

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:

Guam Long-term Coral Reef Monitoring Program Reef Fish Surveys since 2010

1.2. Summary description of the data:

The Government of Guam's Comprehensive Long-term Monitoring at Permanent Sites in Guam project, also known as the Guam Long-term Coral Reef Monitoring Program (GLTMP), is a NOAA-funded project currently coordinated through the University of Guam Marine Laboratory. The program involves the regular, intensive collection of data for a suite of coral reef ecosystem health parameters at high priority reef areas (HPRAs) around Guam, as well as critical support for coral bleaching response and other activities carried out by the multi-partner Guam Coral Reef Response Team. The program currently utilizes a split-panel sampling approach, whereby a mix of permanent and non-permanent sampling stations (one sampling station = one transect) are visited within each HPRA. The HPRAs were selected by an advisory body comprised of reef managers, researchers, and technicians. The locations of the sampling stations within each HPRA are generated randomly using GIS software. Various coral reef surveys are carried out on an annual basis along the seaward slope between 7 and 15 m depth in the Tumon Bay Marine Preserve and in East Agana Bay, while surveys are carried out biennially within the Piti Bomb Holes Marine Preserve, the Achang Reef Flat Marine Preserve, and the eastern side of the Cocos Barrier Reef (Cocos-East). Surveys were also carried out along reef margin (1-2 m) and slope (2-15 m) of Western Shoals, in Apra Harbor, in 2011. The surveys, which are currently conducted by University of Guam Marine Laboratory biologists, and which were supported by NOAA PIRO through 2019, currently include benthic photo transects, stationary point count fish surveys, macroinvertebrate belt transects, and chain-length rugosity surveys. The GLTMP has conducted surveys at the Tumon and East Agana HPRAs since 2010, the Piti HPRA since 2012, and the Achang and Cocos-East HPRAs began in 2014. Surveys for Fouha Bay HPRA began in 2015 with data collections also occurring in 2019 and 2021, but the site has not been re-visited due to shifting management priorities. Baseline data is available for the Western Shoals HPRA from 2011 but this site has not been re-visited.

Fish are a culturally and economically valuable resource for the island of Guam (van Buekering et al., 2007). In recognition of the high value of this resource, reef fish surveys

are a key component of the Guam Long-term Coral Reef Monitoring Program. Reef fish assessment surveys have been conducted at high priority reef areas around Guam since August 2010. The monitoring team uses a Stationary Point Count Method, adapted from Ault et al. (2006) and NOAA Fisheries, Coral Reef Ecosystem Division (Williams et al., 2011), to conduct the reef fish surveys. These monitoring data can be used to monitor the status and trends in fish density, biomass, diversity; to explore community structure by functional group and size structure; and examine changes in community structure over time.

IMPORTANT NOTE: Significant changes have been made to the fish SPC survey methodology since its first deployment in 2010. These changes, which are documented in the Data Quality and Lineage sections of this metadata record, must be considered in order to properly analyze these data. Also, please note that the results of a 2020 analysis of the fish SPC data conducted by Dr. Peter Houk of the University of Guam Marine Laboratory indicated that data collected in 2010 and 2011 by one observer did not meet quality assurance standards. In response to the results of this analysis observations recorded by this observer are not included in the dataset submitted to NCEI. However, these data can be made available upon request. More information regarding Dr. Houk's analysis can be found in the Data Quality section of the metadata record. Also note that a recent analysis conducted by the program coordinator showed that there were significant, consistent differences in biomass, density, and species richness values calculated using observations obtained by each of the two main fish observers. It is strongly suggested that any users of these data review the report in which these results are presented (https://www.uog.edu/_resources/files/ml/technical_reports/UOGLM_TechRep170_GLTMP_2023.pdf) and reach out to the program coordinator to ensure the data are used appropriately. Please refer to the Supplemental Information section below for a list of important considerations and recommendations for any analysis of these data.

