

# PALMER STATION MONTHLY SCIENCE REPORT

NOVEMBER 2014



**Bruiser rides again!** The Schofield (C-019-P) and Ducklow (C-045-P) field teams begin their 24<sup>th</sup> season of water sampling at Palmer Station. Using their zodiac platform, affectionately named Bruiser, the team samples bi-weekly at oceanographic stations B (near shore) and E (off shore) for physical, optical, phytoplankton, and bacterial community data. *(Image Credit: Elaine Hood)*

## NEWS FROM THE LAB

Carolyn Lipke, Summer Laboratory Supervisor

After taunting us for the first part of November, the sea ice has finally left the Palmer Station boating area. With the departure of the sea ice came a huge increase in wildlife sightings on station. Skuas and Wilson's storm petrels have returned, and gentoo and Adélie penguins have been frequenting station. An elephant seal pup also took up residence near station for a few days. On the 15<sup>th</sup> we had our first whale sighting from station, a minke.

This month three additional groups arrived at Palmer Station, the Yen group (B-048-P), the Fraser group (C-013-P), and a portion of the Kohut group (B-005-P). The Kohut field team set up their first CODAR antenna at Palmer Station and then went back out on the ARSV *Laurence*

*M. Gould* (LMG) to install the other two antennas in the Wauwerman and Joubin Islands. The group was successful in getting all three antennas up and running despite losing several days to sea ice and high winds. Meanwhile back at Palmer, the LTER team got out for their first water sampling days at stations B and E. The Fraser group began their seabird and penguin censuses and noted the first Adélie eggs laid on Humble on November 12<sup>th</sup>. As the summer season picks up we are still struggling to make the new boat ramp an efficient operation.

At the end of the month we took a brief pause to enjoy a spectacular Thanksgiving feast together. Our chefs prepared an amazing spread, and it was a wonderful time to sit back and be mindful of all the people throughout the years that have worked to make Palmer the amazing place that it is.

## **NOVEMBER 2014 WEATHER**

Mark Dalberth, Research Associate

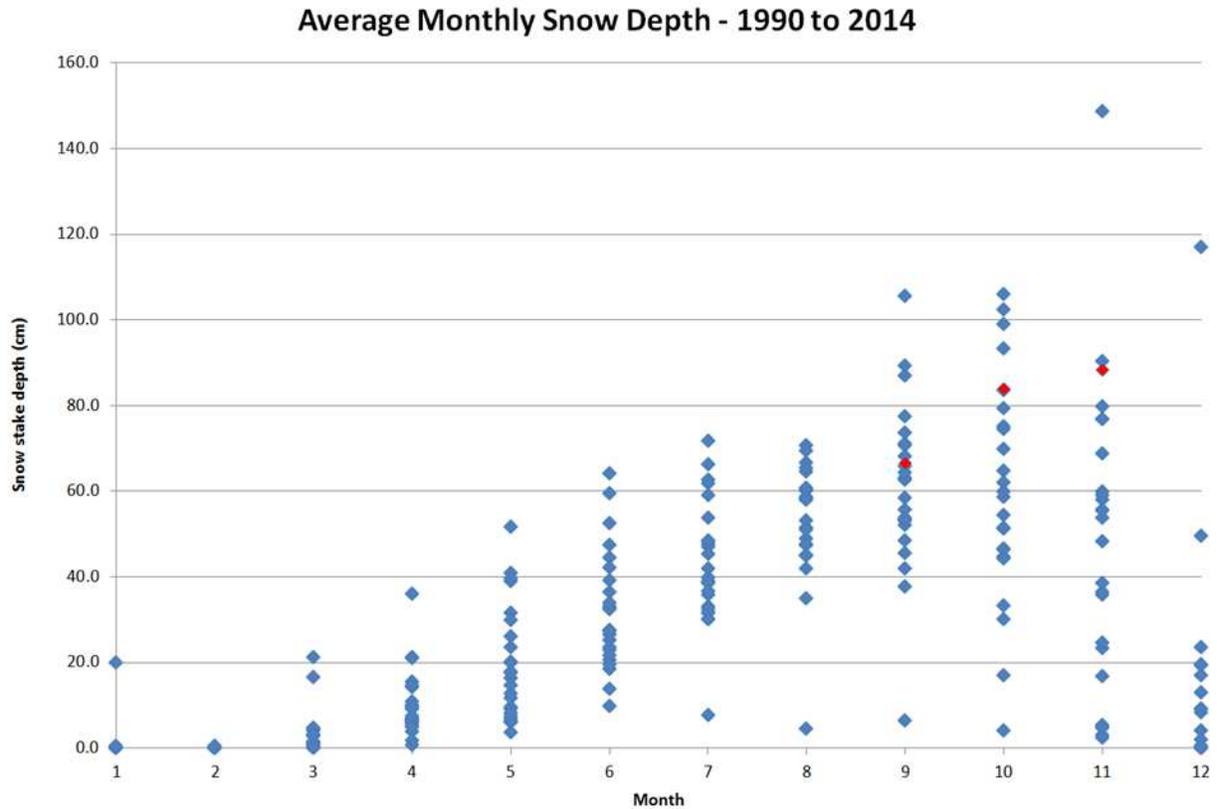
Palmer Station was iced in at the beginning of November. This prevented science groups from sampling and also impacted operations of the *ARSV Laurence M. Gould* (LMG) which was in the area to install a Coastal Ocean Dynamics Radar system (CODAR). Luckily, a low pressure system came into the area during the early morning of November 10. It brought with it 45-50 knot gusts from the east that blew the ice away in a matter of hours. A 50 knot gust observed during this storm was the maximum for the month. The minimum and maximum temperatures were seen in this time period. The lowest temperature was -7.2 C on the morning of November 4. The highest temperature was 7.2 C on the evening of November 9.

