

*Please provide the following information, and submit to the NOAA DM Plan Repository.*

### **Reference to Master DM Plan (if applicable)**

*As stated in Section IV, Requirement 1.3, DM Plans may be hierarchical. If this DM Plan inherits provisions from a higher-level DM Plan already submitted to the Repository, then this more-specific Plan only needs to provide information that differs from what was provided in the Master DM Plan.*

URL of higher-level DM Plan (if any) as submitted to DM Plan Repository:

## **1. General Description of Data to be Managed**

### **1.1. Name of the Data, data collection Project, or data-producing Program:**

National Coral Reef Monitoring Program: Diel seawater carbonate chemistry observations from a suite of instrumentation deployed at coral reef sites across the Hawaiian Archipelago since 2016

### **1.2. Summary description of the data:**

The ocean acidification diel suite is an autonomous instrument package that measures diel variability in coral reef seawater carbonate chemistry. Diel suite surveys are conducted by the NOAA Pacific Islands Fisheries Science Center (PIFSC), Ecosystem Sciences Division (ESD) within coral reef ecosystems across the Pacific Islands Region as part of the NOAA National Coral Reef Monitoring Program (NCRMP). The data provided in this record are from diel suites deployed across the Hawaiian Archipelago since 2016 during ESD-led NCRMP missions. Specifically, at select sites at Kure Atoll and Lisianski Island between September 14th - 26th, 2016 as well as Lanai and the Main Hawaiian Islands between July 10th - July 30th, 2019.

Diel suites were deployed on the reef for at least 24 hours to measure in-situ salinity, temperature, pressure, pH, and current direction and magnitude. Seawater samples were also collected for laboratory analyses of dissolved inorganic carbon (DIC) and total alkalinity (TA). Components of the carbonate system--including pH, pCO<sub>2</sub> (partial pressure of carbon dioxide), and aragonite saturation state--are calculated from DIC, TA, temperature, salinity and pressure. Each diel suite consisted of: 1 SBE-19plus CTD sensor, 1 Nortek Acoustic Doppler Current Profiler (ADCP), 1 Satlantic SeaFET Ocean pH sensor, and up to 9 Programmable Underwater Collectors (PUCs), each of which collected 1 water sample at 4-hour intervals; however, only data from the CTD and water samples were recovered from the diel surveys at Kure and Lisianski in 2016. Starting 2018, 1 SBE-43 oxygen sensor was tethered to the CTD sensor for diel surveys. Stand-alone dissolved oxygen (DO) and photosynthetically active radiation (PAR) loggers were included with the diel suite deployments starting HARAMP 2019. Instruments deployed, samples collected, and sample intervals are recorded in the summary file enclosed with the data package, and exceptions to the standard diel suite are also noted.

### **1.3. Is this a one-time data collection, or an ongoing series of measurements?**

One-time data collection

**1.4. Actual or planned temporal coverage of the data:**

2016-09-20 to 2016-09-21, 2016-09-14 to 2016-09-15, 2019-07-10 to 2019-07-30, 2019-07-11 to 2019-07-19

**1.5. Actual or planned geographic coverage of the data:**

W: -178.3409, E: -173.9944, N: 28.3851, S: 25.9871

Extent of diel surveys at Kure Atoll and Lisianski Island of the Northwestern Hawaiian Islands (NWHI) during HARAMP cruise (HA1606) in 2016.

