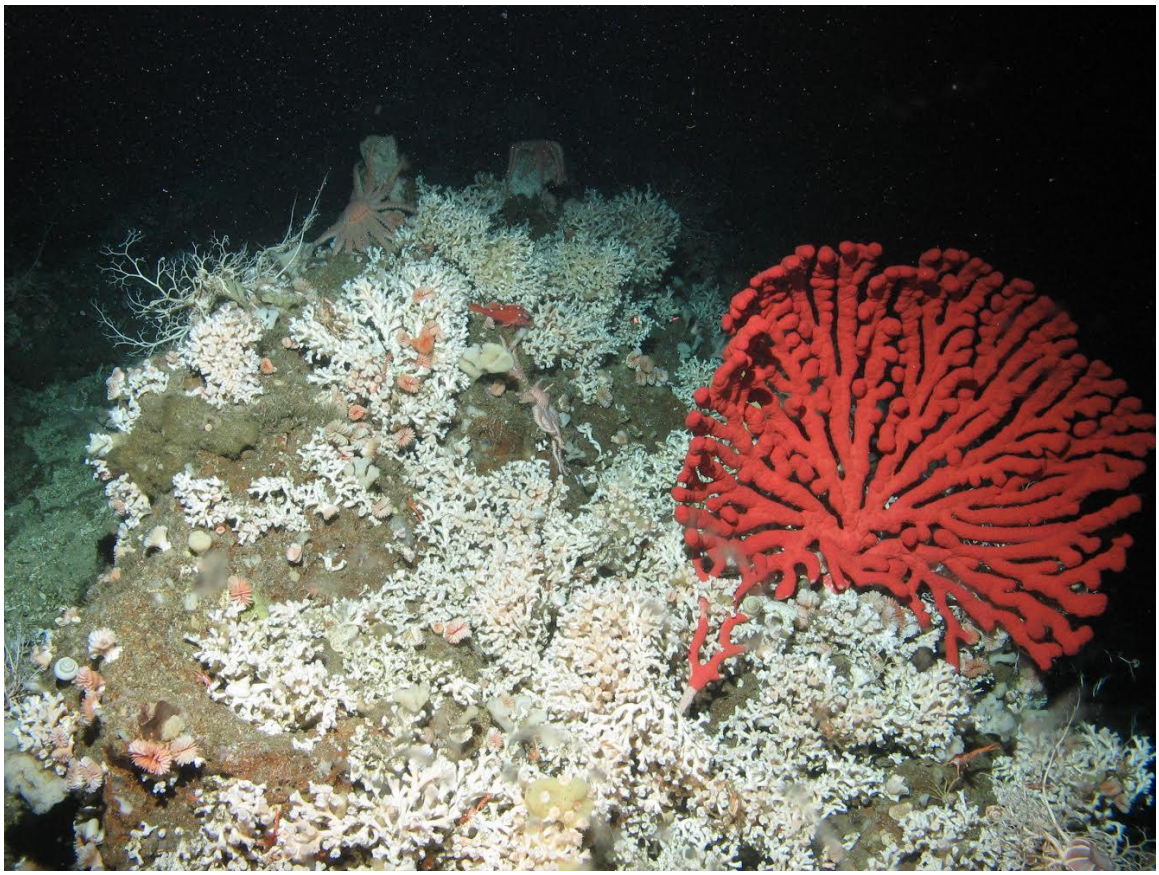
An Introduction to NOAA's National Database for Deep-Sea Corals and Sponges



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Cover Image:

Deep-sea scleractinian coral *Lophelia pertusa* with a bubblegum octocoral (in red, *Paragorgia* sp.*)* at 300 meters depth in Southern California's Channel Islands National Marine Sanctuary, courtesy NOAA National Centers for Coastal Ocean Science.

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Abstract:

NOAA's Deep Sea Coral Research and Technology Program (DSCRTP) is compiling a national database of the locations of deep-sea corals and sponges, beginning in U.S. waters. The DSCRTP will make this information accessible to resource managers, the scientific community, and the public over the World Wide Web. The database fulfills NOAA's requirements under the Magnuson-Stevens Fishery Conservation and Management Act (MSA) to identify and map locations of deep-sea corals and to submit this information for use by regional fishery management councils. At present, there is no comprehensive, national-scale data portal for deep-sea corals and sponges. Given the authorities outlined in the MSA, NOAA's DSCRTP will serve as a central data aggregator and distributor. The DSCRTP will aggregate and make accessible historical records from samples archived in museums, research institutions, and reported in the scientific literature augmented by observations collected during deep-water *in situ* surveys conducted by NOAA and other research institutions. The database schema accommodates both linear (trawls, transects) and point data (samples, observations). The schema captures information in 95 fields across eight main categories related to surveys (e.g. cruises or expeditions), events (e.g. dives or transects), observations (e.g. specimens or images), as well as taxonomic identification, environment, occurrence details, metadata and record-keeping information. Not all fields are required for submission to the database. The minimal data requirements for point observations, transects, and trawls are outlined in this document. The database represents a new standard to catalyze progress in deep-sea coral and sponge resource management and habitat suitability modeling. Records will be compiled continuously by NOAA, and distributed online in a map atlas format beginning in 2015.

1. Introduction:

The National Oceanic and Atmospheric Administration (NOAA) Deep Sea Coral Research and Technology Program (DSCRTP) has developed a National Database for Deep-Sea Corals and Sponges (database). The database is designed to compile and disseminate existing biological observations on deep-sea corals and sponges and their locations, and serve as a primary data outlet for new spatial data records from the DSCRTP's funded research. These data will be made available in standard formats that are useful to scientists, natural resource managers, and the public through an on-line map portal at https://deepseacoraldata.noaa.gov. This document lays out the background, scope, and schema for the database. The Appendix provides a full description for each data field that is included in the database.

a. Deep-sea corals and sponges

Deep-sea corals and sponges thrive in cold, dark water in all of the world's oceans (Cairns 2007, Roberts et al. 2009, Hogg et al. 2010), and are found in U.S. waters from New England to the Caribbean Sea, throughout the Gulf of Mexico, from Alaska to California and across the insular Pacific (Etnoyer & Morgan 2005, Watling & Auster 2005, Reed et al. 2006, Stone 2006, Lumsden et al. 2007, NOAA 2010). Deep-sea corals, also called cold-water corals, lack symbiotic algae in appreciable numbers, unlike their shallow and mesophotic counterparts that rely directly on photosynthesis for autotrophy. Deep-sea corals and sponges are heterotrophic suspension feeders that rely primarily on particles that "rain" down from the surface for food (Davies et al. 2009, Sherwood et al. 2011).

Corals and sponges are sessile invertebrate taxa that reach large sizes, provide structural complexity, and are generally the most important contributors to biogenic habitat in deeper waters. The habitats and ecosystems they create help to sustain biodiversity and provide important refuge and habitat for fishes and invertebrates, including a number of commercially and recreationally important species (Lumsden et al. 2007). Deep-sea corals and sponges are generally slow-growing and fragile, making them and their associated communities vulnerable to damage, particularly physical disturbance.

Damage from bottom-tending fishing gear, especially bottom trawl gear, is well documented and poses the most widespread current threat in regions and depths zones where these gear types are used (Morgan et al. 2005, Lumsden et al. 2007, Roberts et al. 2009, Hogg et al. 2010). The importance and vulnerability of these ecosystems makes them of particular conservation concern. Habitats formed by, and associated with, corals and sponges have been identified as priorities for deep-sea conservation in the U.S. (NOAA, 2010) and internationally (Convention on Biological Diversity, 2008; Fisheries and Agriculture Organization, 2009).

