Users Guide to the Unified Florida Coral Reef Tract Map

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Introducing the Unified Florida Coral Reef Tract Map

What is the Unified Florida Coral Reef Tract Map?

The Unified Florida Reef Tract Map (Unified Reef Map) provides a consistent geographic spatial framework for management, monitoring, and characterization of the Florida reef tract from Martin County to the Dry Tortugas. The map integrates existing benthic habitat maps of Martin, Palm Beach, Broward, and Miami counties, Biscayne National Park, Florida Bay, and the Florida Keys, including the Dry Tortugas. The map is available to coral reef managers, researchers and stakeholders through Internet-based mapping tools accessible to desktop and laptop computers, tablets, and smartphones.

❖ Unified Class Levels

Through the mapping process, lines are drawn around different seafloor types and the dominant biological cover (such as live coral or seagrass) and geological formations (such as patch reef, sand or pavement) are described using categorical classification schemes. Classification schemes differ among mapping projects. Unified Class Levels (UC Levels) integrate the classification schemes into a common framework and provide flexibility in selecting the amount of benthic information detail needed. The amount of detail needed would be dictated by the research question or need. There are five levels of detail with UC Level 0 being the most general and UC Level 4 being the most detailed. Acting as a common denominator, the general UC Levels ensure consistency across the entire reef tract. The first 3 UC Levels are described in Table 1. Detailed information for benthic classification values can be found in this NOAA technical report.

Unified Class Level 0	Unified Class Level 1	Unified Class Level 2
Artificial	Artificial	Artificial
Coral Reef and Hardbottom	Aggregate Reef	Aggregate Reef
		Spur and Groove
	Individual or Aggregated Patch Reef	Individual or Aggregated Patch Reef
	Pavement	Pavement
		Colonized Pavement
		Pavement with Seagrass
		Pavement with Sand Channels
	Reef Rubble	Reef Rubble
		Colonized Reef Rubble
		Reef Rubble with Seagrass
	Ridge	Ridge
Dredged/Excavated	Dredged/Excavated	Dredged/Excavated
Seagrass	Seagrass (Continuous)	Seagrass (Continuous)
	Seagrass (Discontinuous)	Seagrass (Discontinuous)
Unconsolidated Sediment	Scattered Coral/Rock in Unconsolidated Sed	Scattered Coral/Rock in Unconsolidated Sed
	Unconsolidated Sediment	Tidal Flats
		Unconsolidated Sediment

Table 1. UC Levels 0, 1 and 2.

❖ Spatial integration

The Unified Reef Map is composed of different source maps that differ not only categorically, but spatially as well. Where maps meet, there are often discrepancies at the seams and where they overlap. Interpretations of habitat types and boundaries may differ based on data sources used, methods (particularly mapping scale), and the interpreters themselves. In order to integrate the maps, **overlap is removed and boundaries are edited to match at the seams**. Individual maps that are assigned UC Levels but retain the original spatial information are also available.

➢ How to use the Unified Reef Map

❖ What kinds of questions can this map address?

Being a geospatial dataset, the Unified Reef Map can **quantify spatial information**. The area, perimeter and length of features can be calculated and statistics can be calculated based on the spatial orientation of features. Information can also be **visualized or analyzed** with other spatial information as a digital map.

❖ When not to use the Unified Reef Map

Map **limitations must be considered** when conducting analysis based on the Unified Reef Map. If, for example, one were to ask what species of seagrass or hard coral were present at a vessel grounding location, the Unified Reef Map would not be appropriate as it does not detail species type. While monitoring data is available at some locations with species specific information, a field survey would likely be necessary to detail species distribution in a specific area. Example scenarios for proper use of the Unified Reef Map are provided below.

❖ Map Limitations

- Maps are **not perfect.** They are abstract representations of reality. The Unified Reef Map is not an exception!

- There **may be errors** in the map. While research staff work hard to ensure high accuracy, not every single point on the map can be verified.
- There are **gaps** in the map. The absence of information for a location does not mean there is nothing of value in that area. Research staff are actively working to fill in gaps where possible.
- Some seafloor features **change over time**. The density and distribution of seagrass, for example, can change within a few years time.
- Small features may not be represented in the map. For the most part, the smallest seafloor feature mapped is 1 acre. Patch reefs are the exception; they are mapped to a much finer scale.
- Biscayne National Park and Dry Tortugas National Park are mapped at a finer scale than the rest of the Florida Reef Tract. These **scale differences** should be considered when conducting tract wide analysis.

