

**PALMER STATION MONTHLY SCIENCE REPORT**  
**May 2018**



The Wauwermans as seen from the RHIB Hadar. *Images Credit: Andrew Shilling*

## NEWS FROM THE LAB

Jason Johns, Winter Laboratory Supervisor

Shorter days and high winds did not slow science support and operations at Palmer Station this month. In the beginning of the month, the Countway group B-028-P wrapped up their season by handing off their samples, which were loaded onto the ARSV *Laurence M. Gould* for transit on LMG 18-04 NB. After a short visit back to Chile the *Gould* was back for the fifth time this year with four more eager members of the Detrich team B-037-P, a PolarTREC teacher to work with the Amsler/Baker/McClintok diving team B-022-P, and a representative from the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) for project T-998-P.

There have been many successful fishing trips for the Detrich team B-037-P from the *Gould* on both LMG 18-04 and LMG 18-05, and many rare species of fish have been caught from different styles of traps deployed both from the *Gould*, and from the Solas and Zodiac boats. These fish were successfully transferred to the tanks on station with help from volunteers, lab operations personnel, and heavy equipment operators. Some have been spawning in record numbers for Palmer Station yielding eggs of exceptional quality which will be incubated over the winter by members of the Detrich team B-037-P. The Divers (Amsler/Baker/McClintok B-022-P) were able to dive in some locations that have never seen divers before thanks to the R/V *Hadar*, which was a very useful vessel for them again this month, but was later pulled from the water for the winter.

We had a couple of fierce storms this month but also some great weather days which allowed for plenty of opportunities for grantees to make sample collections. There have also been some long sunrises and sunsets. The snow has started to fill in gullies and troughs but the glaciers and high points remain bare or sheer ice necessitating very careful negotiation. It has been mostly cloudy but that rare glimpse of the moon or sun can really be spectacular.

## Palmer Monthly Met summary for May, 2018

<b>Temperature</b>
<b>Average:</b> -2.8 °C / 27 °F
<b>Maximum:</b> 5.3 °C / 41.54 °F on 20 May 07:46
<b>Minimum:</b> -9.1 °C / 15.62 °F on 26 May 09:54
<b>Air Pressure</b>
<b>Average:</b> 985.4 mb

<b>Maximum:</b> 1010.3 mb on 17 May 22:02
<b>Minimum:</b> 960.1 mb on 29 May 04:13
<b>Wind</b>
<b>Average:</b> 12.9 knots / 14.9 mph
<b>Peak (5 Sec Gust):</b> 67 knots / 77 mph on 28 May 09:03 from NNE (25 deg)
<b>Prevailing Direction for Month:</b> SW
<b>Surface</b>
<b>Total Rainfall:</b> 32.3 mm / 1.27 in
<b>Total Snowfall:</b> 21 cm / 8.2 in
<b>Greatest Depth at Snow Stake:</b> 22.6 cm / 8.8 in
<b>WMO Sea Ice Observation:</b> 1-5 icebergs with growlers and bergy bits
<b>Average Sea Surface Temperature:</b> -.98 °C / 30.2 °F

Winds peaked at 77 mph on the 28<sup>th</sup> and the average speed for the month was 14.9mph. The prevailing wind direction for the month was from the north north east. Temperatures peaked at 41.5° F and reached a low of 15.6° F. Several systems passed through bringing 21 inches of snow. There has been some grease and pancake ice and several large icebergs in the area.