Managing impacts to deep-sea coral and sponge habitats is difficult because these habitats occur at depths from 50 m to 6000 m, often far offshore. Until now, there has been no unified, quality-controlled, public resource that provides the relevant and available information on deep-sea corals and sponges necessary for effective resource management. Data must be made available in a timely manner and a useful format, to assist spatial management decisions. The DSCRTP is addressing this need with a standardized national spatial database of deep-sea coral and sponge occurrences, distributed online in a digital map atlas format.

b. Management requirements and the Deep Sea Coral Research and Technology Program

The *NOAA Strategic Plan for Deep-Sea Coral and Sponge Ecosystems* (NOAA 2010) identifies NOAA authorities and management requirements for the study and conservation of deep-sea coral and sponge habitats. These range from authorities to manage fisheries in federal waters in partnership with the regional fishery management councils (Councils), to management responsibilities in National Marine Sanctuaries and Marine National Monuments. The *Strategic Plan* sets NOAA's objectives and activities for these deep-sea ecosystems, and defines the need for data management and dissemination (Box 1).

Box 1. NOAA Strategic Plan for Deep-Sea Corals

Appropriate research and development is needed to maximize the quality and efficiency with which NOAA acquires, manages and distributes its data and associated products and services to ensure they are accurate, reliable, secure, understandable, timely, appropriate and readily accessible.

To ensure that information from NOAA's exploration and research on deep-sea coral and sponge communities is available to researchers and managers, NOAA will … provide access to NOAA deep-sea coral and sponge data and information, including metadata, links to online data (*i.e.*, regional map servers), products and publications.

The 2007 reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act (MSA; U.S.C. 1801 *et seq*.) directed NOAA to establish a Deep Sea Coral Research and Technology Program (Box 2). The DSCRTP is required to collect information about existing research on deep-sea corals, to map known locations of deep-sea corals, to conduct new research on deep-sea corals, to map new locations, and provide this information to regional fishery management councils.

The reauthorized act also gave NOAA and the Councils new authorities to protect deep-sea corals identified by the DSCRTP from damage by fishing gear. Measures that may be enacted to protect these habitats include fishing area closures, bottom contact restrictions, and gear modifications.

Box 2. MSA Section 408. Deep Sea Coral Research and Technology Program

(a) IN GENERAL- The Secretary, in consultation with appropriate regional fishery management councils and in coordination with other federal agencies and educational institutions, shall, subject to the availability of appropriations, establish a program--

(1) to identify existing research on, and known locations of, deep sea corals and submit such information to the appropriate Councils;
(2) to locate and map locations of deep sea corals and submit such information to the Councils;
(3) to monitor activity in locations where deep sea corals are known or likely to occur, based on best scientific information available, including through underwater or remote sensing technologies and submit such information to the appropriate Councils;
(4) to conduct research, including cooperative research with fishing industry participants, on deep sea corals and related species, and on survey methods;
(5) to develop technologies or methods designed to assist fishing industry participants in reducing interactions between fishing gear and deep sea corals; and
(6) to prioritize program activities in areas where deep sea corals are known to occur, and in areas where scientific modeling or other methods predict deep sea corals are likely to be present.

(b) REPORTING- Beginning 1 year after the date of enactment of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006, the Secretary, in consultation with the Councils, shall submit biennial reports to Congress and the public on steps taken by the Secretary to identify, monitor, and protect deep sea coral areas, including summaries of the results of mapping, research, and data collection performed under the program.

NOAA recognizes that sponges, like corals, provide important three-dimensional structure in many deep-water benthic communities and may serve similar ecological roles as corals. Although much less is known about deep-sea sponges, they have been identified as habitat for managed fish stocks in certain regions and face many of the same threats as deep-sea corals. NOAA is therefore committed to expanding efforts to understand and conserve deep-sea sponge habitats and has informed Congress that the DSCRTP will collect and include in the database complementary information, when available, on deep-sea sponge habitats (NOAA, 2010).

c. Considerations for data management and communication

To make the data more useful to fisheries and other natural resource managers, the DSCRTP program collates, analyzes, manages, maps, and maintains coral and sponge occurrence data, alongside predictive model outputs, and external physical/ biological datasets. To be of maximum utility to the science and management community, the data are intended to be discoverable and publicly accessible on the World Wide Web. These requirements led the DSCRTP to design a web-accessible map portal to display and distribute the collected information. This web accessible map portal will be available to the public by 2015 at https://deepseacoraldata.noaa.gov.

The National Database serves as the data repository for DSCRTP-funded field surveys and data analysis projects. It also seeks to obtain and aggregate other datasets from within NOAA and from other institutions and researchers that contribute on a voluntary basis. The staff at DSCRTP will work personally with data providers to help incorporate and add value to these data sets.

While locations of deep-sea corals can be described using only latitude, longitude, depth, and the species name, more information is necessary to understand the context of these observations. The scope of the information included in the database (i.e., the number of fields) is therefore much more than location. The database goes beyond basic information to reflect our best understanding of information that can be most useful to both managers and scientists. The needs identified by managers have helped shape the parameters included in the database. For example, to aid conservation it is important to discern between large, healthy coral aggregations and small, marginal ones in order to understand differences in habitat quality or vulnerability to bottom contact fishing. It is also important to discern areas where corals have already been impacted by bottom tending gear. Parameters related to abundance, density, size, and condition can be used to help assess habitat quality for deep-sea corals and sponges.

In MSA Sec. 408 Congress also recognized the value of "scientific modeling or other methods that predict deep-sea corals are likely to be present." Predictive models for deep-sea coral distribution and habitat suitability have been one of the initial applications of data from the database (e.g., Guinotte & Davies 2014). Results of these models can be used to guide ocean exploration and management. Environmental parameters related to seafloor geology and water chemistry are incorporated into the database schema to help develop models of coral/sponge distribution and of habitat suitability.

As with other compilations of data from various sources, users should be aware of the limitations of individual data records, certain data sets, and the database as a whole. For example, some records may represent discrete points, while others represent multiple coral or sponge observations over a larger area integrated into a single value (e.g., trawl catch). Metadata are made available at the individual record and data set level to provide information on the history and quality of the information. The database does not include 'observations of absence' for corals or sponges. Few areas have been surveyed for deep-sea corals or sponges, so areas showing no observations in the database should not be interpreted as lacking these taxa. One purpose of habitat suitability modeling is to help fill the gaps between surveyed areas.

2. Scope of the National Deep-Sea Coral and Sponge Geographic Database

a. Taxonomic Scope

Taxonomically, the deep-sea coral group includes representatives from classes Anthozoa and Hydrozoa in Phylum Cnidaria, while deep-sea sponges include representatives from four classes in the Phylum Porifera (Table 1). The database includes occurrence records of sponges and azooxanthellate coral species that occur predominantly deeper than 50 meters. We recognize, however, that certain important cold-water taxa have emerged into shallow water, particularly in higher latitudes. These shallower records of predominantly deepwater species are also included in the database.

The 50 meter depth guideline was established by NOAA for practical purposes. It is shallower than most definitions of "deep sea" (generally defined as deeper than the continental shelf or 200m) but captures coral and sponge records of relevance to resource managers that would not be captured by a deeper threshold (e.g., azooxanthellate *Oculina* reef-forming corals off Florida). In tropical and sub-tropical waters, the 50m depth provides a useful guideline to limit the overlap with light-dependent (and mostly shallow-water) corals. There is evidence that octocorals around this depth are predominantly azooxanthellate (Bridge et al. 2012).