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:

2012-09-05 to 2012-11-19, 2014-09-03 to 2014-09-09, 2015-08-10 to 2015-09-04, 2017-04-10 to 2017-08-10, 2010-08-04 to 2010-09-03, 2019-07-26 to 2019-10-23, 2020-07-23 to 2020-10-13, 2021-06-23 to 2021-08-18, 2022-08-05 to 2022-09-28, 2023-05-11 to 2023-06-29, 2024-07-10 to 2024-08-16, 2010-09-07 to 2010-11-26, 2012-11-16 to 2012-11-28, 2014-09-10 to 2014-09-16, 2015-11-10 to 2015-12-04, 2017-07-12 to 2017-12-27, 2019-10-30 to 2019-12-19, 2020-10-13 to 2020-11-24, 2021-08-04 to 2021-09-03, 2022-09-29 to 2022-10-27, 2023-08-16 to 2023-09-13, 2024-08-16 to 2024-11-19, 2011-07-11 to 2011-08-19, 2012-07-23 to 2012-08-31, 2014-09-17 to 2014-11-13, 2018-01-02 to 2018-08-28, 2020-06-30 to 2020-07-16, 2022-05-22 to 2022-08-14, 2024-09-26 to 2024-11-08, 2014-10-22 to 2014-10-27, 2018-09-04 to 2018-09-26, 2021-04-21 to 2021-05-14, 2023-06-30 to 2023-08-25, 2014-10-27 to 2014-10-28, 2021-04-30 to 2021-06-10, 2023-10-19 to 2023-11-08, 2015-05-06 to 2015-10-27, 2019-05-20 to 2019-05-22, 2021-05-19 to 2021-05-27

1.5. Actual or planned geographic coverage of the data:

W: 144.789408, E: 144.798507, N: 13.517207, S: 13.510711

These bounding coordinates pertain to the Tumon Bay site boundaries modified after the 2010 survey effort and prior to the 2012 survey effort; these are the current boundaries for the Tumon Bay monitoring site.

W: 144.784502, E: 144.795528, N: 13.512988, S: 13.508506

These bounding coordinates pertain to the original Tumon Bay site surveyed in 2010. The site boundaries were modified prior to the 2012 surveys; the coordinates of the modified site boundaries are presented in a separate Geographic Area above.

W: 144.758065, E: 144.766983, N: 13.491396, S: 13.483792

These bounding coordinates pertain to the current boundaries for the East Agana Bay site, which has been monitored since 2010

W: 144.653292, E: 144.656443, N: 13.454042, S: 13.449599

These bounding coordinates pertain to the Western Shoals monitoring site in Apra Harbor. The Western Shoals site has not been re-surveyed since 2011 due to a shift in management priorities.

W: 144.683913, E: 144.697634, N: 13.47632, S: 13.468317

These bounding coordinates pertain to the Piti (Tepungan) Bay site, which has been surveyed since 2012.

W: 144.69765, E: 144.712233, N: 13.242611, S: 13.239282

These bounding coordinates pertain to the current Achang monitoring site boundaries, which were established in 2014.

W: 144.674888, E: 144.685944, N: 13.23992, S: 13.235939

These bounding coordinates pertain to the current Cocos-East site, which was established in 2014

W: 144.653677, E: 144.656082, N: 13.305903, S: 13.303514

These bounding coordinates pertain to the current Fouha Bay monitoring site, which was established in 2015

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:

David R Burdick

2.2. Title:

Metadata Contact

2.3. Affiliation or facility:

2.4. E-mail address:

burdickd@triton.uog.edu

2.5. Phone number:

671-735-2175

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:

David R Burdick

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 Stationary Point Count Survey methodology for reef fishes, employed by the Guam Long-term Coral Reef Monitoring Program since 2010.

Process Steps:

- The fish team uses a Stationary Point Count Method (SPC) adapted from Ault et al. (2006) and NOAA Fisheries Coral Reef Ecosystem Division (Williams et al., 2011). Slight modifications to the method were made in 2012, allowing more refined

classification of non-instantaneous observations, but more substantial changes to the method were implemented beginning in 2020 [although note that the "full" method was utilized in 2022 in order to maximize comparability of GLTMP reef fish SPC survey data and data obtained by NOAA PIFSC staff (and GLTMP Observer 2) during the 2022 NOAA PIFSC Reef Assessment and Monitoring Program cruise in the Marianas]. These changes are described in detail below. While the core method remains intact, and some parameters are still directly comparable across all years, these changes must be taken into account when making comparisons of certain parameters using observational data obtained before 2020 and those obtained during and after 2020. All sampling stations have been selected in hard-bottom habitats using a stratified random sampling design, and the stations have been designed using the split-panel approach (combination of fixed and non-fixed transects).