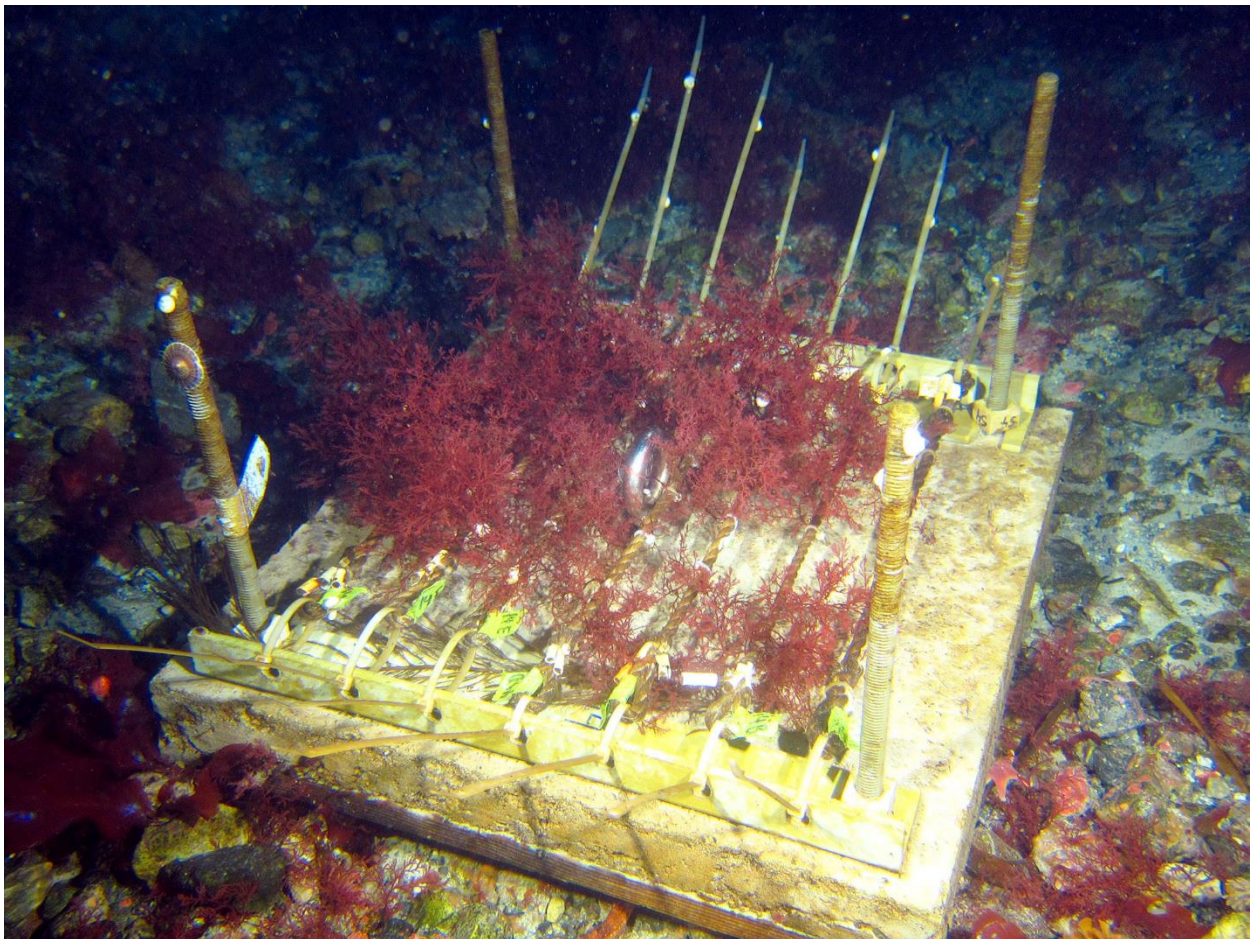
#### **B-022-P: THE CHEMICAL ECOLOGY OF SHALLOW-WATER MARINE MACROALGAE AND INVERTEBRATES ON THE ANTARCTIC PENINSULA**

Charles Amsler and James McClintock, Principal Investigators, University of Alabama at Birmingham,  
 Bill Baker, Principal Investigator, University of South Florida

Personnel on station: Charles Amsler, Margaret Amsler, CJ Brothers, Michelle Curtis, Sabrina Heiser, Andrew Shilling, Keith Smith.

Personnel movements this month: Keith Smith, an educator joining us as part of the PolarTREC Program, arrived with LMG18-05 on 23 May.