Winds stayed from the east for the next few days which helped ensure that the ice would be blown well away from shore. The weather cleared up after the 11<sup>th</sup> and the Birders were able to get to Biscoe and Dream Islands on the 12<sup>th</sup>. Also on the 12<sup>th</sup>, the LMG put the Kohut camp in at the Joubins for the CODAR installation.

On the 19<sup>th</sup>, the ice returned, pushed by south westerly winds, but it was quickly blown out again on the 20<sup>th</sup> by easterly and north-westerly winds. Hopefully, it stays away from Palmer's boating limits for the rest of the season.

It has come up in conversations over the past few weeks that the snow depth seems to be high this year. This phenomenon would be indicated by snow on the ground, not the total snow fall this year; the data most relevant to this observation are the daily snow stake measurements. Performing a monthly average going back to 1990, it turns out that this November had the third highest average snow depth of the past 24 years. This backs up much anecdotal evidence that the snow this year has lingered longer than is usual.

The plot below shows all the monthly averages of the snow stake measurements from 1990 to 2014. The three red data points are for September, October and November 2014.



**B-005-P: COLLABORATIVE RESEARCH: IMPACTS OF LOCAL OCEANOGRAPHIC PROCESSES ON ADÉLIE PENGUIN FORAGING ECOLOGY**

Dr. Josh Kohut, Principal Investigator, Rutgers University, Institute for Marine and Coastal Sciences; Dr. William R. Fraser, Co-PI, Polar Oceans Research Group; Dr. Kim Bernard, Co-PI, Oregon State University; Chris Linder, Co-PI; Dr. Matt Oliver, Co-PI, University of Delaware; Hank Statscewich, Co-PI, University of Alaska Fairbanks; Dr. Peter Winsor, Co-PI, University of Alaska Fairbanks

Personnel on Station: Hank Statscewich, Steve Sweet, and Peter Winsor

Project CONVERGE is deploying a coordinated ocean observing network to better understand ecological connections along the Western Antarctic Peninsula (WAP). This project is an adaptive field study that investigates the impact of local physical processes on Adélie penguin foraging ecology in the vicinity of Palmer Deep off Anvers Island. To do this, partners from Rutgers University, the University of Alaska, Fairbanks (UAF), Oregon State University, the University of Delaware, and the Polar Oceans Research Group are deploying a multi-platform observing network that includes gliders, animal telemetry, acoustics, and CODAR High Frequency Radar (HFR).

A first big step was completed in November with an incredible effort and support from the science team, Palmer Station and the LMG. Peter Winsor, Hank Statscewich, and Steve Sweet

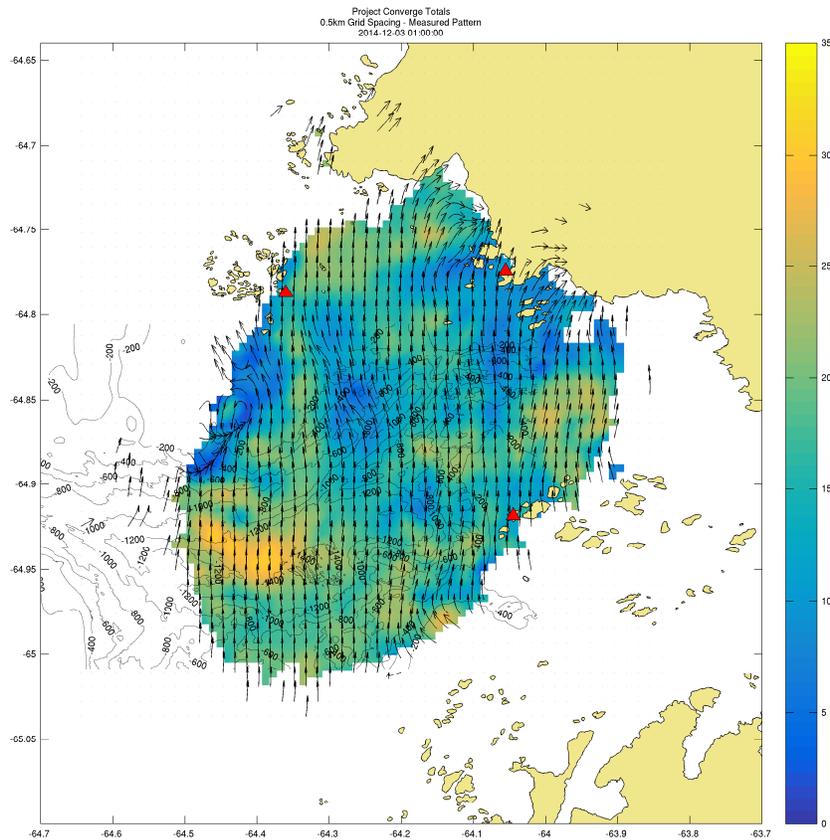
from the University of Alaska, Fairbanks led the field team. They successfully installed three HFR sites, one at Palmer Station, one in the Joubin Island group and a third in the Wauwerman Island group. The two sites in the outer island groups required the construction of a remote power module that will support the site through a combination of solar and wind power. The team was able to work through tough weather and ice conditions to get all sites up, operational and calibrated.



