

Coral Reef Conservation Program Grant Update

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Gulf of Mexico Fishery Management Council Meeting

Baton Rouge, Louisiana
January 30, 2023



Outline

- ❖ Coral Reef Conservation Program grant overview
- ❖ Objective and expectations from the recent grant
- ❖ Selected deliverables produced from task activities
 - Learning Modules
 - Web Applications
 - Stakeholder Engagement
 - Information Dashboard
- ❖ Product highlights
- ❖ Future activities

Coral Reef Conservation Program Grants

2011-2013 Grant Cycle

Inspiring deep-sea learning

- Deep-sea ecosystems
 - Biologically important
 - Little known outside scientific community
- Print and digital posters highlighting Deep-sea species & ecosystems (e.g., ecosystems of the deep & creatures of the deep)
- Wide-spread distribution of outreach materials
- Developed more digital content

2014-2016 Grant Cycle

Expanding digital content

- Coral, EFH, HAPC, Spiny Lobster, Lionfish Mapper Applications
- Developing species-habitat models, learning modules and Decision Support Tools
- Communicate and coordinate with other management partners in coral ecosystem management efforts through workshops and outreach materials

2017-2020 Grant Cycle

Endangered Coral Species

- Learning modules on deep sea corals, life history, and climate change effect on corals
- Applications and Decision Support tools for exploring ESA coral distribution, HAPC, ESA Coral Habitat Models.
- Gulf of Mexico common coral dive booklet and hosting ESA coral database.

What does the most recent grant include?

Two-year project (2020-2022) addressing changes in **coral reef habitats** and **potential management implications** to promote the **sustainability** of coral reef associated fisheries in the Gulf of Mexico using:

- Comprehensive scientific review
- Broad stakeholder engagement
- Spatial decision-support tools

Proposed activities were divided into two tasks, each having a goal towards fulfilling the overall objective of the project.

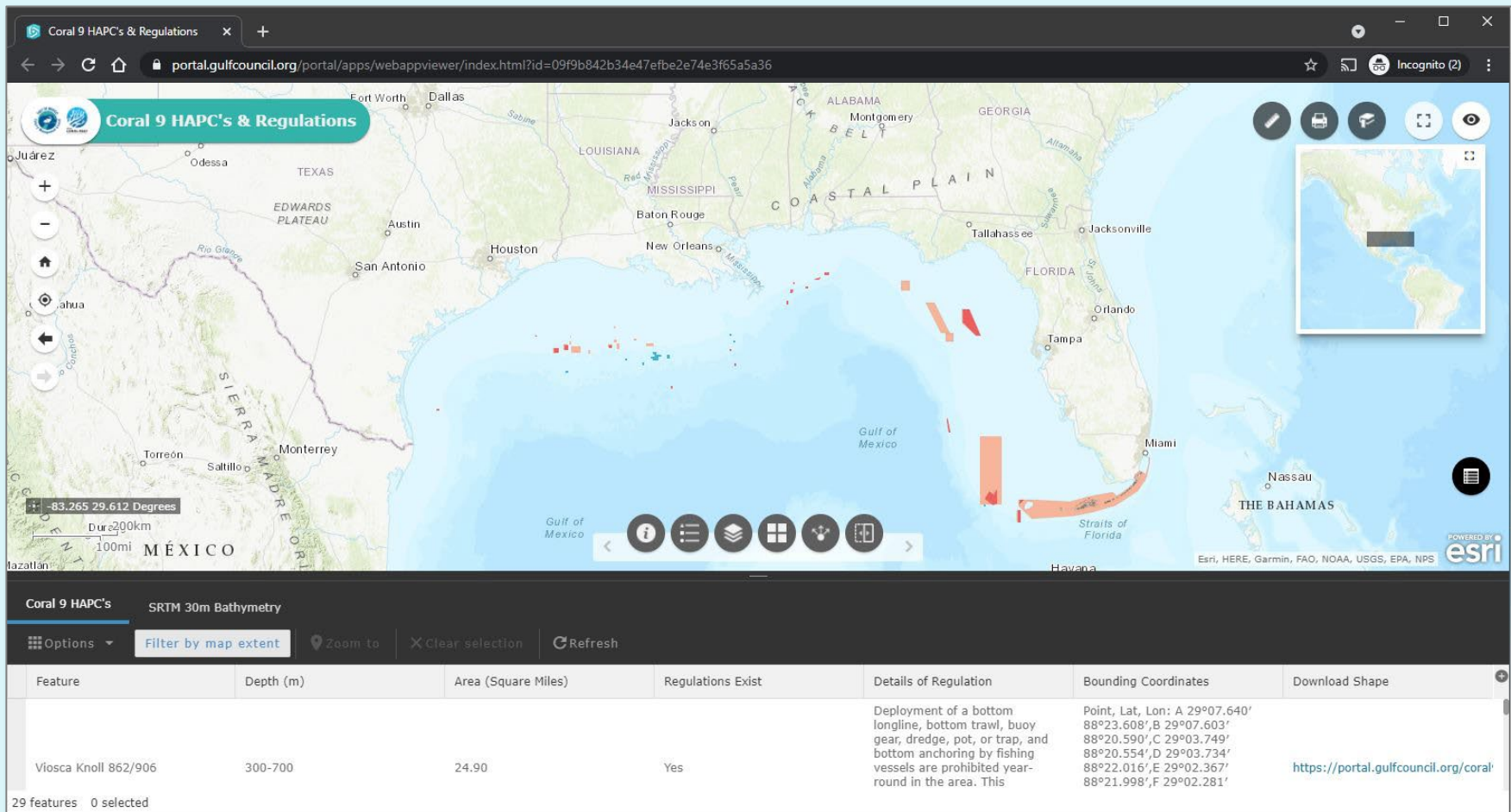
Task 1: Evaluation of Existing Management Measures

Identification of potential additional coral habitat areas for protection and an evaluation of the effectiveness of current management areas for coral reefs, and associated fishes in the Gulf of Mexico.

