field guide.

We have been able to film and photograph humpback whales feeding (topside), and have deployed a remote video camera to depths of 150 feet to try to photograph krill schools. We have been unsuccessful so far in our attempts to film krill schools at depth.

Our team made one trip to Dream Island. We saw more leopard seals at Dream Island than other places nearer to station, and indeed, we filmed a leopard seal predation event on the way out there. In short, our visit to Dream Island was productive, and we'd like to return.

The seas have been cooperative, the boats have been excellently maintained, and the Palmer staff has been most helpful. We are making the usual slow but steady progress toward our goals of creating a Palmer-area marine life field guide and accumulating a library of still and HDTV images for use in numerous venues.

PALMER STATION
RESEARCH ASSOCIATE MONTHLY REPORT
January, 2010
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.

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

Rhett Butler, 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. Data files are recorded to tape and also sent real-time to the U.S. Geological Survey (USGS).

The seismometer operated normally for the duration of the month. Facilities/Engineering is installing a new power and fiber-optic cable routing to the seismic hut.

**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 DECADAL 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. Air samples were shipped to Scripps.

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.

Sampling occurred normally during the month. Air samples were shipped to NOAA.

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 system collected data normally throughout the month.

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 collected data normally during the month. The antenna ground in Hero Inlet was inspected and repaired. Antenna posts on the glacier were drilled and reset. A server at Stanford was found to be the cause of delayed data transfers.

T-312-P TERASCAN SATELLITE IMAGING SYSTEM.

Dan Lubin, Principal Investigator, Scripps Institution of Oceanography

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.

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 operated normally during the month. A passer-by with a radio near the sensor was found to be the cause of some erroneous data.

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 webcam and thermosalinograph operated normally during the month.

T-998-P: IMS RADIONUCLIDE MONITORING

Michael Pickering, Principal Investigator, 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. Fourth quarter 2009 filter samples were shipped to Vienna.

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 during the month.

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).

A corroded connector was found to be the reason for the inoperability of the ceilometer. Replacements are not available on station, but other temporary solutions are under consideration.

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.