PALMER STATION MONTHLY SCIENCE REPORT

May 2013

Corey Oldham from B-036-P (O'Brien) prepares a red-blooded notothenioid for part of the group's research to determine maximal oxidative capacities of aerobic tissues.
Image Credit: Theresa Grove

NEWS FROM THE LAB
By Janice O'Reilly, Assistant Supervisor of Laboratory Operations

Palmer Station supported a busy month of lab experiments, field work, and fishing cruises. Members from B-027-P (McClintock/Amsler), B-029-P (Postlethwait), and B-036-P (O'Brien) filled the labs with ongoing research. Diving operations for B-027-P (McClintock/Amsler) continued as weather permitted, and two fishing trips were completed onboard the *ARSV Laurence M. Gould* (LMG) for B-029-P (Postlethwait) and B-036-P (O'Brien). Station personnel continued weighing giant petrel chicks for B-013-P (Fraser) through the last day of the study on 10 May.

Recreational boating allowed for several opportunities to observe the flora, fauna, and biota of the local waters and islands. Fur seals frequented the Palmer area and were commonly observed resting on local islands and in the backyard on both the Arthur Harbor and Hero Inlet shores. Groups of up to one dozen fur seals were commonly seen across Hero Inlet on Bonaparte. Elephant seals congregated in large groups on Elephant rocks – on 22 May over 50 were observed. Smaller groups of elephant seals were seen on Humble, Amsler, Christine, and Hermit Islands. One day a resting crabeater seal appeared in front of Bio Lab. Leopard seals were observed occasionally, hauled up on floating ice in Arthur Harbor and adjacent to Bonaparte Point.

Adélie penguins were observed in small numbers on Janus Island. On 11 May, 30 Adélies were observed, and on 22 May, 13 were observed. There was a report of one Gentoo penguin on Amsler Island on 22 May. Other bird populations observed during May included blue-eyed shags, kelp gulls, Wilson's storm-petrels, snow petrels, Antarctic terns, snowy sheathbills, and giant petrels. With very little snow cover during May, mosses and grasses accented the landscape with green and brown hues. On 1 May several mushrooms were found and photographed on Hermit Island coexisting with mosses, an interesting find.

MAY 2013 WEATHER
By Graham Tilbury, Research Associate

During the month of May, the weather at Palmer was far less turbulent than the previous month. Temperatures dropped steadily, with minimum temperatures dropping well into minus values most early mornings, and reaching a low of -8.7C on the last day of the month. However, on two separate occasions, maximum temperatures reached well above zero, rising to the month's maximum of 5.2C on the afternoon of the 4th.The average temperature for the month was -1.8ºC, making it a slightly warmer May than last year.

Except for a few gusty days, it was a fairly calm month. For an extended period during the middle of the month, the average wind speed remained below 20 knots. During the last week, a high pressure system settled across the area, bringing with it cooler day temperatures and much lower wind speeds.

The sea surface temperature averaged -0.5ºC., and other than brash ice from the glacier, very little ice was seen. A few very large icebergs passed well offshore of the station. The Arthur Harbor glacier continued calving steadily throughout the month, at times filling the bay with small ice floes.

Total snowfall for the month was 49 cm, with almost one third of that falling on the 6th.

B-027-P: THE EFFECTS OF OCEAN ACIDIFICATION AND RISING SEA SURFACE TEMPERATURES ON SHALLOW−WATER BENTHIC ORGANISMS IN ANTARCTICA

James McClintock, Charles Amsler, and Robert Angus, Principal Investigators, University of Alabama at Birmingham

Personnel on station: Margaret Amsler, Kate Schoenrock, Julie Schram.

The month began with the departure of principal investigator Chuck Amsler. Maggie Amsler was assigned role of field team leader.

One of this season's two main ocean acidification experiments (mesocosm approach) ended 6 May. The 18 bucket mesocosms were maintained at either pH 7.2, 7.6, or 8.0. Each bucket contained a natural population and density of amphipods on the brown alga *Desmaerestia menziesii*. The experiment ended after the planned four week duration at which time live:dead amphipod counts were taken and the photosynthetic ability of the algae determined via PAM. Additionally, a feeding bioassay was conducted to investigate the palatability of the alga maintained at the three pH treatments to the omnivorous amphipod *Gondogeneia antarctica*.

As with previous months the bulk of our daily efforts throughout this month involved daily monitoring of water chemistry of ambient seawater, stocks used to maintain the 2 pH microcosm treatments as well as the 48 microcosms. This monitoring ended 30 May after amassing an impressive dataset. The records include over 1200 spectrophotometrically derived pH measurements to validate an equal number of Durafet probe readings. For each pH measurement a matching number of titrations were done to determine total alkalinity.