- Incorporating new information gathered from a review of recent scientific studies, existing habitat protection measures, fishing activities, and monitoring outcomes.
- Identify and evaluate the performance of existing management measures by comparing coral cover inside/adjacent to managed sites.
- Create outreach materials in the form of learning modules and decision support tools and publish them in the Coral Portal.

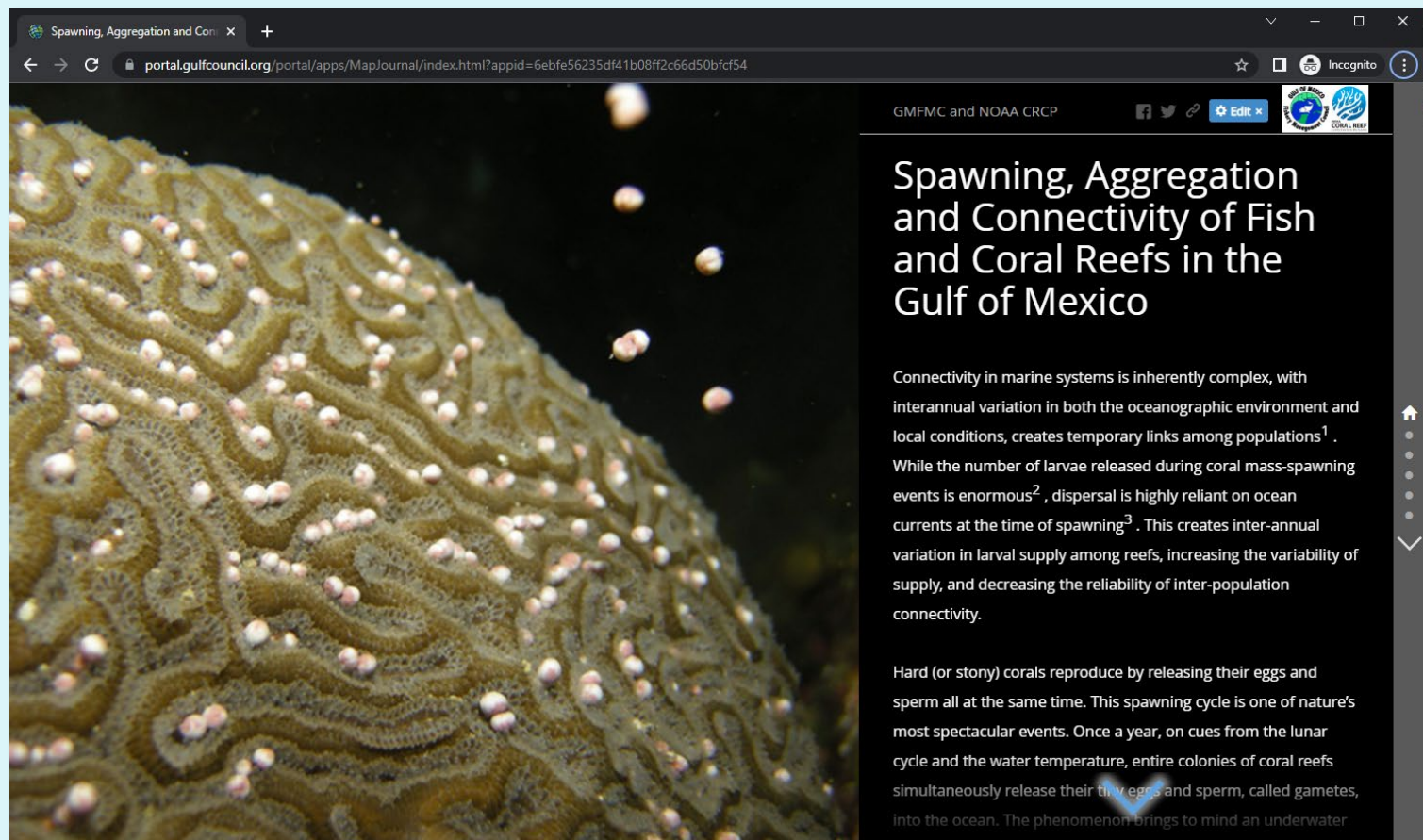
Web Application

Coral 9 HAPC Explorer application. The application displays the HAPCs established through Coral Amendment 9 in relation to other existing HAPCs in the Gulf with detailed regulations existing in each of them. It can be accessed from <https://portal.gulfcouncil.org/coral9/>



