# PALMER STATION MONTHLY SCIENCE REPORT

# APRIL 2015

**A full moon sets over the *ARSV Laurence M. Gould* as the ship approaches Palmer Station. The ship is returning to station after a four day fishing trip for B-036-P/L (O'Brien).**
*(Image Credit: Julian Race)*

## NEWS FROM THE LAB

Emily Longano, Winter Laboratory Supervisor

It has been a busy and productive start to the winter science season. After a few quiet weeks in the Palmer labs, we welcomed the arrival of four science groups to station: A-109-P (Moore), B-036-P/L (O'Brien), B-518-P (Klein), and T-998-P (CTBTO).

The science teams have been actively working in the labs and the surrounding Palmer area. In the backyard, A-109-P (Moore) completed installation of the new set of extremely low frequency (ELF) antennas. This system compliments the previously installed very low frequency (VLF) antenna on station. Members of B-518-P (Klein) have also been working in the backyard to collect soil samples. Their initial efforts were made increasingly difficult by a thick layer of snow. The snow has since melted after multiple days of heavy rain. In addition to these samples,

the team has been making frequent boating trips around the Palmer area to collect limpets and sediments with the assistance of a diving team.

After three fishing trips on the *ARSV Laurence M. Gould* (LMG), the aquariums have been abundant with multiple species of icefish and invertebrates. B-036-P/L (O'Brien) is continually conducting experiments and processing the fish specimens.

Special thanks to the members of I&O and other support staff for all of their hard work this month. They have been working around the clock to prepare science construction and fix issues that arise.

**APRIL 2015 WEATHER**
Lance Roth, Research Associate

During the month of April, we started to see more snow accumulation as temperatures dropped below 0°C. A few storms brought heavy snow accumulation which was beneficial for winter recreation activities. However, as temperatures rose toward the end of the month, the precipitation turned to rain and melted all of the snow.

We saw 52.1 mm of melted precipitation which includes over 50 cm of snow. All the snow melted and did not accumulate as temperatures did not remain below freezing. The maximum temperature was 7.8 C (46 F) on April 28th, and the minimum temperature was -5.2 C (22.6 F) on April 12th. The average wind speed was 11 knots while the highest five second gust was 56 knots recorded on the 29th of this month.

No sea ice was observed in the area this month. We did have a lot of brash ice in the harbor, which minimally affected boating operations. The tide gauge on the pier measured on average sea surface temperature of -0.8 C (30.5 F). The minimum sea temperature recorded was -1.5 C (29.3 F) on April 23rd, and the maximum sea surface temperature recorded was -0.1 C (31.8 F) on April 11th.

**A-109-P: ANTARCTIC EXTREMELY LOW FREQUENCY/VERY LOW FREQUENCY (ELF/VLF) OBSERVATIONS OF LIGHTNING AND LIGHTNING-INDUCED ELECTRON PRECIPITATION (LEP)**
Robert Moore, Principal Investigator, University of Florida

Personnel on station: Timothy Clingenpeel and Neal Dupree

Through the combined efforts of the Palmer I&O team, Palmer science support team, and project grantees, Neal Dupree and Timothy Clingenpeel, a new set of extremely low frequency (ELF) antennas have been installed into a protective dome in the Palmer Backyard. The backyard provides a stable, relatively quiet environment for antenna operation. The new ELF antenna system and existing VLF antenna system provide continuous observations of ELF/VLF radio waves at Palmer Station. Both the ELF and VLF systems operating in the Palmer Backyard are

working excellently without any problems. Grantees on station will continue to monitor the operation of the antenna systems until departure.