**Installing the CODAR antenna in the Palmer Station backyard during less than ideal weather conditions (left), and constructing the foundation of the Wauwermans power module (right). Below is the completed power module at the Joubins installation. Photo credit: Peter Winsor**



The total vector surface current maps are coming in real-time, ready to guide the multi-platform sampling planned for this coming summer season. We would like to thank all that supported this incredible effort.



**Surface current map from 3 December 2014. Red triangles show the locations of the three CODAR sites.**

## **B-018-P: MOLECULAR ASSESSMENT OF PHYTOPLANKTON COMMUNITY DYNAMICS AND METABOLISM IN THE WEST ANTARCTIC PENINSULA**

Dr. Shellie Bench, Principal Investigator, Stanford University, CA

Personnel on Station: Shellie Bench, (PI and Post-Doctoral Research Fellow)

The month began with unfavorable sea ice and winds that prevented sampling from small boats for the first week and a half. I collected one sample from the pump house during that time to avoid missing any early season phytoplankton dynamics. The ice and weather finally cooperated from the second week of the month onward, and we were able to get out sampling four times before the end of the month. So, I collected and processed five samples during the month (one from the pump house, and four from station B). On each sample, I carried out my standard processing of each sample including filtering replicates for RNA and DNA, as well as preparation of samples for microscopy and flow cytometry (run by the C-045-P group). ASC

support staff has been providing valuable support for the boating needs of my sampling activities.

During the last week of the month, I noticed more color on my filters, and slower filtration, suggesting the phytoplankton biomass is beginning to increase. In December I expect we will continue to see a rapid increase in biomass corresponding with the annual summer phytoplankton bloom.

Finally, in anticipation of my departure in December, I have been preparing supplies and testing laboratory equipment and that will be used during the annual LTER cruise in January. This will make it easier and less time consuming for the C-045-P group members when they need to set up for my sampling in the laboratories on the *ARSV Laurence M. Gould*.

### **B-048-P: COLLABORATIVE RESEARCH: PTEROPOD SWIMMING BEHAVIOR AS A BIO ASSAY FOR OCEAN ACIDIFICATION**

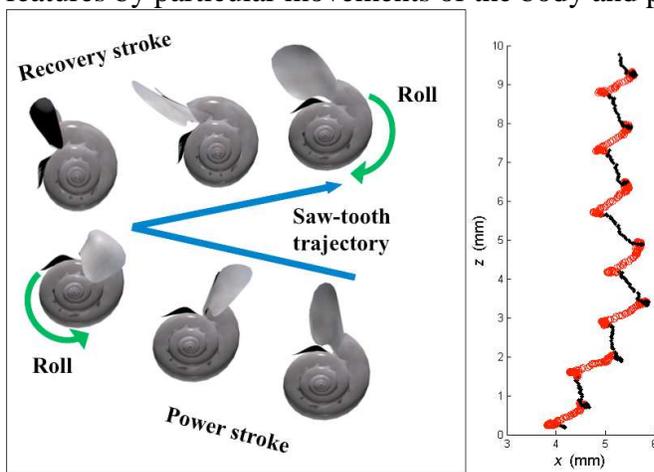
Dr. Jeannette Yen, Principal Investigator, Georgia Institute of Technology, School of Biology; Dr. Don Webster, Co-PI, School of Civil and Environmental Engineering, Georgia Tech; Dr. Rajat Mittal, Co-PI, Mechanical Engineering, Johns Hopkins University

