Department of Defense
Legacy Resource Management Program

10-306

Natural Resources Conservation
Coral Reef Initiative Database
Technical Note

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Coral Reef Initiative Database

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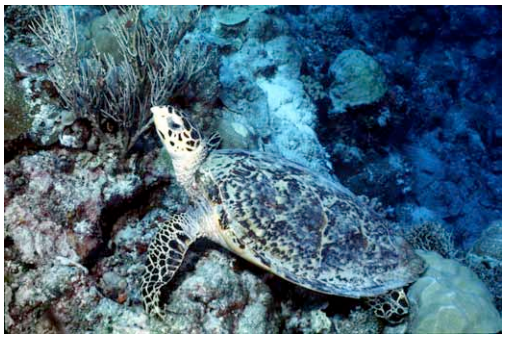


Department of Defense
Coral Reef Initiative Database Project

Abstract

Up to 75% of the world's coral reefs are threatened due to continued pressure from both local and global stressors. Local stressors include overfishing, deforestation resulting in increased siltation, coastal development, and point and non-point source pollution. Global stressors result from global climate change raising ocean temperatures and contributing to the acidification of the oceans. Rising sea level and increased storm frequency and severity also threaten coral reefs.

As data on the conservation status on marine species are updated, the number of these species occurring in coral reefs habitats has increased dramatically. In order to make these data easily accessible to Naval personnel, the previous version of the Coral Reef Initiative Database has been updated, expanded and reorganized. The database of scientific information presented here will greatly benefit resource mangers in successfully managing and assessing coral reefs and species of special conservation status associated with coral reefs.

While biologists have been engaged in the study and characterization of coral reef ecosystems for decades, recent efforts have focused on the development and implementation of effective monitoring and assessment programs. This database provides an example of a four tier assessment protocol and numerous scientific and management based publications on the issue.

Establishing baseline data is the foundation of any assessment program and this supports the mapping and inventory initiative of all US coral reef ecosystems. Assessment and monitoring initiatives include conducting rapid assessment and inventories, monitoring of coral, fish, and other resources, and evaluation of water and substrate quality.

To implement DoD's responsibilities under the CRTF and comply with the CRCA, mapping and inventory information must be gathered on the military's coral reef resources. As a member of the CRTF, it is DoD's role and duty to conduct these activities. Moreover, DOD Instruction 4715.3, Environmental Conservation Program, directs DoD to inventory biologically or geographically significant or sensitive natural resources. This information is also necessary for preparation of Integrated Natural Resource Management Plans (INRMPs) required by the Sikes Act Improvement Act, 16 USC §670a – o.

This database will serve as an aid in the identification of sensitive coral reef species and their critical habitats in addition to providing the latest information on threats and assessment techniques. The successful assessment and

characterization of reef ecosystems will benefit DoD environmental planners and operators.

Background

Coral reefs are complex marine ecosystems of plants, animals and microbes often compared to tropical rain forests in terms of their diversity. These ecosystems are also valuable assets that provide food, jobs, recreation, protection from storms, and billions of dollars of revenue to local communities and national economies. In response to the rapid deterioration of coral reefs worldwide, President Clinton signed Executive Order 13089 on Coral Reef Protection, directing Federal agencies to study, restore, and conserve US coral reef ecosystems. It also established the Coral Reef Task Force (CRTF), comprised of 11 Federal agencies and the governors of 7 states, territories or commonwealths with responsibilities for coral reefs.

The CRTF was directed to oversee Federal agency implementation of EO 13089 and to implement initiatives in the following areas: Coral reef mapping and monitoring; research on causes of reef degradation; conservation, mitigation and restoration measures; and international cooperation strategies. Since its inception, the Task Force has made significant progress in establishing goals and prioritizing actions to prevent the further decline of coral reefs.

In March 2000 the Task Force published The National Action Plan to Conserve Coral Reefs, a comprehensive document outlining 13 conservation actions to prevent the further decline of coral reefs categorized according to important themes: (1) Understanding coral reef ecosystems, and (2) Reducing adverse anthropogenic impacts. The Coral Reef Conservation Act of 2000 (16 U.S.C. 6401 et seq.) incorporated by reference the provisions of EO 13089 and directed the National Oceanic Atmospheric Administration (NOAA) to prepare the National Coral Reef Action Strategy (Strategy). Published in June 2002, the Strategy builds on the initial themes and goals established by the Action Plan as well as implementation plans and other information developed by the Task Force working groups. The Strategy also prioritized key threats and conservation and management actions for each region and listed targeted actions necessary to fulfill specific strategy goals.

Project Specifics

A database in an easily searchable “website” format was produced to provide information on coral reef ecosystems for resource managers. The goal was to provide, in one location, general scientific background on all aspects of coral reefs, their inhabitants, assessment strategies and conservation issues.

Items Completed during this Update:

- Continued additions of new reference articles to the database
- Localities Added:
  - Australia
- Regional Information Pages Added:
  - Pacific Ocean
  - Atlantic Ocean
  - Caribbean Sea
- Reef Assessment Section Expanded
- Marine Conservation Topics Subsections Added:
  - Threatened and Endangered Species
    - Links to spreadsheets listing T/E species by region, taxon and by conservation status
  - Reef Health/Monitoring (Disease, Bleaching, Invasive Species)
- Marine Conservation Topic Subsections were updated
- Comprehensive reference section was compiled to facilitate future updates (see reference section at the end of this report).

Items to be Completed in Future Updates:

- Continue gathering new references for the database
  - Updated searching for all localities
  - Updated searches need to be done for Base Specific Information
- Fact Sheets for Critically Endangered Species
- Searches specifically for the newly added sections for additional references

Reorganization: HOME Page

The website has been reorganized into four new sections to make navigation and searching for specific information easier (Figure 1). The majority of scientific papers are linked to downloadable pdf files in addition to links to outside sources for additional information. The new home page directs searchers to:

Coral Reef Info
The general biology of coral reefs and reef fishes

Locations
Specific information organized by geographic location or region

Reef Assessment
Current reef assessment methods

Conservation
Conservation issues including a new section specifically on
Threatened and Endangered Species