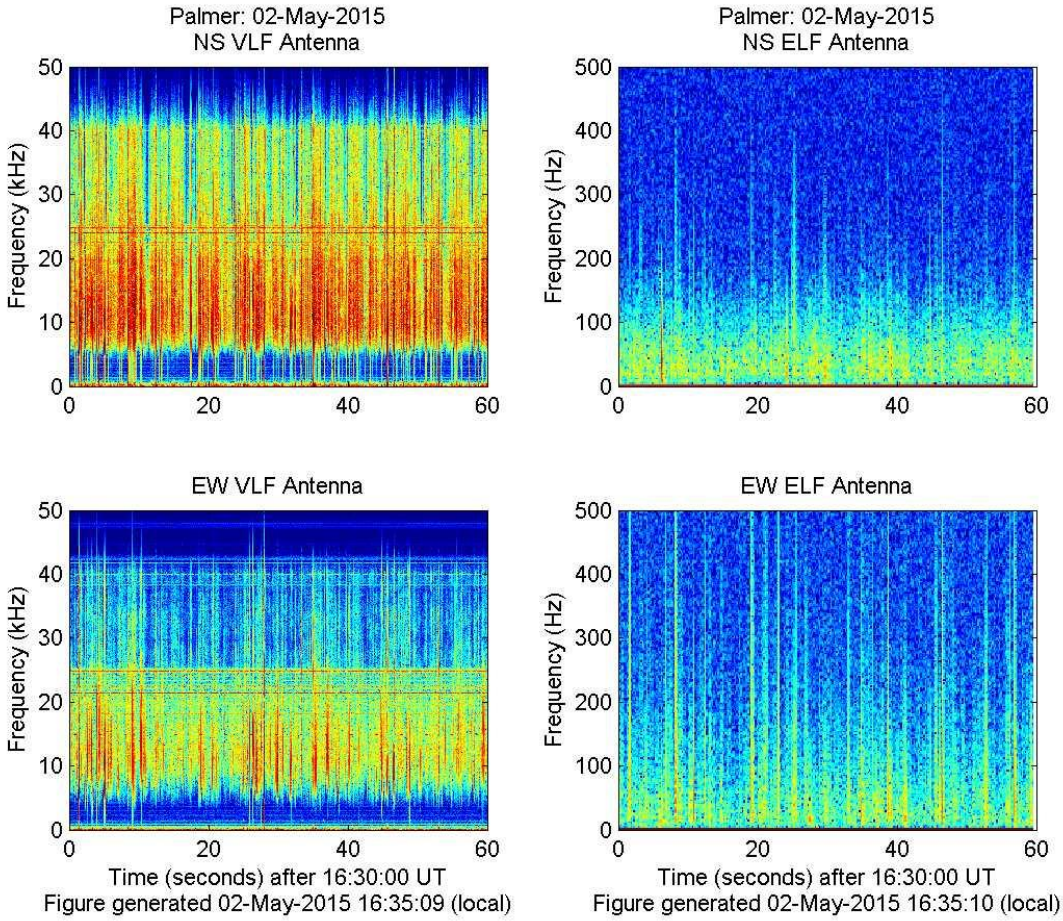



**Figure 1.** 60 second snapshot of the data set produced by the ELF and VLF antenna systems, exhibiting radio atmospherics.

## B-036-P/L: COLLABORATIVE RESEARCH: THE PHYSIOLOGICAL AND BIOCHEMICAL UNDERPINNINGS OF THERMAL TOLERANCE IN ANTARCTIC NOTOTHENIOID FISHES

Dr. Kristin O'Brien, Principal Investigator, University of Alaska Fairbanks, Institute for Arctic Biology

Personnel on Station: Amanda Biederman, Elizabeth Crockett, Stuart Egginton, Anthony Farrell, Theresa Grove, Iskander Ismailov, and Kristin O'Brien

In virtually all of the experiments planned for this field season we are utilizing a comparative design using notothenioid fishes with the full spectrum of hemoglobin/myoglobin expression, including *Chaenocephalus aceratus* (-Hb/-Mb), *Chionodraco rastrospinosus* or

*Pseudochaenichthys georgianus* (- Hb/+Mb) depending on availability and size, and *Notothenia coriiceps* (+Hb/+Mb).

The loss of hemoglobin in the icefishes (Family Channichthyidae) is accompanied by a 10-fold reduction in oxygen carrying capacity. This is, at least partially, offset by elevations in ventricular mass (i.e., cardiomegaly) and blood volume. One of the objectives of our work is explore the consequences of cardiomegaly in Antarctic icefishes by assessing the maximum pumping capacity of the heart in both white-blooded species (i.e., icefishes) and red-blooded notothenioids held at ambient and warm (4$^{o}$C) temperatures. Currently, Dr. Tony Farrell is working with animals held at ambient temperature, but we have also started a warm (4$^{o}$C) acclimation using the red-blooded *Notothenia coriiceps*. To date, we have results on intrinsic heart rate and maximum cardiac output for two white-blooded species (*Chaenocephalus aceratus* and *Chionodraco rastrospinosus*) measured at 0.5$^{o}$C. Cardiac stroke volume for these species will likely set a record among all vertebrate species studied to date.

We have also made significant progress on experiments designed to monitor heart rate ($f_H$) during a thermal ramping procedure, which we have used during previous field seasons to identify critical thermal maximum ($CT_{MAX}$). We are interested in how $f_H$ responds to acute warming. In addition, one of our objectives is to determine if $CT_{MAX}$, as indicated by the loss of right response, coincides with the temperature at which cardiac work fails, as indicated by a prolonged cardiac arrhythmia. Thus far, Dr. Stuart Egginton has completed these analyses on individuals of *Chaenocephalus aceratus* (-Hb/-Mb), *Pseudochaenichthys georgianus* (-Hb/+Mb), and *Notothenia coriiceps* (+Hb/+Mb). Electrocardiogram (ECG) recording electrodes are surgically implanted in the animals. After a minimum of 48 hours of recovery from surgery, basal $f_H$ is monitored prior to the onset of thermal ramping. Thermal ramping (3.5$^{o}$C/hour) is begun, and $f_H$ is continuously monitored. Our preliminary data suggest a decoupling of the temperatures at which $CT_{MAX}$ and cardiac failure occur. In addition, our results indicate that disruption of cardiac rhythmicity appears in all species, regardless of Hb and Mb expression, at ≈ 10$^{o}$C. The onset of more severe cardiac arrhythmia, however, occurs at a temperature that is approximately 2$^{o}$C lower in *C. aceratus* (-Hb/-Mb) than with both +Mb species. We are planning to collect more icefishes on the next fishing trip to increase the sample number of individuals in these important experiments, which are designed to reveal the physiological underpinnings of thermal tolerance limits.

Myography of efferent and afferent branchial arteries and epibranchial and hypobranchial arteries from *P. georgianus* and *C. aceratus* is being conducted to examine effects of hormones and neurotransmitters (e.g. noradrenaline, serotonin, carbamoylcholine, and angiotensin II) on vasodilation and vasoconstriction of the large bore blood vessels of icefishes. Blood vessels are dissected and placed in an organ bath in physiological saline and connected to a force transducer. After tension is normalized, dose-response curves are conducted using KCl (5mM-60mM), after which the blood vessel is placed in physiological saline with low KCl and a dose-response curve to a one of the select signaling molecules. At the end of the experiment, the blood vessel is challenged with the level of KCl that resulted in maximum force production to ensure the viability of the blood vessel. The forces produced are then normalized per mg wet weight of tissue. Effects of KCl and signaling molecules on dilation and constriction will then be compared to the red-blooded notothenioid, *Notothenia coriiceps*.