Table 1. Major groups of deep-sea corals (Phylum Cnidaria) and deep-sea sponges (Phylum Porifera)

Phylum	Class	Subclass	Order	Common Names	Additional Information
Cnidaria	**Anthozoa**	Hexacorallia	Scleractinia	Stony corals	A few branching species form deep-water biogenic reef frameworks known as bioherms, coral banks, or lithoherms.
			Antipatharia	Black corals	Many branching forms. Certain species harvested for jewelry in Hawaii.
			Zoantharia	Gold corals	Only a few species in the family Parazoanthidae form rigid skeletons.
		Octocorallia	Alcyonacea	True soft corals	Most are not major structure-forming species.
			Gorgonacea (=Alcyonacea)	Gorgonians, sea fans, sea whips	Many branching forms. At least 12 families contain major structure-forming species.
			Pennatulacea	Sea pens	Unlike most other coral orders, sea pens are mostly found on soft sediments. Contribution as habitat and to biodiversity is not well understood.
			Helioporacea	Lithotelestids	Only three species in one genus are known from deep water.
	Hydrozoa	Hydroidolina	Anthoathecata (Family Stylasteridae)	Stylasterids or lace corals	Can form branching colonies. May be confused with stony corals but the resemblance is superficial.
			(Family Solanderiidae –in part)	Sessile hydrozoans, solanderiids	Only a few species of solanderiids form large branching colonies with chitinous skeletons
			(Family Hydractiniidae – in part)	Longhorn hydrozoans	Only one species of this group known from deep water.
			Leptothecata (Family Haleciidae)	Sessile hydrozoans, haleciids	A few species in this family can form large, branching colonies with chitinous skeletons
Porifera	**Demospongiae**	*Note: The taxonomy and systematics of this Class are being revised. There are at least 12 recognized Orders.*		Demosponges	Demosponges are a large, diverse group. Many species reach large sizes and along with glass sponges represent a major structure-forming taxon in deep water.
	Hexactinellida	Amphidiscophora	Amphidiscosida	Glass sponges	Glass sponges along with demosponges represent the primary structure-forming deep-water taxa. A few species form large reefs or bioherms in Southeast Alaska and British Columbia.
		Hexasterophora	Aulocalycoida Hexactinosida Lychniscosida Lyssacinosida		
	Calcarea	Calcaronea	Baerida Leucosolenida Lithonida	Calcareous sponges	Most calcareous sponges are found in shallow water. A few species occur in deeper water.
		Calcinea	Clathrinida Murrayonida		
	Homo-scleromorpha	--	Homosclerophorida	--	A small group of mostly encrusting forms in deep water.

b. Geographic Scope

The primary mandate of the DSCRTP is domestic, so the program has begun by targeting data sets that include U.S. waters (state waters and the U.S. exclusive economic zone). The U.S. legislative mandate guided the inclusion of a geographic data field for regional fishery management council. The official Council regions are: North Pacific, Pacific, Western Pacific, Gulf of Mexico, South Atlantic, Mid-Atlantic, New England, and Caribbean.

NOAA's *Strategic Plan* recognizes that U.S. information can contribute to international exploration, research and conservation efforts, and identifies that NOAA will: "Support inclusion of U.S. data on deep-sea coral and sponge species and communities in multilateral database efforts." This requirement places a premium on ensuring that the database structure is compatible with similar international efforts and standards. There is increasing international interest in deep-sea corals and sponges – e.g., as indicators of ecologically and biologically significant areas (CBD 2008) or of vulnerable marine ecosystems (FAO 2009). Therefore we will include records from outside U.S. waters and are actively seeking partnerships with international organizations and researchers who wish to submit deep-sea coral and sponge records to the database.

3. Principles guiding development of a schema:

NOAA's National Database for Deep-Sea Corals and Sponges builds on an earlier effort, the US Geological Survey Cold Water Coral Geographic Database (Scanlon et al., 2010). NOAA participated in development of this initial database, which was limited in geographic and taxonomic scope. A technical working group of federal and academic partners was formed in 2010 to reconsider the various resources and institutions that contribute samples or observations of deep-sea corals and sponges. One goal of the working group was to develop a new structure, i.e., a schema or data framework, for a revised database that combines the available resources in a unified way. The working group gathered records from a number of sources to identify their shared characteristics. Over 200,000 occurrence records from U.S. waters were identified from the scientific literature and from federal, state, and private institutions.

Given the potentially large volume of information available about deep-sea corals and sponges, and the need for a centralized database to share this information, our working group envisioned an (1) *integrated,* (2) *standardized,* and (3) *quality controlled* database that is (4) *networked* to outside resources for the purposes of periodic updates. The four principles are discussed below as an introduction to the topics guiding NOAA's development of a database schema for deep-sea corals and sponges.

a. Records are *integrated* across sampling methods, record types, and institutions.

i. Sampling methods that contribute to deep-sea coral and sponge records include dredges, trawls, tangle nets, longlines, grab samplers, collections from sampling tools onboard remotely operated vehicles (ROVs) and submersibles, photo and video from ROVs and manned submersibles, and more recently, autonomous underwater vehicles (AUVs). While most samples before 1985 were biological specimens hauled from the seafloor, many modern samples are images or direct observations from submersibles. Specimens (preserved in museums) and observations (data from videos, photographs) can be represented together in a spatial data framework, provided that universal parameters, like latitude, longitude, and depth, are available. Ancillary fields are used to address data origin, sampling equipment, and location accuracy, among other things.

ii. Record types available to the database come from specimens in museum archives, video and still images, descriptions in the scientific literature, and records of fisheries bycatch or scientific trawl surveys. All can contribute to a baseline for coral and sponge occurrence and distribution, but each will have a different level of geographic or taxonomic specificity.

iii. The institutions conducting deep-water benthic research include federal and state agencies, academic institutions, private research institutions, and non-profit organizations. These institutions (and individuals) are referred to as 'Data Providers.' Given this diverse institutional landscape, NOAA can serve as a data aggregator and distributor.

b. Data are *standardized* to facilitate data discovery, access and application

The database's schema follows standards developed by the US Geological Survey for OBIS-USA (http://www.usgs.gov/obis-usa/), the U.S. node of the Ocean Biogeographic Information System (http://www.iobis.org). The OBIS-USA standard is called MBG (for Marine BioGeography) (http://snapper.colorado.edu/ObisUsa/portal/XsdReader.php) and is itself an extension of the international Darwin Core standard (http://rs.tdwg.org/dwc/terms). The Darwin Core standard is intended to facilitate the sharing of information about the occurrence of biological taxa in nature as documented by observations, specimens, samples, and related information. The US Integrated Ocean Observing System program uses a related MBG/Darwin Core extension for its Biological Data Services (http://www.ioos.noaa.gov/biological_observations. Alignment of the database with these US and international standards will facilitate regular uploads to OBIS and integration with other US and international resources, leveraging OBIS' mature platforms for discovery, access and applications. Direct discovery and access will also be available via a dedicated NOAA web portal and mapping system, which supports download in several standard formats (including kml, shapefile, and csv) and provides additional linkages to other DSCRTP data products.

Taxonomic nomenclature in the database has been standardized based on the World Register of Marine Species (WoRMS, http://www.marinespecies.org), which maintains current information on taxonomy of marine species. This ensures that the valid scientific name and associated taxonomy are the same for all records of a taxon, while allowing access to older names in a "Synonyms" field.[1]

Common standards have been adopted, including coordinates in decimal degrees for recording location, International Standards Organization (ISO) time and date standards, and units based on the metric system. The DSCRTP is developing templates and online forms to facilitate data and metadata entry in standard formats. To facilitate interoperability with other datasets and data systems, the database employs standards in schema development, metadata, data access protocols, and download formats.

Integrating historic records from a broad range of sources and sample methods means that certain parameters and values cannot be standardized. For example, abundance may be reported as weight in trawl data, but counts, density, or percent-cover are more common metrics in visual surveys. All of these metrics can be captured in a data schema, but it becomes necessary to maintain meticulous metadata on the origination of records and perhaps links to outside original sources. An International

1 *Currently, the only exception to WoRMS standard nomenclature is the use of "Gorgonacea" as a separate order under the cnidarian subclass Octocorallia. While most taxonomists now subsume Gorgonacea as part of the order Alcyonacea, this separate subordinal designation is still widely used and has been retained for practical purposes for the time being.*

Standards Organization (ISO 19115) standard metadata record will be published to national metadata clearinghouses to facilitate data discovery and use in ocean portals. Where appropriate, the DSCRTP is working to improve standardization of survey methodologies and reporting funded by our program.

