

*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:**

Pacific Reef Assessment and Monitoring Program: Calcification Rates of Crustose Coralline Algae Derived from Calcification Accretion Units (CAUs) Deployed across American Samoa and the Pacific Remote Island Areas in 2010

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

Calcification accretion units, or CAUs, are used to assess the current effects of changes in seawater carbonate chemistry on calcification and accretion rates of calcareous and fleshy algae in the Hawaiian and Mariana Archipelagos, American Samoa, and the Pacific Remote Island Areas as part of the Pacific Reef Assessment and Monitoring Program (RAMP).

Laboratory experiments reveal calcification rates of crustose coralline algae (CCA) are strongly correlated to seawater aragonite saturation state. Predictions of reduced coral calcification rates, due to ocean acidification, suggest that coral reef communities will undergo ecological phase shifts as calcifying organisms are negatively impacted by changing seawater chemistry.

Deployed on the seafloor for a period of time, CAUs allow for recruitment and colonization of CCA and hard corals. By measuring the change in weight of the CAUs, the reef carbonate accretion rate can be calculated for that time period. Monitoring net accretion over successive deployments allows for the detection of changes in calcification rates over time.

The calcification rate data described here are from CAUs that have been deployed and retrieved at existing, long-term monitoring sites during NOAA Pacific Islands Fisheries Science Center (PIFSC), Coral Reef Ecosystem Program (CREP) led RAMP missions around American Samoa and the Pacific Remote Island Areas in 2010 and 2012, in accordance with protocols developed by Price et al. 2012. There are typically (but not always) five CAU sites established at each location CREP visits with five units deployed at each site. CAUs are composed of two 10 x 10 cm flat, square, gray PVC plates, stacked 1 cm apart, and are attached to the benthos using stainless steel threaded rods. Calcareous organisms, primarily crustose coralline algae and encrusting corals, recruit to these plates and accrete/calcify carbonate skeletons over 2-3 year deployments. Due to the

simple, low-cost design and analysis, statistically robust numbers of calcification plates can easily be deployed, recovered, and processed to provide estimates of net calcification.

This study provides information about Pacific-wide spatial patterns of algal calcification and accretion rates and serves as a basis for detecting changes associated with changing seawater chemistry due to ocean acidification. In conjunction with benthic community composition data (separate dataset), the calcification rates will aid in determining the magnitude of how ocean acidification affects coral reefs in the natural environment. The data can be accessed online via the NOAA National Centers for Environmental Information (NCEI) Ocean Archive.

Analysis of these data will expand scientists' capacity for assessing coral reef resilience regarding the effects of ocean acidification outside of controlled laboratory experiments. These data can also be used in comparative analyses across natural gradients, thereby assisting efforts to determine whether key reef-building taxa can acclimatize to changing oceanographic environments. These data will have immediate, direct impacts on predictions of reef resilience in a higher carbon dioxide (CO<sub>2</sub>) world and on the design of reef management strategies.

This effort is a partnership between CREP and Drs. Nichole Price of Bigelow Marine Laboratory and Jen Smith of Scripps Institution of Oceanography, who have extensive knowledge of marine benthic algal community ecology.

**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:**

2010-02-17 to 2012-04-26, 2010-01-25 to 2012-05-17

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

W: -171.09222, E: -168.13785, N: -11.04576, S: -14.55962

W: -176.623933, E: -160.01393, N: 16.74769314, S: -0.37611

Phoenix (Baker and Howland) and Line Islands (Jarvis, Kingman, and Palmyra), and Johnston Atoll. These six of the seven PRIA are routinely surveyed as part of the American Samoa RAMP (ASRAMP) missions (Johnston, Baker and Howland during the first leg of ASRAMP, and Jarvis, Kingman, and Palmyra during the last leg of ASRAMP).

**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.)*

**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:**

Annette M DesRochers

**2.2. Title:**

Metadata Contact

**2.3. Affiliation or facility:****2.4. E-mail address:**

annette.desrochers@noaa.gov

**2.5. Phone number:**

(808)725-5461

**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:**

Charles W Young

**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:

Assembled calcification accretion units (CAUs) are attached to the benthos using stainless steel threaded rods. There are typically five CAU sites established at each location (island) the NOAA Coral Reef Ecosystem Program (CREP) visits with five CAUs deployed at each site (n=25 per location). Calcareous organisms, primarily crustose coralline algae and encrusting corals, recruit to these CAUs and accrete/calcify carbonate skeletons over 2-3 year deployments. Once recovered from the seafloor, the CAUs are processed to provide estimates of net calcification, percent cover, and vertical accretion rates. CAUs have been deployed and replaced at existing, long-term monitoring sites during Pacific Reef Assessment and Monitoring Program (RAMP) cruises, in accordance with protocols developed by Price et al. 2012.

