PALMER STATION MONTHLY SCIENCE REPORT

SEPTEMBER 2013

A Weddell seal and her pup on the ice in Hero Inlet.
(*Image Credit: Ryan Wallace)*

NEWS FROM THE LAB
By Carolyn Lipke, Assistant Supervisor of Laboratory Operations

September marked the changing of the guard once again at Palmer Station. The summer support staff arrived mid-month on the *ARSV Laurence M. Gould*. Lisa Clough, NSF Integrated Systems Science Director, made a site visit to Palmer during the port call as well.

Sea ice lingered in the Palmer area for most of the month, significantly limiting zodiac operations. But even without boating, winter science in the Bio Lab continued. Fish embryos are developing and microbial incubation experiments are progressing.

Everyone on station was excited to discover a Weddell seal had given birth to a very cute pup on the ice in Hero Inlet sometime near September 21st. Kelp gulls and sheathbills are prevalent around station, and an occasional giant petrel is seen, but other wildlife has been scarce.

We send our sincere thanks to the winter grantees and ASC staff for keeping the station in such great shape.

SEPTEMBER 2013 WEATHER
By Glenn Grant, Research Associate

September started calm and relatively warm, averaging near freezing, but the weather soon changed and brought some of the coldest, windiest conditions of the year. The low temperature for the month was -24.7C (-12.6 F) on the 10th. The cold snap lasted until the middle of the month, after which the temperatures returned to more seasonable levels, hovering a bit below freezing. The average temperature for September was -7.3 C (18.9 F), and the maximum was 4.9 C (40.8 F) on the 29th. The average wind speed was 10 knots, with a peak gust of 83 knots on the 18th -- coinciding with the arrival of the *ARSV Laurence M. Gould*. The station's anemometer catastrophically failed during the storm, so the actual peak gust may have been higher; the instrument was replaced the next day. After mid-month, a significant high pressure system settled into the Peninsula region, bringing fair weather and calmer conditions. Total melted precipitation was 15.2 mm, most of which fell as snow (27 cm), snow pellets, or graupel. The deepest snowstake accumulation for the year, 61 cm, occurred on the 23rd.

Sea ice concentrations were light at the beginning of the month, however the change in weather and wind direction pushed the pack up against the southwest side of Anvers Island. By mid-month fast ice was present around Palmer Station, with floes, first year ice, and gray ice solid to the horizon. At the end of September the station was still mostly beset by sea ice. The minimum observed sea surface temperature was -1.7C (29 F).

B-029-P: DEVELOPMENTAL MECHANISMS FOR THE EVOLUTION OF BONE LOSS

Dr. John H. Postlethwait, Principal Investigator, Institute of Neuroscience, University of Oregon, Eugene, and Dr. H. William Detrich, Co-PI, Northeastern University

Personnel on station: Ashley Nelson, Urjeet Khanwalkar

Our goal is to understand the molecular genetic mechanisms for the evolution of bone loss in the icefish lineage of Antarctic Notothenioid fish. To investigate the developmental origins of these differences, we made matings for several species Notothenioid species; currently only *N. coriiceps*, a robustly mineralized species, are still developing at Palmer.
A second goal is to understand how embryos of Antarctic fish respond to increasing temperature. As the Southern Ocean begins to warm, what will happen to embryonic development of Antarctic fish? Any of several possibilities suggest themselves. 1) Embryos might just die, unable to cope with the increasing temperature. 2) Embryos will develop more rapidly and immediately hatch in the Austral winter or too early in the Spring before sufficient returning sunlight allows phytoplankton to proliferate to provide food for the larvae. 3) Embryos will develop more rapidly but will delay hatching until the lengthening photoperiod signals the historically normal time for hatching. To distinguish these possibilities, we are growing a group of animals at higher temperature, as described below.