Standardization of deep-sea coral and sponge data has the following benefits:

- Standards make it feasible to have common understanding of special parameters needed by the deep-sea coral community.
- Standards enable common education and collaboration among data originators to foster improved data standardization and survey methods.
- Standards enable systematic approaches to quality, whether human, automated, user-sourced, or other means.
- Standards enable interoperability, creating a larger, more useful, and more cost-effective dataset from the components.

c. Records are *quality-controlled* with procedures to 'flag' and correct problems.

The biological observations NOAA aggregates from external sources can only be as complete and accurate as the data from which they originated, so to this extent, non-NOAA data in our database are provided "as is." However, DSCRTP has instituted a systematic set of quality assurance/quality control (QA/QC) procedures to ensure that the data are generated, compiled, and distributed in a way that meets quality goals and criteria. Potentially problematic records are identified using a set of standard procedures to check depth ranges, dates, taxonomic identifications, and geographic alignments.

All changes to the database, whether they are additions of new data, or changes to old data are entered into version control system designed to track changes to the dataset by multiple editors and reconcile conflicting changes. This system prevents inadvertent edits caused by human error, while keeping a log of the edits and the associated reasoning. As editors with specific expertise review and correct records in the dataset, all edits are reconciled into a single version of the database. All editors have access to the latest version of the data for continued review.

Potentially problematic records are identified using a set of standard procedures. Failing records are flagged and the reason for the flag is recorded. Flagged data records will not be included in publicly released data sets. Flagged records are checked, and if possible, corrected for future release. The five main components of the DSCRTP data QA/QC process are:

1. Field Mapping - Importing the new dataset to the DSCRTP database schema.
2. Mechanical Processing – These steps are accomplished using automated scripts.
    a. Whitespace deletion before and after entries
    b. Insertion of null values (e.g., NA, -999).
3. Automated Checks – The checks add a flag to records that need additional review.
    a. Reasonable range check for each numeric field.
    b. Valid values check to ensure matching data type (e.g., integer, string, etc.).
    c. Valid vocabulary check against the verbatim entries to ensure compliance.
    d. Check if the point is intersecting land based on the geographic coordinates.
    e. Bounding box (if available) check against the latitude/longitude.
4. Visual GIS Check – Visual inspection of the data in mapped form by expert reviewers.

5. Expert QA – Manual review of data by qualified individuals.
    a. Taxonomic ID checks.
    b. Fix flagged records that are reparable - reference original and supplemental data.
6. Repeat steps 2 & 3 to ensure no human errors.
7. Add new data to the current version and reconcile changes with the data in the repository.
8. Additional scripts that assist in loading the data to the data delivery platform (portal).

Database metrics will be computed as part of DSCRTP data stewardship activities, in order to monitor progress. Database metrics are useful for comparing new datasets and tracking changes to the database as a whole. Example metrics include the number of records (*volume*), the number of parameters (*breadth* or *scope*), the proportion of flagged records (*accuracy*), and the number of fields populated per observation (*completeness*). These metrics are used for quality control, as threshold criteria for distribution, to recognize exceptional or inadequate datasets, or to track the growth and development of a dataset over time. In addition to internal QA/QC procedures, the DSCRTP is working with data providers, taxonomists and other experts with experience on deep-sea corals and sponges to review both the data schema and the data records. Together, these efforts will help ensure that records served by the database meet quality standards that represent the best available science.

d. The database system is *networked* with outside resources

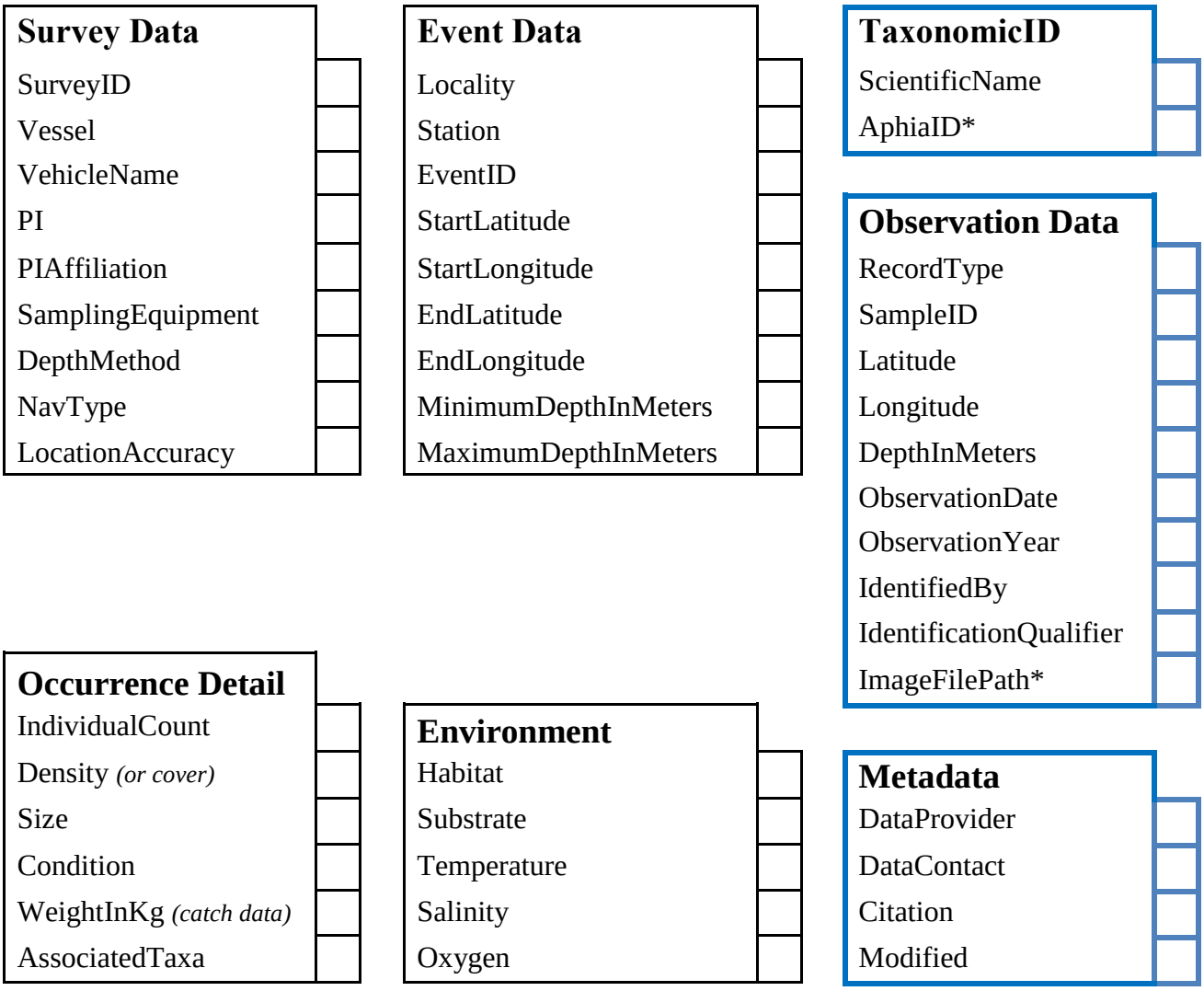
The National Database for Deep-Sea Corals and Sponges represents a distillation of data and information from many sources and at the same time will become a source for future analyses and products. The intent is that users can discover and access this full range of related data and information, from input data to analyzed products. To do this we will take advantage of existing online resources where these are stable and persistent, and establish new online resources as needed. For example, taxonomic names and relationships will be updated regularly through linkages with WoRMS. This is important because the systematic classifications of many coral and sponge taxa are currently undergoing revision. Increasingly museum collections are also accessible online (e.g., Smithsonian Institution, California Academy of Sciences). NOAA Central Library is an important physical archive for images and video. DSCRTP sees these institutions as important physical archives, resources, and research partners, but also as 'nodes' in a virtual network for the processing and exchange of data pertaining to deep-sea coral and sponges.