Personnel on Station: Deepak Adkighari, Roi Holzman, and Jeannette Yen

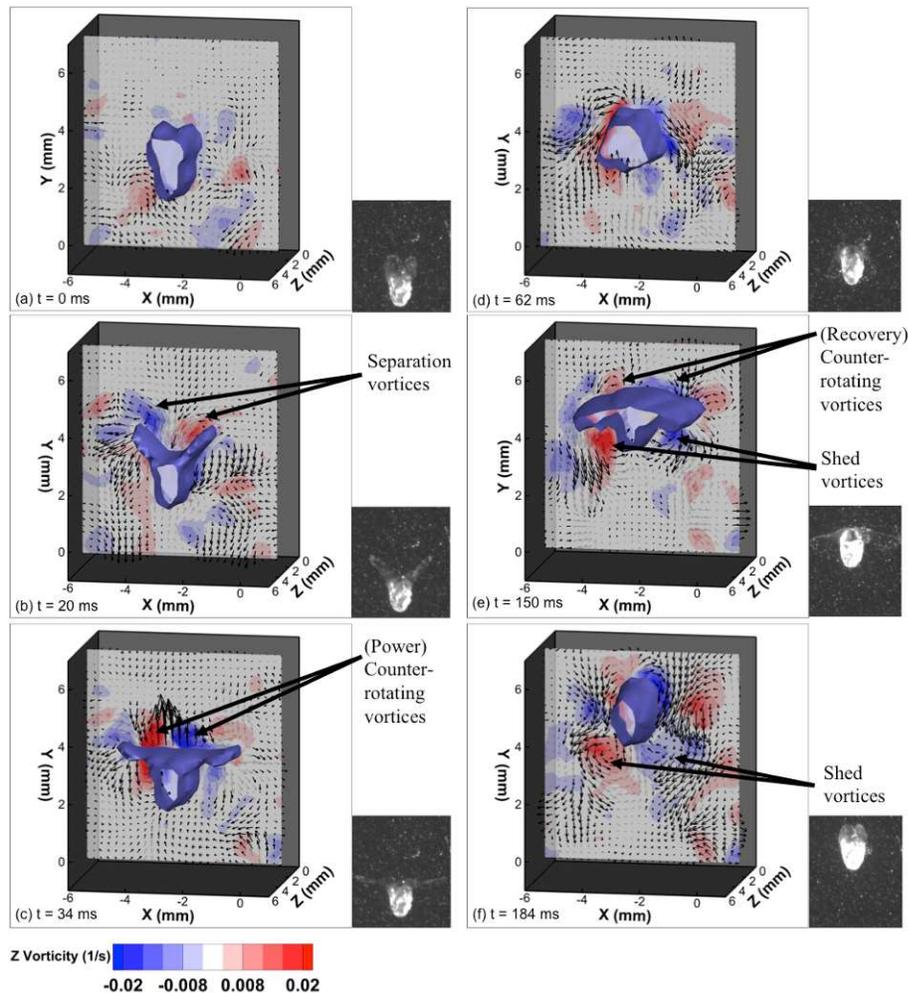
Ocean acidification (OA) poses a serious threat, particularly to organisms that precipitate calcium carbonate from seawater. Our target organism, *Limacina helicina*, secretes an aragonite shell, which is 50% more soluble than the calcite (Feely et al. 2004; Fabry et al., 2008). According to McNeil and Matear (2008), by no later than 2038, the wintertime aragonite undersaturation will occur in the Southern Ocean. With the expected rate of change in carbonate chemistry of the ocean due to the absorption of anthropogenic CO<sub>2</sub>, and the observed shell weight loss of pteropods that have been experimentally subjected to these conditions of ocean acidification, Roberts et al. (2008) predict that by 2020, *Limacina helicina antarctica* forma *antarctica* may be unable to sustain a shell. The loss of these sentinels of anthropogenic increases in CO<sub>2</sub> may result in an ecological shift since thecosome pteropods are responsible for ingesting nearly half the primary production in the Southern Ocean and also serve as a primary food resource to upper trophic levels like fish. Since locomotory data can be gathered immediately, the bioassay we are developing can serve as an early warning of the onset of OA.

During this austral spring period (Oct. 30-Dec. 1, 2014), we have been successful in collecting pteropods from 1-5 mm in shell size, with individuals collected above 100 m near Livingston Island being smaller than those in Palmer Deep. For this research, a biological oceanographer (Yen, Georgia Tech), a fluid dynamicist (Adhikari, Georgia Tech), and a biomechanicist (Holzman, Tel Aviv University) worked together at Palmer Station in an interdisciplinary collaboration to study aquatic propulsion by the shelled pteropod *Limacina helicina*. Sea butterflies, *Limacina helicina*, swim in sea water with a pair of gelatinous “wings” (or parapodia). Their unique propulsion mechanism has been hypothesized to consist of a combination of drag-based propulsion (rowing) and lift-based propulsion (flapping). Drag-based propulsion utilizes maximum drag on the wings during power stroke, followed by minimum drag