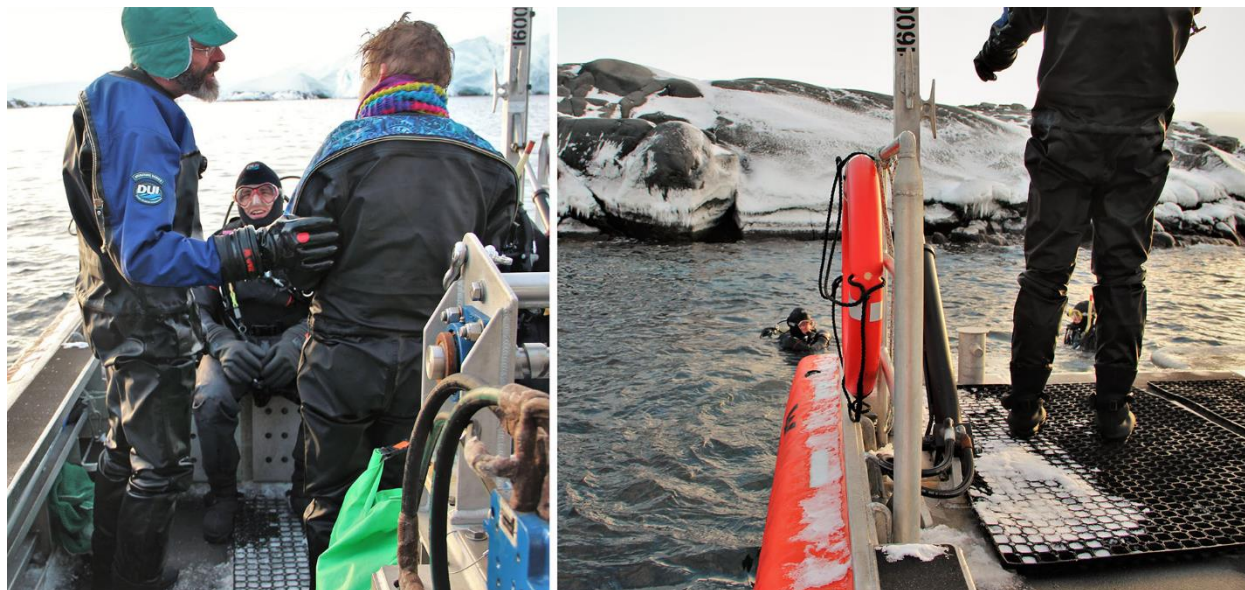
May was a successful month in the field although shortening days and deteriorating weather limited us to 28 dives. A major accomplishment was the recovery between 14 and 22 May of 14 racks of macroalgae from the transplant experiment we established in May 2017. We finished moving the concrete substrates the algae had been attached to into shallow water on 26 May, the last day of the month when conditions allowed boating. We await a June day with relatively low winds so that the substrates can be returned to the surface with the aid of the davit on the R/V *Tin Can*.



A concrete substrate with a rack of ropes containing transplanted individuals of the red alga *Plocamium cartilagineum* immediately prior to the racks being retrieved from 23 m depth at Norsel Point on 22 May. Photo by Sabrina Heiser.

Another field success was being able to make three dives collecting our main focus organism, *Plocamium cartilagineum*, on 17 May in the Wauwermans Islands with support of the R/V *Hadar*.

Combined with dives we made in April from *Hadar* in the Casey and Joubin Islands areas, this vastly expanded the geographic component of our studies of *P. cartilagineum* defensive chemical variation. We also made four dives throughout the month sampling *P. cartilagineum* along transects within the normal boating limits. On 25 May we made the last dive to complete a survey of the densities of gastropods (snails and limpets) on select, ecologically important macroalgal species that has been ongoing since our 2017 field season.



B-022 members diving from the R/V *Hadar* in the Wauwermans Islands. Photos by Lance Roth.