❖ Zones and Regions

Coral reef environments poses distinct **Zones** (Figure 1) created by differences in depth, morphology, wave and current energy, temperature, and light. At a larger scale, reef environments also differ based on their general geographic location – their **Region** (Figure 2). A benthic classification type may have distinctly different ecological communities based on the Zone and/or Region in which it occurs. For example, Spur and Groove has different ecological characteristics depending on its location in Lagoon, Reef Crest or Fore Reef Zones. Zone and Region should be considered when evaluating benthic classification in ecological terms.

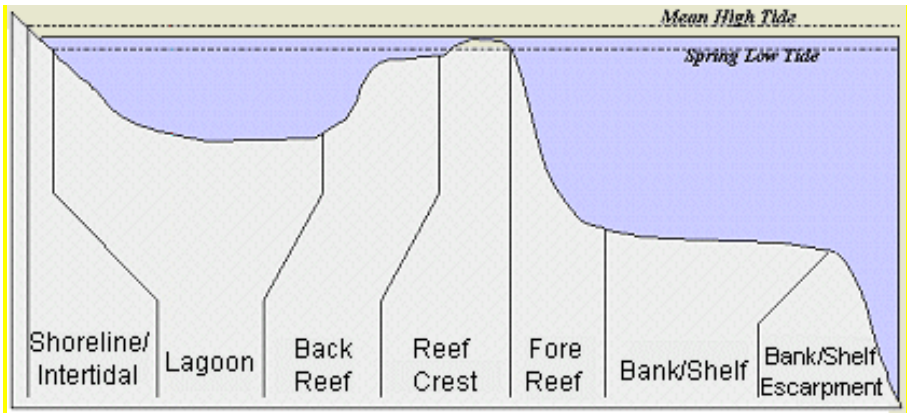

Figure 1. Coral Reef Zones (Graphic curtsey of NOAA NCCOS)

Figure 2. Florida Coral Reef Tract Regions

❖ Example scenarios

Consider a **coarse scale question** such as: What are the total areas for mapped hardbottom and seagrass in South Florida and the Florida Keys? If seagrass density distinctions are not necessary, the UC Level 0 would be most appropriate for consistently representing the entire Florida Reef Tract since seagrass density is not mapped for all parts of the Florida Reef Tract. Figure 3 illustrates the differences between UC Level 0 and 1.

