

*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:**

Reefs for the future: Resilience of coral reefs in the main Hawaiian Islands

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

Declining health of coral reef ecosystems led scientists to search for factors that support reef resilience: the ability of reefs to resist and recover from environmental disturbance. Scientists recently identified 11 measurable factors that affect the resilience of coral reefs (McClanahan et al., 2012). Reef resilience factors include characteristics of the coral assemblage, populations of fish that live on the reef, land use practices, and water temperature variability. These factors were used by NOAA Pacific Islands Fisheries Science Center (PIFSC) Coral Reef Ecosystem Program (CREP) to conduct a quantitative assessment of the resilience potential of reefs across the main Hawaiian Islands (MHI). Locations of Rapid Ecological Assessment (REA) surveys conducted by NOAA Coral Reef Ecosystem Program (CREP) from 2010 to 2013 were used to designate study units called "georegions". Watersheds upstream of georegions were then grouped to delineate the area that could affect adjacent reefs through pollution, runoff, and sedimentation. REA surveys provided data to evaluate biological/ecological resilience factors, and external data sources were used to inform physical and environmental factors not directly measured by CREP. Five of the resilience factors can be directly influenced by local management. Data for each factor was compiled, normalized, and averaged to produce a composite resilience score for each georegion.

In all, twenty-nine study areas were analyzed across the MHI. Lowest composite resilience scores were earned by reefs near densely populated areas on O`ahu, while highest scores were earned near relatively sparsely populated areas of other islands. The reef resilience framework data package described herein comprises the original data sources used in this analysis, the intermediary and final data resulting from the analysis, the process documentation, and the 2-page PIFSC Special Publication published in 2014 (SP-15-001).

Data can be accessed via the NOAA National Centers for Environmental Information (NCEI) Ocean Archive, accession #0128219.

### **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:**

2013-01 to 2014-12, 2008 to 2013, 1985 to 2012, 1978 to 2007

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

W: -160.4, E: -154.7, N: 22.4, S: 18.8

Main Hawaiian Islands

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

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

PDF document (digital), tabular digital data (csv), and vector digital data

**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:**

Brett D Schumacher

**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 principal analytical task of this project was to calculate eleven metrics of "reef resilience" as identified by McClanahan et al. (2012). These metrics account for various aspects of the coral reef ecosystem, and are derived from several data streams, as described in the process steps.

Process Steps:

- The first task was to identify and define zones of interest, hereafter known as "georegions." Georegions were defined based on locations of Rapid Ecological Assessment (REA) surveys. REA surveys include surveys of fish and corals, and are conducted by the NOAA Coral Reef Ecosystem Program (CREP) at the Pacific Islands Fishery Science Center on a triennial basis as part of the Reef Assessment and Monitoring Program (RAMP). Surveys were grouped based on proximity and shared exposure to wind and wave conditions.
- The basis of the pollution metric is the Watershed Health Index (Kido 2006), which has been calculated for watersheds throughout the Main Hawaiian Islands (MHI) and is available online (<http://hbmweb.pbrc.hawaii.edu:8000/WHI/WHI.html>). We used ArcGIS to combine this information by merging watersheds associated with each georegion and calculating a weighted mean WHI by area. (Citation: Kido MH (2006) A GIS-based Watershed Health Index for the State of Hawaii. Technical Report to the Hawaii Department of Health, Environmental Health Administration - Environmental Planning Office, July 2006.)
- The sedimentation metric is based on precipitation that falls on the watersheds associated with each georegion. A "precipitation index" was derived based on interpolated rainfall information from the Rainfall Atlas of Hawai`i (Giambelluca et al. 2013). This information is available at <http://rainfall.geography.hawaii.edu/downloads.html>. Rainfall was scaled by the coastline of each georegion. (Citation: Giambelluca TW, Chen Q, Frazier AG, Price JP,

Chen Y-L, Chu P-S, Eischeid JK, Delparte DM (2013) Online Rainfall Atlas of Hawai`i. Bulletin of the American Meteorological Society 94: 313-316, doi: 10.1175/BAMS-D-11-00228.1.)