Routine maintenance of the microcosm experiment continued. Amphipods in the treatments were observed daily for molt collection and mortality and fed regularly. Photosynthetic measurements of macroalgae in the microcosms also continued.

Field work greatly decreased in part by design and in part due to unfavorable weather. A total of eight dives were made in the month. Sufficient fresh algae for microcosm feedings were collected as needed. Field measurements of macroalgal photosynthetic parameters for comparison to the microcosm experiment data were completed. Also a survey of the photosynthetic ability of a suite of local macroalgae was completed this month. Additionally, the final collection for determination of seasonal endophyte load on select algae was made.

We are grateful for the generous and professional assistance of numerous ASC staff. Janice O'Reilly and Juliet Alla facilitated our laboratory operation. Both Hannah Gray and her replacement Meredith Helfrich kindly and efficiently assisted our boating operation, and Graham Tilbury ensured our scuba tanks were routinely filled. Our zodiac-based diving would not have been possible without the competent volunteer assistance of Juliet Alla, Yuki Takahashi and Darren Yates.

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: Braedan McCluskey, Nathalie LeFrancois, Ashley Nelson, Urjeet Khanwalkar.

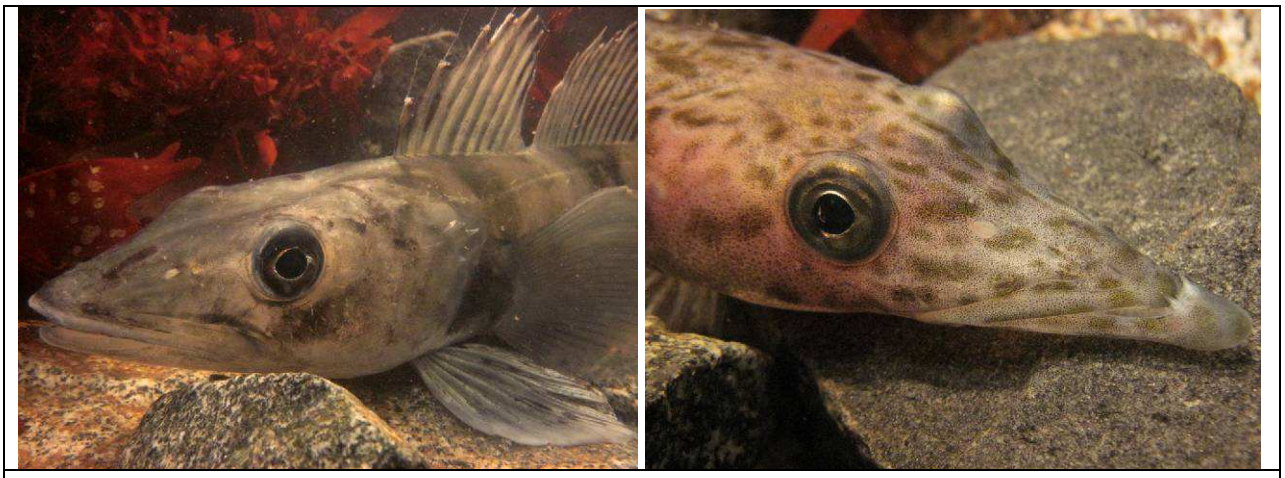

Figure 1. Left, Mackerel Icefish, *Campsocephalus gunnari*. Right, naked dragonfish *Gymnodraco acuticeps* Photo taken at Palmer Station by B-029 team member Thomas Desvignes.

This was an eventful month. Our team exchanged members on station mid-month with graduate student Braedan McCluskey and Professor Nathalie LeFrancois being replaced by undergraduates Ashley Nelson and Urjeet Khanwalkar, who will overwinter to care for fish and collect samples as embryos mature. In overview, we set up infrastructure for culture of Antarctic fish embryos and had some success at getting embryo clutches started.

We submitted lower jaws for microCT scans to query bone mineral density, involving two replicates of fish of the following species: *Chaenocephalus aceratus, Campsocephalus gunnari, Gobionotothen gibberifrons, Nothothenia coriiceps,* and *Pseudochaenichthyes georgianus.*

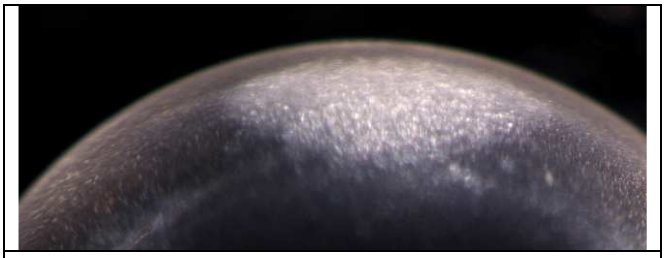

Figure 2. *N. coriiceps* embryo about 5 days post fertilization from the first cross established this month. Cells that will give rise to the embryo form a whitish cap on top of the yolk cell.