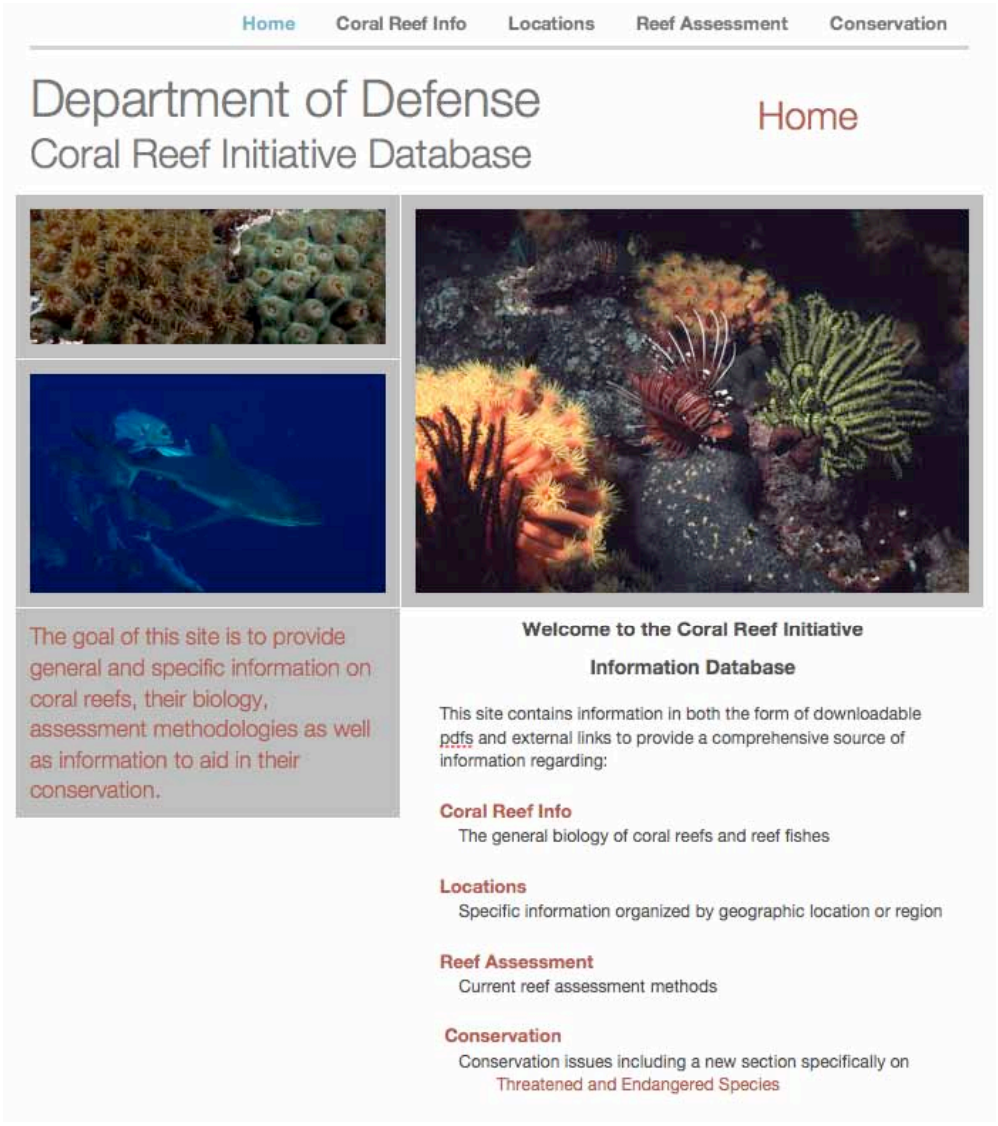


Figure 1. Screenshot of website home page.

A further description of the information available within each of these sections of the website follows. The sections that have been newly added and expanded are discussed in more detail.

SECTION 1:

Coral Reef Info

The general biology of coral reefs and reef fishes

This section contains downloadable pdf files from the general scientific literature on the basic biology of coral reefs and coral reef fishes (Figure 2).

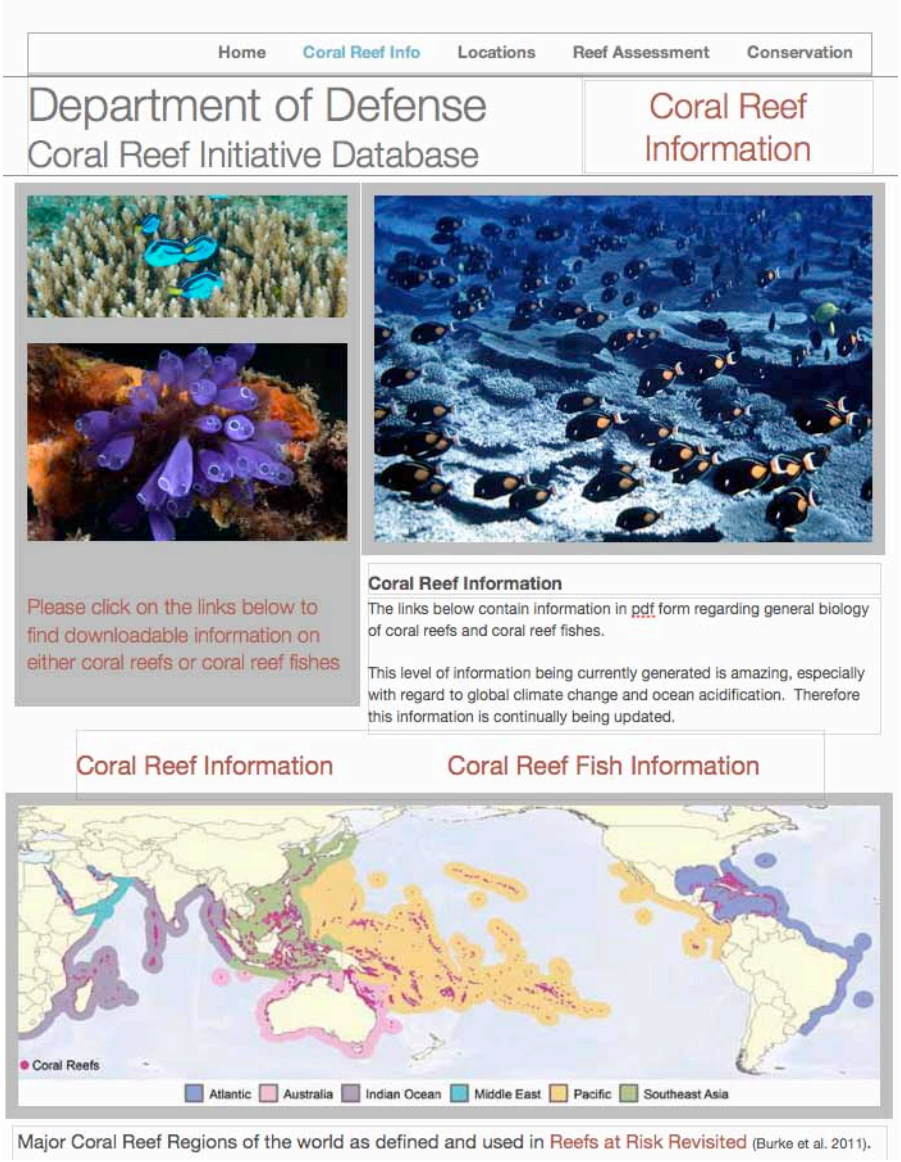


Figure 2. Page directing users to general information regarding either coral reefs or coral reef fishes.

SECTION 2:

Locations

Specific information organized by geographic location or region

This section allows the searcher to look for information based on generalized regions such as the Caribbean or on a much smaller scale such as Hawaii or Guantanamo Bay, Cuba (Figure 3). Forty five regions/locations are listed ranging from large ocean basins, information based on individual countries to smaller islands or facilities.