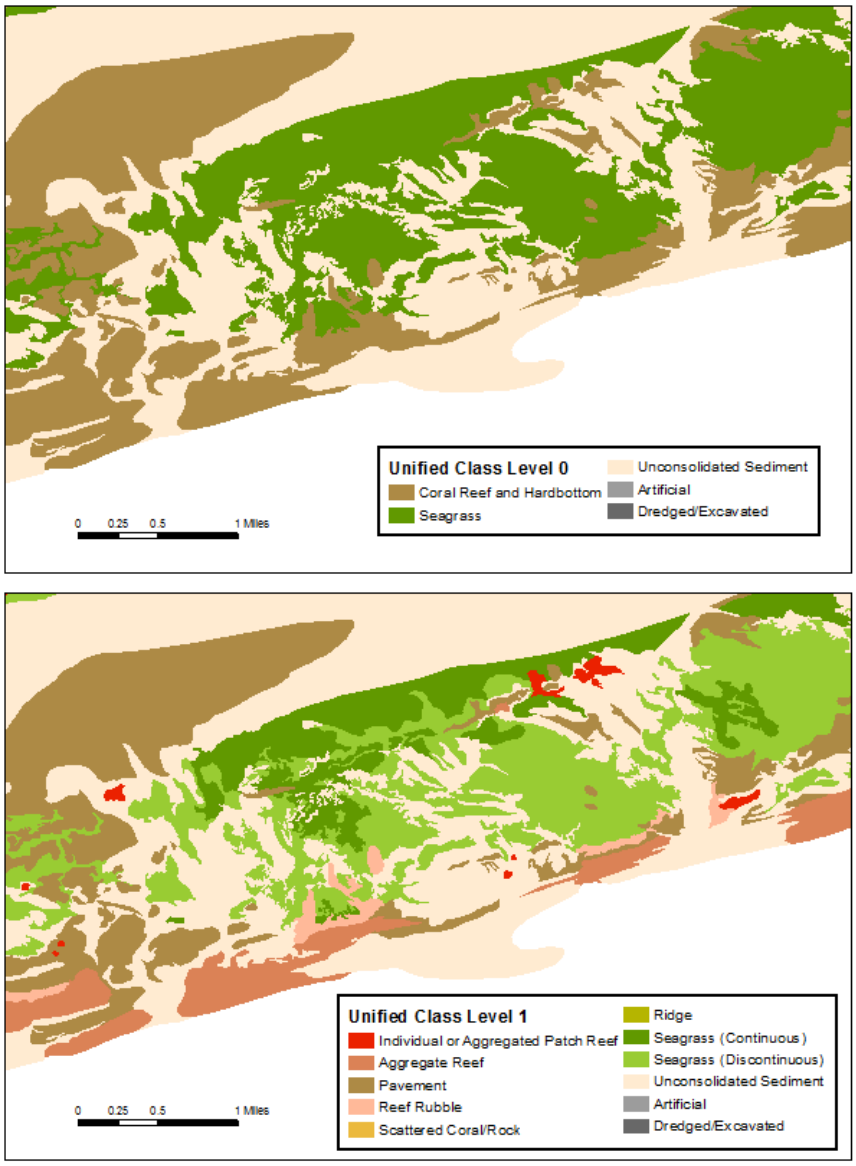

Figure 3. UC Levels 0 and 1 at Looe Key

Hypothetical Example Scenario: A vessel runs aground on a coral reef in Biscayne National Park. The vessel drags across the coral reef creating a scar track. An estimate of seafloor habitat types affected by the grounding is needed. Referencing the benthic mapping index available in the Unified Reef Map Geodatabase indicates the event occurs in an area where two maps provide coverage (Figure 4). At this location, the National Park Service (NPS) map, was created using a finer scale minimum mapping unit than the NOAA map; therefore, it provides more spatial detail.

