National Coral Reef Monitoring Program
Dry Tortugas National Park: Climate Monitoring Brief 2021

Atlantic Oceanographic & Meteorological Laboratory Coral Program,
University of Miami Cooperative Institute of Marine and Atmospheric Science,
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New Subsurface Temperature Recorder deployed at White Shoal in Dry Tortugas National Park. Picture Credit: Kevin Davidson.

About this summary brief

NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML) conducts part of the long-term National Coral Reef Monitoring Program (NCRMP) Climate Monitoring to track the status and trends of coral reef ecosystems of the U.S. Atlantic and Caribbean jurisdictions. This FY21 summary brief provides an overview of the most recent survey efforts in Dry Tortugas National Park in Florida.

Expedition summary

- The most recent NCRMP Atlantic and Caribbean Climate Monitoring trip took place at Dry Tortugas National Park from June 24th to June 29th, 2021.
- Four different sites were visited by five team members completing a total of 63 dives.
- These monitoring sites are fixed so we can track changes in sea water temperature and chemistry over time to see how they may be affecting coral reef status.

Data collection

- Subsurface **temperature** recorders were recovered and redeployed at four study sites (Fig. 1), accounting for 1.1 million observations over three years:
  - Pulaski Shoal (1m): 311,609 obs.
  - White Shoal (5m): 311,213 obs.
  - Bird Key Reef (15m): 311,560 obs.
  - Black Coral Rock (25m): 165,695 obs.
- At Bird Key Reef, instruments were deployed for 72 hr to monitor daily fluctuations in:
  - **Current**: 880 obs.
  - **pH**: 879 obs.
  - **Light**: 876 obs.
  - **Carbonate chemistry**: 24 samples collected
- Changes in benthic cover and carbonate production were monitored at Bird Key Reef by recording:
  - **Bioerosion**: five Bioerosion Monitoring Units (BMUs) collected after three years at the site & 10 redeployed
  - **Calcification**: five Calcification Accretion Units (CAUs) collected after three years at the site & five redeployed
  - **Benthic cover**: six landscape photomosaics
  - **Carbonate budget surveys**: Benthic cover, sponge, urchin, and parrotfish surveys completed at six transects

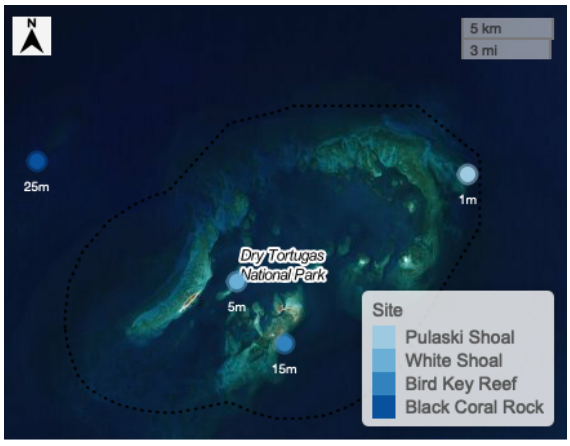

Figure 1: Study sites and depths in Dry Tortugas National Park.

Temperature

Three years of temperature measurements were retrieved and processed from all four sites (Fig. 1). Temperature was measured at 5-minute intervals for three years using SeaBird Electronics Subsurface Temperature Recorders (STRs).

Temperatures were similar among the 1m, 5m, and 15m depths, with the lowest temperatures recorded during February 2021 (20.8, 20.7, and 19.9 °C, respectively) and the highest temperatures during the summers of 2019 and 2020 (31.7, 31.6, and 31.5 °C, respectively). Though the 25m STR stopped recording on February 7, 2020, it detected consistent temperature variation at this site during the summers. Temperatures at 25m were on average 5-6°C lower during summer 2018, and 1°C lower during summer 2019, compared with the values at other depths (Fig. 2).