To investigate whether DNA binding by hypoxia inducible factor (HIF) is altered with temperature in notothenioid hearts, Dr. Theresa Grove is optimizing a procedure to obtain a cellular fraction that is enriched with nuclei. The protocol to isolate nuclei calls for a sucrose (2.1 M) cushion. In our hands, we have found that this cushion is too dense (at least for nuclei from red-blooded *Notothenia coriiceps*). To separate nuclei from other cellular components (e.g. mitochondria, sarcoplasmic reticulum, and cytoplasmic material), we are trying a lighter (1.8 M) sucrose cushion. Ultimately, our goal is to obtain a pellet enriched with nuclei. We identify nuclei by staining with methylene blue. Our next step will be to determine if the same concentration of sucrose cushion can be used to obtain enriched nuclear pellets from icefish species, *Pseudochaenichthys georgianus* and *Chaenocephalus aceratus*. Nuclei will then be isolated from ventricles of control animals and those exposed to $CT_{MAX}$, which will then be used in electrophoretic mobility shift assays at University Alaska-Fairbanks (UAF) planned for the fall semester.

Dr. Iskander Ismailov is nearing completion of the electrophysiological setup in Environmental Room 1. He has set up and tested an aquarium tank to video-monitor and quantify behavioral landmarks of both *C. aceratus* (-Hb) and *N. coriiceps* (+Hb) during an experimental heat ramp (i.e., $CT_{MAX}$ experiment). In addition, he has finished constructing the Faraday cage and is currently working on installing the electrophysiological instrumentation.

Graduate student, Amanda Biederman, is working on a procedure to simultaneously isolate synaptosomal and mitochondrial membranes from the brains of both white- and red-blooded notothenioids. These membranes will be used in experiments to quantify and compare the physical properties (e.g., membrane fluidities and Arrhenius break temperatures) of membranes from white- and red-blooded fishes. While at Ohio University, Amanda was successful in isolating these membranes in a fish model, the striped bass (*Morone saxatilis*). She is currently applying the method she adapted in the striped bass with brain tissues from the Antarctic fishes. She has done four membrane preparations thus far, and is currently analyzing membrane fractions from density- gradient centrifugation for activities of membrane marker enzymes, including acetylcholine esterase (synaptosomes) and succinate dehydrogenase (mitochondria).

Experiments are underway by Kristin O'Brien and Lisa Crockett to determine whether mitochondrial function and/or properties of mitochondrial membranes limit cardiac performance and thermal tolerance. Mitochondria have been isolated in notothenioids (differing in expression of hemoglobin and myoglobin) held at ambient temperature or exposed to their critical thermal maximum ($CT_{MAX}$). Mitochondrial respiration rates are being measured and mitochondria frozen for shipping to UAF for identifying oxidized proteins and measuring enzyme activity. In addition, mitochondria prepared from hearts of ambient and $CT_{MAX}$ animals are also being collected for lipid analyses, specifically to quantify unsaturation indices of the phospholipid cardiolipin and for determinig levels of oxidative damage to membrane phospholipids (e.g. phospholipid hydroperoxides). Lipid analyses will be conducted at Ohio University and the Kansas State Lipidomics Center.

**B-518-P: TEMPORAL VARIABILITY IN NATURAL AND ANTHROPOGENIC DISTURBANCE OF PALMER STATION, ANTARCTICA**

Dr. Andrew Klein, Principal Investigator, Texas A&M University; Dr. Paul Montagna, Co-PI, Texas A&M-Corpus Christi, Dr. Terry Wade, Dr. Jose Sericano and Mr. Stephen Sweet, Co-PIs Texas A&M University

Personnel on station: Andrew Klein, Terence Palmer and Stephen Sweet

The focus of the project is to establish a long-term environmental monitoring program at Palmer Station which examines the impact of science and operations on the local Palmer Station environment both on land and offshore. This is an extension of the environmental monitoring program that began at McMurdo Station in 1999 and which continues to the present. A secondary focus of our efforts this season is to recollect soil, marine sediment, and limpet samples at a number of sites initially collected in the three years following the Bahia Paraiso fuel spill to examine change over a quarter century.

B-518-P deployed to Palmer Station on the LMG15-04. The project deployed to Palmer previously last year on the LMG14-05 for a reconnaissance visit to the Station and to collect marine sediments from the LMG. Steven Sweet, a member of this year's B-518-P team, previously deployed to Palmer Station from 1989-1991 to conduct an environmental assessment of the effects of the Bahia Paraiso spill.

The focus of this season's research was to collect an assortment of environmental samples (marine sediments, limpets, and soil) primarily in the vicinity of Palmer and Old Palmer Stations as well as additional samples on some of the surrounding islands. Weather permitting, a trip to Biscoe Point is planned to investigate the chemical signal of contamination from welding rods on vegetation. We also collected limpets and soil samples at a number of locations that were initially sampled in 1989-1991.

**Benthic Sediment Sampling**

With the help of station personnel, B-518-P successfully collected the targeted benthic sampling sites. Benthic samples were collected at eight locations along four transects surrounding Palmer Station (**Figure 1**). Along each of the four transects, samples were collected at depths of 60 and 80 feet. Two samples were collected at 60 foot depth immediately off of the Bahia Paraiso. Collection was done by Terence Palmer (B-518-P) and Shawn Harper (ASC) using sample coring tubes.

The cores will be shipped back to Texas A&M University in College Station to be analyzed for various petroleum hydrocarbons and other common environmental contaminants. A subset of the samples will be analyzed at Texas A&M-Corpus Christi to investigate the benthic infauna communities.