4. Database schema and structure:

The database fields are organized into eight notional categories (see Appendix 1).

- **Survey Data**– Data describing the cruise or project (e.g., vessel, Principal Investigator, etc.).
- **Event Data**– Data describing the dive, trawl, tow, or transect in which the record was collected, including the geographic location where the event took place.
- **Observation Data–** Point data about the coral or sponge occurrence describing positional information (e.g. geographic coordinates and depth), date and time of observation, etc.
- **Taxonomic ID –** The taxonomic identification of the coral or sponge.
- **Occurrence Detail –** Quantification of various aspects of the coral or sponge (e.g., number or weight) and other biological details (e.g., condition and biological associates).
- **Environment –** Quantification of the environmental conditions, habitat, and geology immediately surrounding the coral or sponge occurrence.
- **Metadata–** Data describing the provenance of the dataset or record.
- **Record-Keeping** – Information created by DSCRTP for record provenance tracking and quality assurance. Two of these fields (Flag and FlagReason) will remain private.

Table 2. A quick-look checklist of the primary fields needed for datasets to be incorporated into NOAA's National Database of Deep-Sea Corals and Sponges, organized by notional category. Of these, the fields within the thick blue boxes are most critical for incorporation. Other fields listed are desired, but not required. (An asterisk marks two exceptions; these two fields are desired, but not required.) The data categories capture the hierarchical relationships among the data fields: Metadata fields describe the overall dataset; Survey Data fields describe each cruise or survey within a dataset; Event Data fields describe each transect (dive, trawl, or tow) within a survey; and Observation Data, Environment, and Occurrence Detail fields pertain to each individual occurrence record. Note that the requirements can be relaxed for historical data. A complete listing of required/desired fields for all data types is given in Table 3.



The DSCRTP does not anticipate that any given record consists of all available fields, but does consider that the fields provided are sufficient to capture the important types of information found in the various record types from most data sources. Some of the data fields are referred to as 'primary' (see Table 2). These fields are 'required' or 'desired' from data providers, depending on their resources and their data gathering activity. Other fields are 'secondary' fields, useful for sorting, record tracking, or annotation (see Appendix 1 for a full list of all database fields and definitions). Certain fields are specific to linear observations (trawls, transects, etc.) and other fields are specific to discrete point observations.

All records made public will have a unique database CatalogNumber and other record keeping fields provided by the DSCRTP (e.g., EntryDate). Records from field surveys funded by the DSCRTP have more stringent requirements than records from external programs and legacy data sources. Requirements also vary by data type, e.g., NOAA funded trawl and ROV surveys are requested to submit start and stop coordinates when available, a requirement that, in some cases, may not be applicable to others.

'Required' fields provide some minimum level of information necessary to incorporate the data into the database and make it useful for management. 'Desired' fields are highly recommended. They include various types of information, such as colony density, organism size, organism condition, in-situ imagery, and ecological characterizations that are of particular value to marine managers. Some of these 'desired' parameters are 'required' for research funded by the DSCRTP. Table 3 gives a detailed summary of required and desired fields for point, transect, and trawl data from different data sources.

'Desired' fields are of considerable interest to our program, but are not required from most external data providers. For example, density, cover, temperature, salinity, and dissolved oxygen are highly desirable, but not always available. The database schema also accommodates emerging parameters of interest to climate change and ocean acidification that may be desired in the future. Fields are provided for pH, pCO2, total alkalinity, and dissolved inorganic carbon, but it may be some time before these measures are widespread, or collected periodically in the field.

Some fields have values that may change with each observation (longitude, latitude, depth, time, and species). The observations are associated with particular EventIDs, e.g., a specific dive or trawl haul. Data providers may submit these fields as a spreadsheet or database file, along with other media (e.g., image files) if available.

Metadata are important for record tracking, provenance, and quality control of data sets. Dataset-level (as opposed to record-level) metadata fields have values that need to be reported only once for any given dataset (e.g. repository, data provider, email). The DSCRTP will facilitate acquisition of most of this information through an online form filled out by data providers. While most of this information also resides in associated ISO metadata documents, including these fields in the individual records helps to ensure that they remain linked to the original occurrences and observations.

In cases where metadata are not provided or associated with records, some metadata can be generated by DSCRTP. Existing record information can be used as a basis for completing unknown fields. For example, cross checking a record's latitude/longitude with GIS polygons to determine the country, ocean, fishery council region, or large marine ecosystem in which the record resides. This metadata generation adds additional value to the dataset and provides a valuable quality assurance tool.

Table 3. Primary database fields requested from data providers to NOAA's National Database for Deep-sea Corals and Sponges. "Historical" records are derived from literature, museum collections, or databases. "New" records are for researchers who wish to submit records. "Program" records are efforts funded by NOAA DSCRTP. R = Required; D = Desired; P = Program-provided; * = Calculated or derived; and - = not applicable.

Field Name	Discrete Point Observations			Transect Observations			Trawl Surveys		
	Historical	New	Program	Historical	New	Program	Historical	New	Program
Metadata									
DataProvider	R	R	R	R	R	R	R	R	R
DataContact	R	R	R	R	R	R	R	R	R
Citation	R	R	R	R	R	R	R	R	R
Modified	R	R	R	R	R	R	R	R	R
Survey Data									
SurveyID	D	D	R	D	D	R	D	D	R
Vessel	D	D	R	D	D	R	D	D	R
VehicleName	D	D	R	D	D	R	D	D	R
PI	D	D	R	D	D	R	D	D	R
PIAffiliation	D	D	R	D	D	R	D	D	R
SamplingEquipment	D	D	R	D	D	R	D	D	R
DepthMethod	D	R	R	D	R	R	D	R	R
NavType	D	D	R	D	D	R	D	D	R
LocationAccuracy	P	P	R	P	P	R	P	P	R
Event Data									
Locality	D	R	R	D	R	R	D	R	R
Station	D	D	D	D	D	D	D	D	D
EventID	D	R	R	D	R	R	D	R	R
StartLatitude	-	-	-	D	D	R	D	D	R
StartLongitude	-	-	-	D	D	R	D	D	R
EndLatitude	-	-	-	D	D	R	D	D	R
EndLongitude	-	-	-	D	D	R	D	D	R
MinimumDepthInMeters	D	D	D	D	D	R	D	D	R
MaximumDepthInMeters	D	D	D	D	D	R	D	D	R