W: -156.81341, E: -155.9014, N: 20.8439, S: 19.2099

Extent of diel surveys at Lanai and the Main Hawaiian Islands (MHI) during HARAMP cruise (SE1902) in 2019

**1.6. Type(s) of data:**

*(e.g., digital numeric data, imagery, photographs, video, audio, database, tabular data, etc.)*  
Table (digital)

**1.7. Data collection method(s):**

*(e.g., satellite, airplane, unmanned aerial system, radar, weather station, moored buoy, research vessel, autonomous underwater vehicle, animal tagging, manual surveys, enforcement activities, numerical model, etc.)*

Instrument: Aquadopp Profiler, Programmable Underwater Collector (PUC), RBRsolo<sup>3</sup> DO logger, RBRsolo<sup>3</sup> PAR, SBE 19plus V2, SBE 43 DO Sensor, SeaFET v2

Platform: Diel Suite

**1.8. If data are from a NOAA Observing System of Record, indicate name of system:**

**1.8.1. If data are from another observing system, please specify:**

**2. Point of Contact for this Data Management Plan (author or maintainer)**

**2.1. Name:**

Lori H Luers

**2.2. Title:**

Metadata Contact

**2.3. Affiliation or facility:**

**2.4. E-mail address:**

lori.luers@noaa.gov

**2.5. Phone number:**

### 3. Responsible Party for Data Management

*Program Managers, or their designee, shall be responsible for assuring the proper management of the data produced by their Program. Please indicate the responsible party below.*

**3.1. Name:**

Hannah C Barkley

**3.2. Title:**

Data Steward

### 4. Resources

*Programs must identify resources within their own budget for managing the data they produce.*

**4.1. Have resources for management of these data been identified?**

Yes

**4.2. Approximate percentage of the budget for these data devoted to data management (specify percentage or "unknown"):**

Unknown

### 5. Data Lineage and Quality

*NOAA has issued Information Quality Guidelines for ensuring and maximizing the quality, objectivity, utility, and integrity of information which it disseminates.*

**5.1. Processing workflow of the data from collection or acquisition to making it publicly accessible**

*(describe or provide URL of description):*

Lineage Statement:

The Ocean Acidification Diurnal Suite is a collection of instruments deployed by SCUBA divers onto the seafloor that makes autonomous measurements and collects seawater samples. For a typical 24 hour sampling, the diurnal suite consists of: 1 Sea Bird Electronics (SBE)-19plus CTD sensor, 1 Nortek Acoustic Doppler Current Profiler (ADCP), 1 Satlantic SeaFET Ocean pH sensor, and 7 Programmable Underwater Collectors (PUC), where each PUC collects 1 discrete water sample at a 4-hour interval from 12:00 on day 1 to 12:00 on day 2. Starting 2018 an oxygen sensor was co-located with the CTD sensor, and beginning in 2019 a stand-alone PAR sensor as well as oxygen sensor were added to the deployment. All instruments are weighted or zip-tied to rubble on the seafloor, or both, to secure the position of the instrumentation for the duration of the deployment. Instruments 3-7 were not in the diel suite package for the 2016 deployment.

Process Steps:

- Water samples collected with Programmable Underwater Collectors (PUC) Developed by Dr. Chris Langdon's laboratory at the University of Miami, PUCs are computerized timers attached to a low-power peristaltic pump. An array of PUCs collects water samples at 4-hour intervals over the course of at least 24-hours, usually starting at 12:00 pm local time on day 1 and ending at 12:00 pm on day 2. While PUCs are programmed to collect water on this regular sampling schedule,

issues with the pumps can occasionally result in missing samples for some of the time steps. For some deployments, paired water samples were collected simultaneously at the benthos and 1.5 meters above the seafloor. Samples are collected underwater in tedlar bags pre-poisoned with mercuric chloride and transferred to glass bottles within a few hours of recovery. Water samples are analyzed for DIC using a coulometer (SOP #2) and for TA using a titrator (SPO #3b) by the NOAA Pacific Marine Environmental Laboratory. On occasion, poor pump performance results in half-filled sample bags. These samples are only analyzed for TA due to insufficient sample volume for DIC analysis. Full carbon system chemistry values (including pH, pCO<sub>2</sub>, and aragonite saturation state) are derived from DIC/TA and salinity/temperature/pressure data from a co-deployed CTD using the R package seacarb. (Citation: Dickson, A.G., Sabine, C.L. and Christian, J.R. (Eds.) 2007. Guide to best practices for ocean CO<sub>2</sub> measurements. PICES Special Publication 3, 191 pp.)