Learning Module

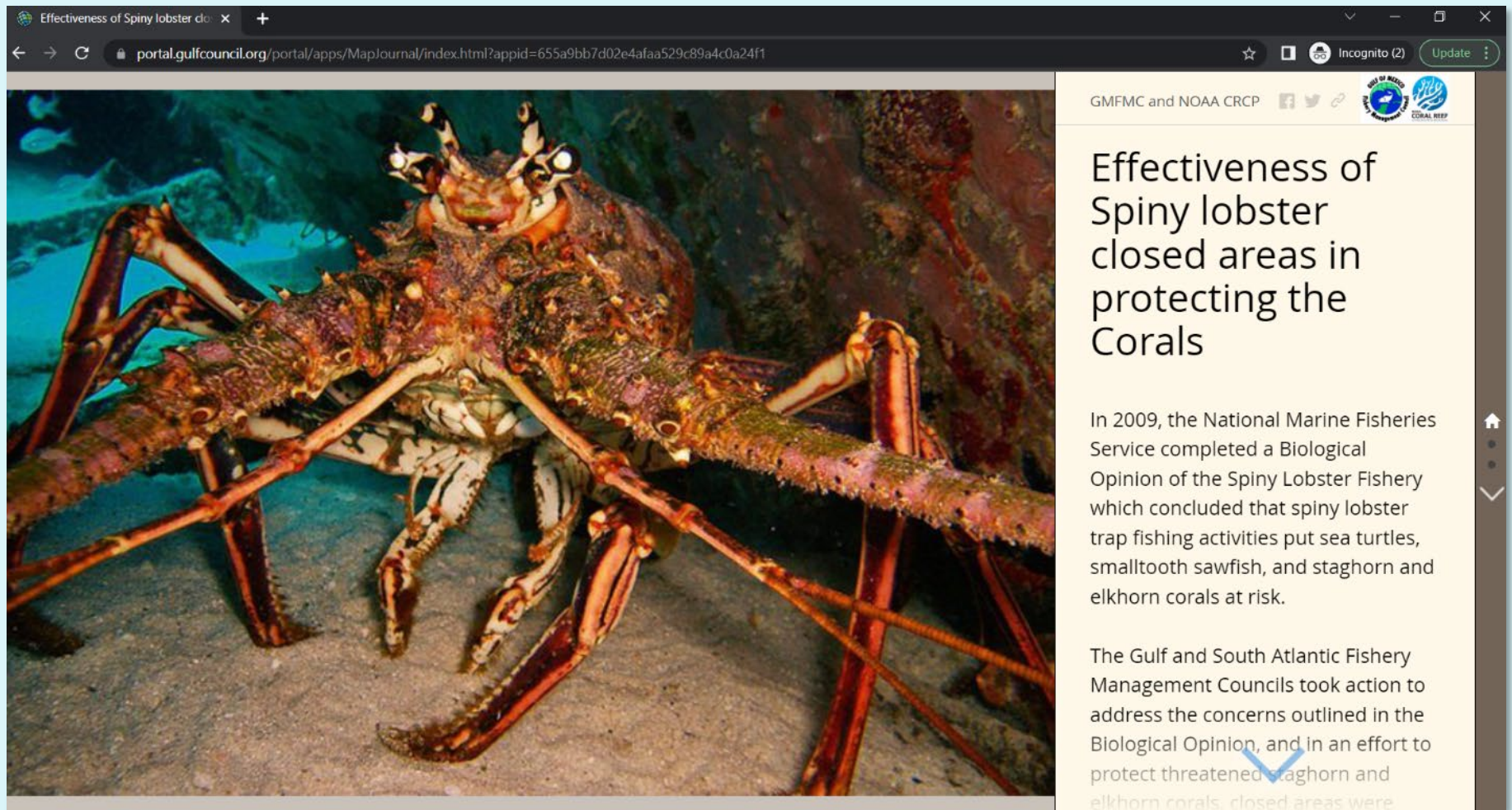
The learning module highlights known coral and fish aggregations, spawning areas in the Gulf, and known connectivity among these locations. It can be accessed online at <https://portal.gulfcouncil.org/spawnagg/>



The screenshot shows a web browser window displaying the 'Spawning, Aggregation and Connectivity of Fish and Coral Reefs in the Gulf of Mexico' learning module. The browser's address bar shows the URL: portal.gulfcouncil.org/portal/apps/MapJournal/index.html?appid=6ebfe56235df41b08ff2c66d50bfcf54. The page features a large, close-up photograph of a coral reef with numerous small, pinkish-white eggs or larvae attached to its surface. To the right of the image, the title 'Spawning, Aggregation and Connectivity of Fish and Coral Reefs in the Gulf of Mexico' is displayed in a large, bold font. Below the title, there is a paragraph of text discussing the complexity of marine connectivity and the importance of spawning events. The text mentions that connectivity is inherently complex, with interannual variation in both the oceanographic environment and local conditions, creating temporary links among populations. It also notes that the number of larvae released during coral mass-spawning events is enormous, and dispersal is highly reliant on ocean currents at the time of spawning. This creates inter-annual variation in larval supply among reefs, increasing the variability of supply and decreasing the reliability of inter-population connectivity. Below this paragraph, there is another paragraph starting with 'Hard (or stony) corals reproduce by releasing their eggs and sperm all at the same time. This spawning cycle is one of nature's most spectacular events. Once a year, on cues from the lunar cycle and the water temperature, entire colonies of coral reefs simultaneously release their tiny eggs and sperm, called gametes, into the ocean. The phenomenon brings to mind an underwater'.