On 16 May we ended a mesocosm experiment examining the impact of gastropods on the very large and ecologically dominant brown alga *Himantothallus grandifolius*. The mesocosms consisted of 10 large aquaria plumbed on the deck outside the aquarium and the experiment was initiated on 24 March. Initial observations support our hypothesis that the gastropods benefit *H. grandifolius* by helping to keep them relatively free of microalgal biofouling.

The station gas chromatograph was once again in constant use throughout the month enabling us to determine which of 14 or more chemical groups (chemogroups) *P. cartilagineum* individuals belong to. With that knowledge, we have been continuing feeding experiments assessing the relative palatability of the different *P. cartilagineum* chemogroups. Near the end of the month we began to finish season-long experiments established in March looking at the growth of *P. fissicauda* on the different chemogroups as well as the impact of the different chemogroups on the fecundity and embryonic development of *P. fissicauda*. Significant lab time was also spent processing the algae from our transplant experiment and gastropod survey for subsequent analyses at our home institutions.

We finished a very successful season of post blogs on our [UAB in Antarctica web site](#) on 24 May. The last post recaps our efforts throughout the season and links to new team member [Keith Smith's](#)

[PolarTREC outreach site](#) with encouragement for our readers to continue to follow the project at Keith's site. Keith posts new blogs there most days. Keith conducted a live PolarConnect outreach event on 29 May (archived [here](#)) which set an all-time record for PolarTREC Polar Connect Events in terms of the 161 computers logged in to participate (mostly in classrooms with many students watching each).

We are grateful for the generous and professional assistance of numerous ASC staff in assisting with our activities. Jason Johns, Hannah James, Mike Burns, Andrew Purves, and Joe Left deserve special thanks for facilitating our laboratory and field efforts.

### **B-037 ANTARCTIC NOTOTHENIOID FISHES: SENTINEL TAXA FOR SOUTHERN OCEAN WARMING**

H. William Detrich, Principal Investigator

Marine Science Center, Dept. of Marine and Environmental Sciences, Northeastern University

Personnel on Station May 1-9: Thomas Desvignes, Juliette Auvinet, Frank Hegyi, and Henrik Lauridsen

Personnel on Station May 10-22: Thomas Desvignes, Juliette Auvinet, and Henrik Lauridsen

Personnel on Station since May 23: Thomas Desvignes, Juliette Auvinet, Nathalie Le Francois, Jacob Grondin, Henrik Lauridsen, Maggie Streeter, and John Postlethwait

Antarctic notothenioid fishes have evolved a remarkable suite of characters, including the acquisition of macromolecular antifreezes by most species and the loss of red blood cells and hemoglobin by the "white-blooded" icefish family, as the Southern Ocean (SO) cooled to the freezing point of seawater ( $-1.9^{\circ}\text{C}$ ) over the past 25-40 million years. Today, these cold-adapted stenotherms are threatened by rapid warming of the SO, the temperature of which is likely to increase by  $2-4^{\circ}\text{C}$  over the next two centuries. The major goal of the B-037 research program is to assess the molecular and organismal consequences of this warming by analyzing the effects of elevated temperature regimes on gene expression in developing embryos of red- and white-blooded Antarctic notothenioids (notothens and icefishes, respectively). In addition, B-037 is exploring the genomic basis for the loss of red blood cells and hemoglobin by Antarctic icefishes and the compensatory adaptations that have ameliorated these losses.

A lot of progress has been made during the month of May for the B-037-L/P.

First, on Friday May 4<sup>th</sup>, the *LMG* departed Palmer Station to conduct a three-day fishing operation with team members Thomas Desvignes, Juliette Auvinet, and Frank Hegyi onboard. In addition