- The herbivore biomass metric was derived from data from NOAA Coral Reef Ecosystem Program (CREP) Rapid Ecological Assessment (REA) fish surveys. Mean herbivore biomass for each georegion, as well as all subsequently described metrics based on data from REA surveys, were calculated based on a weighted average of reef area in three depth zones (0-6 meters, 6-18 meters, 18-30 meters). (Citation: Ayotte P, McCoy K, Williams I, Zamzow J. 2011. Coral Reef Ecosystem Division standard operating procedures: data collection for Rapid Ecological Assessment fish surveys. Pacific Islands Fisheries Science Center Administrative Report H-11-08, 24 p.)

- The macroalgal cover metric was derived from analysis of digital images of the benthos (photoquadrats) from NOAA Coral Reef Ecosystem Program (CREP) Rapid Ecological Assessment (REA) fish and coral surveys. (Citation: NOAA Coral Reef Ecosystem Program (CREP) Benthic Image Analysis Standard Operating Procedures. Unpublished methods documented on the NOAA Wiki and unofficially available on the CoRIS website at

[http://data.nodc.noaa.gov/coris/data/NOAA/nmfs/810\\_Reef\\_Resilience/SOP\\_BenthicImageAnalysis\\_v2](http://data.nodc.noaa.gov/coris/data/NOAA/nmfs/810_Reef_Resilience/SOP_BenthicImageAnalysis_v2)

- Metrics for coral diversity, coral recruitment, physical impacts to coral, and disease prevalence were calculated from data gathered by NOAA Coral Reef Ecosystem Program (CREP) Rapid Ecological Assessment (REA) benthic surveys. (Citation: "Ecological Assessment of Coral." Coral Reef Ecosystem Program. Pacific Islands Fisheries Science Center, n.d. Web. <<http://www.pifsc.noaa.gov/cred/corals.php>>)

- The bleaching resistance metric was calculated based on the percent corals of a given species found in georegions, scaled by their sensitivity to bleaching as determined by observations of corals during a bleaching event.

- The fishing pressure metric was derived from multiple data sources. The proximity of human population was the primary driver, and was scaled by the percentage of households that fish (Allen and Bartlett 2008) and the percentage of habitat that is protected from fishing in a form of marine protected area designated by the State of Hawaii as a "Marine Life Conservation District." U.S. Census data was used to estimate mean population within 10 kilometers of reef in each georegion, results of a social science study done by Allen and Bartlett (2008) were used to identify the percentage of households that fish, and ArcGIS was used to estimate percentage of shallow-water habitat protected from fishing. (Citation: Allen SD, Bartlett N. 2008. Hawaii Marine Recreational Fisheries Survey. How analysis of raw catch data can benefit regional fisheries management and how catch estimates are developed: An example using 2003 data. Pacific Islands Fisheries Science Center Administrative Report H-08-04, 33 p. + Appendices.)

- The Sea Surface Temperature (SST) variability metric was derived from Pathfinder v5.2 ~4 kilometer (1/24 degrees) daily SST data for the period 1985-2012, provided by the Group for High Resolution Sea Surface Temperature (GHRSSST) and the U.S. National Oceanographic Data Center. The Pathfinder project was supported in part by a grant from the NOAA Climate Data Record (CDR) Program for satellites. Scott

Heron created derived data sets based on these data under a NOAA Coral Reef Conservation Program (CRCP) grant (Heron-786), and these derived data sets were used as the basis of the SST variability metric. Based on discussions with Heron, the number of significant thermal events (defined as a period where a reef area experienced 4 consecutive degree heating weeks) and the interannual variability (standard deviation) of the climactically warmest month were combined to calculate the SST variability metric. Additional information about thermal history products is available at the Coral Reef Watch website ([http://coralreefwatch.noaa.gov/satellite/thermal\\_history/th\\_index.php](http://coralreefwatch.noaa.gov/satellite/thermal_history/th_index.php)).

**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):**

With some datasets, two different individuals generated summary statistics that were verified against each other. In other cases, the analysis was run two different ways or two different times and results were cross-checked. "Sanity checks" were also performed to evaluate if the results make sense and are logical.

## **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/23147>

**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/0128219>

<https://accession.nodc.noaa.gov/0128219>

<https://accession.nodc.noaa.gov/0128219>

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

Data can be accessed via the NOAA National Centers for Environmental Information (NCEI) Ocean Archive, accession #0128219.

### 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.*