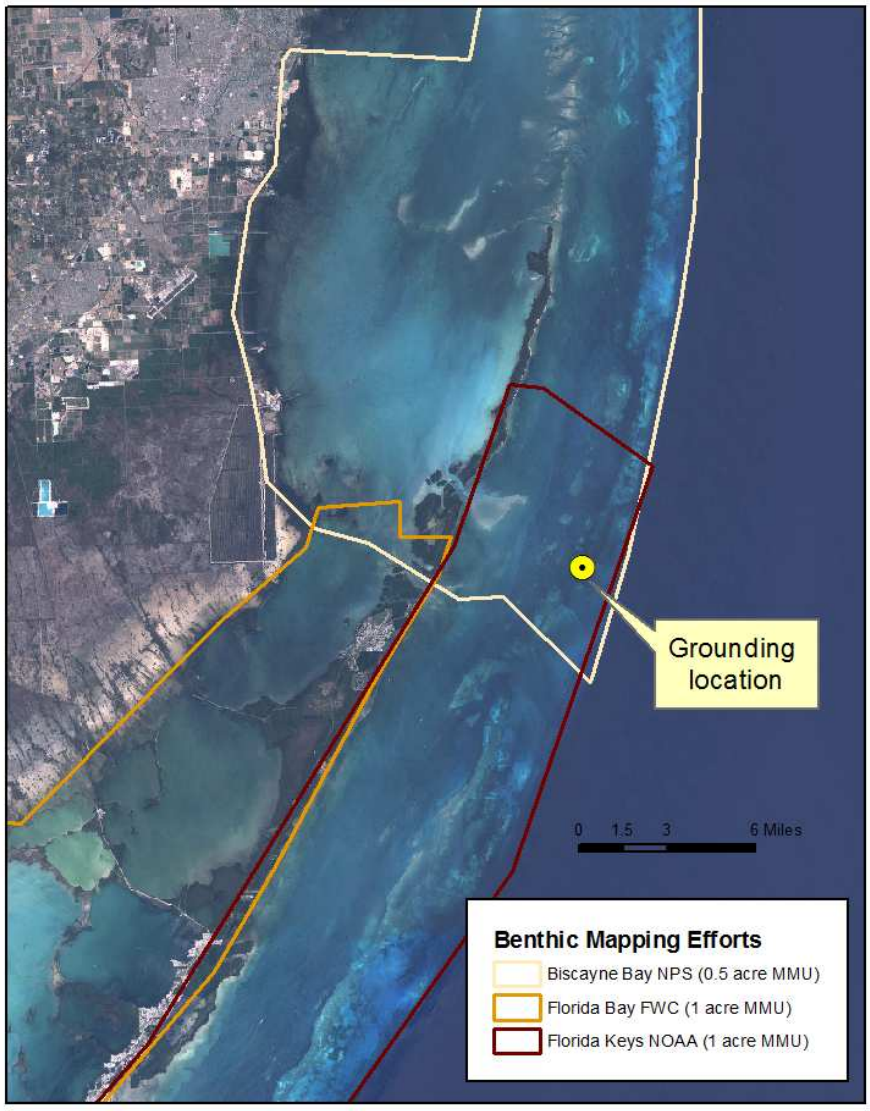

Figure 4. Location of hypothetical grounding event relative to available benthic maps

Comparing the vessel grounding location to the benthic map provides an initial assessment of what benthic types may be affected by the grounding. A 500-meter buffer around the scar track is created to represent the area that may be affected by the vessel grounding event. Differences between spatial resolution for this area can be visualized in Figure 5. To represent this small area, the NPS map may be more appropriate as it provides higher spatial resolution. Note that even the finer scale map will not capture every small unique seafloor feature. Since this analysis would only be applied to a single map and a small area, UC Level 4 may be useful as it provides all classification detail from the original source map. In reality, a field survey would be necessary to assess benthic habitats affected by the grounding event.