- Conductivity-Temperature-Depth (CTD) sensor CTD data are collected by a Sea Bird Electronics 19plus v2 SeaCAT every 2 minutes. Data are uploaded as HEX files, converted to CNV using SBE Data Processing Software, and converted to CSV using the 'oce' package in R. Depth in CTD csv file is that logged by the CTD itself (the depth in other csv files is that of the deployed depth as read by dive computer)

- Acoustic Doppler Current Profiler (ADCP) sensor The diel suite includes either a 1.0 MHz or a 2.0 MHz side-looking ADCP (1.0 MHz ranges 20-m depth, while the 2.0 MHz ranges 10-m). ADCP measurements are collected at 2 minute intervals and binned by height above the sensor. Each height bin is represented in the data set as the upper limit of the bin height above the sensor on the seafloor (e.g., a 1.4 m bin represents current data collected between 0.4 m and 1.4 m above the ADCP). ADCP data include a blanking region, or a small distance in front of the transducer in which measurements cannot be made, of 0.2-0.4 m. Current data are grouped into 1-m height bins. Raw data downloaded from the ADCP are processed in R using the oce package. XYZ coordinate data are converted to ENU (east-north-up) coordinate system. Current speed is calculated as the square root of the sum of the squared u and v velocities and direction as the arctan(v/u). Data are trimmed to a maximum height bin for each time step using pressure data to remove above-water signal. As a result, NULL values may exist for larger height bins above the surface of the water due to waves and tides.

- SeaFET pH sensor The SeaFET pH measures in-situ pH using a solid state ISFET sensor with an AgCl external reference electrode. The electrode is conditioned in running seawater up to a week prior to deployment and stored in artificial seawater between deployments. pH data are collected in bursts of 30 measurements every 5 minutes. The SeaFET is co-deployed with a CTD, and temperature and salinity values from the CTD time series are used to correct the raw pH time series. The SeaFET derives pH from both internal and external potentiometric cells, but only external pH is reported. SeaFET pH values are compared to pH values calculated from discrete TA and DIC samples collected at the same time and location.

- Oxygen sensor An SBE-43 oxygen sensor is tethered to the SBE-19plus CTD sensor to provide DO readings in mg/L of diel suite deployment.
- PAR and Oxygen sensors: Two new stand-alone instruments are included with surveys beginning with 2019 diel suite deployments: 1) RBRsolo<sup>3</sup> dissolved oxygen sensor and 2) RBRsolo<sup>3</sup> PAR sensor. Diel Suite deployments included either the stand-alone RBRsolo<sup>3</sup> DO logger or the SBE-43 oxygen sensor tethered to the CTD. Both oxygen sensors are not deployed simultaneously; oxygen sensors alternate between deployments.

**5.1.1. If data at different stages of the workflow, or products derived from these data, are subject to a separate data management plan, provide reference to other plan:**

**5.2. Quality control procedures employed (describe or provide URL of description):**

The data is quality controlled by NOAA PIFSC Ecosystem Sciences Division (ESD) personnel after the data is downloaded from the instruments, after it is migrated to the database, and once again when the data are submitted to the NOAA National Centers for Environmental Information.

NOAA Pacific Marine Environmental Laboratory (PMEL) conducts quality assurance and quality control on their seawater analyses according to protocols #2 and #3b in Dickson et al (2007).

## **6. Data Documentation**

*The EDMC Data Documentation Procedural Directive requires that NOAA data be well documented, specifies the use of ISO 19115 and related standards for documentation of new data, and provides links to resources and tools for metadata creation and validation.*