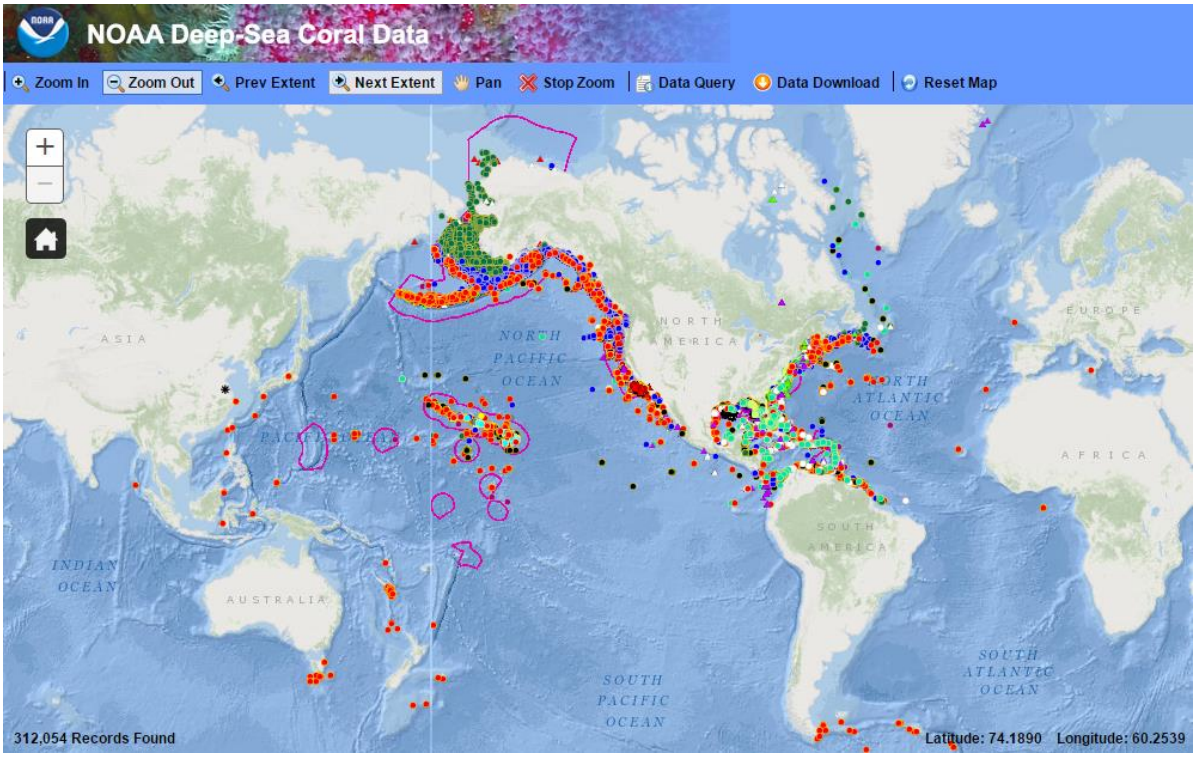
Field Name	Discrete Point Observations			Transect Observations			Trawl Surveys		
	Historical	New	Program	Historical	New	Program	Historical	New	Program
Observation Data									
RecordType	P	R	R	P	R	R	P	R	R
SampleID	R	R	R	R	R	R	R	R	R
Latitude	R	R	R	R*	R*	R*	R*	R*	R*
Longitude	R	R	R	R*	R*	R*	R*	R*	R*
DepthInMeters	D	R	R	D*	R*	R*	D*	R*	R*
ObservationDate	D	R	R	D	R	R	D	R	R
ObservationYear	R	R	R	R	R	R	R	R	R
IdentifiedBy	D	R	R	D	R	R	D	R	R
IdentificationQualifier	D	P	R	D	R	R	D	P	R
ImageFilePath	D	D	R	-	-	-	D	D	D
TaxomomicID									
AphiaID	P	R	R	P	R	R	P	R	R
ScientificName	R	R	R	R	R	R	R	R	R
Environment									
Habitat	D	D	D	D	D	D	D	D	D
Substrate	D	D	D	D	D	D	D	D	D
Temperature	D	D	D	D	D	D	D	D	D
Salinity	D	D	D	D	D	D	D	D	D
Oxygen	D	D	D	D	D	D	D	D	D
Occurrence Detail									
IndividualCount	D	R	R	D	D	D	D	D	D
Density or Cover	D	D	D	D	D	D	-	-	-
Size	D	D	R	-	-	-	-	-	-
Condition	D	D	D	-	-	-	-	-	-
WeightInKg	-	-	-	-	-	-	D	D	R
AssociatedTaxa	D	D	D	-	-	-	-	-	-

5. Data visualization and access

One major challenge for data sharing and distribution is to develop a useful interface that will engage and enable the intended users – regional fisheries management councils, researchers, and the public. A digital online map application has been developed to provide basic visualization and data access for the National Database and associated data online at https://deepseacoraldata.noaa.gov. The map interface (Fig. 1) supports simple database queries by taxon, region, water depth, and year of observation. Resulting observations are symbolized on the map; clicking an observation brings up a table with selected fields from the database for quick reference. A separate, more advanced search interface provides for more complex database queries and for data export in one of several common formats, including csv, json, kml, or html. The physical database model comprises a single table, simplifying the task of downloading and using the data within the users' own analytical software framework.

In addition to providing an interface to the database, the map application will also point to associated datasets that are archived and made available through NOAA's National Data Centers. In particular these are data and information that have been collected on DSCRTP-funded cruises and projects that may be of interest to the research and management communities, including water-column measurements and seafloor remote sensing data, and site-level summaries.

Figure 1. The map interface for NOAA's National Database for Deep Sea Corals and Sponges.



6. Program-specific issues and next steps

NOAA's National Database for Deep-Sea Corals and Sponges includes provisions to address certain program-specific issues. For example, legal requirements preclude making certain observations publicly available – for example, geographically specific data on fisheries bycatch. Additionally, there may be reasons not to publicly release certain geographically specific data on vulnerable species (e.g.,

certain precious coral locations). The DSCRTP has protocols for addressing these requirements on a case-by-case basis, while still retaining the ability to utilize the records for management purposes.

Several aspects of the database require further elaboration to increase their utility. The DSCRTP will be working on several of these issues over the coming years, including the following:

- *Habitat:* While we have identified a field for "Habitat," there is currently no single deep-water habitat classification system that is used by all researchers. Ideally this field would reflect a consistent habitat standard, but current systems are not yet mature enough or well enough delineated to be used as yet. NOAA is working to advance the use of a Coastal and Marine Ecological Classification Standard (CMECS; FGDC 2012) both internally and externally for full utilization by 2018 (NOAA 2014). Eventually we hope to standardize habitat designations for new observations in the database using CMECS.

- *Associated Taxa:* The value of deep-sea corals and sponges lies partly in their role as a provider of habitat for numerous other species. Our database includes a field for "Associated Taxa" to record these associations. However, there is currently no consensus among researchers about what types of associations should be included or how to measure associations. Furthermore, since many researchers are not currently recording associated taxa, a null value in this field does not reliably indicate that no associated taxa were present. We hope to develop standard methodologies for documenting associated taxa on DSCRTP-funded surveys in the future.

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The National Database for Deep-Sea Corals and Sponges builds on a foundation developed under an earlier collaboration between the U.S. Geological Survey (USGS) and NOAA that resulted in a USGS Cold-Water Coral Geographic Database for the Gulf of Mexico and Western North Atlantic Ocean (Scanlon et al. 2010). Andrew Shepherd and Chris Kelley were key participants in a NOAA-led group that refined the ideas outlined in this document. Two workshops provided additional input from NOAA and external experts to the database schema. We would like to thank the following individuals who provided initial reviews of this document: Andy David, Phil Goldstein, Chris Kelley, Martha Nizinski, Chris Rooper, Kathy Scanlon, Bob Stone, Mary Yoklavich, Enrique Salgado, and Matthew Rittinghouse.

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Appendix: Field Definitions for the National Database

Metadata		
Field Name	**Field Description**	**Valid Values**
DataProvider	Identifies the originator of the data. This is the institution, publication, or individual who ultimately deserves credit for acquiring or aggregating the data and making it available. Institution is preferred, but an individual can be listed as "Last Name, First Name". Separate multiple entries by a semicolon. Publications should be abbreviated, e.g. Pante et al. 2012.	[value]
DataContact	The name and e-mail of the individual who is the primary representative of the "DataProvider". The preferred format is "Last Name, First Name; e-mail". "DataProvider" and "DataContact" may be the same person, if "DataProvider" is an individual and not an institution.	[value]; NA
Citation	A list (concatenated and separated) of identifiers (publication, bibliographic reference, global unique identifier, URI) of literature associated with the Occurrence. Equivalent to the term associatedReferences in Darwin Core. The preferred style guide is Chicago/Turabian. Michigan State University Libraries publishes a helpful guide on how to cite data at the following link: http://libguides.lib.msu.edu/citedata	[value]; NA
Modified	The most recent date the DataProvider updated or verified the record. Format: YYYY-MM-DD. If the DataProvider does not record or provide this information, the date the record became available to NOAA will be used.	[value]; NA
Repository	Location where the physical sample, or image is stored. This may be a museum, if samples are physical (e.g., "Smithsonian NMNH") or it may be an institution (e.g., "NOAA Central Library") that maintains master copies of images or video.	[value]; NA