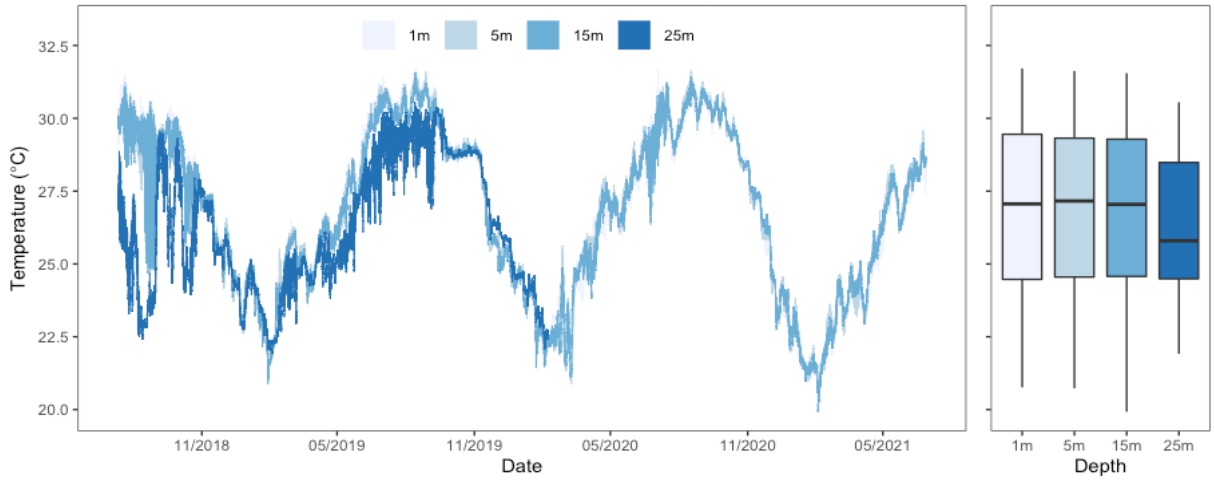

Figure 2: Temperature profiles at four sites of differing depths within Dry Tortugas National Park: Pulaski Shoal Lighthouse (1 m) White Shoal (5m), Bird Key Reef (15m), and Black Coral Rock (25m). Data were collected from November 2018 to June 2021, with the exception of the 25m STR that recorded until February 7th, 2020.

Diurnal Suite Deployment

At Bird Key Reef, additional instruments were deployed to measure diurnal variation in pH and temperature (SeaBird SeaFET), light (SeaBird EcoPAR), and current speed (Lowell tiltmeter) over a 72-hr period (Fig. 3).