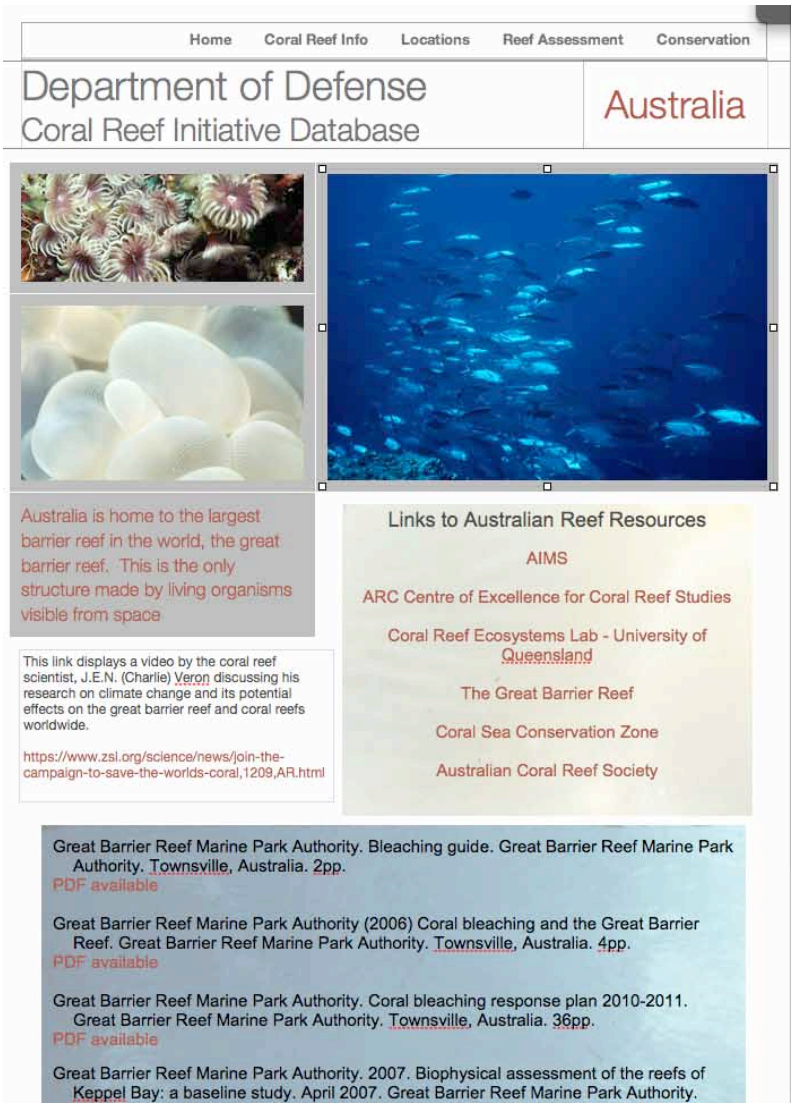


Figure 3. Example location page for Australia. Links are available for specific reports and literature as well as outside sources.

SECTION 3:

Reef Assessment

Current reef assessment methods

This sections leads us to an example assessment protocol as well as a separate page with downloadable pdf files containing scientific literature on assessments and procedures as well as links to the major outside websites (e.g. NOAA, EPA) that have reef assessment information (Figure 4).

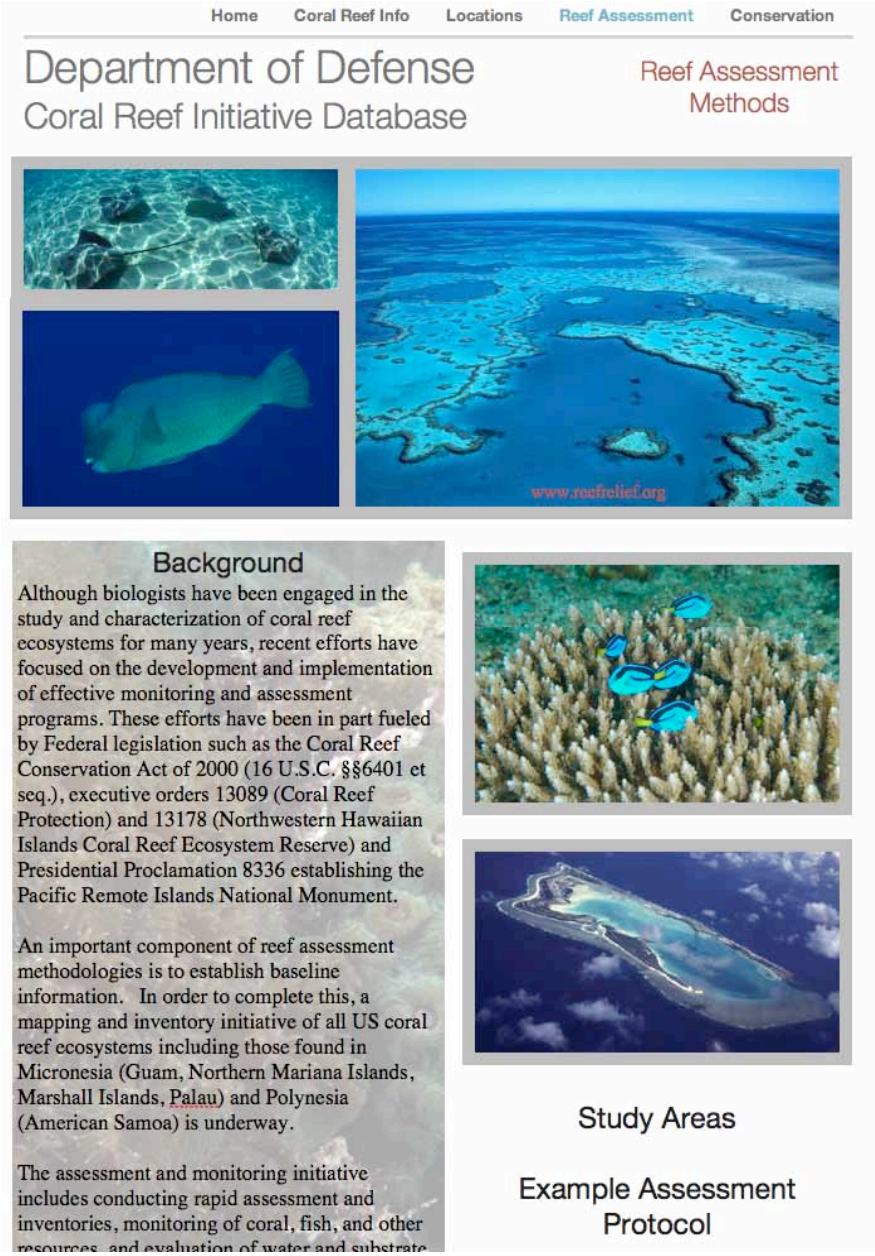


Figure 4. Web page covering reef assessment methods.

Although biologists have been engaged in the study and characterization of coral reef ecosystems for many years, recent efforts have focused on the development and implementation of effective monitoring and assessment programs. These efforts have been in part fueled by Federal legislation such as the Coral Reef Conservation Act of 2000 (16 U.S.C. §§6401 et seq.), executive orders 13089 (Coral Reef Protection) and 13178 (Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve) and Presidential Proclamation 8336 establishing the Pacific Remote Islands National Monument.

A major objective in both the action plan developed under EO 13089 and the Strategy is a mapping and inventory initiative of all US coral reef ecosystems, to include those found in Micronesia (Guam, Northern Mariana Islands, Marshall Islands, Palau) and Polynesia (American Samoa). The assessment and monitoring initiative includes conducting rapid assessment and inventories, monitoring of coral, fish, and other resources, and evaluation of water and substrate quality.

In particular, the mapping strategy established two major objectives:

1. Produce comprehensive digital maps of all shallow (< 30 meters) coral reefs, and

2. Characterize priority deep water (> 30 meters) reef systems in the U.S. and Trust Territories by 2009.

To implement DoD's responsibilities under the CRTF and comply with the CRCA, mapping and inventory information must be gathered on the military's coral reef resources. As a member of the CRTF, it is DoD's role and duty to conduct these activities. Moreover, DOD Instruction 4715.3, Environmental Conservation Program, directs DoD to inventory biologically or geographically significant or sensitive natural resources. This information is also necessary for preparation of Integrated Natural Resource Management Plans (INRMPs) required by the Sikes Act Improvement Act, 16 USC §670a – o.

