

PALMER STATION MONTHLY SCIENCE REPORT
May 2010



Elephant seal relaxing on some rocks on Dream Island.

Image Credit: Christopher Seliga

NEWS FROM THE LAB

Christopher Seliga, Winter Assistant Supervisor of Laboratory Operations

May was an active month for the two research groups on station, B-037-P (Detrich) and B-022-P (Amsler/Baker/McClintock), finishing up their work and sending their science samples back home. The ARSV *Laurence M. Gould* (LMG) helped Bill Detrich's research group conduct three fishing cruises in May, collecting specimens all along the Peninsula from as far north as Elephant Island and as far south as the Antarctic circle. The research divers were able to continue with their dive operations, but couldn't conduct as many as they would have liked, due to Mother Nature, especially towards the end of the month.

On station, personnel continued to be busy supporting science, but still had time to participate in a scavenger hunt one Sunday. This hunt for various hidden art throughout station has been conducted each of last three winters, and everyone who took part enjoyed it immensely. The wildlife sightings around the surrounding area continue to produce various species of birds and seals, even as we progress through the fall and into the winter. Even some penguins were still seen around station and the boating area in the month of May. Two groups of Fur seals were

seen resting on the rocks near our sea water pump house and aquarium for four to five consecutive days.

The weather this month can be described with one word, windy. It was extremely windy, especially toward the last third of the month, and the wind brought with it, warmer temperatures and rain to station. One deep low that passed just south of station, caused hurricane strength gusts, which, with the seas swells, caused one of our boat fenders on our pier to break free, with the other one hanging on by one chain. Luckily with the personnel on station, we were able to retrieve the missing fender, reattach it to the pier and fix the other fender in place, so the LMG could tie up.

MAY WEATHER

Neal Scheibe, Research Associate

Palmer Station started May with picturesque sunrises and sunsets before giving way to warm, windy conditions for the final two weeks. Nearly all boating for the second half of the month was halted by winds. Strong westerly winds, coupled with high sea swells during the last week were enough to break the pier bumpers free.

The coldest day was the 5th at -9.1°C. The warmest temperature was on the 24th at 5.2°C. The average temperature for the month was -1.5°C. Sea surface temperatures hovered near -0.7°C throughout the month. Very little sea ice has been seen at this point. The large iceberg that has been parked in front of the station since early in the year has finally drifted around to the other side of Bonaparte Point.

There was 29 cm of snowfall throughout the month, often with snow being followed by rain to wipe out most accumulation around Palmer Station. A total of 69.1 mm melted precipitation fell during the month, with nearly a third of that coming on the 27th which also reported the highest winds at 63 knots.

THE FOLLOWING PROJECTS CONDUCTED RESEARCH AT PALMER STATION:

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, Bill Baker, Margaret Amsler, Jason Cuce, Alan Maschek, Ruth McDowell, and Kate Schoenrock;

This report includes the first three days of June. We are scheduled to sail north on LMG10-04 at first light on 4 June. Our last day of diving operations was 1 June.

Although the weather was a bit more harsh than we have usually experienced in May, particularly in the latter third of the month, we completed 37 research SCUBA dives between 1 May and 1 June. Algae from our last algal outplant experiment were successfully recovered. Although hampered by technical issues, weather, icebergs too close to the dive site for boating, and leopard

seal sightings over the last two weeks of May, we were able to complete deployment of invertebrate outplants on 1 June for recovery in 2011.

Diving also supported collections for numerous laboratory experiments including several different sets of amphipod feeding experiments on live macroalgae and on pure and semi-purified compounds from sponges and tunicates. A suite of laboratory assays to examine oxidative burst responses of freshly-collected macroalgae continued throughout the month.

Jason Cuce was able to accompany Bill Detrich's research group (B-037-P) on several trawling cruises to collect deep water benthic invertebrates which also occur in our shallow water collections for comparative analysis. (These specimens were from the fish trawl bycatch.) We are grateful to Dr. Detrich for this opportunity and for the RPSC staff on the LMG for facilitating it.

Overall, we have had a very productive season here at Palmer. In addition to significant results from this season alone, we have set the stage for a number of experiments to be conducted or continued during our 2011 season.

We are grateful for the generous and professional assistance of numerous RPSC staff at Palmer. Chris Seliga, James Bucklin, Ryan Wallace, Neal Scheibe, and Jon Miller deserve special thanks for facilitating our laboratory and diving operations

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

H. William Detrich, Principal Investigator
Dept. of Biology, Northeastern University, Boston, MA

Personnel on Station: H. William Detrich, Corey Allard, Mo Hu, Kristen Kuhn, Sandra Parker, Hugo Yebenes, and Juan Carlos Zabala

We have two major scientific goals this season: 1) to examine cold adaptation of the folding of tubulin and actin by the chaperonin CCT using proteins purified from Antarctic fishes (*Gobionotothen gibberifrons* and *Notothenia coriiceps*); and 2) to determine the ontogeny of cartilage and bone formation by embryos of robustly ossified and poorly ossified Antarctic fishes (*N. coriiceps* and *Chaenocephalus aceratus*, respectively).