Survey Data		
Field Name	**Field Description**	**Valid Values**
SurveyID	Name or ID of the cruise or project in which the sample or observation was collected (e.g, "EX1202L2" or "Lophelia II: Reefs, Rigs, and Wrecks"). Many events ("EventID") can be associated with one survey ("SurveyID").	[value]; NA
Vessel	Name of the vessel used for collecting the sample or observation.	[value]; NA
VehicleName	Name or ID of the AUV, ROV, submersible, etc. used to collect sample (e.g., "Jason II").	[value]; NA
PI	Principal Investigator or Chief Scientist of the cruise during which the sample was collected, or individual who collected the sample. Desired format is "LastName, FirstName".	[value]; NA
PIAffiliation	Affiliation of the Principal Investigator. Well established acronyms or abbreviations are acceptable (e.g., MBARI or WHOI).	[value]; NA
SamplingEquipment	Method of data collection.	ROV; AUV; submersible; drop camera; towed camera; trawl; net; dredge; longline; pot; hook and line; grab; corer; SCUBA; other; NA
DepthMethod	Select method by which best singular depth in meters (DepthInMeters) was determined. Place method details in "LocationComments". Select "averaged" when start and stop depths were averaged. Select "assigned" when depth was derived from bathymetry at the location. Select "reported" when depth was reported based on instrumentation or described in literature.	averaged; assigned; reported; NA
NavType	Navigation type used to determine coordinates (e.g., "USBL" or "ship GPS"). Further detail on NavType can be captured in "LocationComments"	ship GPS; USBL; LORAN; pre-GPS satellite; NA
LocationAccuracy	An expression in meters of the estimated overall uncertainty of the coordinate data. The uncertainty can combine issues of both accuracy and precision, and depends on the method the "DataProvider" used to determine coordinates.	20m; 50m; 100m; 500m; 1000m; >1000m; NA

Survey Data		
Field Name	**Field Description**	**Valid Values**
Ocean	Ocean basin where the observation or sample was collected.	Arctic; North Atlantic; South Atlantic; North Pacific; South Pacific; Indian; Southern
LargeMarineEcosystem	Large Marine Ecosystem using designations set forth at http://www.lme.noaa.gov/. "NA" = outside of LME boundary.	[list of LME's]; NA
Country	Country in whose Exclusive Economic Zone the observation or sample was collected, based on: http://marineregions.org/downloads.php	[value]; NA
FishCouncilRegion	U.S. Fisheries Management Council (FMC) region where the occurrence is located. In cases of boundary overlap, two councils can be listed separated by a semicolon. If the occurrence is in state waters, the adjacent FMC region will be listed. For a map, see: http://www.nmfs.noaa.gov/sfa/management/councils/	North Pacific; Pacific; Western Pacific; Gulf of Mexico; South Atlantic; Caribbean; Mid-Atlantic; New England; NA
Purpose	Purpose of the cruise during which the sample or observation was collected (e.g. "deep-sea coral survey", "exploration", or "groundfish survey").	[value]; NA
SurveyComments	Comments and other info about the cruise/survey or programs sponsoring the cruise/survey.	[value]; NA
OtherData	Other data types collected on the same event where this sample was taken. List of data types separated by a comma (e.g."CTD, push cores").	[value]; NA
WebSite	World Wide Web link (URL) to an online resource for the "SurveyEvent" (e.g., a web page devoted to this dataset or expedition).	[value]; NA

Event Data		
Field Name	**Field Description**	**Valid Values**
EventID	ID of the survey event (e.g., dive, transect, or trawl haul number) on which the sample was made.	[value]; NA
Station	Reference ID for a place where samples or observation are collected repeatedly over time. For example, "78G9-III".	[value]; NA
StartLatitude	Starting latitude in decimal degrees for observations or samples collected over a distance (e.g., trawls, transects). Precision should be the same as that originally reported; ideally to five decimal places. Datum should be WGS1984. If another datum, use 'LocationComments'.	[value], -999
StartLongitude	Starting longitude in decimal degrees for observations or samples collected over a distance (e.g., trawls, transects). Precision and datum should be as 'StartLatitude'.	[value], -999
EndLatitude	Ending latitude in decimal degrees for observations or samples collected over a distance (e.g., trawls, transects). Precision should be the same as that originally reported; ideally to five decimal places. Datum should be WGS1984. If another datum, use 'LocationComments'.	[value], -999
EndLongitude	Ending longitude in decimal degrees for observations or samples collected over a distance (e.g., trawls, transects). Precision and datum should be as 'EndLatitude'.	[value], -999
MinimumDepthInMeters	Positive integer used to express the minimum depth of the observation. If "DataProvider" gives a single depth, the "MinimumDepthInMeters" and "MaximumDepthInMeters" will be equal. If no depth information was provided, both the min and max terms will be -999.	[value], -999
MaximumDepthInMeters	Positive integer used to express the maximum depth of the observation. See "MinimumDepthInMeters".	[value], -999
LocationComments	Comments and other info about how the location was determined.	[value]; NA
Locality	A specific named place or named feature of origin for the specimen or observation (e.g., Dixon Entrance, Diaphus Bank, or Sur Ridge). Multiple locality names can be separated by a semicolon, arranged in a list from largest to smallest area (e.g., Gulf of Mexico; West Florida Shelf, Pulley Ridge).	[value]; NA

Observation Data		
Field Name	**Field Description**	**Valid Values**
RecordType	Denotes the origin and type of record. The options are: published literature ("literature"); a collected specimen ("specimen"); observation from a still image ("still image"); observation from video ("video observation"); notation without a specimen or image ("notation"); or observation from trawl surveys, longline surveys, and/or observer records ("catch record").	literature; specimen; still image; video observation; notation; catch record; NA
SampleID	The primary identification number of the specimen or catch record from the "DataProvider". This field, along with "TrackingID", is used to establish record provenance. Image samples may use a unique filename.	[value]; NA
TrackingID	Additional ID of the sample or observation provided by the "DataProvider" (e.g. an additional ID of the occurrence used during field activities or other sample tracking). May be used to indicate transects within an "EventID".	[value]; NA
Latitude	Latitude in decimal degrees where the sample or observation was collected. Precision should be the same as that originally reported; ideally to five decimal places. Datum should be WGS84 (World Geodetic System standard). Use "NavType" to report measurement method. Use "LocationComments" to cover any other details regarding the determination of geographic position.	[value]
Longitude	Longitude in decimal degrees where the sample or observation was collected. See “Latitude”.	[value]
DepthInMeters	Best single depth value for sample as a positive value in meters.	[value], -999
ObservationDate	Date as YYYY-MM-DD. If month or day is unknown use YYYY-MM or YYYY. Please convert from local date to Universal Time Code (UTC).	[value], NA
ObservationYear	Year the observation was made in YYYY format (or beginning year of a range, if exact year is unknown)	YYYY; -999
ObservationTime	Time as hh:mm:ss when the sample/observation occurred. Use UTC.	[value], NA
IdentifiedBy	Name of individual or institution that assigned the "ScientificName." Desired format is "LastName, FirstName" or a list of names delimited by semicolons.	[value]; NA