Learning Module

Learning module on the effectiveness of spiny lobster closed areas in protecting corals. The module can be accessed at <https://portal.gulfcouncil.org/SpinyLobster/slca>



Effectiveness of Spiny lobster closed areas in protecting the Corals

GMFMC and NOAA CRCP

In 2009, the National Marine Fisheries Service completed a Biological Opinion of the Spiny Lobster Fishery which concluded that spiny lobster trap fishing activities put sea turtles, smalltooth sawfish, and staghorn and elkhorn corals at risk.

The Gulf and South Atlantic Fishery Management Councils took action to address the concerns outlined in the Biological Opinion, and in an effort to protect threatened staghorn and elkhorn corals, closed areas were

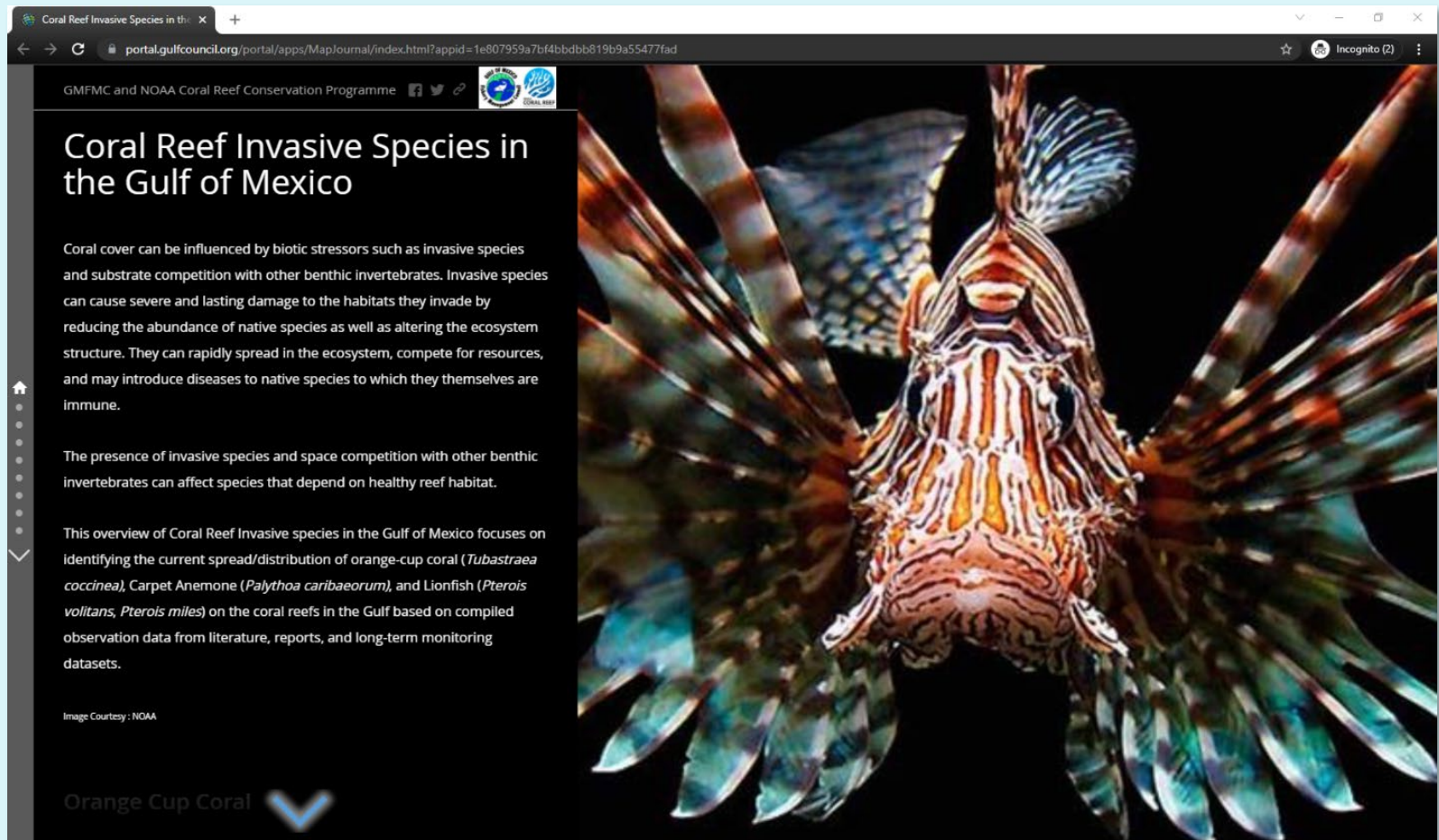
Task 2: Assessing Changes to Coral Reef Habitat Composition

Identifying change in coral reefs habitat composition across the Gulf to improve management of coral reef and associated resources in the future.

- An extensive review of information (i.e. literature, data) to assess changes in coral habitat composition associated with invasive species.
- Mapping the impact of non-climatic stressors for coral reef habitats in the Gulf in recent years.
- Conduct a survey to stakeholders to identify the gap in management from their perception of changing coral reef habitat and available data.
- Create a comprehensive coral disease dashboard for the Gulf.