to the B-037-L/P team members, Jack Norray, ASC Safety Consultant, joined in order to observe the pot fishing operations, and Palmer Station's Resident Artist Karen Romano-Young (W-218-P) came to add a fishing experience to her "Antarctic Logs". The fishing destinations were "North Dallmann Bay", at the North-West corner of ASPA 153 (Eastern Dallmann Bay) and "Hugo Deep" at the north east of Hugo Island. At both places, catches were very good and represented a scientifically interesting diversity of species that included the main targeted species Bullhead notothen *Notothenia coriiceps* (Fig. 1A) and Blackfin icefish *Chaenocephalus aceratus* (Fig. 1B). In addition, specimens of many other Antarctic Notothenioid species were captured, including several species of Trematomus, the Humped notothen *Gobionotothen gibberifrons*, three species of dragonfish (Charcot's dragonfish *Parachaenichthys charcoti*, *Akarotaxis nudiceps*, and the Naked dragonfish *Gymnodraco acuticeps*), and an additional species of icefish (the ocellated icefish *Chionodraco rastrospinosus*).

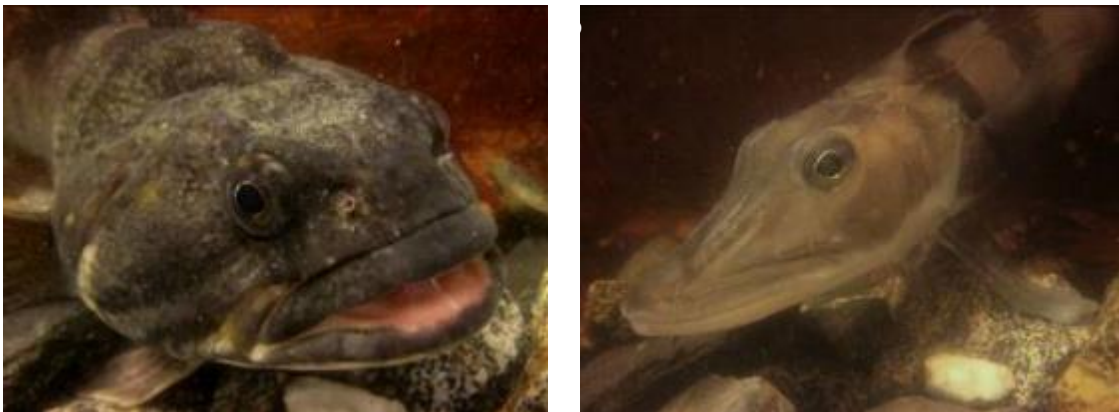


Figure 1: A) Bullhead Notothen *Notothenia coriiceps*, B) Blackfin icefish *Chaenocephalus aceratus*.

On May 9<sup>th</sup>, the LMG departed north to Cape Shireff in order to pull-out the camp of the Costa group (B-232-L), and then continued to Punta Arenas to conclude the cruise LMG18-04, bringing with her B-037-L/P member and cameraman Frank Hegyi. At Palmer Station, Hegyi generated one of the Broader Impacts of our research program by producing videos to document the life and work of polar scientists. These videos are targeted to middle schoolers, a critical demographic for recruitment to STEM fields, including polar research. Hegyi, a cinematographer from Boston, has been recording and is producing a series of four science documentaries (~15 min each) to showcase our research program to this audience. Topics include: 1) the history of Antarctic Exploration, 2) life at Palmer Station and some "fun polar facts," 3) evolution, DNA, and the surprising emergence of the hemoglobinless white-blooded icefishes, and 4) climate change and the risk of mass extinctions of Antarctic fauna as the SO warms. Since his deployment on LMG18-03, Hegyi accumulated many hours of footage and made substantial progress in the production of the short documentaries, including editing and animating.

In between the two cruises, team members Desvignes, Lauridsen and Auvinet continued sampling a multitude of tissues to support current and future research, finalized the installation of embryo incubators in the Environmental Room, and performed a wide array of experiments on many specimens

that were not reproductively active. One of the compensatory adaptations of Antarctic icefishes is an extensive ramification of blood vessels to facilitate the delivery of oxygen in the absence of red blood cells. Lauridsen is applying ultrasound and vascular cast technologies to explore the evolution of icefish retinal vasculature (Figure 2A-B). This work includes microCT (computed X-ray tomography) to be performed at his home institution in Denmark on samples collected and prepared at Palmer Station. We are also studying the chromosomal rearrangements that may have driven, in part, speciation during the notothenioid radiation. Auvinet is preparing mitotic chromosome spreads from multiple species for use in mapping these rearrangements (Figure 2C-D).

