

*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: Benthic Cover Derived from Analysis of Benthic Images Collected during Stratified Random Surveys (StRS) across the Hawaiian Archipelago from 2013 to 2019

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

The coral reef benthic community data described here result from the annotation (classification) of benthic images collected during photoquadrat surveys conducted by the NOAA Pacific Islands Fisheries Science Center (PIFSC), Ecosystem Sciences Division (ESD, formerly the Coral Reef Ecosystem Division) as part of NOAA's ongoing National Coral Reef Monitoring Program (NCRMP).

SCUBA divers conducted benthic photoquadrat surveys in coral reef habitats during ESD-led NCRMP missions to the islands and atolls of the Hawaiian Archipelago in 2013, 2016, and 2019 according to protocols established by ESD and NCRMP. Still photographs were collected with a high-resolution digital camera mounted on a pole to document the benthic community composition at predetermined points along transects at stratified random sites surveyed only once as part of Rapid Ecological Assessment (REA) surveys for corals and fish (Ayotte et al. 2015 and Winston et al. 2020, respectively), with 30 photoquadrat images collected at each survey site. A stratified random sampling (StRS) design was employed to survey these coral reef ecosystems. The StRS design effectively reduces estimate variance through stratification using environmental covariates and by sampling more sites rather than sampling more transects at a site. Therefore, site-level estimates and site to site comparisons should be used with caution.

The benthic habitat images were quantitatively analyzed using the Coral Point Count with Excel extensions (CPCe; Kohler and Gill, 2006) software from 2010-2014 and using the web-based image annotation tool, CoralNet (Beijbom et al. 2015) from 2015 to present. Ten points were randomly overlaid on each image and analysts identified the organism or type of substrate beneath, with 300 annotations (points) generated per site following Lozada-Misa et al. (2017). Images are analyzed to produce three functional group levels of benthic cover: Tier 1 (e.g., hard coral, soft coral, macroalgae, turf algae), Tier 2 (e.g., Hard Coral = massive, branching, foliose, encrusting; Macroalgae = upright

macroalgae, encrusting macroalgae, bluegreen macroalgae, and Halimeda), and Tier 3 (e.g., Hard Coral = *Astreopora* sp, *Favia* sp, *Pocillopora*; Macroalgae = *Caulerpa* sp, *Dictyosphaeria* sp, *Padina* sp).

**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:**

2013-08-02 to 2013-08-22, 2013-09-18, 2013-10-18 to 2013-10-31, 2016-07-13 to 2016-08-24, 2016-08-31 to 2016-09-27, 2019-10-30 to 2019-10-31, 2019-04-21 to 2019-08-06

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

W: -160.251839, E: -154.804172, N: 22.218748, S: 18.91922507

Main Hawaiian Islands (MHI), including Hawaii, Kauai, Maui, Oahu, Molokai, Niihau, Kahoolawe, and Lanai.

W: -178.3843301, E: -166.053528, N: 28.457971, S: 23.6242

Northwestern Hawaiian Islands (NWHI), including French Frigate Shoals, Kure, Lisianki, and Pearl & Hermes.

**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:**

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:

Bernardo Vargas-Angel

#### 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 stratified random sampling (StRS) design and benthic photoquadrat survey methodology, employed by the NOAA Fisheries, Ecosystem Sciences Division (ESD) since 2013. Benthic imagery is collected at stratified random sites. The imagery is analyzed using Coral Point Count with Excel Extensions (CPCE) or CoralNet to derive benthic cover values.

Process Steps:

- A stratified random sampling (StRS) design was employed to survey the coral reef ecosystems through the U.S. Pacific regions. The survey domain encompassed the majority of the mapped area of reef and hard bottom habitats. The stratification scheme included island, reef zone, and depth in all regions, as well as habitat structure type in the Main Hawaiian Islands. The habitat structure types included simple, complex, and coral-rich. Depth categories of shallow (0-6 m), mid (> 6-18m) and deep (>18-30 m) were also incorporated into the stratification scheme. Allocation of sampling effort was proportional to strata area and variance in coral density. Sites were randomly selected within each stratum. A geographic

information system (GIS) and digital spatial databases of benthic habitats (NOAA National Centers for Coastal Ocean Science NCCOS), reef zones (IKONOS satellite imagery, NDGC 1998) bathymetry (NDGC 1998, CREP benthic mapping data), and marine reserve boundaries (NOAA) were used to facilitate spatial delineation of the sampling survey domain, strata, and sample units. Map resolution was such that the survey domain could be overlain by a grid using a GIS with individual cells of size 50 m by 50 m in area. A one-stage sampling scheme following Cochran (1977) was employed. Grid cells containing hard-bottom reef habitats were designated as primary sample units (referred to as sites).

- Photoquadrat surveys were conducted by both the fish (Ayotte et al. 2015) and benthic (Winston et al. 2020) teams. Still photographs were collected to record the benthic community composition at predetermined points along the transect line with a high-resolution digital camera mounted on a pole. Overall, 30 photoquadrat images are collected at each site. The fish team conducts these surveys along one 30-m transect that spans the length of two stationary point count (SPC) cylinders used to assess fish abundance (30 images total, Transect A). As of 2018, the benthic team also conducts photoquadrat surveys along one 30-m transect, where one photo is taken every meter for a total of 30 photographs. Prior to 2018, the benthic team conducted photoquadrat surveys along two 18-m transects, with 15 photos collected along each transect (Transect A and B).

- The benthic photoquadrat imagery that are collected as part of the Rapid Ecological Assessment (REA) surveys for coral and fish are analyzed by using Coral Point Count with Excel extensions (CPCe; Kohler and Gill 2006) software through 2014 or by using the web-based annotation tool CoralNet (Beijbom et al. 2015) from 2015 to present. CPCe or CoralNet assigns 10 random points per photo and the benthic elements falling directly underneath each point is identified to three functional group levels: Tier 1 (e.g. hard coral, soft coral, macroalgae, turf algae, etc.), Tier 2 (e.g. Hard coral by morphology = massive, branching, foliose, encrusting, etc.; Macroalgae = upright macroalgae, encrusting macroalgae, bluegreen macroalgae, and Halimeda, etc.), and Tier 3 (e.g. Hard coral by genus and morphology; Macroalgae by genus or grouped genera). The detailed list of each functional group level or tier is included in the benthic image analysis classification scheme. (Citation: Lozada-Misa P, Schumacher BD, Vargas-Angel B. 2017. Analysis of benthic survey images via CoralNet : a summary of standard operating procedures and guidelines. Pacific Islands Fisheries Science Center, PIFSC Administrative Report, H-17-02, 169 p.)

- Raw survey data includes unique image name and individual point observations identified at three functional group levels of benthic cover with the corresponding physical data which reflect the description of the site. The physical data for all records includes the following: region, island, site, date (day, month, year), latitude (dd), longitude (dd), reef zone, habitat type, depth category, minimum depth and maximum depth.

#### **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):**

Quality control is enforced by means of point-to-point, inter-observer calibration exercises that are conducted before each image analysis production series. Training modules and standard operating procedures have also been developed and documented to ensure improved performance and consistent imagery analysis results produced by multiple analysts.

**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)

**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/36155>

**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:**

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/0217940>

[https://www.ncei.noaa.gov/erddap/tabledap/CRCP\\_Benthic\\_Cover\\_Hawaii.html](https://www.ncei.noaa.gov/erddap/tabledap/CRCP_Benthic_Cover_Hawaii.html)

<https://accession.nodc.noaa.gov/0157633>

<https://accession.nodc.noaa.gov/0164295>

<https://accession.nodc.noaa.gov/0159140>

**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.*