Learning Module

Learning module on coral reef invasive species in the featured distribution map of common invasive species in the Gulf. The module can be accessed at <https://portal.gulfcouncil.org/invasives/>



The screenshot shows a web browser window with the URL <https://portal.gulfcouncil.org/invasives/>. The page is titled "Coral Reef Invasive Species in the Gulf of Mexico" and is part of the "GMFMC and NOAA Coral Reef Conservation Programme". The main content area features a large, detailed image of a lionfish, which is a common invasive species in the Gulf of Mexico. The lionfish has a brown and white striped pattern and long, spiny fins. To the left of the image, there is a sidebar with a list of topics, including "Orange Cup Coral", which is currently selected. The text on the page describes the impact of invasive species on coral reefs and provides an overview of the current spread/distribution of orange-cup coral (*Tubastraea coccinea*), Carpet Anemone (*Palythoa caribaeorum*), and Lionfish (*Pterois volitans*, *Pterois miles*) on the coral reefs in the Gulf based on compiled observation data from literature, reports, and long-term monitoring datasets. The page also includes a "Image Courtesy : NOAA" credit.

Coral Reef Invasive Species in the Gulf of Mexico

GMFMC and NOAA Coral Reef Conservation Programme

Coral cover can be influenced by biotic stressors such as invasive species and substrate competition with other benthic invertebrates. Invasive species can cause severe and lasting damage to the habitats they invade by reducing the abundance of native species as well as altering the ecosystem structure. They can rapidly spread in the ecosystem, compete for resources, and may introduce diseases to native species to which they themselves are immune.

The presence of invasive species and space competition with other benthic invertebrates can affect species that depend on healthy reef habitat.

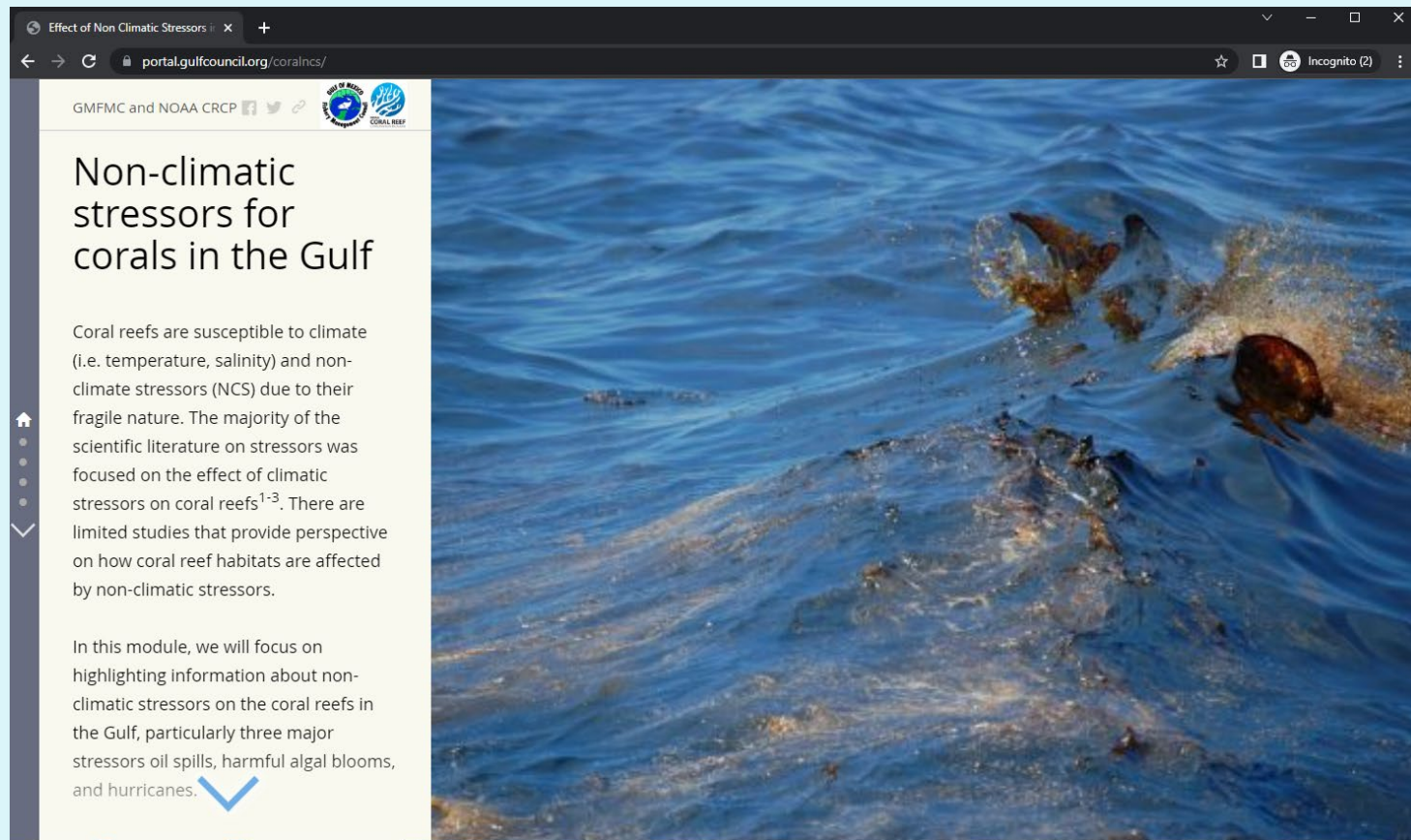
This overview of Coral Reef Invasive species in the Gulf of Mexico focuses on identifying the current spread/distribution of orange-cup coral (*Tubastraea coccinea*), Carpet Anemone (*Palythoa caribaeorum*), and Lionfish (*Pterois volitans*, *Pterois miles*) on the coral reefs in the Gulf based on compiled observation data from literature, reports, and long-term monitoring datasets.