during recovery stroke. Lift-based propulsion, in contrast, utilizes a pressure difference between the top and bottom of the wings. Analyses of the 3D kinematics of a free-swimming sea butterfly from temperate seas and its induced volumetric velocity field using tomographic PIV was presented at the 2014 meeting of the Division of Fluid Dynamics section of the American Physical Society (Adhikari et al. 2014). Both upstroke and downstroke motions propel the animal (1 – 3 mm) upward in a sawtooth-like trajectory with average speed of 5 – 15 mm/s ( $Re = 5 - 45$ ) and roll the calcareous shell forwards-and-backwards at 4 – 5 Hz. The rolling motion effectively positions the wings such that they stroke downward during both the power and recovery strokes, hence inducing upward motion during both phases. A clap-and-fling mechanism is observed at the beginning of the flapping cycle. As the wings come into contact, the velocity of the organism is 2 mm/s. During fling motion, high (unsteady) lift causes the organism velocity to reach 35 mm/s. Separation vortices are observed during the fling motion, and vortices with an opposite sense of rotation form closer to the base of the wing due to the upward translation of the organism. The separation vortices shed into the wake, as the organism translates upward, in the form of separate vortex pairs. Tomographic records currently are being obtained on pteropods collected off the Antarctic peninsula. As shown for the temperate species [figures above], the three dimensional flow fields reveal the generation and shedding of flow features by particular movements of the body and parapodia.



(a) Schematic Diagram of Free-swimming *L. helicina* : Swimming consists of power and recovery strokes, saw-tooth trajectory, and oscillatory roll ('wobble').  
 (b) Measurement of the center of shell showing sawtooth trajectory. Black represents power stroke and red represents recovery stroke

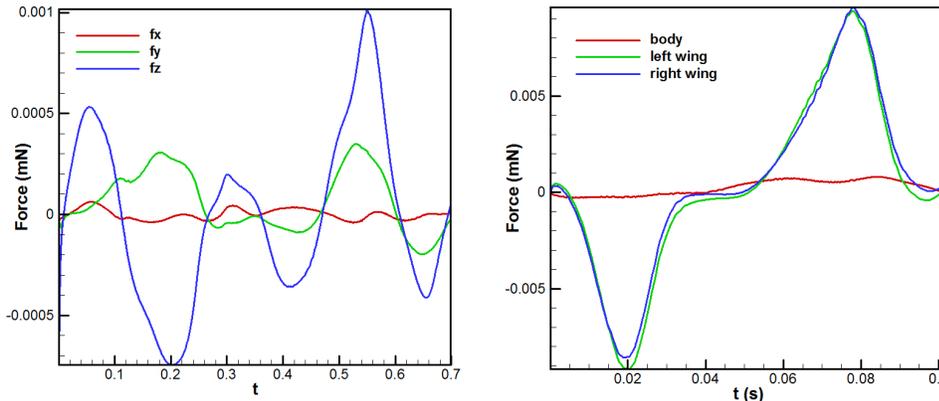


Fluid volumetric vector field of *L. helicina* during one cycle of consecutive (a) – (d) power and (e) – (f) recovery strokes. Insert image shows one of the tomographic PIV images of the *L. helicina* for the corresponding vector field. The sagittal plane of the *L. helicina* is parallel to the  $y$ - $z$  plane.

Paired high-speed videosequences are being gathered for this same set of pteropods to document the range of variation in the pteropod behavior. This range can be an indicator of the adaptive capacity of the pteropod. Preliminary analyses show a size-related wing beat frequency, with higher rates performed by smaller pteropods. Morphometric analyses will compare the wing area and geometric center of the pteropods while kinematic analyses will quantify the location of the center of mass, wingbeat frequency, rotational amplitude, swimming speed and swimming trajectory [e.g. helicity] for a given body size. Pteropods in the same size range have been placed in water of increasing viscosity to quantify modifications in their kinematic performance.

Sea butterflies exhibit a clap-and-fling type kinematics as well as a strong interaction between the parapodia and the body of the animal at the end of downstroke. Using numerical simulations based on videogrammetric data to examine the fluid dynamics and force generation associated with this swimming motion (Figure below: Zhou et al. 2014), we found that the unsteady lift-generating mechanism of clap-and-fling results in a sawtooth trajectory with a characteristic "wobble" in pitch. Coupled flow-body-dynamics simulations were employed to model the free-

swimming motion of the organism and explore the efficiency of propulsion as well the factors such as shell weight, which affect its sawtooth swimming trajectory.



**Force generation associated with unsteady lift-generating mechanism of clap-and-fling swimming motion.**

Adhikari, D, Georgia Tech, D.W. Murphy, Johns Hopkins University, D.R. Webster, J. Yen, Georgia Tech. 2014. Fluid-Dynamics of Underwater Flight in Sea Butterflies: Analysis using Tomographic PIV. DFD14 Meeting of The American Physical Society.

Fabry VJ, Seibel BA, Feely R, Orr JC (2008) Impacts of ocean acidification on marine fauna and ecosystem processes. ICES J Mar Sci 65:414–432.

Feely RA, et al. (2004) Impact of anthropogenic CO<sub>2</sub> on the CaCO<sub>3</sub> system in the oceans. Science 305: 362–366.

McNeil, Ben I. and Richard J. Matear. 2008. Southern Ocean acidification: A tipping point at 450-ppm atmospheric CO<sub>2</sub>. PNAS 105: 18860-18864.