The four transects in proximity of Palmer Station were selected to be representative of areas with possible ongoing environmental impacts (off the sewage outfall and off of the Pier) as well areas where lower intensity of impacts are expected (sea water intake) and a reference transect (off of the Hazardous Storage Building). Areas between Humble and Litchfield islands as well as between Christine, Hermit, and Limitrophe islands were investigated as possible off-station

reference sites, however, fine sediment was not present at the appropriate depths to enable sampling. **Figure 1** illustrates where benthic sediments were collected.

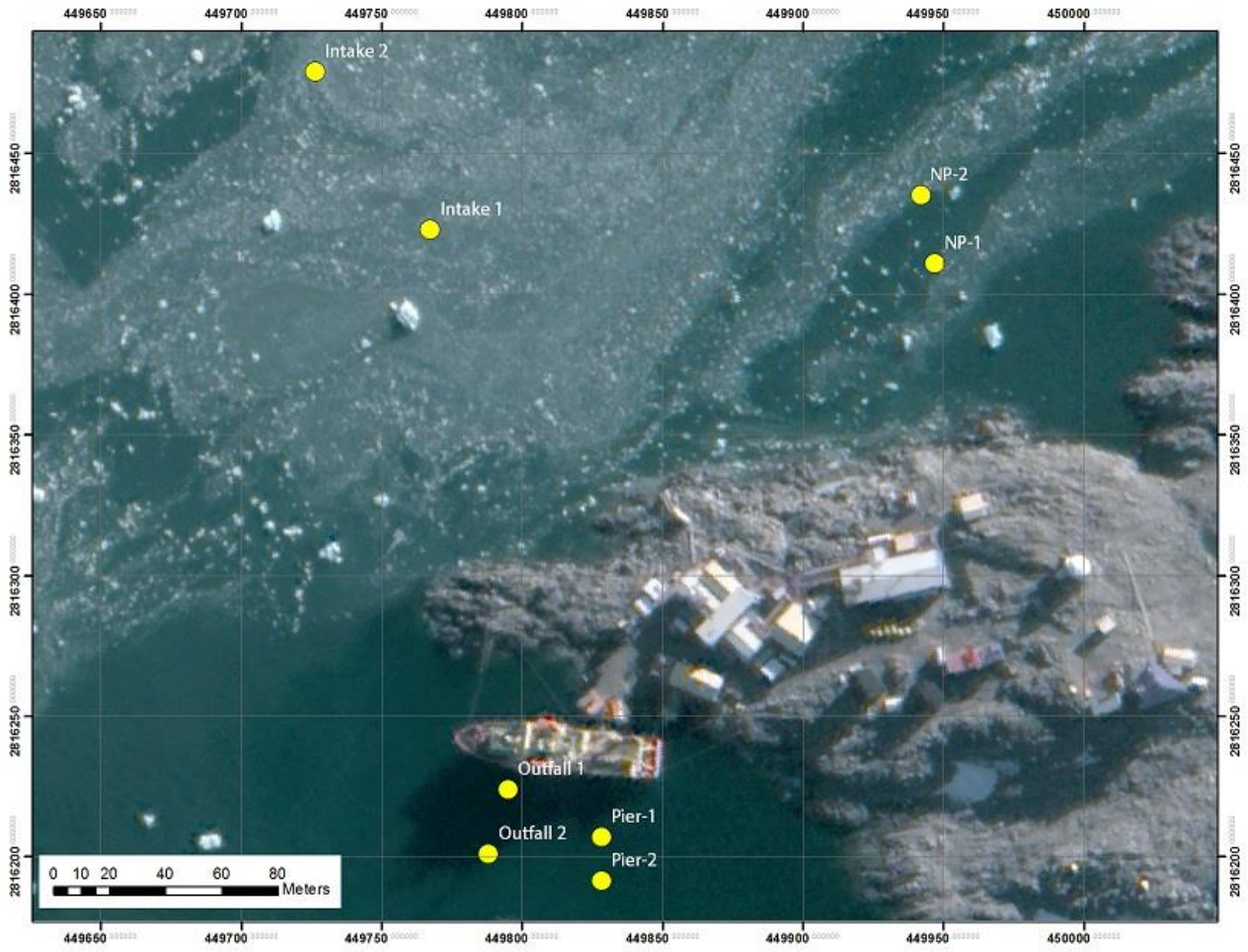



**Figure 1**. Diver collected benthic samples collected near Palmer Station. The additional site near the Bahia Paraiso is not shown. The background image is a WorldView2 satellite image from March 24, 2013 courtesy of the Polar Geospatial Center.

## Limpet Sampling

Limpets (*Nacella concinna)* were collected at two shallow depths (at 15 feet and between 0 and 5 feet) in the vicinity of Palmer Station and at selected sites on surrounding islands and off of the Bahia Pariso at depths of 0 to 5 feet. Limpets were found to be a useful organism in studying environmental impacts following the BP spill. For this project, it is hoped that because limpets are ubiquitous at shallow depths, they may serve as a useful means to investigate chemical contaminants between the terrestrial and at deeper marine depths (60 feet) where fine sediment is located. **Figure 2** indicates where limpets have been collected this season.