Image Courtesy : NOAA

Orange Cup Coral

Learning Module

A learning module presents the result of an analysis that evaluated the Coral reef vulnerability to three major non-climatic stressors namely, spill incidents (oil, chemical, and others), observed red tide events, and hurricane-induced stress locations in the Gulf. The module can be accessed from <https://portal.gulfcouncil.org/coralnecs>

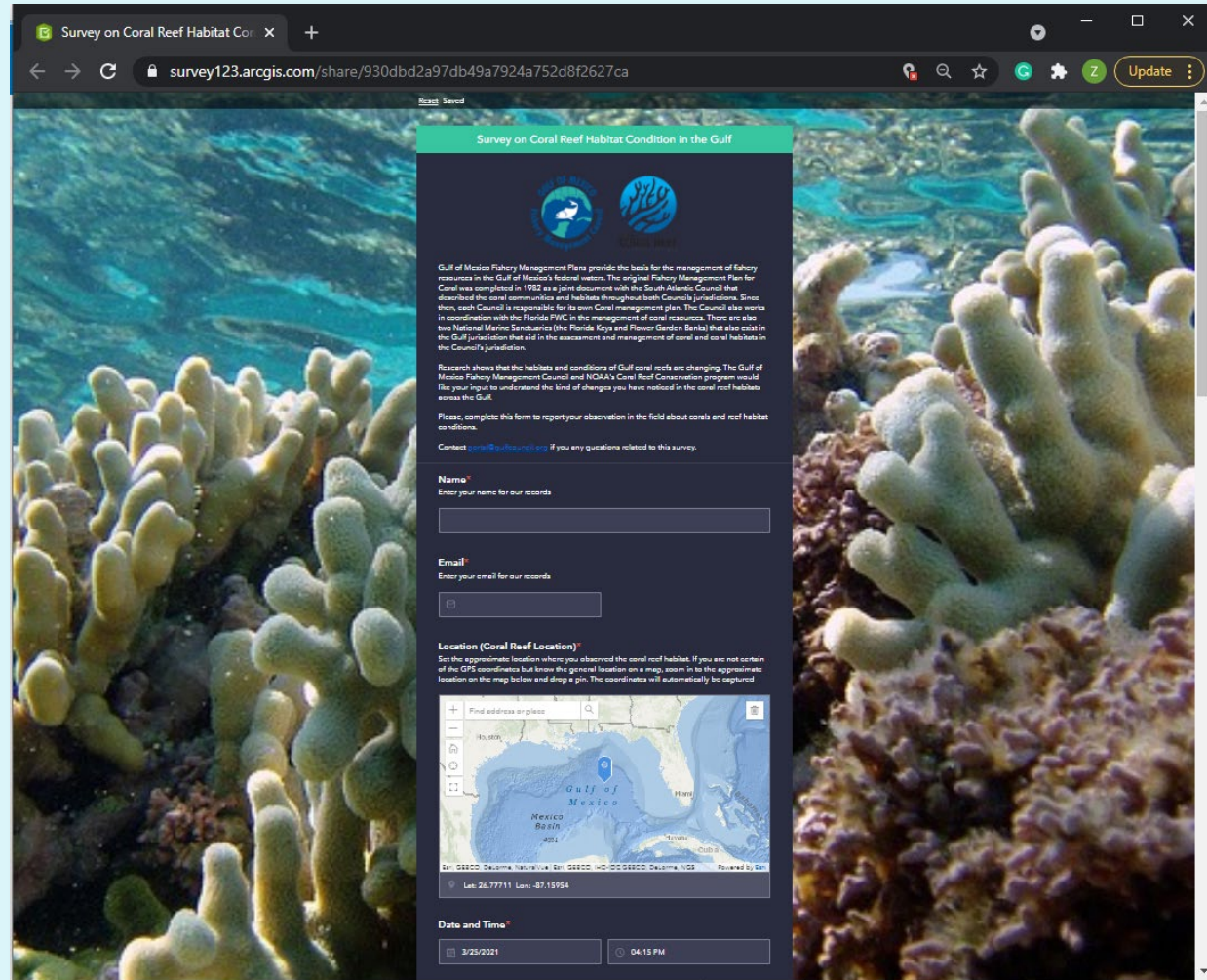


The screenshot displays a web browser window with the address bar showing portal.gulfcouncil.org/coralnecs/. The page header includes logos for GMFMC and NOAA CRCP, along with social media icons. The main heading is "Non-climatic stressors for corals in the Gulf". The text on the page reads: "Coral reefs are susceptible to climate (i.e. temperature, salinity) and non-climate stressors (NCS) due to their fragile nature. The majority of the scientific literature on stressors was focused on the effect of climatic stressors on coral reefs¹⁻³. There are limited studies that provide perspective on how coral reef habitats are affected by non-climatic stressors." Below this, it states: "In this module, we will focus on highlighting information about non-climatic stressors on the coral reefs in the Gulf, particularly three major stressors oil spills, harmful algal blooms, and hurricanes." The right side of the page features a large image of a coral reef with a significant oil spill, showing dark, viscous oil coating the coral and surrounding water.