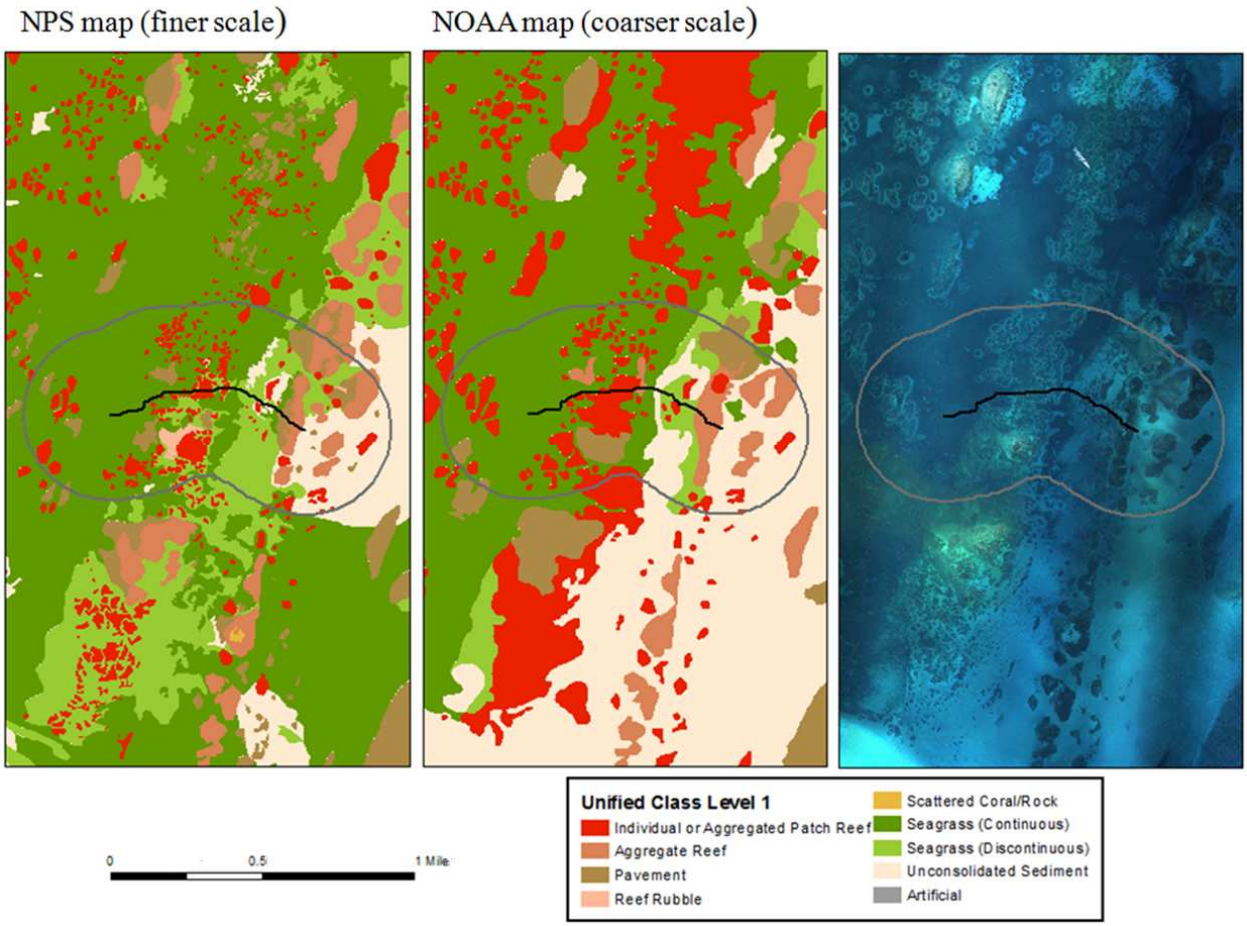

Figure 5. Hypothetical scar track (black line) created by a vessel grounding with a 500m buffer (gray line) laid over 2 different maps and an aerial photograph.

It turns out that the hypothetical vessel grounded on the coral reef is an oil tanker. The vessel's hull fractures and oil is released into the ocean. Much of the oil is spread far across the Florida Coral Reef Tract by winds and currents before boom can be deployed around the vessel to contain the spill. Satellites are used to map the extent of the oil slick on the surface of the water. Figure 6 shows the 12,000-square-kilometer extent of the hypothetical oil slick. Given that the oil slick intersects multiple mapping areas, the Unified Reef Map may be more appropriate for summarizing benthic areas coinciding with oil as it provides a more consistent picture of the entire reef tract.