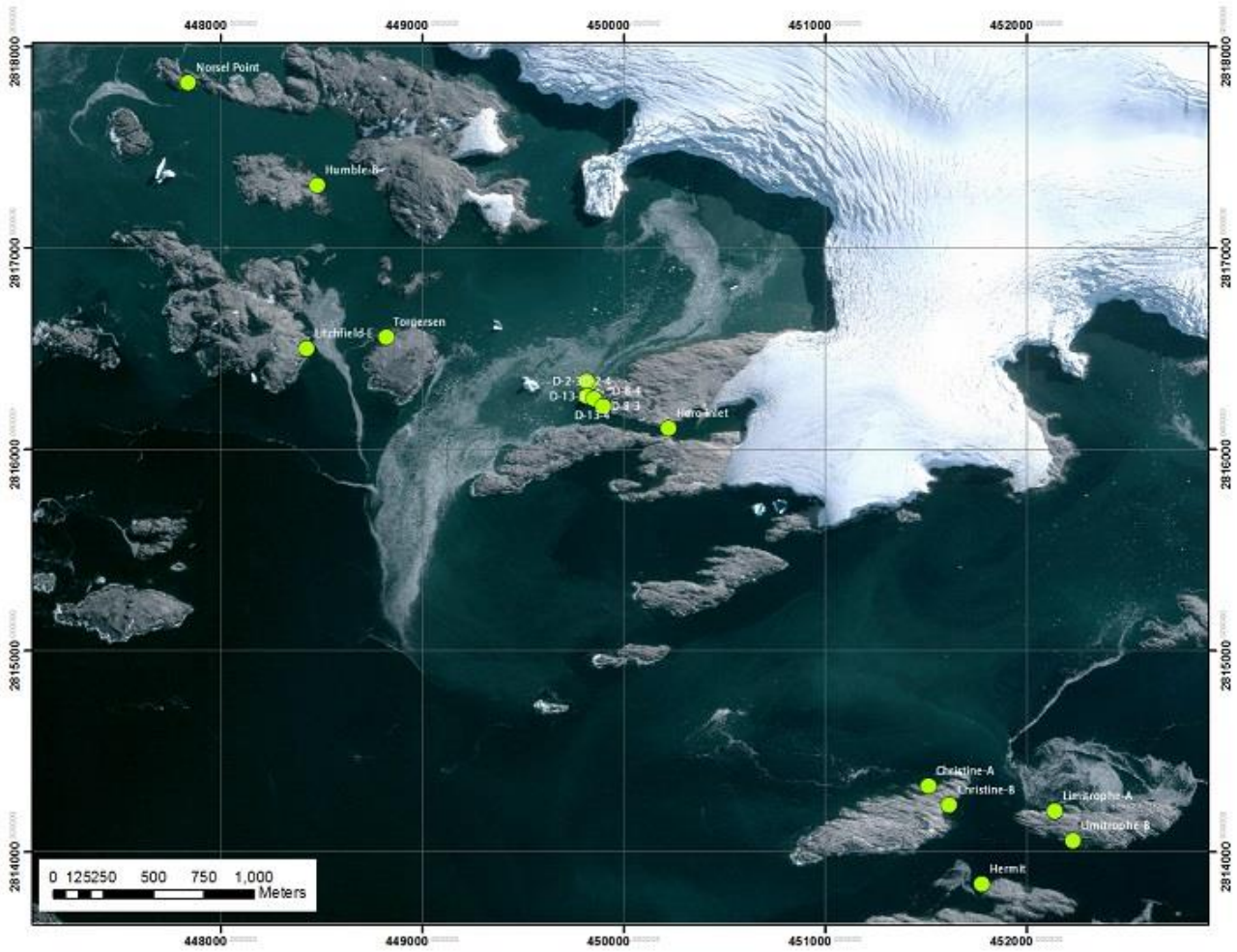



**Figure 2**. Diver collected limpet samples collected near Palmer Station and shallow (0-5 feet) limpet sites in the local area. The background image is a WorldView2 satellite image from March 24, 2013 courtesy of the Polar Geospatial Center.

## Terrestrial Soil Sampling

A major focus of this year's sampling efforts was collection of terrestrial soil samples. The original sampling plan was to intensively sample in two areas, each a hexagon 25 meters in diameter, where activities would be expected to introduce petroleum hydrocarbons and other compounds related to human activities into the environment. The two areas selected for intensive sampling were in the area between BIO, the Boathouse, and the Pier and the second to the southeast of GWR. In each of these areas, 16 soil samples would be collected. Twelve samples were collected at sites originally sampled by Texas A&M Team members in 1989-1991. An additional 70 samples were planned to be placed at random locations around the station and in the backyard, but weather conditions impeded the complete collection. The final collected sample locations are illustrated in **Figure 3**.