The successful assessment and characterization of reef ecosystems will greatly benefit DoD environmental planners and operators. Significant challenges to resource managers involve discerning "local" contamination from global baseline contaminant levels in order to adequately characterize contamination sources and determine when restorative measures are warranted. Often a lack of baseline measurements is a significant source of difficulty in discriminating between anthropogenic impacts and those due to natural environmental and oceanographic processes and/or disturbances (i.e., determining whether a bleaching event was caused by a weather pattern or is associated with industrial activities).

Approach

A reef assessment program conducted by DoD should utilize a combination of scientists and military divers to conduct comprehensive assessments of reef areas managed by DoD in a consistent manner and within the operating budgets of DoD's natural resources programs, supplemented by grants from the Legacy Resource Management Program and DoD diver training funding. Working with trained marine biologists, Navy divers will assist in collecting data using established and proven assessment and inventory techniques. The level of data collection will be tailored to the training level of the divers and the more advanced data collection and analysis activities will be conducted by marine biologists from the Navy and a scientific research team. The success of this approach has been demonstrated by volunteer assessment programs such as those used by Reefcheck and community-based marine protected areas. This effort will supplement current diver mission requirements for construction and assessment of underwater facilities and will provide valuable training and work experience. This program will substantially benefit military divers by increasing funding for the dive program, providing educational opportunities, and increasing the divers' technical skills.

These efforts will be supplemented by the deployment of state of the art remote sensing technology and establishment of permanent monitoring platforms at each assessment site. The development and use of remote sensing technology is an integral component of this mapping effort and is critical to producing an accurate and comprehensive picture of a particular benthic ecosystem over time. The deployment of data collection equipment will further enhance these capabilities and provide real time data to detect trends and reduce monitoring costs.

Research conducted using this approach will provide operators and natural resources personnel with "knowledge superiority" of benthic habitats and coral reef communities under DoD purview. Additionally, these assessments will enable the military to document natural ecological patterns, such as coral bleaching, that may be erroneously attributed to military impacts. This information is necessary for operational and environmental planning and will provide decision-makers with crucial information needed to maintain compliance. Obtaining baseline data is an important element not only for Federal coastal management of protected resources but to provide a foundation for environmental documentation necessary to conduct operations. Such documentation requires the assessment of environmental conditions prior to any incidents possibly resulting in damage to or loss of habitat. Successful and legally defensible documentation requires the assessment of environmental conditions prior to conducting operations and implementation of mitigation measures. Assessment information is also necessary for resolving Federal trustee matters related to damage assessments. Up-to-date, scientifically defensible data is necessary to communicate and negotiate all regulatory actions in the marine environment. Furthermore, the information from this effort will assist DoD in ensuring maritime sustainability by providing operators with a firm foundation

on which to plan future training exercises and other operations in areas containing coral reef communities. It will also form the basis of all environmental planning documentation prepared for such activities occurring in these areas.

Finally, assessment data will be used to develop best management practices for vessels and facilities located or operating near coral reefs, making coral reef protection and stewardship practices part of their standard operating procedures.

The Naval Facilities Engineering Command (NAVFAC) headquarters, located in Washington, D.C. NAVFAC provides complete acquisition and engineering services to the Navy and Marine Corps worldwide, such as coordinating public works projects, real estate, capital improvements, and other construction and engineering projects. Additionally, NAVFAC provides environmental protection specialists responsible for scientific and technical services. NAVFAC is the environmental office that not only provides leadership with respect to these efforts, but coordinates with the military divers, academic scientists, and the Office of the Assistant Secretary of the Navy's (Installations & Environment) to implement an assessment program and maintain compliance with EO 13089 and the CRCA.

Study Areas

The Navy facilities listed below are responsible for managing coral reef ecosystems and have been identified as candidates for ecological exploratory surveys. Current designated assessment areas (incomplete list):

- Andros Island, AUTEC
- Naval Station Guantanamo Bay, Cuba
- Navy Support Facility Diego Garcia, Indian Ocean
- NAS Key West, Florida
- Hawaii - PMRF Barking Sands, Marine Corp Base Hawaii, Naval Station Pearl Harbor, Naval Air Station, Barbers Point
- White Beach, Okinawa, Japan
- Awase Transmitter Site, Okinawa
- Marianas Islands – Farallon de Medinilla, Tinian, Naval Activities Guam
- Puerto Rico - NASD, EMA, & AFWTF, Vieques, Naval Station Roosevelt Roads

Example Assessment Framework

OVERALL PURPOSES OF AN ASSESSMENT:

1. Produce an ecological inventory and baseline assessment of DoD coral ecosystems to achieve compliance with Federal regulations.

2. Collect current, scientifically reliable data on corals and coral reefs, Essential Fish Habitat (EFH) and threatened and endangered species and species of concern.

3. Establish long-term monitoring strategy for sites focused on the following ecological indicators:
   - Temperature - deployment of temperature loggers to detect climatic warming trends associated with coral bleaching;
   - Coral Health - photodocument and evaluate coral cover and disease incidence;
   - Fishes - photodocument and evaluate species health, abundance, size distribution and diversity; and
   - Ciguatera - detection of toxic microorganisms associated with ciguatera fish poisoning.

4. Establish best assessment strategy for each DoD site.

5. Train Navy divers about coral reef ecosystems and on the monitoring procedures referenced above to increase their alertness to ecological manifestations that may have regulatory impact.

Many methodological approaches to the monitoring and assessment of coral reefs currently exist and differ according to the desired target species and spatial/temporal scales. Although conducting fine scale, comprehensive assessments is useful for observing important growth, recruitment, and mortality trends in individual organisms, broader scale observations are necessary to detect the temporal and spatial occurrence and effects of natural disturbances and anthropogenic impacts. For these reasons, the DoD assessment protocol was developed using a combination of the most appropriate and best available scientific methods to conduct data collection.

An assessment protocol may be structured into four tiers:

Tier 1: Exploratory Ecological Survey - first quick overview of site; develops the scope for additional work and defines site-specific issues.

Tier 2: Rapid Ecological Assessment and Installation of Permanent Transects - initial rapid survey.

Tier 3: Annual Assessment and Compliance Monitoring - detailed surveys as required for regulatory compliance.

Tier 4: Comprehensive Mapping (collaborative effort) - extensive mapping and assessment, conducted collaboratively with other Federal

agencies. Specific site studies should be conducted to provide the required ecological data for the US Navy's Integrated Resources Management Plan (INRMP) and EFH requirements. The necessary data will be obtained using the strategy of an Exploratory Ecological Survey (EES).

Initial steps in an assessment process often include a preliminary site survey and rapid ecological assessment, to be conducted at each site by an Ecological Survey Team (EST). In addition to the initial survey and site assessment, rapid site surveys will be conducted as needed and subsequent to major disturbances (e.g. ship grounding or hurricane). The objectives of the initial EES are: aerial survey and photography of the location; site evaluation and selection for assessment; and development of species checklists and site description. Following site selection, the EST will conduct surveys and may establish permanent monitoring stations. Annual monitoring of permanent transect sites will be conducted by Navy personnel and the video will be analyzed by survey team members. Subsequently, data will be forwarded to Navy Engineering Facilities Command (Code ENV). When appropriate and feasible, comprehensive mapping and assessment will be conducted collaboratively with marine survey expeditions conducted by the National Oceanic and Atmospheric Administration (NOAA).