**6.1. Does metadata comply with EDMC Data Documentation directive?**

Yes

**6.1.1. If metadata are non-existent or non-compliant, please explain:**

**6.2. Name of organization or facility providing metadata hosting:**

NMFS Office of Science and Technology

**6.2.1. If service is needed for metadata hosting, please indicate:**

**6.3. URL of metadata folder or data catalog, if known:**

<https://www.fisheries.noaa.gov/inport/item/54894>

**6.4. Process for producing and maintaining metadata**

*(describe or provide URL of description):*

Metadata produced and maintained in accordance with the NOAA Data Documentation Procedural Directive: [https://nosc.noaa.gov/EDMC/DAARWG/docs/EDMC\\_PD-](https://nosc.noaa.gov/EDMC/DAARWG/docs/EDMC_PD-)

Data\_Documentation\_v1.pdf

## 7. Data Access

*NAO 212-15 states that access to environmental data may only be restricted when distribution is explicitly limited by law, regulation, policy (such as those applicable to personally identifiable information or protected critical infrastructure information or proprietary trade information) or by security requirements. The EDMC Data Access Procedural Directive contains specific guidance, recommends the use of open-standard, interoperable, non-proprietary web services, provides information about resources and tools to enable data access, and includes a Waiver to be submitted to justify any approach other than full, unrestricted public access.*

### 7.1. Do these data comply with the Data Access directive?

Yes

#### 7.1.1. If the data are not to be made available to the public at all, or with limitations, has a Waiver (Appendix A of Data Access directive) been filed?

#### 7.1.2. If there are limitations to public data access, describe how data are protected from unauthorized access or disclosure:

### 7.2. Name of organization of facility providing data access:

NOAA National Centers for Environmental Information (NCEI)

#### 7.2.1. If data hosting service is needed, please indicate:

#### 7.2.2. URL of data access service, if known:

<https://accession.nodc.noaa.gov/0186952>  
<https://accession.nodc.noaa.gov/0186952>  
<https://accession.nodc.noaa.gov/0186952>  
<https://accession.nodc.noaa.gov/0186952>  
<https://accession.nodc.noaa.gov/0186952>  
<https://accession.nodc.noaa.gov/0240410>  
<https://accession.nodc.noaa.gov/0240410>  
<https://accession.nodc.noaa.gov/0240410>  
<https://accession.nodc.noaa.gov/0240410>  
<https://accession.nodc.noaa.gov/0240410>  
<https://accession.nodc.noaa.gov/0240410>  
<https://accession.nodc.noaa.gov/0240410>

### 7.3. Data access methods or services offered:

Data can be accessed online via the NOAA National Centers for Environmental Information (NCEI) Ocean Archive.

### 7.4. Approximate delay between data collection and dissemination:

Unknown

**7.4.1. If delay is longer than latency of automated processing, indicate under what authority data access is delayed:**

## **8. Data Preservation and Protection**

*The NOAA Procedure for Scientific Records Appraisal and Archive Approval describes how to identify, appraise and decide what scientific records are to be preserved in a NOAA archive.*

### **8.1. Actual or planned long-term data archive location:**

*(Specify NCEI-MD, NCEI-CO, NCEI-NC, NCEI-MS, World Data Center (WDC) facility, Other, To Be Determined, Unable to Archive, or No Archiving Intended)*

NCEI\_MD

#### **8.1.1. If World Data Center or Other, specify:**

#### **8.1.2. If To Be Determined, Unable to Archive or No Archiving Intended, explain:**

### **8.2. Data storage facility prior to being sent to an archive facility (if any):**

Pacific Islands Fisheries Science Center - Honolulu, HI

### **8.3. Approximate delay between data collection and submission to an archive facility:**

Unknown

### **8.4. How will the data be protected from accidental or malicious modification or deletion prior to receipt by the archive?**

*Discuss data back-up, disaster recovery/contingency planning, and off-site data storage relevant to the data collection*

The data is captured in several locations: files stored on the cruise server during the mission and the PIFSC network, and data are imported into the PIFSC Oracle database. The cruise server is regularly backed up by the cruise data manager while at sea, and the PIFSC network and Oracle database are maintained and regularly backed up by PIFSC ITS.

## **9. Additional Line Office or Staff Office Questions**

*Line and Staff Offices may extend this template by inserting additional questions in this section.*