- Each sampling station is located using a GPS receiver. Upon reaching a given station, a small weight and line tied to a buoy is carefully lowered to the ocean floor. In optimal situations where four divers are available, two divers enter the water first to carry out the fish surveys. For permanent sampling stations marked with rebar, the divers descend to the weight tied to the buoy and locate the rebar representing the beginning of the transect. For non-permanent sampling stations the weight tied to the buoy is used to represent the beginning of the transect. A 30-meter transect is laid out [25 m-long transects were used prior to 2017] beginning at the rebar or weight. The transect is laid out in a clockwise direction relative to the island, following the depth contour if it can be readily determined; if the area is relatively flat and a depth contour is not readily discernible the transect is laid at an angle parallel to the reef margin (which is determined prior to entering the water). At permanent sampling stations the transect tape is deployed between the three rebar representing the beginning, middle, and end of the transect. Surveys are not completed if the visibility is less than 7.5 m. Compact digital point and shoot cameras and housings are used by individual observers to document unknown organisms, incidences of coral disease, and species/behaviors of special interest. To conduct the reef fish surveys divers are positioned at 7.5 m and 22.5 m along the transect and count fish within a 7.5 m radius cylinder extending from the substrate to the limits of vertical visibility. The simultaneous surveys start once the divers deploy the transect and both divers are ready to proceed. To minimize diver disruptions, the two divers conducting the benthic surveys enter the water approximately 20-30 minutes after the divers conducting the fish surveys, once the fish team has finished enumerating fish. A fish observer partners with a benthic observer or technical support diver when two fish observers are not available to conduct the survey replicates simultaneously. In this situation, the fish observer lays the transect and conducts the first SPC at 22.5 m while the benthic diver works from 0-15 m; they then switch positions along the transect.
- The SPC surveys are conducted in two parts. During the first five minutes, divers record all species observed within the cylinder, but do not count or size fish. All fish are identified to species level or the next lowest taxonomic level possible (genus or

family). While some small and/or cryptic taxa, such as most gobies or blennies, are not given high priority in the survey and are usually not reported, some larger-bodied or otherwise notable representatives of those taxa, such as *Exalias brevis*, *Plagiotremus* spp., and *Valenciennea strigata* are typically reported. Small fishes and those cryptic during the day, such as apogonids and holocentrids, are explicitly targeted for the survey but are likely undercounted. If a rare fish (shark, species of concern, large mobile predators, etc.) is observed during the first 5 minutes, it is counted and sized, but the diver notes that it was not an instantaneous count. Note that this approach to surveying rare fish was not in place during surveys carried out at the Tumon Bay and East Agana Bay in 2010 and at the Western Shoals site in 2011. For surveys at these sites during that time period rare fish were counted and sized but it was not clear if it was an instantaneous count or not. After the first five minutes divers enumerate fish, one species grouping at a time, using rapid visual sweeps of the plot. The counts are designed to be instantaneous to avoid double counting. All fish of the target species within the SPC boundaries are counted and sized to the nearest centimeter; however, divers use size classes for large schools or high densities. Note that the list of species considered a target species for counting and sizing changed beginning in 2020 to include only food fishes (see process step below for more information). At the end of the survey, divers swim throughout the 7.5-m radius plot to enumerate small and cryptic species that were not captured from the stationary central position. While core aspects of fish SPC survey, namely the listing of all species in the first 5 minutes and the instantaneous counting and sizing of targeted species after 5 minutes, have remained consistent since the first GLTMP surveys in 2010, significant modifications have been made to the original method in the intervening years. These modifications, which must be taken into account during any temporal analysis of these data, are detailed in the process step below.