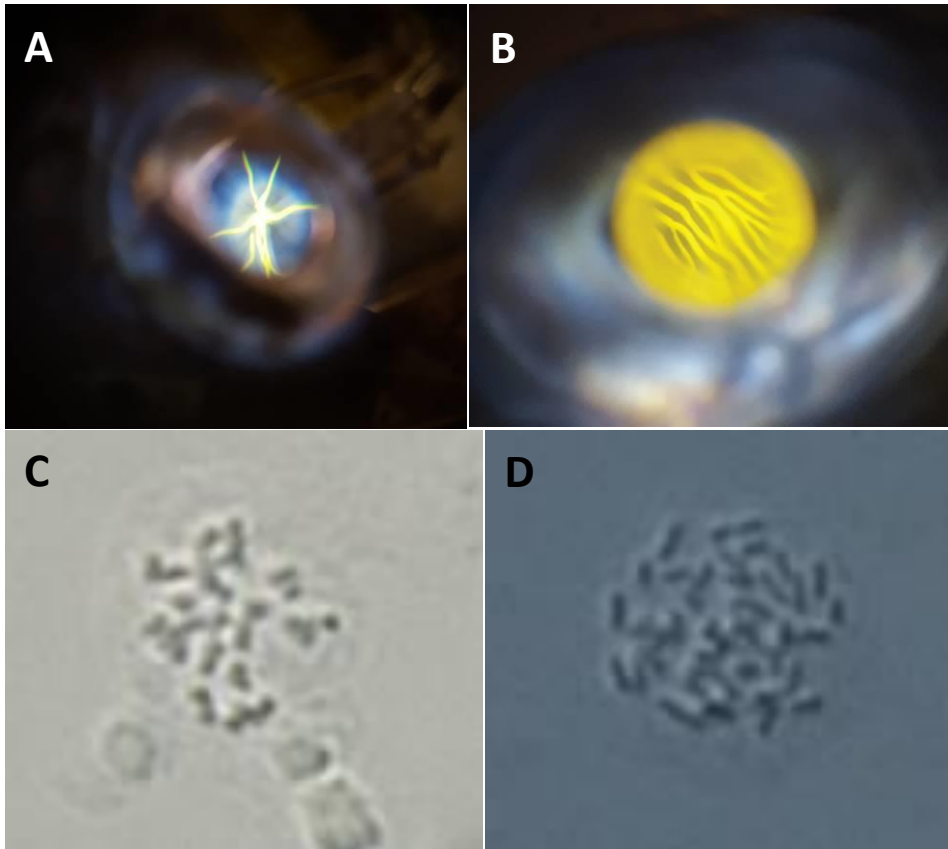


Figure 2: Some experimental results from this month. A) Few capillaries (yellow) were observed on the retina of the red-blooded Humped notothen *Gobionotothen gibberifrons*. B) Many more capillaries can be observed on the retina of the white-blooded Blackfin icefish *Chaenocephalus aceratus*. C) Chromosome preparation of the Bullhead Notothen *Notothenia coriiceps* showing a reduced number of chromosomes (11 pairs). D) Chromosome preparation of Jonah's icefish *Neopagetopsis ionah* showing the typical number of chromosomes (24 pairs).

In the morning of May 23<sup>rd</sup>, the LMG arrived at Palmer with four new B-037-L/P members (John Postlethwait coming for LMG18-05, and Nathalie Le Francois, Jacob Grondin, and Maggie Streeter coming for the winter season). The initial plan was to depart Station the following morning to conduct the first fishing trip of the LMG18-05 cruise. However, a medical evacuation situation at the Ukrainian



Research Station Akademik Vernadsky, to which the *LMG* had to respond, pushed back by 4 days departure for fishing of team members Desvignes, Postlethwait, and Lauridsen.