Stakeholder Engagement

An targeted online survey was designed to ask stakeholders about their perceptions of change in coral reef habitat in the Gulf.

Survey responses were compared with the effect of invasive species presence, non-climatic stressors, and coral disease impact on reef habitats to identify the gaps in knowledge.

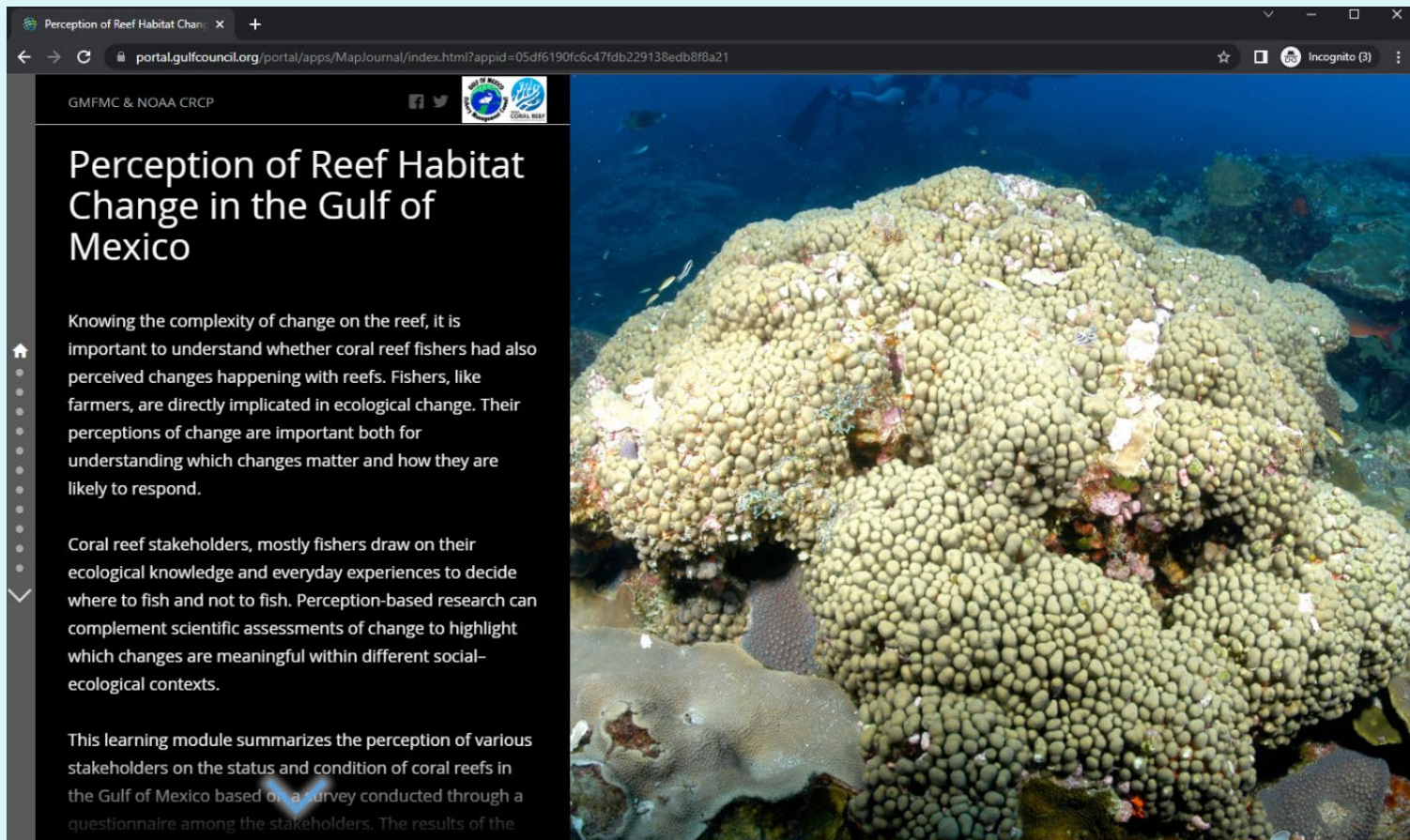


The screenshot shows a web browser displaying an online survey titled "Survey on Coral Reef Habitat Condition in the Gulf". The survey is hosted on ArcGIS and features a background image of coral reefs. The survey form includes the following sections:

- Header:** "Survey on Coral Reef Habitat Condition in the Gulf" with logos for the Gulf of Mexico Fishery Management Council and NOAA.
- Introduction:** A paragraph explaining the purpose of the survey, which is to gather information on coral reef habitat conditions in the Gulf of Mexico. It mentions the Gulf of Mexico Fishery Management Council and NOAA's Coral Reef Conservation Program.
- Form Fields:**
 - Name:** A text input field with the label "Enter your name for our records".
 - Email:** A text input field with the label "Enter your email for our records".
 - Location (Coral Reef Location):** A section with a map of the Gulf of Mexico. The map shows the Gulf of Mexico, Mexico, and the United States. A blue pin is placed on the map, indicating the location of the survey. Below the map, the coordinates are displayed: "Lat: 26.77711, Long: -87.15954".
 - Date and Time:** Two input fields. The "Date" field is set to "3/25/2021" and the "Time" field is set to "04:15 PM".