Tier 1: Exploratiory Ecological Survey (EES)

Biological Reconnaissance. A careful review of pertinent material and interviews with knowledgeable personnel is a critical first step. Sources which should be considered include, but are not limited to the following:

- Nautical charts are available for all areas. They may or may not accurately depict the presence of coral reefs, and will not include information on EFH or protected species. They will however, provide essential data on the basic benthic geomorphology (relief, rocky substrate, sand, mud, etc.).

- In many cases, NOAA Benthic Habitat Maps will be available. Although the resolution on these maps is generally not sufficient for Navy purposes, they can be used to obtain an overview of both the study area and adjacent locations. The Benthic Habitat maps do delineate major habitat types, including coral reefs, sea grass beds, etc.

- Aerial and satellite photographs are available for most if not all the locations that might be investigated. Of course, resolution is a function of the cameras used, altitude of the photographs and the weather and sea conditions at the time. In most cases, these types of photos are very useful in gaining an overview of the study area.

• Hyper-spectral imaging detects radiation at multiple spectral wavelengths. It can produce dramatically improved resolution compared with conventional aerial and satellite photos. Low resolution data (about 1 to 10 sq. km pixel size) can be obtained from NASA's Sea-Viewing Wide Field-of-View Sensor (SeaWiFS) and NOAA's Advanced Very High Resolution Radiometer (AVHRR). Ten to 30 sq. meter resolution can be obtained from Systeme Pour l'Observation de la Terre (SPOT) and Landsat Thematic Mapper (Landsat TM).

• One of the most useful information sources, from a Navy perspective can be obtained from Quickbird. These multi-spectral + panchromatic satellite images can be purchased from the Image Library at DigitalGlobe.com. The Gram-Schmidt Spectral Sharpening feature of ENVI (Environment for Visualizing Images, Research Systems, Inc.) can be used to further enhance and sharpen the images, resulting in color bands at approximately one-meter distances.

• If recreational dive guides are available for adjacent areas, they should be reviewed.

• Personnel from any local fish and wildlife agencies, as well as NMFS and USFWS should be contacted.

Tier 2: Rapid Ecological Survey and Installation of Permanent Transects

The purpose of this survey is to conduct a rapid assessment of DoD coral reefs managed by DoD using established reef survey protocols. In addition to serving as a stand-alone rapid ecological assessment, the data gathered during this effort can serve as a baseline for future monitoring in order to detect ecological changes and discern between the natural and anthropogenic influences. The qualitative and quantitative data collected by these surveys will subsequently be made available to military resource managers and base commanders to help them manage these ecosystems.

Minimum personnel required: Each site assessment should be completed in a series of dives over the course of several days. The time and personnel required will vary greatly depending on site characteristics and funding availability; however, at a minimum, the team should consist of at least four personnel with scientific training. An optional component of Tier 2 is the deployment of monitoring equipment and establishment of permanent transects and mooring stations.

The site selected for intensive sampling should be in the area of maximum reef development and reef areas in which contamination is a concern. These areas

should be noted as such. The habitat selected for assessment should also accessible from a boat anchored or moored in one place. These areas will generally be located in the 1-5 m depth interval and in the 8-15 m depth interval, however, this will vary from site to site. The following will be recorded at each location:

- Site name, GPS coordinates.
- Date and Time.
- Cloud cover
- Wind and sea state
- Transect depth
- Water visibility and temperature
- Structural composition of reef (patch reef, fringing reef, etc.)

Chemical and Geographic Analyses

Temperature loggers will be deployed at each site to provide continuous temperature data for a period of five years. In addition, salinity, light, and water motion will also be measured at each site. Bathymetry will be recorded using a Cobra-Tac bathymetry meter. In addition to the site description and environmental data collected in Tier 1, turbidity and salinity will be measured. Screening of marine sediments and biota for inorganic and organic contaminants will be conducted as required to fulfill regulatory compliance requirements and the determination for screening will be made on a site-to-site basis.

Tier 3: Annual Assessment and Compliance Monitoring

Monitoring of coral reef or closely associated habitats, by DoD normally occurs under the following circumstances:

- A DoD facility is located adjacent to a coral reef area, such as Pearl Harbor, Hawaii or White Beach, Okinawa.

- An operational or training area is located over, or adjacent to a coral reef, such as Marine Corps Base Hawaii's Bellows Training Area, or the range at Farallon de Medinilla in the Commonwealth of the Northern Marina Islands.

- A DoD activity, such as a dredging or construction project, is proposed for an area that supports coral reefs.

Prior to designing a monitoring program, baseline assessment should be completed as described in the previous section. As a result of the baseline findings, a monitoring program may be tailored to evaluate selected aspects of the marine environment, over a period of five years or more. The frequency of monitoring will be determined on a case-by-case basis, but will normally range from quarterly to annual visits. Permanent monitoring stations will be surveyed

on a regular basis and/or after impact-causing events by a team of divers trained in video survey techniques. In general, regular monitoring will be conducted using the survey protocol used for the initial rapid site assessment; however, this protocol may be modified as needed to address site-specific concerns. Survey videos will subsequently be analyzed by scientific team members and the data compiled and forwarded to NAVFACENGCOM (Code ENV).

Annual surveys could generally include the following:

1. Site Description

2. Surveys using a video camera in an underwater housing at permanent monitoring stations:

   • Stationary visual census (described below)
   • Belt transects
   • Quadrats
   • RDT
   Procedures:
   At each site, record the following:
   • Site name, GPS coordinates.
   • Date and Time.
   • Cloud cover
   • Wind and sea state
   • Water visibility and temperature

Tier 4: Comprehensive Mapping (Collaborative Effort)

Mapping of benthic communities is often done for limited areas where the level of detail provided by the NOAA Benthic Habitat Mapping Program is not sufficient. For example, a very detailed benthic habitat map of a 2000 X 800 foot area in Apra Harbor, Guam was produced in June 2004 using the PCQM combined with GPS and range finders. A second, smaller area within Apra Harbor was mapped in December 2004 using a combination of Quickbird satellite photos, the Gram-Schmidt Spectral Sharpening feature of ENVI, a modified LPIM, GPS and range finders. This second area was generally in the 30 to 50 foot depth range, while the first area contained depths to 160 feet. The methods used, must be adjusted to local conditions. Satellite and aerial photography become less reliable, or even useless as water depths and/or turbidity increases.

The NOAA Benthic Habitat Mapping Program uses a hierarchical system of zones and habitats. The terms ‘Zone’ and ‘Habitat’ as defined in 2002 by NOAA are “…benthic community location…” and “…substrate and/or cover type”, respectively

(http://biogeo.nos.noaa.gov/projects/mapping/pacific/main8/classification/). The number of categories which NOAA has adopted varies slightly from region to region. For example, in the Caribbean NOAA has used nine zones and 26 habitat types; in Hawaii they have utilized 11 zones and 27 habitat types. Examples of zones and habitats in Hawaii are 'Reef Flat Zone' and 'Uncolonized Pavement Habitat'. The general rule, utilized by NOAA, is that if a substrate is less than 10% colonized, it is designated as 'Uncolonized'. The size of the minimum-mapping unit (MMU) utilized by NOAA is one acre. For DoD, this level of detail may not always be adequate. To the extent possible, the DoD's limited mapping efforts should be compatible with the NOAA approach.