Meanwhile, males and females of *N. coriiceps* and *C. aceratus* were kept under observation for reproductive maturity. Unfortunately, icefish specimens were non-reproductive and many of them died within the two weeks post-capture before the *LMG* arrived. However, the bullhead notothenes were strong and in a fully reproductive state. In the night of May 21<sup>st</sup>, our first spontaneous reproductive event took place and the next morning about 10,000 embryos were collected (Figure 3).



Figure 3: A) The environmental room setup with conical embryo incubators (left) and tray incubators (right). B) Discovery of a Bullhead Notothen *Notothenia coriiceps* reproductive event in a tank in the aquarium room, with surfactants from milt forming bubbles due to the tank's aerators. C) Thousands of Bullhead Notothen *Notothenia coriiceps* embryos floating at the water's surface in a conical incubator.

For the first fishing trip of LMG18-05, the priority was to capture reproductively active Blackfin icefish *Chaenocephalus aceratus*, a key component of the research. At Low Island, where we usually catch such specimens, fishing operations on May 28 yielded 25 Blackfin icefish, several Bullhead

notothen *Notothenia coriiceps*, Humped notothen *Gobionotothen gibberifrons*, four South Georgia Icefish *Pseudochaenichthys georgianus*, and one specimen of the rare Jonah's icefish *Neopagetopsis ionah*. That catch was good and offered a great diversity of species, unfortunately, however, for our project, we didn't manage to capture any large reproductive adults of the Blackfin icefish. We know from previous years that the reproduction of the Blackfin icefish occurs at the end of May. We suspect that the already late schedule of LMG18-05 coupled with the four-day delay in fishing due to the medical evacuation event impaired our attempts to obtain gravid icefish to achieve this aim in our grant. In the night of May 29<sup>th</sup>, we performed two trawls in the middle part of Andvord Bay, and each trawl yielded record numbers of fish, with five different species of icefish! In total, approximately 60 spiny icefish *Chaenodraco wilsoni*, 45 ocellated icefish *Chionodraco rastrospinosus*, 8 long-finned icefish *Cryodraco antarcticus*, 7 tall-fin icefish *Pagetopsis macropterus*, and two small Jonah's icefish *Neopagetopsis ionah*, in addition to 24 Striped Notothen *Trematomus hansonii* and about 200 Scott's Notothen *Trematomus scotti*. Among the Scott's Notothens, about forty of them possessed pink epithelial papilloma-like growths covering up to 20% of the body (Figure 4). Tumors such as this have rarely been seen in fish in nature. Whether the tumors are viral-induced will be further investigated using samples we generated. Given these astonishing numbers of fish captured, we stopped fishing around 22:00 and headed back to station with all six aquarium tanks full of fish providing plenty of work for the next couple weeks on station!



Figure 4. *Trematomus scotti* with papilloma-like tumor on face and head.

Team members who remained on station continued tending the reproduction of bullhead Notothen *Notothenia coriiceps*, which continued reproducing at a strong pace: each night, for four nights in a row, two spontaneous breeding events occurred, bringing up the total number of embryo clutches to 9, providing between 150,000 and 200,000 embryos growing in our incubators! And this number is likely to continue increasing as many mature females haven't spawned yet! Even though we didn't succeed in obtaining icefish embryos this season, we have plenty of material for the winter crew. In addition, this large number of embryos enables us to diversify our experimental conditions and test a variety of temperature regimes to understand the impact of different global ocean warming scenarios on the development of these embryos. Control embryos from each species will be incubated at  $-1^{\circ}\text{C}$ , whereas experimental embryos will be raised at  $+4^{\circ}\text{C}$ . Embryos will be sampled at regular intervals during the 6-7 months required to reach the hatching stage. Control and experimental embryos will be analyzed for

potential perturbation of skeletal morphology and gene expression by high-throughput RNA sequencing (RNAseq) at our home institutions.

We thank the ship and station personnel for their exceptional help in making the month of May a great success.