Roberts, D., W. R. Howard, A. D. Moy, J. L. Roberts, T. W. Trull, S. G. Bray, and R. R. Hopcroft. 2008. Interannual variability of pteropod shell weights in the high-CO<sub>2</sub> Southern Ocean. Biogeosciences Discuss. 5: 4453–4480.

Zhou, Zhouyu, R Mittal, Johns Hopkins University, J Yen, D Webster, Georgia Institute of Technology. 2014. Fluid Dynamics of Underwater Flight in Sea Butterflies: Insights from Computational Modeling. DFD14 Meeting of The American Physical Society.

### **C-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: Ben Cook, Shawn Farry, and Carrie McAtee

C-013 personnel arrived at Palmer Station on November 1<sup>st</sup> and with ice threatening successfully conducted field work on the first full day on station. This proved to be a wise decision as Palmer

Station was then iced in for the next 7 days. However, on November 11<sup>th</sup> the ice retreated allowing for a total of 20 boating/field days this month compared with only 4 boating days during a very icy November 2013.

This month we began our censuses of local Adélie penguin colonies on Torgersen, Humble, Cormorant and Christine Islands as well as on Biscoe and Dream Islands. Breeding chronology studies were initiated on a subset of Adélie nests on Torgersen and Humble Islands and Adélie adult and egg morphometric data was collected at the 1-egg stage. A peak egg census was also completed for Adélie on all local islands as well as on Dream and Biscoe Islands. We also began monitoring Gentoo colonies on Biscoe and Chinstrap colonies on Dream.

The Penguin Cam <http://www.usap.gov/videoclipsandmaps/palwebcam.cfm> was also set up on Torgersen Island (64°46'S, 64°04'W), off the coast of Anvers Island. This camera is seasonal and operates primarily from November to February, the Adélie breeding season.

Mark-recapture and breeding chronology studies began with brown skuas on Torgersen, Humble, Cormorant, Christine, Litchfield, Dream and Biscoe Islands, and with south polar skuas on Shortcut Island. Population monitoring of the blue-eyed shag colony on Cormorant Island also began this month, as did our marine mammal censuses. An early-season census of giant petrel nests on Humble Island was also completed.

During weather days in November we conducted lab work and were able to complete the processing of all samples collected during the 2013 season.



**Adélie penguin colony 14 on Torgersen Island, taken on Nov 21st. Photo credit: Shawn Farry**

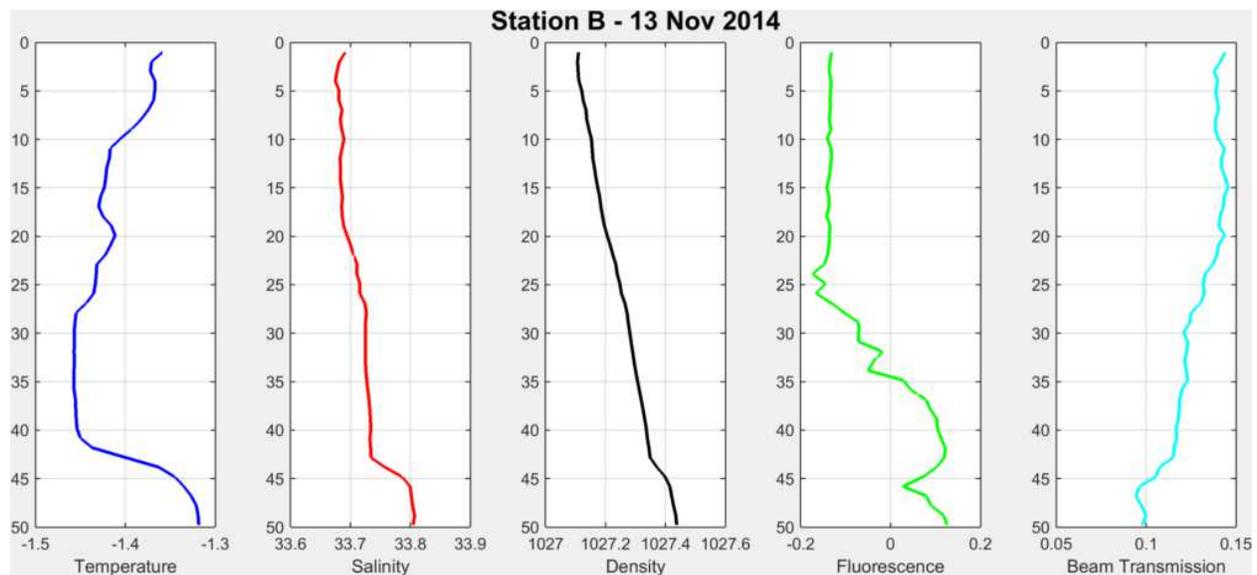
## C-019-P: PALMER LONG TERM ECOLOGICAL RESEARCH (LTER): LOOKING BACK IN TIME THROUGH MARINE ECOSYSTEM SPACE, PHYTOPLANKTON COMPONENT