#### Process Steps:

- 2015-08-01 00:00:00 - CALCIFICATION ACCRETION UNIT (CAU) ASSEMBLY, DEPLOYMENT and RECOVERY CAUs are composed of two 10 x 10 centimeter (cm) flat, square, gray PVC plates, stacked 1 cm apart. Five CAU units are deployed per site on individual stainless steel stakes driven into the substrate. The units are deployed in a clustered group with the spacing between each unit being 0.5 to 5 meters. CAU sites are situated at an average depth of 15 meters. Units are placed so the CAU plates are ~10 cm above the surface substrate and the top of the CAU plate is parallel to the surface of the water. CAU units are recovered from the seafloor 2 to 3 years after deployment. Refer to the data files for the individual CAU site to determine the exact deployment time of a specific unit. Refer to the NOAA Coral Reef Ecosystem Program (CREP) Calcification Accretion Unit (CAU) Assembly, Deployment, and Recovery Standard Operating Procedure (2015) for a detailed description of the protocols. (Citation: NOAA Coral Reef Ecosystem Program (CREP) Calcification Accretion Unit (CAU) Assembly, Deployment, and Recovery Standard Operating Procedure (2015))
- 2015-09-01 00:00:00 - CALCIFICATION ACCRETION UNIT (CAU) LABORATORY ANALYSIS Once CAU units are recovered they are disassembled and each plate is rinsed with saltwater to remove loose sediment, sand and mobile fauna. The plates are photographed and individual images are captured of the Upper Plate, Top Side; Upper Plate, Bottom Side; Lower Plate, Top Side; Lower Plate, Bottom Side. These images are later analyzed to determine benthic composition on each plate surface. If pieces of calcified material fall off during the photographing process, the pieces are retained with the plate for the dissolution process. After the plates have been photographed they are rinsed with fresh water and placed on a pre-weighed drying plate along with any dislodged pieces, and left to begin drying at room temperature for 24 hours and to allow excess water to be removed. The drying plate assembly is then placed in the oven to dry at 60 degrees Celsius. If the difference in weights is less than 0.2 grams, the plates are considered dry and no further drying/weighing is required. If the difference in weights is greater than 0.2 grams the drying/reweighing process is repeated for as many 24-hour cycles as needed to obtain a difference of less than 0.2 grams. It should be noted that since the initial sample processing in 2012, the standard weighing protocol has since been improved such that the acceptable weight difference is 0.1 grams. Once the plates are dry, each plate is

placed in 5% Hydrochloric Acid (HCl) solution to dissolve the calcium carbonate materials. The plate is scraped to remove all materials and rinsed with the 5% HCl solution. The plate is then placed in the oven at 60 degrees Celsius to dry for 24 hours before the dry plate is obtained. Through the entire dissolution process all 5% HCl rinse solution is preserved for later filtering. The 5% HCl rinse process is repeated on all materials removed from the plate until the dissolution process has stopped and all calcium carbonate material has been removed. The fleshy material and used 5% HCl rinse materials are then separated using a vacuum filtration pump by pouring the solution into a Buchner funnel, mesh layer and pre-weighed filter paper. The filter paper and fleshy material are then dried and weighed to determine the weight of fleshy algae present on each plate. The weight of calcified materials on each plate is determined by difference, where the initial weight of the dried plate (prior to the dissolution process) minus the fleshy material weight equals the weight of carbonate material dissolved. The resulting calcification rates are reported in units of grams/area/time. Refer to the NOAA Coral Reef Ecosystem Program (CREP) Calcification Accretion Unit (CAU) Laboratory Analysis Standard Operating Procedure (2015) for a detailed description of the protocols. (Citation: NOAA Coral Reef Ecosystem Program (CREP) Calcification Accretion Unit (CAU) Laboratory Analysis Standard Operating Procedure (2015))

**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):**

Prior to processing a batch from each region/jurisdiction, laboratory analysts inventory the recovered Calcification Accretion Units (CAUs) to ensure all units are accounted for and all serial numbers assigned to each unit match field data records. The Data Manager additionally performs quality control checks on the site deployment data and the recovery data for further accuracy. Once all CAUs from the jurisdiction have been processed, the dataset is checked by the analysts to ensure: 1) all CAU plates have been processed, 2) there are no missing cell values, and 3) calculations for net weight of calcified materials are correct. The dataset is then turned over to the Data Manager for further quality control procedures and data ingestion into the NOAA Coral Reef Ecosystem Program's master database.

## 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?**

No

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

Missing/invalid information:

- 1.7. Data collection method(s)
- 7.2. Name of organization of facility providing data access
- 7.2.1. If data hosting service is needed, please indicate

**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/26945>

**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-Data\\_Documentation\\_v1.pdf](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:**

**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/0137093>

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<https://accession.nodc.noaa.gov/0137093>

**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*

NOAA IRC and NOAA Fisheries ITS resources and assets.

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

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