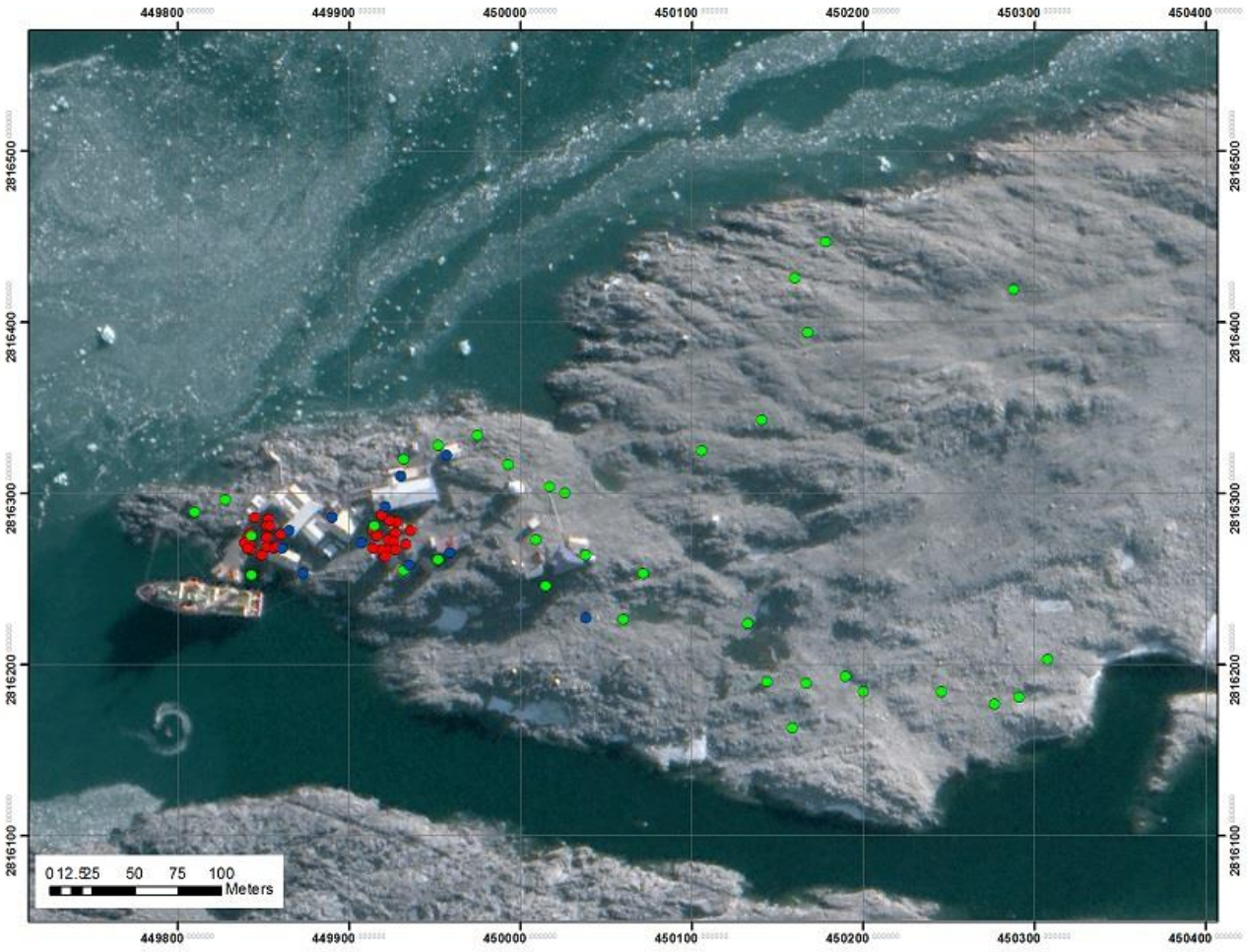



**Figure 3.** Intensive (Red), Random (Green) and Reoccupied (Blue) terrestrial soil samples collected in the vicinity of Palmer Station. The background image is a WorldView2 satellite image from March 24, 2013 courtesy of the Polar Geospatial Center.

Unfortunately, snow with depths typically ranging from 20 cm to over 1 meter covered the local vicinity from our arrival at Palmer until a rain event on April 28$^{th}$ and 29$^{th}$ which reduced snow depths considerably. While we waited as long as was feasible to collect snow samples our primary collection period ran from April 25$^{th}$ to 28$^{th}$. At this time, deep snow and frozen soil beneath hindered soil sampling with the number of quality of samples less than what we would have desired. Nevertheless, the two intensive sites and 11 of the 12 reoccupied sites were collected. One reoccupied site fell very close to two of the intensive sites so was not resampled. As of April 29$^{th}$, thirty-four random samples were also collected. Due to logistical problems these were not collected at the originally specified locations, but rather in two general areas at sites we were able to locate some sediment beneath the snow pack.

While the sampling was not as spatially robust as we had envisioned, the collected samples should provide a robust statistical measure of background concentrations of petroleum hydrocarbons and selected trace metals at the station for which to compare samples collected at impacted sites. In the future, we hope to undertake more extensive spatial sampling.

We also collected six soil samples at Old Palmer Station and Base N as well as an additional 16 samples on Amsler Island to investigate as a potential reference location in the future to compare to samples collected at Palmer Station.

**Biscoe Point**

With support from station personnel, B-518-P was able to visit Biscoe Point. Using previously determined locations, the team was able to locate 5 welding rods and sampled the soil immediately around the rods and at one site 40 cm away in an area where moss appeared to be unimpacted. The intent is to quantify chemical contamination around these rods to assess the impact of the rods on soil geochemistry.

**Snow Sampling**

Prior to our departure we also intend to collect 30 snow samples at various locations in the Palmer Station vicinity. We have already collected samples at Bonaparte Point and will collect more weather permitting prior to departure.

**Google Trekker**

Our project contacted Google to bring a Google Trekker Backpack on Station and we have acquired imagery at two times of good weather. The first was at Biscoe Point and returning to Station on a Zodiac and the second was on Station on the Glacier and a portion of Bonaparte Point. Some additional Trekker Data will be collected.