Observation Data		
Field Name	**Field Description**	**Valid Values**
IdentificationQualifier	Taxonomic identification method and level of expertise. Desired format would be along the following lines: “genetic ID”; “morphological ID from sample by taxonomic expert”; “ID by expert from image”; “ID by non-expert from video”; etc. An additional qualifier may be included (e.g., “ID Uncertain”)	[value]; NA
IdentificationDate	UTC date (YYYY-MM-DD). Date on which the sample was identified. If day or month is unknown, use YYYY-MM or YYYY.	[value]; NA
IdentificationComments	Comments and other info about the taxonomy of the species of the sampled or observed organism. If the record is of a type specimen (e.g., holotype), this should be identified in this field.	[value]; NA
ImageFilePath	Full path to image on the hard drive that is used to transfer photos to the program. Two or more paths can be submitted per observation, separated by semicolon.	[value]; NA
ImageURL	URL to the image on the DSC portal or appropriate archive that displays the specimen of record.	[value]; NA
OccurrenceComments	Biological or other detail about the observation event that is not addressed elsewhere (e.g. fishing debris). May be remarks from a corresponding column in original data, or "IndividualCount" values reported as text "few scattered", or "pieces" when integers are expected.	[value], NA
VerbatimLatitude	Latitude as given in original material. Place notes on original coordinate system and datum in "LocationComments".	[value]; NA
VerbatimLongitude	Longitude as given in original material. See “VerbatimLatitude”.	[value]; NA

Taxonomic ID		
Field Name	**Field Description**	**Valid Values**
AphiaID	AphiaID of 'ScientificName' from World Register of Marine Species (WoRMS). Access these numeric codes here: http://www.marinespecies.org/index.php	[value]; -999
ScientificName	Taxonomic identification of the sample as a Latin binomial (e.g., *Primnoa pacifica*), or lowest practical level (e.g., Primnoidae).	[value]; NA
AssociatedSequences	Additional ID of samples where genetic sequences have been submitted to GenBank, for example. Multiple sequences may be separated by semicolons.	[value]; NA
ScientificName Authorship	Author who originally described the species or subspecies. The author should be consistent with AphiaID and TaxonRank.	[value]; NA
VernacularName Category	Common (vernacular) name category of the organism.	stony coral (cup coral); stony coral (branching); stony coral (unspecified); black coral; gold coral; gorgonian coral; soft coral; sea pen; lace coral; stoloniferan coral; lithotelestid coral; longhorn hydrozoan coral; other coral-like hydrozoan; sponge (unspecified); glass sponge; demosponge; calcareous sponge; scleromorph sponge; NA
VernacularName	Common name of the observed species.	[value]; NA
Synonyms	Other scientific names used for the observed taxon. Also, other scientific names that have been used for the individual observation or specimen.	[value]; NA
TaxonRank	TaxonRank term is a companion to the ScientificName term. TaxonRank identifies the level in the taxonomic hierarchy of the ScientificName term.	phylum; class; subclass; order; suborder; family; subfamily; genus; subgenus; species; subspecies
Phylum	Phylum in which the taxon is classified.	[value]; NA
Class	Class in which the taxon is classified.	[value]; NA
Subclass	The Subclass of the taxon.	[value]; NA
Order	Order in which the taxon is classified.	[value]; NA
Suborder	Suborder in which the taxon is classified.	[value]; NA
Family	Family in which the taxon is classified.	[value]; NA
Subfamily	Subfamily in which the taxon is classified.	[value]; NA

Taxonomic ID

Field Name	Field Description	Valid Values
Genus	Genus in which the taxon is classified.	[value]; NA
Subgenus	Subgenus in which the taxon is classified.	[value]; NA
Species	Specific epithet of the taxon.	[value]; NA
Subspecies	Subspecies in which the taxon is classified.	[value]; NA

Environment

Field Name	Field Description	Valid Values
Habitat	A description of the geological and biotic environment in which the organism was sampled or observed, described in plain language, preferably in a manner consistent with Coastal and Marine Classification Standard (CMECS) or other regional habitat classification standards. Methods should be reported in "OccurrenceComments".	[value]; NA
Substrate	Attachment or contact substrate (e.g., dropstone, outcrop, or boulder) of the organism observed. The purpose is to distinguish habitat (like a sandy plain) from attachment point (for instance, a dropstone in a sandy plain). Methods or classification system should be reported in "OccurrenceComments".	[value]; NA
Temperature	Temperature in degrees Celsius for "EventID". Use best value or averaged value. Methods should be reported in "OccurrenceComments".	[value]; -999
Salinity	Salinity in PSU for "EventID". Use best value or averaged value. Methods should be reported in "OccurrenceComments".	[value]; -999
Oxygen	Dissolved oxygen in mg/L for EventID. Use best value or averaged value. Methods should be reported in "OccurrenceComments".	[value]; -999
pH	pH value in units of total pH. Methods should be reported in "OccurrenceComments"	[value]; -999
pHscale	Scale used to measure pH. Methods should be reported in "OccurrenceComments"	total; NBS; seawater; free; NA
pCO2	Partial pressure of CO2 in seawater, units = microatmospheres. Methods should be reported in "OccurrenceComments"	[value]; -999
TA	Total alkalinity, units should be micromoles per kilogram. Methods should be reported in "OccurrenceComments"	[value]; -999
DIC	Dissolved inorganic carbon, units should be micromoles per kilogram. Methods should be reported in "OccurrenceComments"	[value]; -999

Occurrence Detail		
Field Name	**Field Description**	**Valid Values**
IndividualCount	Number of individuals (e.g., sponges or non-colonial corals), colonies (e.g., octocorals, black corals) or patches (e.g., framework forming corals where individual colonies cannot be distinguished) as a positive integer. If categorical, use 'CategoricalAbundance'	[value]; -999
Size	Size of the sponge or coral (colony) observed, or maximum size if the observation is multiple organisms of the same taxon. Methods for determining size (e.g., height or maximum diameter) should be noted in "OccurrenceComments." can be entered as an integer value.	< 10 cm; 10 - 30 cm; 30-50 cm; 50 – 100 cm; > 100 cm; integer value; NA
Condition	Condition of the organism (coral or sponge) when collected or observed. At a minimum, values of "Live", "Dead", or "Damaged" are desired. Some categories of injury currently in use for gorgonian octocorals are listed in the set of valid values on the right.	Live; Damaged; Dead; 1-10% damaged; 11-50% damaged; 51-90% damaged; >90% damaged; Toppled; NA
Density	Number of individuals (or colonies) per square meter for an observation.	[value], -999
Cover	Percent of sampled area covered by organism of interest. This field is generally used for framework-forming stony corals for which individual counts are difficult.	[positive integers from 0-100], -999
Categorical Abundance	Abundance category of corals/sponges of the same ScientificName at the sample location.	1; 2-10; 11-20; 21-50; 51-100; >100; NA
WeightInKg	The recorded weight in kilograms of the individuals in the observation. Use 'OccurrenceComments' for weight methods (e.g., dry weight), calculation or estimation procedures, or other details applied in determining weight.	[value], -999
AssociatedTaxa	Notable organisms that co-occur with the coral or sponge observation. A list of organisms may be separated by semicolon. Commercially fished species are of particular interest to regional fishery management councils. Methods for determining association (e.g., "touching" or "fish within one meter") should be noted in "OccurrenceComments."	[value]; NA

*Record Keeping**		
Field Name	**Field Description**	**Valid Values**
CatalogNumber	Unique record identifier assigned by the DSCRTP. It is persistent and the numbers are retired if records are deleted from the database.	[value]
DatasetID	An alphanumeric value to identify a discrete collection of observations submitted to the Program from an institution, repository, publication, multiyear project, or expedition. The DatasetID is used to assist tracking, communications, and quality assurance.	[value]; NA
EntryDate	The date on which the record was initially merged into the DSCRTP database. Format YYYY-MM-DD.	[value]
Reporter	Person who formatted and submitted the record to the DSCRTP database.	[value]; NA
ReporterEmail	E-mail of the reporter.	[value]; NA
ReporterComments	Other comments by or about the "Reporter".	[value]; NA
Flag	"1" means record is flagged as "do not release" for quality assurance. A value of "0" means that the record is not flagged and it can be released.	1; 0
FlagReason	Reason why the record was flagged for QA. We may have multiple flag reasons separated by a semicolon.	[value]; NA

* Fields in this category are populated by the DSCRTP, not the data provider.

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