## **PALMER STATION**

### **RESEARCH ASSOCIATE MONTHLY REPORT**

**May 2018**

W. Lance Roth

#### **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 throughout the month.

#### **A-111-P: THE NEXT GENERATION OF GEOSPACE RESEARCH FACILITIES AT PALMER STATION**

Andrew Gerrard, Principal Investigator, New Jersey Institute of Technology

The ionosphere-thermosphere-magnetosphere (ITM) region of Earth's atmosphere, which is part of the larger geospace environment, is the portal through which the solar wind can enter and impact our planetary system. Though space weather research over the past decades has greatly increased our understanding of a wide variety of phenomena associated with ITM physics, the sum of these individual processes occurring in the geospace environment does not replicate the rich diversity and scope of this complex region. Thus, a more holistic approach to ITM research is necessary, one that integrates clustered instrumentation at multiple locations to simultaneously look at the interactions within the entire system. Using coordinated and collaborative instrumentation currently installed in Antarctica, researchers will study interrelated ITM phenomena observed at high latitudes. The goal of this research effort is a better understanding of the energy transfer and modulation of the geospace system.

The system operated normally throughout the month.

**A-119-P: CONTINENTAL-SCALE STUDIES OF MESOSPHERIC DYNAMICS USING THE ANTARCTIC GRAVITY WAVE INSTRUMENT NETWORK (ANGWIN)**

Michael Taylor, Principal Investigator, Utah State University

The Antarctic Gravity Wave Imaging Network (ANGWIN) is a cooperative effort of six international Antarctic programs to collect continent-wide gravity wave measurements. This network capitalizes on existing optical and radar measurement capabilities at McMurdo, Palmer, South Pole, and six other research stations: Halley (UK), Syowa (Japan), Davis (Australia), Rothera (UK), and Ferraz (Brazil). Infrared (IR) all-sky mesospheric OH (hydroxyl) imagers are installed at Davis, McMurdo, and Halley stations. The network quantifies the properties, variability, and momentum fluxes of short-period (less than one hour) mesospheric gravity waves and their dominant sources and effects over the Antarctic continent. An all-sky near-IR imager is also installed at Palmer Station to augment the existing instrumentation and create a capability for studying gravity wave properties at each site.

The system operated normally throughout the month.

**A-373-P: TROPOSPHERE-IONOSPHERE COUPLING VIA ATMOSPHERIC GRAVITY WAVES**

Vadym Paznukhov, Principal Investigator, Boston College

The goal of this project is to enhance the comprehensive research understanding of troposphere-ionosphere coupling via Atmospheric Gravity Waves (AGWs) in the Antarctic region. Both experimental and modeling efforts will be used on the Antarctic Peninsula to investigate the efficiency and main characteristics of such coupling and will address several questions remaining in the current understanding of this coupling process.

The system operated well throughout the month.

**O-264-P: A STUDY OF ATMOSPHERIC OXYGEN VARIABILITY IN RELATION TO ANNUAL 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<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 taken twice this month.

#### **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 (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.

CCGG samples were taken once a week in favorable winds and HATS Air samples were taken every other week. A new HATS sampler pump was used for both samples this 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.

The system operated normally throughout the month. Bi-weekly calibrations were completed as necessary.

**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 has operated normally throughout 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.

Several times this month the system had to be power cycled.

**T-998-P: INTERNATIONAL MONITORING STATION (IMS) FOR THE COMPREHENSIVE NUCLEAR TEST BAN TREATY ORGANIZATION. (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 has operated normally throughout the month. It is currently being maintained by a visiting technician.

## **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.

Observations of sea ice around station were made daily and the tidegauge worked well throughout the month.

## **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 once per 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 and emailed to the National Weather Service for entry into the Global Telecommunications System.

The local weather station (PAWS) is working well. Both remote AWS systems are no longer operational due to the lack of sunlight. Observations are archived on the AMRC website:

<ftp://amrc.ssec.wisc.edu/pub/palmer/>