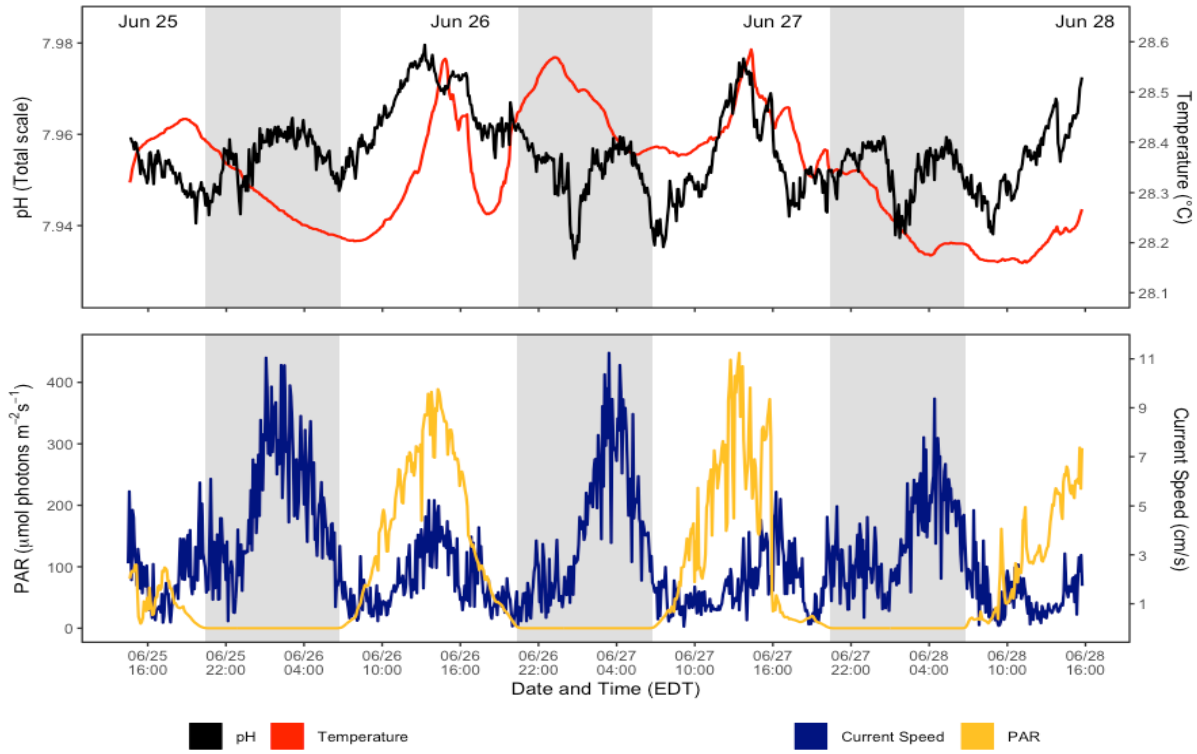

Figure 3: Bird Key Reef (15m) diurnal suite monitoring from June 25th to 28th. Top panel: pH and temperature from SeaFET. Bottom panel: Photosynthetically Available Radiation (PAR) and current speed from EcoPAR and Tiltmeter. Grey blocks denote nighttime throughout the sequence of the plot. Instruments measured parameters every 5 minutes over 72 hours.

As part of the diurnal suite, discrete water samples were collected at three-hour intervals (n=24) using Subsurface Automatic Samplers (SAS). These samples will be analyzed for total alkalinity, dissolved inorganic carbon, and spectrophotometric pH. Using these metrics, we can calculate the partial pressure of CO_2 and the aragonite saturation state. For more information on SAS visit http://www.coral.noaa.gov/sas

Deployed SAS for collecting water samples every three hr. Picture Credit: Kevin Davidson.

Other Deliverables

Calcification Accretion Units (CAUs) and **Bioerosion Monitoring Units (BMUs)** were collected and redeployed for the next sampling cycle.

A CAU (the two, parallel plates) and a BMU (not readily visible, though located at base of stake) before retrieval. These instruments were left in the field for three years to estimate accretion and bioerosion, respectively. Picture Credit: Kevin Davidson.

CAUs are processed by the Pacific NCRMP Climate group, and the data will be available within a year. BMUs will be dried and cleaned using a hydrogen peroxide solution.

These samples will be weighed and scanned using a CT scanner and then compared to their pre-scan sizes to quantify bioerosion. Data will be available in a year. Please see previous datasets for more information.

Landscape photomosaics (n=6) and **carbonate budget** surveys (n=6) were completed to monitor changes in benthic cover and carbonate production.

Scientist N. Formel collects images using a GoPro rig to create landscape photomosaics. Picture Credit: Kevin Davidson.

About the monitoring program

AOML's Atlantic and Caribbean Climate Monitoring efforts are a key part of NCRMP which NOAA's Coral Reef Conservation Program (CRCP) created to provide integrated, consistent, and comparable data across U.S.-managed coral reef ecosystems. CRCP monitoring efforts aim to:

- Document the status of coral reef species of ecological and economic importance.
- Track and assess changes in reef communities in response to environmental stressors and/or human activities.
- Evaluate the effectiveness of specific management strategies and identify actions for adaptive responses.

Point of Contact

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For more information

Coral Reef Conservation Program: http://coralreef.noaa.gov
NCRMP climate monitoring: https://www.coris.noaa.gov/monitoring/climate.html
NOAA Atlantic Oceanographic and Meteorological Laboratory: http://www.aoml.noaa.gov/
Florida Coral Reef Status Report 2020
National Coral Reef Status Report 2020

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NOAA CORAL REEF CONSERVATION PROGRAM

NOAA OCEAN ACIDIFICATION PROGRAM

Our Team

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