- Record of modifications to the fish SPC method Survey years 2010-2011: Only instantaneous observations were recorded during this period. Non-instantaneous observations, such as those made of species that were listed during the first 5 minutes but were no longer present in the cylinder during the counting and sizing phase of the survey, were not recorded. However, as noted above, it appears as though some rare or transient taxa observed during surveys conducted in 2010 at the Tumon and East Agana sites and in 2011 at the Western Shoals site may have been recorded even if those observations were not technically instantaneous observations. Survey years 2012-2014: Beginning in 2012 non-instantaneous observations were included in the survey. Non-instantaneous observations include observations of species that are listed during the first 5 minutes but which are no longer present in the cylinder during the counting and sizing phase of the survey. For these observations divers record their best estimate of the size and number of that species as observed during the listing phase. Species that entered the SPC cylinder after the first five minutes were noted on the species list for the site, but on occasion rare taxa were counted and sized and noted as non-instantaneous observations. Survey years 2015-2019: Beginning in 2015 an additional type of

non-instantaneous observation was recorded in order to account for fishes that were not recorded during the listing phase but which entered the SPC cylinder during the counting and sizing phase. All surveyed taxa--not just rare taxa--were accounted for, and these non-instantaneous observations were delineated by the time period within which they entered the cylinder (e.g., 5-10 min, 10-15 min, 15+ min). However, a review of the data collected during this period found that the two observers represented in this dataset differed in how they denoted fish that entered the cylinder after 15 minutes, with one observer (Observer 1) explicitly noting them as occurring in the cylinder after 15 minutes and the other (Observer 2) noting them as PRESENCE observations and providing count and sizing information for each. Because PRESENCE observations can also include fish observed outside the cylinder, and occasionally counts and sizing information provided for rare or otherwise notable taxa that occurred outside the cylinder, unless fish observations were explicitly denoted as occurring in cylinder it should not be assumed that this was the case. Survey years 2020-present (excluding 2022--see below): Beginning in 2020 significant changes to the fish SPC survey methodology were implemented in an effort to significantly shorten survey times. The core survey structure was retained in order to maximize comparability to previous observations, but the decision was made to focus only on food fishes (and a small number of notable non-food fishes) during the counting and sizing phase, and to eliminate observations of fish that were not present during the listing phase (e.g., Non-instantaneous 5-10, Non-instantaneous 10-15, etc.). A list of all food and non-food species and how each species is surveyed (e.g., counts and sizes, counts only, presence/absence only) using this modified method will be made available with the raw data when acquired from NCEI or can be provided upon request. Because species recorded as presence/absence with the modified SPC method were only those that occurred within the survey cylinder, the data type for those observations is recorded as "Presence (in cylinder)." 2022 The "full" SPC survey method (i.e., the method used between 2015 and 2019) was used for all HPRC sampling stations in 2022 in order to maximize comparability of GLTMP SPC data to data collected during the 2022 NOAA PIFSC Reef Assessment and Monitoring Program cruise in the Marianas.

- Raw data include individual fish observation records with the corresponding methodological information and physical data that reflect the description of the site. Fish observation records include species identification, length (cm), and length-weight values. The physical/methodological data for all records includes the following: site, station, station type, observer, date (day, month, year), latitude (dd), longitude (dd), transect, cylinder radius (m), SPC replicate, observation type (instantaneous/non-instantaneous), depth (m), habitat, and wave exposure. Observations queried from Microsoft SQL server were reformatted to maintain consistency with previous NCEI submissions. This data set does not contain zero counts for species not observed at a given sampling station, but zero counts should be accounted for when calculating mean values for parameters across sampling stations (e.g., by using the `expand_grid` function in R).

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):

All observations entered into the database through the online data entry system are compared against observations recorded on the raw data sheet. Once all database records are verified the quality control process is marked as complete for all observations associated with a given station/sampling period. It should also be noted that the data management system employs hard and soft validation to minimize data entry errors.

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/47783>

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

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/accession#>

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):

University of Guam Marine Laboratory - Mangilao, GU

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

University of Guam Marine Lab 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.