When appropriate, DoD should collaborate with NOAA and other Federal partners conducting comprehensive mapping and assessment, particularly in the Pacific. In 2004, the NOAA research vessel Oscar Elton Sette surveyed reefs at Johnston atoll as part of a 22 day cruise to support the NMFS Coral Reef Conservation Program. Research teams collected data on fish, coral, algae and other invertebrates, and recorded video during the surveys. When possible, DoD sites will be included in NOAA research cruises in the Pacific and may include personnel from the DoD Ecological Survey Team.

SECTION 4:

Conservation

Reef Health and Monitoring

This section contains multiple useful links to outside resources as well as numerous scientific articles available for download (Figure 5).

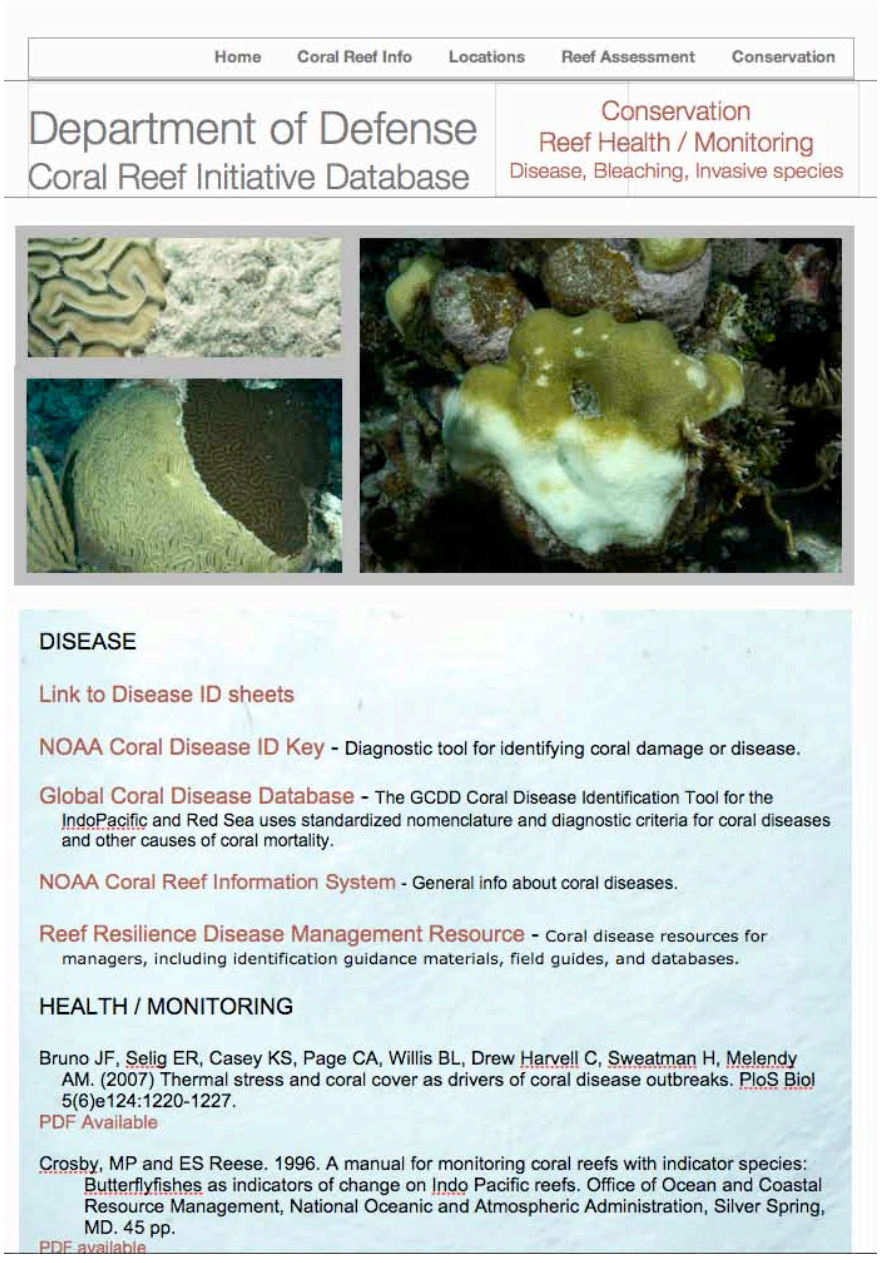


Figure 5. Web page for the conservation section on reef health and monitoring with subsections specifically covering disease, bleaching and invasive species.

Conservation

Conservation issues including a new section specifically on Threatened and Endangered Species

Coral Reef Threatened Species

As data on the conservation status on marine species are updated, the number of these species occurring in coral reefs habitats has increased dramatically (Figure 6). In order to make these data easily accessible to Naval personnel, we have expanded and reorganized the previous version of the Coral Reef Initiative Database.

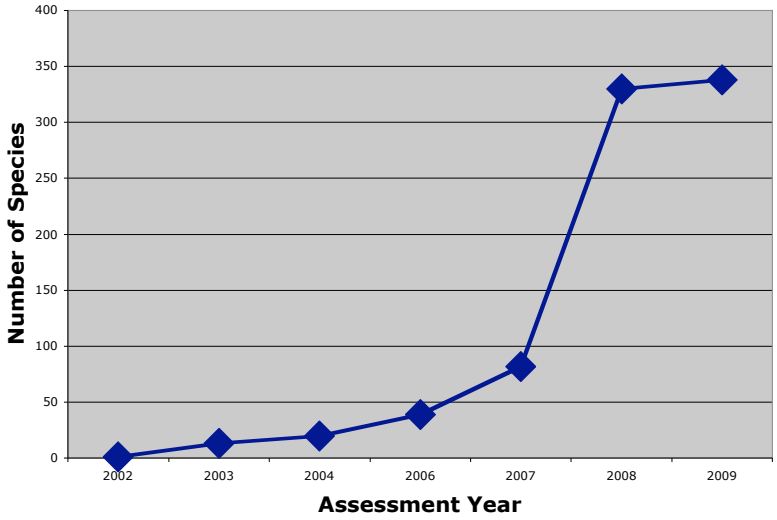
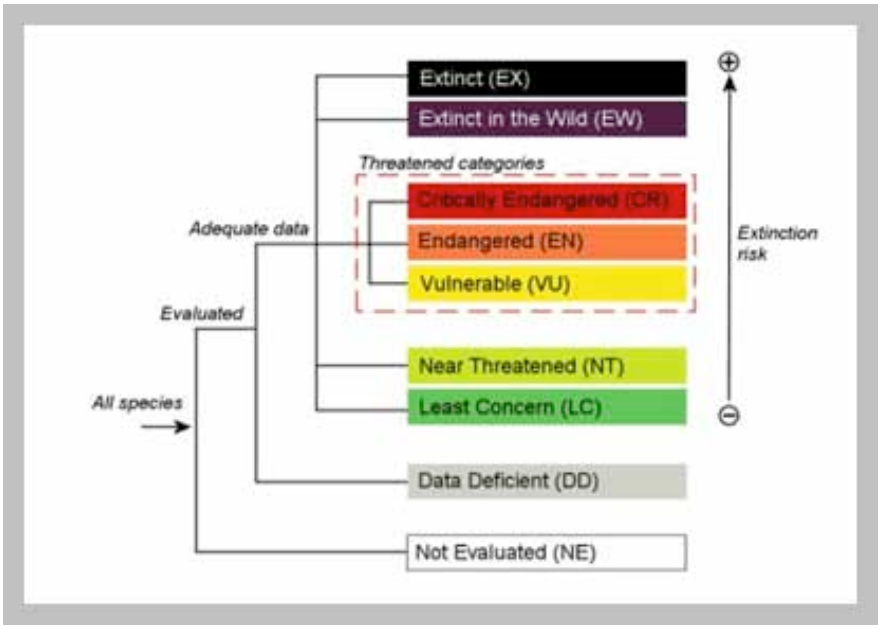


Figure 6. The cumulative number of coral reef associated species listed as vulnerable, endangered or critically endangered (threatened categories) within the IUCN redlist by assessment year. A dramatic increase in species listed occurred in 2008.