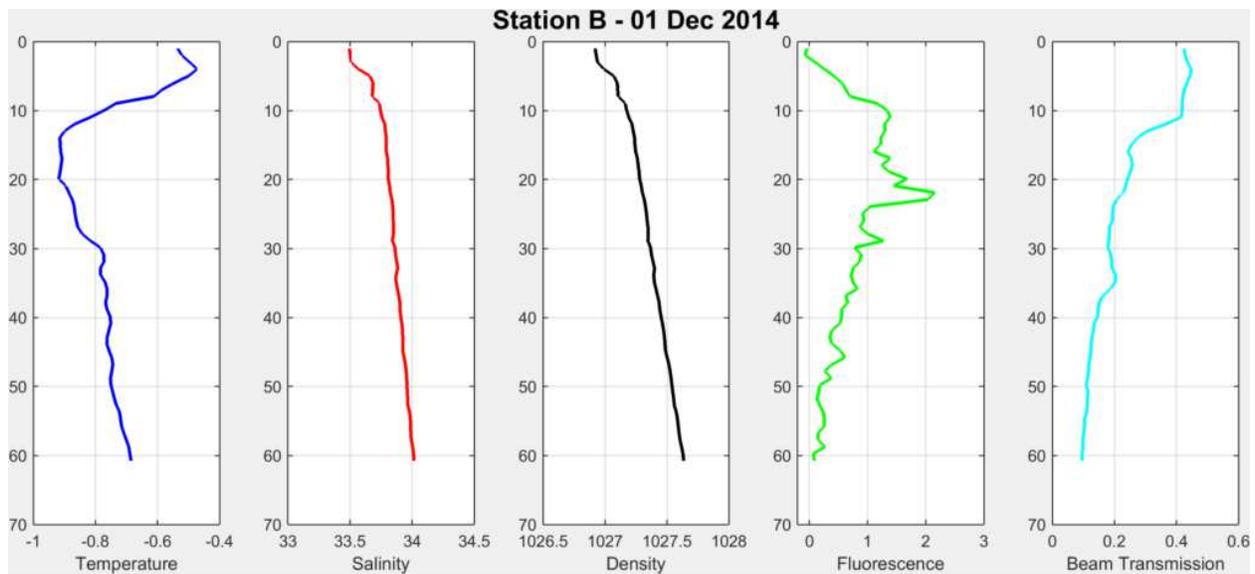
Dr. Oscar Schofield, Principal Investigator, Rutgers University, Institute for Marine and Coastal Sciences

Personnel on Station: Frank McQuarrie and Nicole Waite

It's been a busy and exciting month here at Palmer Station! With the ice finally (mostly) gone from the area, we were able to begin our bi-weekly sampling at stations B and E in conjunction with the Ducklow group! On November 13<sup>th</sup>, we loaded up Bruiser, our zodiac complete with a platform and winch, with several instruments, go-flo bottles, and sample bottles and headed out on our first sampling day after receiving an encouraging pep talk from Carolyn and Carmen.

With LTER water sampling in full swing for the 2014-2015 summer season, the lab has also been full of activity. After a long first few days full of acclimating to and sampling from Bruiser, we've learned to communicate and sample more effectively and efficiently and have fallen into a nice rhythm. It has been great to get out on the water, drive the zodiacs, and begin collecting samples for the LTER's 24<sup>th</sup> season! Primary production experiments, filtering, FIRE, and Chl-*a* analysis keep us busy when we aren't out on Bruiser. We are excited to continue watching how the phytoplankton communities change as the season progresses and the phytoplankton bloom occurs! We're already starting to see a change in the amount of phytoplankton in the water column from just a few weeks ago. Check out the order of magnitude difference between the fluorescence from these two CTD casts!





This month, we were also visited by a team from HBO Vice who are shooting an episode about climate change and are including a piece on the LTER and Antarctica. The Vice crew came out to film water sampling and talk with us about the work we do here and what phytoplankton communities mean for the bigger picture of climate change.

In addition to bi-weekly sampling, a glider, RU 26, arrived for us on the LMG in November. Remaining ice along the peninsula to the south has kept us from deploying the glider, but as part of our filming with HBO Vice, we were able to do 2 practice glider deployments and recoveries here in Arthur Harbor – both with test dives to 10m and both successful. We’d like to thank Dave Aragon (at Rutgers in NJ), Mark, Carmen, and Conor for their help in these deployments!