During May, we continued our research program and the supporting fishing operations. At Palmer Station, Yebenes and Zabala developed improved purification protocols for the protein-folding complex CCT from testis tissues of *G. gibberifrons* and of *N. coriiceps*. These modifications enhanced CCT yields and virtually eliminated protein contaminants. Parker made additional preparations of brain tubulin from *G. gibberifrons*. Using CCT and radiolabeled tubulin or actin substrates, Parker, Yebenes, and Zabala studied the temporal dependence of protein folding at 0°C. Allard, Hu, and Detrich obtained two clutches of embryos of *N. coriiceps* by *in vitro* fertilization. The development of these embryos is being documented by digital brightfield microscopy. Currently, Allard is preparing to inject embryos with antisense morpholino oligonucleotides (MOs) to interfere with the expression of two genes involved in bone formation. He will also perform *in vitro* fertilization using gametes of the icefish *C. aceratus*. Allard, Hu, and Parker continued to collect skeletal tissue samples from the *C.*

aceratus and *N. coriiceps* for total transcriptome comparison of bone gene expression in the US. As of the end of May, we have met most of our objectives and have produced numerous samples for study at our home institutions.

Three fishing trips were conducted on the *ARSV Laurence M. Gould* during Cruise LMG10-04 to obtain fish specimens: 1) On 10 May, Detrich and Kuhn sailed on the *LMG* for a fishing trip to Elephant and Low Islands. Three Otter Trawls were conducted at Elephant Island on 12 May, which produced 15 icefish and one dragonfish. Fishing was terminated at EI due to rapid deterioration of the weather. The *LMG* then transited to the Low Island fishing grounds, where weather conducive to trawling operations was found. Six trawls on 14 May produced 44 icefish (mostly our target species *C. aceratus*) and small numbers of two nototheniids, *N. coriiceps* and *G. gibberifrons* (our other target species). We returned to Palmer Station on 15 May to ensure survival of the stress-sensitive icefishes. 2) Between 17 and 22 May, we (Detrich and Kuhn) conducted our second fishing trip to the 900-m deep “Banana Trench” (between Lavoisier Island and the Antarctic Peninsula) and to Renaud Island. The catch at BT consisted of icefishes, dragonfishes, plunderfishes and nototheniids. These samples were processed on board the *LMG* for future study at our home institutions. Renaud Island, a site we last visited in 1985, yielded *C. aceratus*, *G. gibberifrons*, and several other notothenioids, but our fishing was again cut short by the onset of bad weather.

Our return to Palmer Station was delayed from 21 to 22 May due to high winds and seas. 3) The third fishing trip to Low Island and Dallmann Bay (24-29 May; Detrich, Hu, and Kuhn on board) was also plagued by bad weather. Upon arriving at Low Island, we found the weather conditions and sea state to be severe, which prevented any attempt to fish by trawl or trap. We transited to Dallmann Bay and waited out the storm. When the weather moderated sufficiently, we occupied the southern section of the Dallmann Bay trawling grounds. Twelve Otter Trawls were conducted on 25-26 May, which produced moderate numbers of *N. coriiceps* and *C. aceratus*. Early on 27 May we began our transit to Palmer Station. Severe weather was encountered en route and upon arrival at Palmer Station (12 noon LT, 27 May), which forced us to stand off for two days. On 29 May the ship was still unable to tie up at the Palmer pier, so we transferred our fish to the Palmer aquarium via zodiac. Throughout May the marginal weather precluded the setting of any fish traps.

On 4 June the *ARSV Laurence M. Gould* will depart Palmer Station en route to Punta Arenas, Chile. B-037 participants Detrich, Hu, Kuhn, Parker, Yebenes, and Zabala will re-deploy to our home institutions. Northeastern Univ. undergraduate Corey Allard will spend the winter continuing the embryology studies on *N. coriiceps* and *C. aceratus*.

We thank the ship and station personnel for their excellent help in making the second half of our field season a great success. Due to the extraordinary weather conditions that prevailed during May, they were frequently forced to work under difficult conditions. We tip our hats to them as we depart.

PALMER STATION
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May 2010
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.

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 data acquisition computer needed to be rebooted once due to becoming hung in an idle state overnight. Otherwise, the seismometer operated normally for the duration of the month. Archive data tapes were shipped back to the Albuquerque Seismological Lab.

**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. Full sample flasks were shipped back 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.

Carbon Cycle 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.

During a site visit by a grantee from Stanford University for A-306-P, the new data collection computer for A-109-P was installed. Data collection began mid-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.

A site visit was made by a grantee from Stanford University. The grantee made several upgrades to the software on the data collection computer to bring it up to date with sites elsewhere. The system received annual calibration. Several measurements were made with a portable antenna to look at the background noise around Palmer Station in various locations.

After a power outage on 29 May, several hours of data were lost due to the data collection computer becoming locked up upon reboot once power returned. The computer recovered and resumed normal data collection once repairs were made to the system startup scripts. Archive data was shipped back to Stanford.

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.

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 operated 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 webcam and 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.

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 schedule 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 and the R/V NATHANIEL B. PALMER.

The automated weather system's temperature sensor failed on the 30th at 1800UT. The sensor is sending out low measurements intermittently. The sensor was replaced, but the problem continued as of the end of the month.