September Summary

- From the *N. coriiceps* cross #7/8 (~2000 embryos), which occurred over the course of several days around June 7th, 2013, our oldest embryos were at approximately 110dpf (as of September 26th, 2013). These are currently being raised in a cascade tank in

Environmental Room #1. The cascade tank in Environmental Room #1 continues to run well with little to no issues concerning flooding or mass embryo death.

- From *N. coriiceps* cross #12 (~300 embryos), which were fertilized on June 25th, 2013 (natural overnight spawning in the watch tank), embryos are 93dpf (as of September 26th, 2013). They are currently being raised in two floating incubators in the indoor tank closest to the lab vestibule.
- To test the effect of temperature on embryonic growth, we set up an incubator in a laboratory refrigerator for a warm temperature (+4˚C) experiment using 300 embryos from *N. coriiceps* cross #7/8. Embryos were slowly acclimated to +4˚C over 24 hours to avoid heat shock (an increase of approx. +0.25˚C every hour). We perform a water change of 60% of the tank every 6 hours, and have dimmed the light to match that of Environmental Room #1, hoping to control as many variables as possible between the warm and control embryos. We take a sample of embryos (n=2) once a week for morphology and for gene expression analysis.
- Embryo fixations continue for RNA-seq, Bouin's, in situs (whole and sections), as well as alcian blue-alizarin red (ABAR) and von Kossa's staining for bone development.
    - Sampling is completed for unfertilized eggs, "sphere" stage, "shield" stage, 60-80% epiboly, 10-15 somites, and 60 dpf
    - Fixations for in situ hybridization experiments for gene expression analysis (whole embryos and histological sections), ABAR, and von Kossa's continue every 10 or 20 days, depending on the fixation protocol
    - Photos of the embryos continue to be taken under a dissecting scope every two to three days, depending on the rate of development
- Date(s) of significance
    - September 22, 2013 - The Laurence M. Gould departed Palmer Station for Punta Arenas
        - Urjeet Khanwalkar departed with LMG
        - All histology and RAD-sex samples were sent-off, along with several frozen fish heads
        - The tray incubator and cylindrical incubators were sent to the warehouse in Punta Arenas
- Next cruise (mid-October)
    - End of 2013 season and break-down of experimental set-ups
    - All embryo samples (RNA-seq, in situs, ABAR, Bouin's, and von Kossa's) being sent to the States
    - Remaining live embryos from N. coriiceps crosses #7/8 and #12 being personally transported to Oregon

B-228-P: COLLABORATIVE RESEARCH: MICROBIAL COMMUNITY ASSEMBLY IN COASTAL WATERS OF THE WESTERN ANTARCTIC PENINSULA

Dr. Linda Amaral-Zettler, Principal Investigator, Marine Biological Laboratory, Woods Hole, MA; Dr. Jeremy Rich, co-Principal Investigator, Brown University, Providence, RI

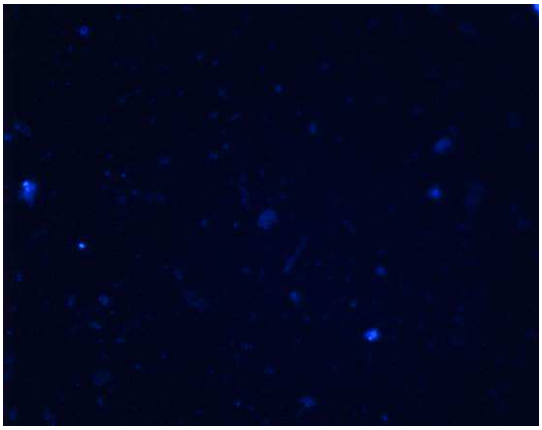
Personnel on station: Sean O'Neill, Monica Stegman, and Madelyne Willis

Early in September Madie and Sean completed a 2nd carboy experiment examining the effects of DOM on the microbial communities in seawater utilizing a different lighting scheme than the 1st

experiment. We continue to examine controls on seasonal changes by conducting seawater carboy experiments (50L) amended with diatom exudates and sea-ice containing diatom biofilms. We are excited with the results to date and look forward to utilizing the data to further modify future carboy experiments.