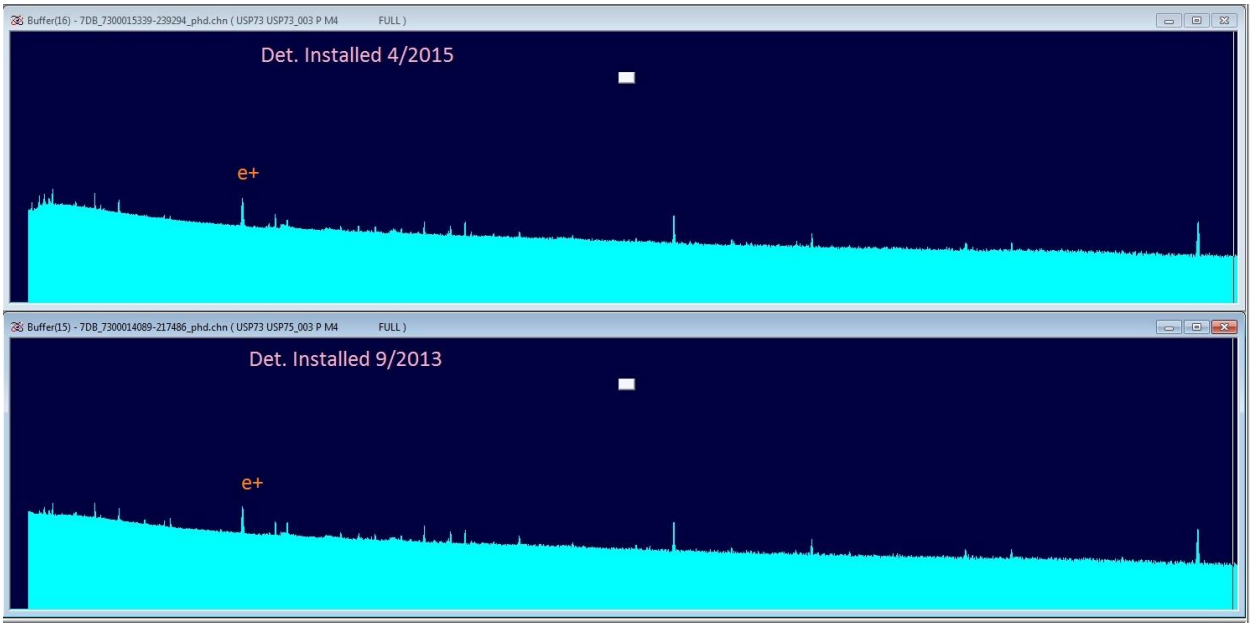
Finally, we appreciate all the support we received both from station and LMG personnel.

**T-998-P: INTERNATIONAL MONITORING STATION (IMS) FOR THE COMPREHENSIVE NUCLEAR TEST BAN TREATY ORG. (CTBTO)**

Managed by General Dynamics

Personnel on Station: Bouvard Hosticka

The senior scientist on the project upgraded the system and characterized the new radiation detector and the background at Palmer Station. As expected the radiation source at Palmer Station does not change over time; however, there are variations in the amount of radon progeny in the samples from day to day due to the local lapse rate, wind conditions, barometric changes, and snow cover. In addition to a more reliable cryo-cooler, the new detector has better resolution and less low energy noise which makes these variations more visible than in the past. The system was not sampling for a total of eight days during the month to perform the characterizations required by the CTBTO whenever the equipment is changed. Other minor upgrades and preventative maintenance were performed on the system.




Horizontal: Energy spanning 33 to 2700 keV. Vertical: Log Total Detected Events over seven days.

Comparison of histograms of two backgrounds at Palmer Station: New detector (top) and old Detector (bottom). The same radionuclides are seen on both spectra but the low energy lines below 100 keV are easier to quantify with the new detector. The strongest signal in both cases is the signature of the annihilation of positrons (e+) at about one event per second.

**PALMER STATION RESEARCH ASSOCIATE MONTHLY REPORT**
**April 2015**
W. Lance Roth

**B-005-P: IMPACTS OF LOCAL OCEANOGRAPHIC PROCESSES ON ADELIE PENGUIN FORAGING OVER PALMER DEEP: COASTAL OCEAN DYNAMICS APPLICATIONS RADAR (CODAR)**
Josh Kohut, Principal Investigator, Rutgers University

The CODAR system consists of three transmitters/receivers located on Anvers Island, Wauwerman Island and on Howard Island in the Joubins. The data from all three transmitters is compiled on computers in Terra Lab and plots of the surface currents over the Palmer Deep are generated.

The CODAR system has been operating normally.

**G-090-P: GLOBAL SEISMOGRAPH NETWORK (GSN) SITE AT PALMER STATION.**
Kent Anderson, Principal Investigator, Incorporated Research Institutions for Seismology (IRIS)

Station PMSA is one of more than 150+ sites in the GSN, monitoring seismic waves produced by events worldwide. Real-time telemetry data is sent to the U.S. Geological Survey (USGS). The Research Associate operates and maintains on-site equipment for the project.

Several large earthquake events were noted in the data including the quakes that trembled in Nepal. The seismograph operated without any problems this month.

**A-109-P: ANTARCTIC EXTREMELY LOW FREQUENCY/VERY LOW FREQUENCY (ELF/VLF) OBSERVATIONS OF LIGHTNING AND LIGHTNING-INDUCED ELECTRON PRECIPITATION (LEP).**
Robert Moore, Principal Investigator, University of Florida

ELF/VLF radio wave observations at Palmer Station are used to provide a deeper understanding of lightning and its effects on the Earth's inner radiation belt. The Research Associate operates and maintains on-site equipment for the project.

The VLF functioned normally this month. I checked the antenna every two weeks, and I replaced the external hard drives on March 20. The antenna, cable, and hardware installation for the ELF antenna was completed this month. It is currently fully functional and operating without any problems.

**O-202-P: ANTARCTIC METEOROLOGICAL RESEARCH CENTER (AMRC) SATELLITE DATA INGESTOR.**
Mathew Lazzara, Principal Investigator, University of Wisconsin

The AMRC computer processes satellite telemetry received by the Palmer Station TeraScan system, extracting Automated Weather Station information and low-resolution infrared imagery and sending the results to AMRC headquarters in Madison, WI. The Research Associate operates and maintains on-site equipment for the project.