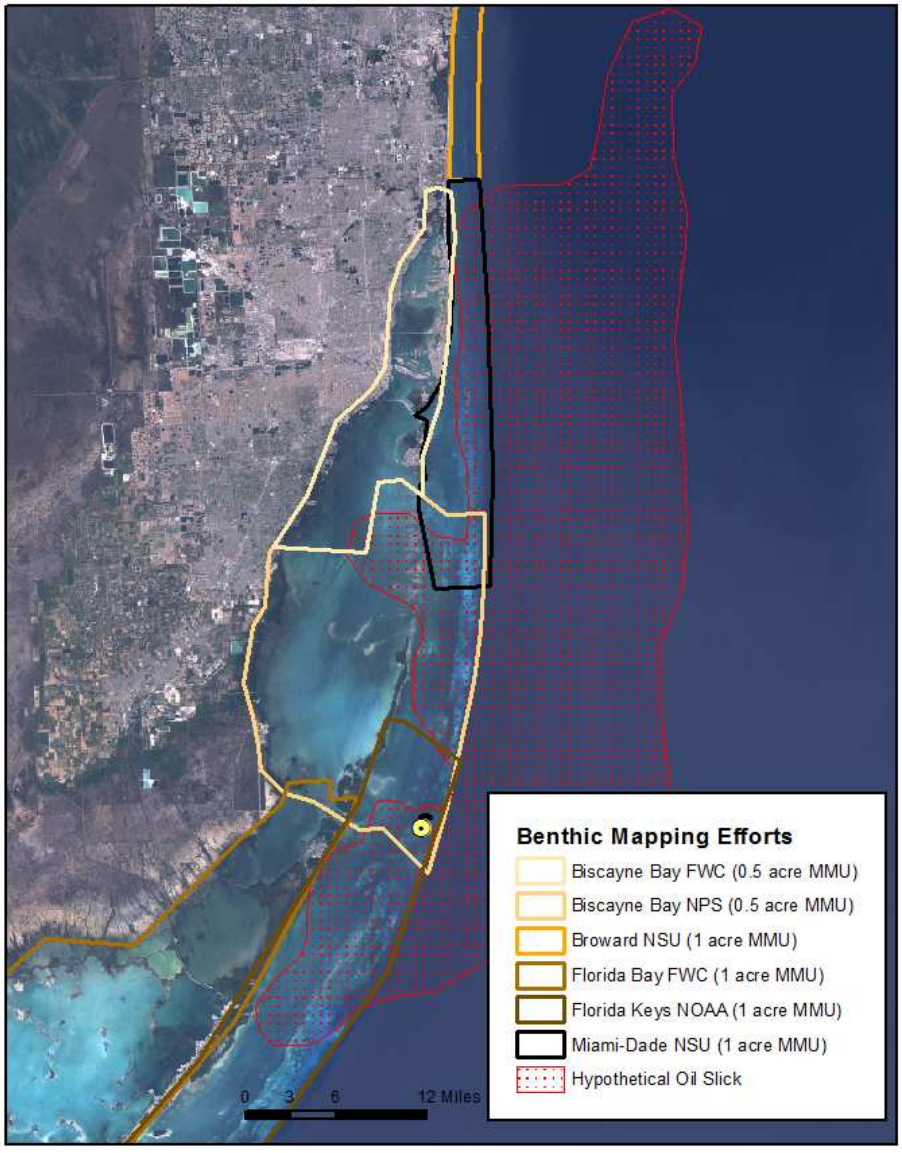

Figure 6. Extent of oil slick

➢ How to Access the Data

❖ Accessing the Unified Reef Map data on the internet

Web mapping tools allow users to easily view and work with GIS data without needing special skills or software. Free Web-based maps operate within Internet browsers (i.e., Microsoft Internet Explorer or Google Chrome). The Unified Reef Map can be viewed along with related coral reef data layers through Web-mapping services and applications. The Web-mapping application can be accessed on ArcGIS.com.

Web-mapping applications can also be used with mobile devices, such as smartphones or tablets. Simply download and install the free ArcGIS application from your device's application store and load the Unified Reef Map by searching the key phrase "FWC Unified Reef Map" at http://www.arcgis.com/home/gallery.html. This Web map will also provide access to additional spatial datasets related to South Florida marine resources.

❖ Unified Reef Map GIS data

GIS files and associated documentation can be downloaded from MyFWC.com. Note that the Unified Reef Map will be updated regularly. Version numbers will be used to track updates. Web-based maps will automatically be updated. Web map services can be accessed directly through ArcMap. The Unified Reef Map service is available here and the related coral reef data layers are available here. The Unified Reef Map source GIS files can be downloaded as a product package from myFWC.com. The Unified Reef Map product package includes: User's Guide, Unified Reef Map Geodatabase with ArcMap symbology, zones layer, regions layer, map project footprints layer, CMECS crosswalk table and metadata. If GIS files are downloaded, users will need to download new versions manually.

The contents of this map product:

1. An ArcGIS Layer file containing (requires ArcMap software to open)
    a. Unified Reef Map - Spatially and Thematically integrated

b. Biscayne National Park NPS map - Thematically integrated but retains finer spatial resolution overlap
c. Regions
d. Zones
e. Source Map Footprints

2. NOAA Coastal and Marine Ecological Classification Standard (CMECS) crosswalk tables
3. Metadata for each GIS file

GIS software is required to directly access GIS files. ESRI ArcReader, a basic free GIS tool, can be downloaded here.

➢ Version Notes

Note that this is currently a draft product, Accuracy Assessment for integration edits will be conducted in 2014. New versions will be released as data are updated. Edits

Version 1.0 – published September 2013

- See report for full details

Version 1.1 – published December 2013

- Data additions: Biscayne Bay Aquatic Preserve
- Zone information added for Southeast Florida and Marquesas