A section on Threatened and Endangered Species was added to Conservation Issues page. This new section of the website focuses on plants and animals found in tropical marine regions that may have special conservation status. The main information source for this section is the IUCN (The International Union for the Conservation of Nature) Red List of Threatened Species (www.iucnredlist.org) which is recognized as a comprehensive and objective method for evaluating the conservation status of species worldwide. This section focuses on species considered to have a threatened conservation status and that fall into one of the three categories below:

This section is being expanded so that users can search for information specific to a location (e.g. Hawaii), more general region (e.g. Pacific) or by organism (e.g. Fishes or Corals). A spreadsheet containing 622 species has been generated from the IUCN Redlist of all Vulnerable (466), Endangered (86) and Critically Endangered (70) species occurring in coral reef habitats. These three categories encompass those considered "threatened" by the IUCN (Figure 7).



From: **IUCN. (2001).** ***IUCN Red List Categories and Criteria***

Figure 7. Graphic depicting evaluation process to categorize species within the ICUN redlist.

Currently users can search for threatened species by taxon (e.g. fishes, reptiles, plants, corals or mammals) or by region (Figure 8). Each link allows the user to open a spreadsheet specific to the species of interest or the region. The data specific to each region are organized on individual pages with maps and a summary of threatened species for that region. Regions are defined by the FAO (Food and Agriculture Organization) major fishing areas. Links to fact sheets are also found on the regional pages. Users can also search for a list of species organized by conservation status within each region. Currently only threatened species are in the database including those that are critically endangered, endangered or vulnerable according to the IUCN Redlist.

Fact sheets for critically endangered species are being created with examples in the database for staghorn and elkhorn corals as well as for the hawksbill turtle (Figure 9). Fact sheets outline species distribution, basic life history information, specifics on critical habitats and conservation actions (Figure 10).

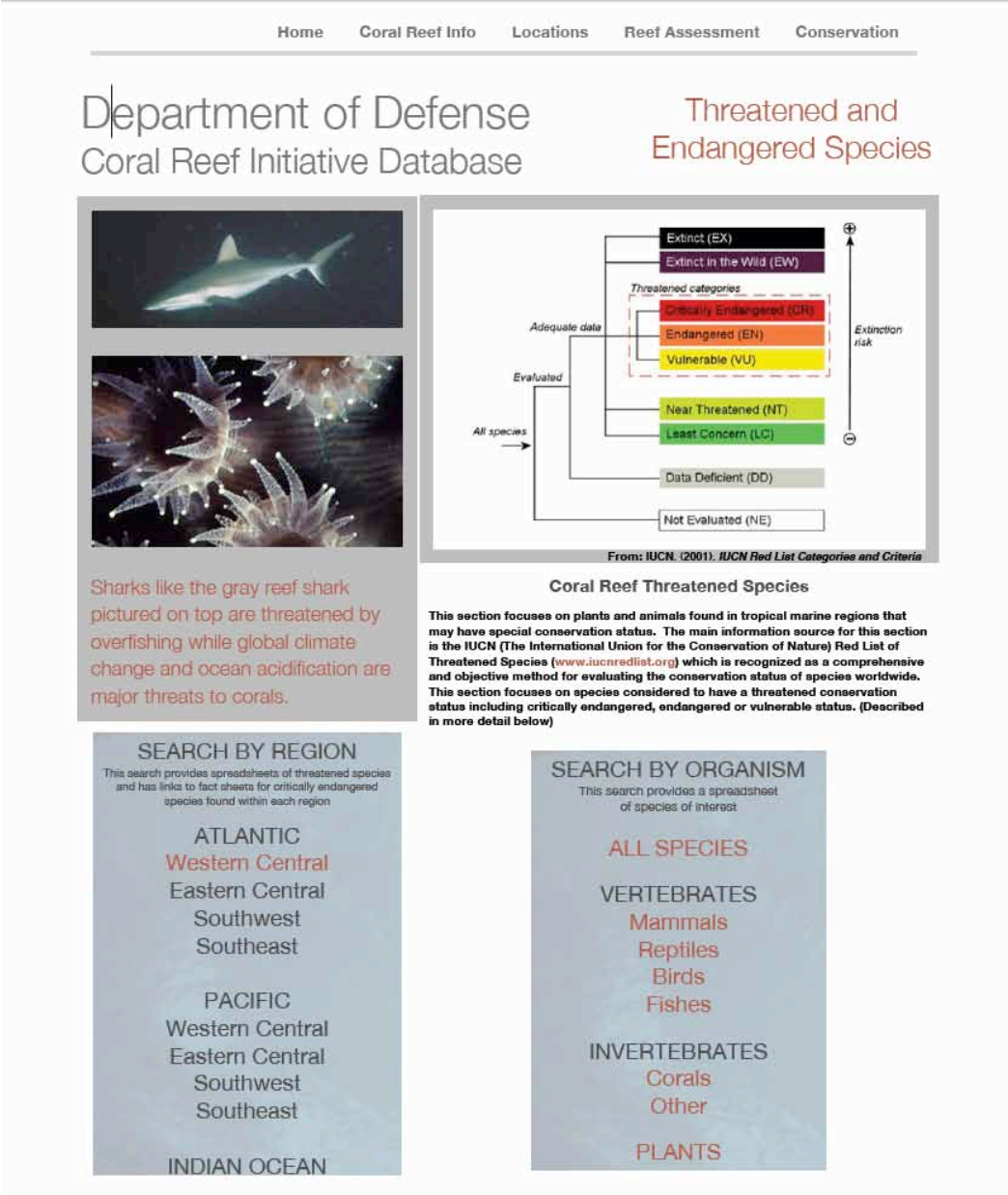


Figure 8. Web page for threatened and endangered species. Users can search by organism. For example a search could include all species of threatened marine reptiles. If information on a specific region is required, links to regional pages defined by FAO major fishing regions are provided.