The data ingestor computer system has been operating normally all month.

**O-264-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 $O_2$ (detected through changes in $O_2/N_2$ ratio), which can help to determine rates of marine biological productivity and ocean mixing as well as terrestrial and oceanic distribution of the global

anthropogenic $CO_2$ sink. The program involves air sampling at a network of sites in both the Northern and Southern Hemispheres. The Research Associate collects samples fortnightly from Terra Lab.

The air samples were taken every two weeks. New flasks came in on LMG15-04.

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

Don Neff and Steve Montzka, Principal Investigators, National Oceanic and Atmospheric Administration / Global Monitoring Division; Boulder, CO

The NOAA ESRL Carbon Cycle Greenhouse Gases (CCGG) group makes ongoing discrete measurements to document the spatial and temporal distributions of carbon-cycle gases and provide essential constraints to our understanding of the global carbon cycle. The Halocarbons and other Atmospheric Trace Species (HATS) group quantifies the distributions and magnitudes of the sources and sinks for atmospheric nitrous oxide (N2O) and halogen containing compounds. The Research Associate collects weekly air samples for the CCGG group and fortnightly samples for the HATS group.

Samples were collected for the carbon cycle and the halocarbon and trace species projects.

**O-264-P: ULTRAVIOLET (UV) SPECTRAL IRRADIANCE MONITORING NETWORK**

James Butler, Principal Investigator, National Oceanic and Atmospheric Administration / Global Monitoring Division; Boulder, CO

A Biospherical Instruments (BSI) SUV-100 UV spectroradiometer produces full sky irradiance spectra ranging from the atmospheric UV cutoff near 290nm up to 605nm, four times per hour. A BSI GUV-511 filter radiometer, an Eppley PSP Pyranometer, and an Eppley TUVR radiometer also continuously measure hemispheric solar flux within various spectral ranges. The Research Associate operates and maintains on-site equipment for the project.

The system operated well throughout the month. During routine Absolute Scan an issue occurred with the systems communication. The issue was resolved and the system is currently working fine.

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

Mathew Lazzara, Principal Investigator, University of Wisconsin

AWS transmissions from Bonaparte Point are monitored using the TeraScan system and the University of Wisconsin's Data Ingestor system. Data collected from this station is freely available from the University of Wisconsin's Antarctic Meteorological Research Center (AMRC) website. The Research Associate monitors data transmissions for the project and performs quarterly maintenance on the station at Bonaparte Point.

The system operated normally throughout the month. Daily quality checks of the downloaded data were performed as scheduled.

**T-295-P: GPS CONTINUOUSLY OPERATING REFERENCE STATION.**
Joe Pettit, Principal Investigator, UNAVCO

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

The system operated normally throughout the month. The Trimble GPS was in great demand this month and both the A-109-P (Moore) and B-518-P (Klein) groups used it to locate points for their projects.

**T-312-P: TERASCAN SATELLITE IMAGING SYSTEM**
The TeraScan system collects, processes, and archives DMSP and NOAA satellite telemetry, capturing approximately 25-30 passes per day. The Research Associate operates and maintains on-site equipment for the project. The TeraScan weather and ice imagery is used for both research and station operations.

The system has operated normally throughout 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. The Research Associate maintains the on-site system.

The magnetometer has functioned normally this month.

**B-466-P: FLUORESCENCE INDUCTION AND RELAXATION (FIRe) FAST REPETITION RATE FLUOROMETRY (FRRF)**
Deneb Karentz, Joe Grzymski, Co-Principal Investigators, University of San Francisco

The focus of this project is to identify and evaluate changes that occur in genomic expression and physiology of phytoplankton during the transition from winter to spring, i.e., cellular responses to increasing light and temperature. A Fast Repetition Rate Fluorometer (FRRF) with a FIRe

(Fluorescence Induction and Relaxation) sensor is installed in the Palmer Aquarium. The Research Associate downloads data and cleans the instrument on a weekly basis.

Daily instrument checks, weekly cleaning, and weekly data downloads were performed when possible. B-036-P/L (O'Brien) is performing light and noise sensitive studies in the aquarium near the FRRF instrument which shifts the schedule of these maintenance events.

**T-998-P: INTERNATIONAL MONITORING STATION (IMS) FOR THE COMPREHENSIVE NUCLEAR TEST BAN TREATY ORG. (CTBTO)**
Managed by General Dynamics

The IMS Radionuclide Aerosol Sampler and Analyzer (RASA) is part of the CTBTO verification regime. The automated RASA continually filters ambient air and tests for particulates with radioisotope signatures indicative of a nuclear weapons test. The Research Associate operates and maintains the instrument.

Bouvard Hosticka is here on station performing maintenance on the system. The system operated normally throughout the month.

**OCEANOGRAPHY**
Daily observations of sea ice extent and growth stage are also recorded, along with continuous tidal height, ocean temperature, and conductivity at Palmer's pier.

Daily observations of the ice around station were made. The new tide gauge has been working without any problems.

**METEOROLOGY**
The Research Associate acts as chief weather observer, and compiles and distributes meteorological data. Weather data collected using the automated electronic system is archived locally and forwarded twice each month to the University of Wisconsin for archiving and further distribution. Synoptic reports are automatically generated every three hours by the Palmer Meteorological Observing System (PalMOS) and emailed to the National Weather Service for entry into the Global Telecommunications System.

PalMOS has operated normally.