We had two successful spawns from the yellow belly rockcod *N. coriiceps*, one of which is still developing (Fig. 2). The other clutch was lost due to a malfunction in the outflow tract from the embryo culture vessel. This is a pity, but we are hopeful for opportunities for more clutches from animals currently on hand for this species.

Eggs were collected from a female of the blackfin icefish *C. aceratus* during a fishing trip on the LMG and separated them into two batches, but partially due to a delay in being able to dock at Palmer Station (winds were at 50 knots) where we had available males, these were not fertilized. The group of Kristin O'Brien kindly provided small pairs of testes following their onboard dissections. We fertilized half of the first group of eggs with macerated testis, which were likely immature, but appeared to be leaking milt. Seawater in the container with the eggs of the fertilized batch subsequently froze (the incubator must run a little cold), so we increased the set temperature and kept the eggs on ice. The other jar of embryos remained unfertilized until reaching Palmer Station. At that point, Ashley and Nathalie began sacrificing males and attempted to fertilize the second batch of eggs. The potentially fertilized eggs were put in the incubator on station (thanks to the great help of Cargo, Lab Supervisor, and I/O). Eggs were observed, but did not show signs of fertilization.

We converted one of the inside aquaria to a 'watch' tank. Into this aquarium, we placed animals that looked like they might soon become gravid. This tank Palmer personnel helped to provide with a separator so we could maintain more than one species in this tank.

We injected Ovaprim, a mixture of gonadotrophin hormones that can induce spawning, into fish of several species.

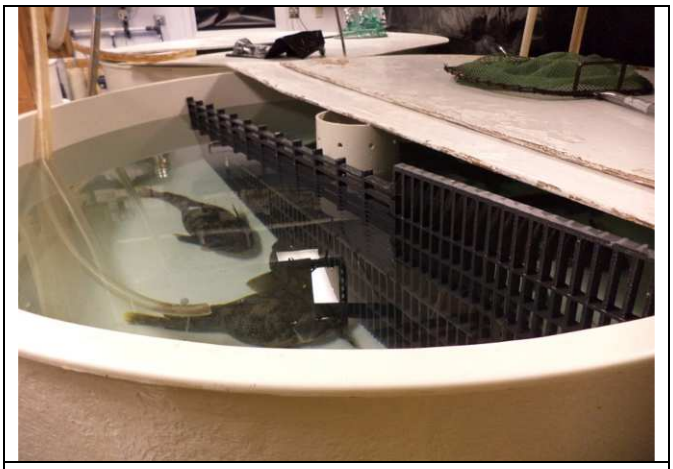

Figure 3. The watch tank.

Figure 4. Embryo culture tanks. Left, the vertical and the cylindrical tanks. Right, the home-made (well, Palmer Station made) upwelling tank.

We installed two types of incubators brought to Palmer specially for our project. One type is a vertical incubator containing eight trays. This style is for species like icefish that cement their eggs to the substratum, at the left of the photograph (Fig. 4).

The other type includes six small individual cylindrical incubators, shown at the right side of the photograph (Fig. 4). This style is appropriate for pelagic embryos like rockcod.

In addition, we placed into servicer two plexiglass incubators equipped with upwelling pumps for rockcod embryos, and two to three more are to be assembled. We do not yet know which type is better for these pelagic embryos.

We collected samples for RAD-sex (a novel next-generation DNA-sequencing protocol we have developed to identify the sex determining genetic locus for any species), GSI (gonadal somatic index, a measure of sexual maturity), and histology (to follow bone development) from all present species after the animals die and are no longer useful for making babies. So far this season (including previous months) we have sampled: C. ace = 204, C. gun = 94, C. ras = 18, G. gib = 117, N. cori = 40, N. ros = 8, P. cha = 2, P. geo = 17.
On the morning of June 2, both fish teams (B-029 and the K. O'Brien team) awoke to several aquaria of dead fish. These were outdoor aquaria, and the night was -9C, with a bit of a wind. Both teams lost many important fish. Potential causes include: 1) water chilled too fast for the animals to acclimate; 2) the oxygen level in the aquaria dropped too low; 3) animal wastes (ammonia is the most frequent) built to unacceptable levels; or 4) a poison of some sort was introduced accidentally into these individual tanks. Any of the first three potential causes could result from inadequate water flow. The fourth might or might not have been eliminated by greater flow rate. In any event, this is a call for steps to be taken to divorce the water flow in the aquaria from the water flow to the rest of the station. We need to take concrete steps to move in that direction if research on Antarctic fish is to be successful at Palmer Station.