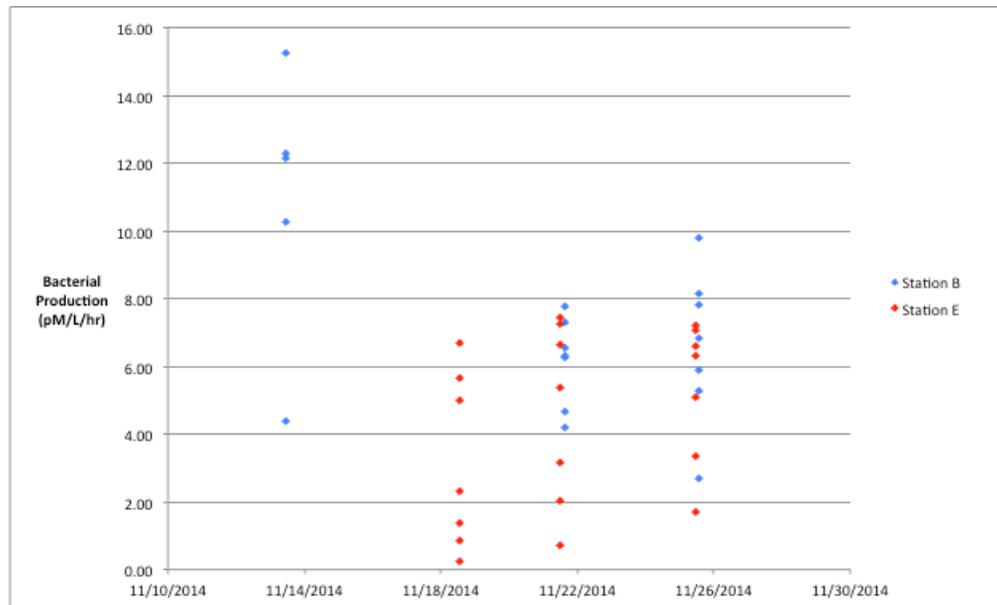
**C-045-P: PALMER, ANTARCTICA LONG-TERM ECOLOGICAL RESEARCH (LTER): CLIMATE MIGRATION, ECOSYSTEM RESPONSE AND TELECONNECTIONS IN AN ICE-DOMINATED ENVIRONMENT: MICROBIAL / BIOGEOCHEMICAL COMPONENT**

Dr. Hugh Ducklow, Principal Investigator, Columbia University, Lamont Doherty Earth Observatory

Personnel on Station: Rachel Kaplan and Conor Sullivan

November brought the true retreat of the sea ice surrounding Palmer Station, and the real start of the LTER summer water sampling season. Twice a week, we pile with the two members of C-019 into our Zodiac, Bruiser, in order to investigate the bacterial and phytoplankton communities at stations B and E. As we’ve begun sampling at both stations, we’ve seen a modest increase in bacterial production throughout the month (see graph below), as well as an increase in phytoplankton levels (see C-019’s report for illustrative CTD graphs), both in accordance with the anticipated summer trends.

## November Bacterial Production



### **PALMER STATION RESEARCH ASSOCIATE MONTHLY REPORT NOVEMBER 2014**

Mark Dalberth

The data collection systems in Terra Lab have been operating well throughout the month. As in October, there was a planned power outage in the middle of the month for the station electrician to perform maintenance on electrical panels. This time it was for the panels in Terra Lab itself. It had minimal impact on experiments in the lab.

### **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.

The seismograph station operated without any problems for the entire 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 system was down for about 24 hours from November 25-26 because data was not being transferred to external hard drives. This was corrected remotely by the research group. The antenna was inspected and found to still be secure.

**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 operated normally throughout the month. Weather data was transferred to servers at AMRC on the first and the sixteenth 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 O<sub>2</sub> (detected through changes in O<sub>2</sub>/N<sub>2</sub> 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<sub>2</sub> 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.

Air samples were collected every two weeks, as scheduled.

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

James Butler, Principal 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 (N<sub>2</sub>O) and halogen containing compounds. The Research Associate collects weekly air samples for the CCGG group and fortnightly samples for the HATS group.

Carbon Cycle and Halocarbon air samples were collected as scheduled.

#### **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.

One of the system's uninterruptible power supplies died. New batteries for the unit are going to be shipped to Palmer. Currently, the system is running directly on power from the wall.

The bi-weekly absolute calibration scans were completed as scheduled.

#### **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 except for one receiver that needed to have its power cycled before it came back online. The RA provided 15 second data to Juan Carlos Baez from the University of Chile who was here on the Chilean icebreaker *Almirante Oscar Viel*.

### **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 been operating well throughout the month. Scans are being retrieved from the satellites and disseminated to forecasting centers. The tape archive has only worked sporadically since the tape drive was changed last 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 Grzymiski, 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 data downloads were performed as scheduled. Due to changing station and science needs the laptop computer used for FRRF data download was switched. The communications software was loaded on the new computer and works correctly.

## **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.

The system continued operating normally throughout the month. For a brief time there was a communications problem between the main gamma ray detector and the software. This was fixed remotely by T-998-P. I was given instructions on how to perform the fix if it should happen again. Daily filter samples were processed and packaged for shipping.

### **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.

The tide gauge has been operating well. Data collection from this instrument has been improved. The RA provided data from 2014 to Dr. Laurence Padman at Earth and Space Research in Corvallis, OR.

### **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.

The system operated normally during the month. A calibration was performed on the Belfort visibility sensor. The RA installed a Present Weather Sensor that had just come back from ERR.