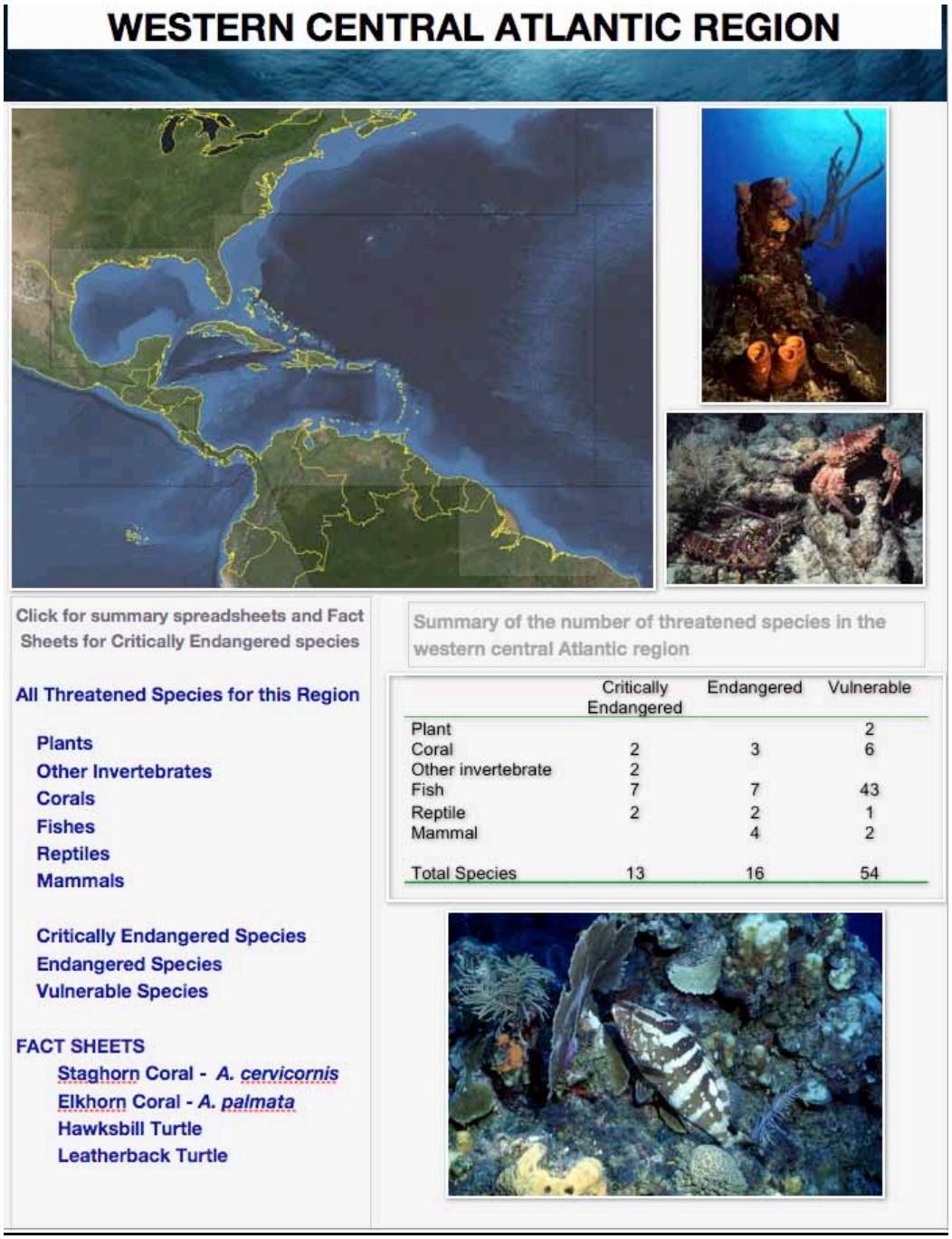


Figure 9. Example of one of the regional pages where users can search for threatened species by taxon or conservation status. A summary of threatened species is provided for each region and a link to a summary spreadsheet of all threatened species is provided. Links to fact sheets for critically endangered species found within the regions will also be located on this page.

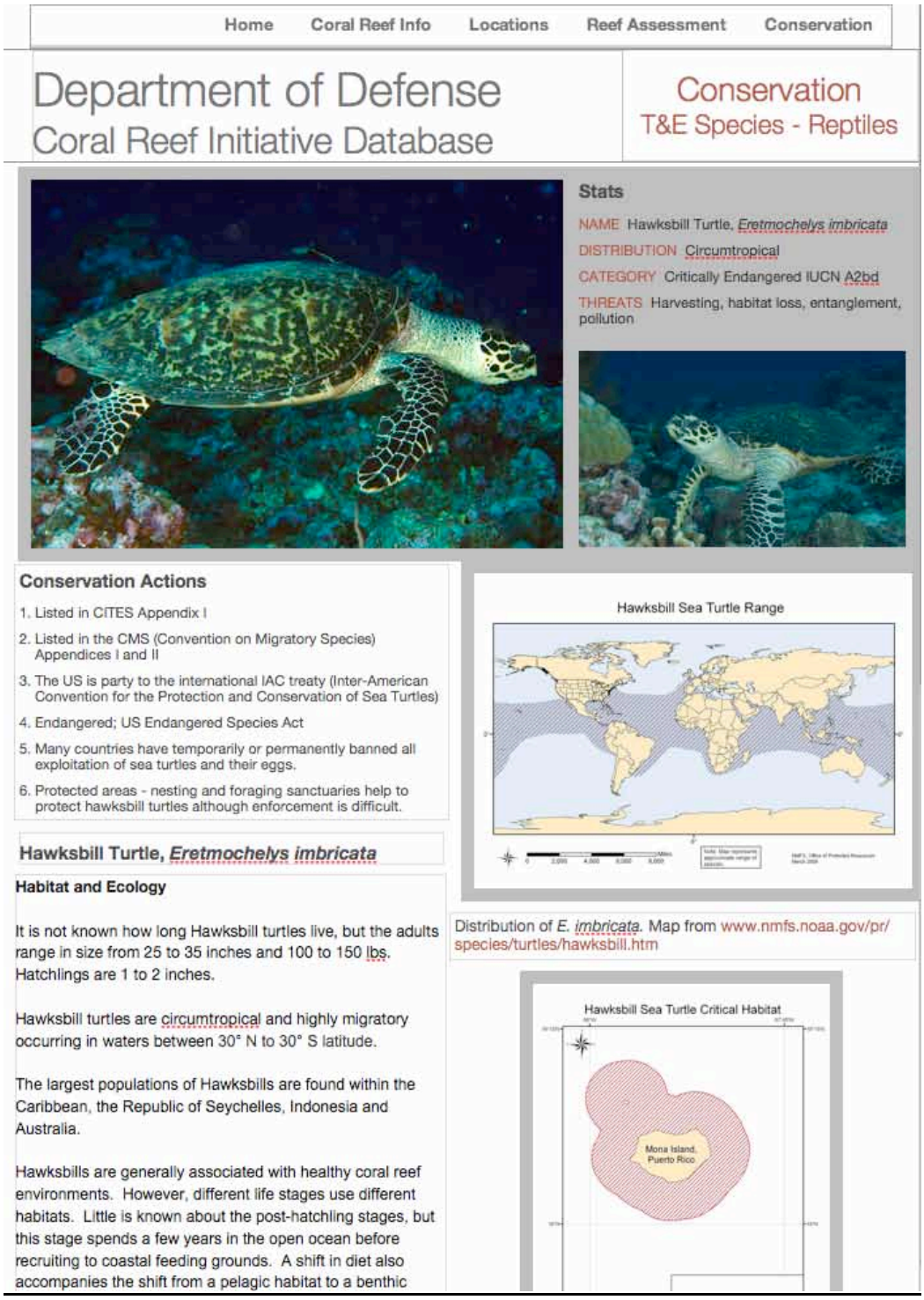


Figure 10. Example of a Fact Sheet for the critically endangered Hawksbill turtle.

REFERENCES

This section lists all references provided in the database. New references are in bold.

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