Thanks are due again to the great support staff at Palmer Station. Particular shout-outs to John Charczuk, who helped fabricate and install the rotary upwelling embryo culture vessel, to Darren Yates who took care of plumbing, and to Janice O'Reilly for helping us get the materials we needed for incubators and in general facilitating in some tough situations for the fish.

B-036-P: REDOX BALANCE IN ANTARCTIC NOTOTHENIOID FISHES: DO ICE FISHES HAVE AN ADVANTAGE?

Kristin O'Brien, Principal Investigator, University of Alaska Fairbanks

Personnel on station: Kristin O'Brien, Elizabeth Crockett, Theresa Grove, Johanne Lewis, Corey Oldham and Amanda Reynolds.

We continue our studies aimed at determining if there is physiological or biochemical advantage to being an icefish. We hypothesize that the presence of the iron-containing proteins hemoglobin and myoglobin increases levels of oxidatively-damaged proteins, warranting greater rates of protein turnover and higher rates of protein synthesis in red-blooded notothenioids compared to icefishes. This season, O'Brien and Amanda Reynolds have measured rates of protein synthesis in hearts, pectoral adductor muscle and liver tissue of the icefishes *Chaenocephalus aceratus* and *Pseudochaenichthys georgianus* and have begun measurements in these same tissues of the red-blooded species *Gobionotothen gibberifrons* and *Notothenia coriiceps*. Dr. Johanne Lewis assisted with these experiments in April but departed Palmer Station on May 2, headed home to Georgia Southern University to fulfill teaching obligations. Dr. Theresa Grove is measuring the energetic costs of protein synthesis in hepatocytes and cardiac myocytes of red-and white-blooded notothenioids. She has successfully measured rates of oxygen consumption associated with protein synthesis in hepatocytes and cardiac myocytes of the icefish *C. acertatus* and has

begun measurements in *N. coriiceps*. Corey Oldham is determining maximal oxidative capacities of aerobic tissues from both red-blooded and white-blooded notothenioids.

We have also begun treating the red-blooded notothenioid *N. coriiceps* with the iron-binding drug, desferioxamine (DFO). Preliminary studies by Crockett and O'Brien have shown that treatment with DFO reduces heme and hemoglobin levels in blood of *N. coriiceps* and decreases levels of non-heme iron in liver and spleen. We will transport tissues home for further analyses and to determine if reducing iron decreases oxidative stress.

Field team members Crockett, O'Brien and Reynolds participated in a successful fishing trip on the *R/V Laurence M. Gould* from May 16-18 off of the south shore of Low Island. We obtained a large number of most all of our target species except the icefish *Chionodraco rastrospinosus*. Crockett, O'Brien and Oldham participated in a second fishing trip to Andvord Bay May 19-20 in search of the icefish *C. rastrospinosus*. Unfortunately, the blake trawl was lost on the first trawl of the evening. Careful surveying of Andvord Bay and the Gerlache Strait failed to identify any suitable areas for trawling.

PALMER STATION
RESEARCH ASSOCIATE MONTHLY REPORT
June 2013
Graham Tilbury

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 site has operated normally since the latest grantee visit.

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 has operated normally since micro switch repair.

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 for 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 TerraLab and the VLF Building.

Air samples were collected as scheduled throughout the month.

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 during the month.

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.

Absolute Calibrations were completed as scheduled.
The system operated normally throughout the month.

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 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.

The Bonaparte Point automated weather station was run in test mode for several days, prior to being installed on Bonaparte Point.

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 performed normally during the month.

A-336-P: ELF/VLF OBSERVATION OF LIGHTNING DISCHARGE, WHISTLER-MODE WAVES AND ELECTRON PRECIPITATION AT PALMER STATION.
John Gill, 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 and magnetosphere. The Research Associate operates and maintains on-site equipment for the project.

The VLF system performed 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.

Satellite passes were captured 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 operated normally throughout the 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.

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 system operated normally during the month.

TIDE GAGE
Tide height and seawater temperature are monitored on a continual basis by a gauge mounted at the Palmer Station pier. The Research Associate operates and maintains on-site equipment for the project.

The tide gage system is to be replaced. It failed shortly after the start of the month. Attempts to diagnose the problem have so far been unsuccessful, due in part to the inaccessibility of the temperature and pressure sensors and data logger section, mounted on the pier. A small platform has still to be constructed to allow safe access to this part of the system.

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 NOAA for entry into the Global Telecommunications System (GTS).

The system operated normally during the month.