Sampling at Station B remains elusive as the sea ice continues to prevent us from boating. However, we are optimistic that the warming weather in October will provide us with the opportunity to return to boating on a weekly basis. Our team continues to sample the Sea Water Intake on a weekly basis and we are finalizing our preparations for our next carboy experiment. On that note, we continue to search for sea ice with visible microbial growth along the shores of Arthur Harbor. We intend to utilize this sea ice for the 3rd carboy experiment designed to look at the effects of sea ice on microbial community development.

Scientists searching for visible microbial growth in the ice (no visible microbial growth).



DAPI slide showing bacteria in seawater from the Sea Water Intake.

Monica Stegman (MS University of Delaware) arrived September 19th on LMG13-09 and will be taking over for Madie for the rest of the season. It only took a couple of days to bring Monica up to speed on our protocols and progress throughout the winter season and we look forward to her addition to the team. Monica's knowledge and expertise in microscopy have allowed us to begin looking closer at the seawater samples utilizing DAPI staining techniques. Our team has also made significant progress in analyzing the Chlorophyll samples collected over the past few months and will continue to process these in the upcoming days.

Overall the project continues to produce new and exciting data on the winter microbial communities around Palmer Station and we are looking forward to continued research throughout the coming spring months. We owe a great thanks and appreciation to Madelyne Willis for her hard work and invaluable contributions to the project over the winter months and wish her well on her journey ahead! We would also like to thank the winter over support staff for all of their assistance and wish them well on their journey home. Finally, we welcome the summer crew and the energy that they have brought along with them and look forward to working with them over the next few months.

PALMER STATION
RESEARCH ASSOCIATE MONTHLY REPORT
September 2013
Glenn Grant

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 system operated normally during the 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 ELF/VLF system collected data normally throughout September.

A-132-P: FABRY-PEROT INTERFEROMETER (FPI)

Qian Wu, Principal Investigator, National Center for Atmospheric Research

The Fabry-Perot Interferometer observes mesospheric and thermospheric neutral winds and temperatures at Palmer Station by measuring the wind-induced Doppler shift in the air's nightglow emissions. The Research Associate operates and maintains on-site equipment for the project.

The system operated normally throughout the month.

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.

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 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 both Terra Lab and the VLF Building.

Air samples were collected as scheduled throughout most of the month. Poor wind conditions at the end of September delayed one sample collection.

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 (N2O) 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 sampling were completed as scheduled, although poor wind conditions near the end of September have delayed one halocarbon sample.

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.

Data was collected normally throughout the month. The seasonal triple absolute scan was completed on schedule.

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 AMRC website. The Research Associate monitors data transmissions for the project and performs quarterly maintenance on the station at Bonaparte Point.

A power cable was received and installed on the Bonaparte Point AWS. The AWS is now in operation again.

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 GPS station collected data normally during the month.

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.

Satellite passes were captured normally throughout the month. The system was modified to process telemetry from the Bonaparte Point AWS, as relayed through the ARGOS receivers carried on NOAA satellites. The AWS data is used by the Research Associate as another method of QAing the AWS operations.

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.

Weekly cleaning of the instrument and data downloads were performed as scheduled.

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 replacement cooler and detector was received and installed in the RASA. As of the end of September, the RASA is in calibration mode to characterize the performance of the new detector. Air filtration/sampling has been discontinued during this process.

OCEANOGRAPHY
Pending the installation of a new tide gage system with salinity and sea water temperature sensors, the Research Associate takes daily manual readings of sea water temperature. Daily observations of sea ice extent and growth are also recorded.

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.

A new wind screen was installed around the automated precipitation gauge. The present weather sensor was found to be inoperative; the automated synoptic report generator was modified to exclude the sensor's data pending further testing and repair. During high winds on September 19th the anemometer suffered a catastrophic failure; the instrument was replaced the next day during calm weather.