Stakeholder Engagement

A learning module summarizes the perceptions of various stakeholders on the status and condition of coral reefs in the Gulf of Mexico, based on a survey conducted through a questionnaire distributed among the stakeholders. The module can be accessed from <https://arcg.is/0fTC1X>



The screenshot shows a web browser window with the URL portal.gulfcouncil.org/portal/apps/MapJournal/index.html?appid=05df6190fc6c47fdb229138edb8f8a21. The page header includes 'GMFMC & NOAA CRCP' and social media icons. The main title is 'Perception of Reef Habitat Change in the Gulf of Mexico'. The content is divided into two columns: text on the left and a large underwater photograph of coral on the right.

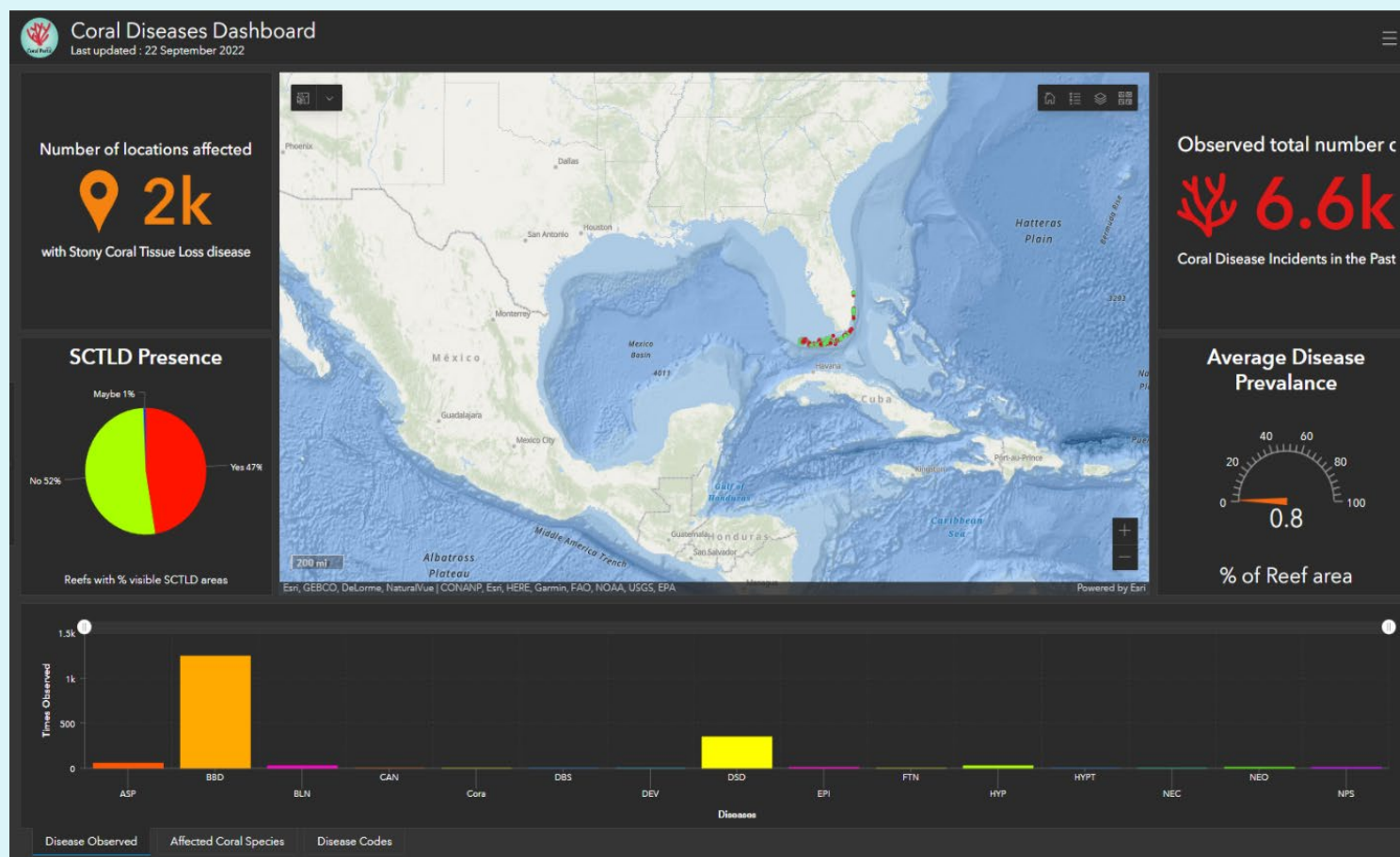
Knowing the complexity of change on the reef, it is important to understand whether coral reef fishers had also perceived changes happening with reefs. Fishers, like farmers, are directly implicated in ecological change. Their perceptions of change are important both for understanding which changes matter and how they are likely to respond.

Coral reef stakeholders, mostly fishers draw on their ecological knowledge and everyday experiences to decide where to fish and not to fish. Perception-based research can complement scientific assessments of change to highlight which changes are meaningful within different social-ecological contexts.

This learning module summarizes the perception of various stakeholders on the status and condition of coral reefs in the Gulf of Mexico based on a survey conducted through a questionnaire among the stakeholders. The results of the

Information Dashboard

A comprehensive information dashboard for coral disease in the Gulf was created using disease occurrence data sourced from partner agencies. The dashboard can be accessed at <https://portal.gulfcouncil.org/coraldisease>

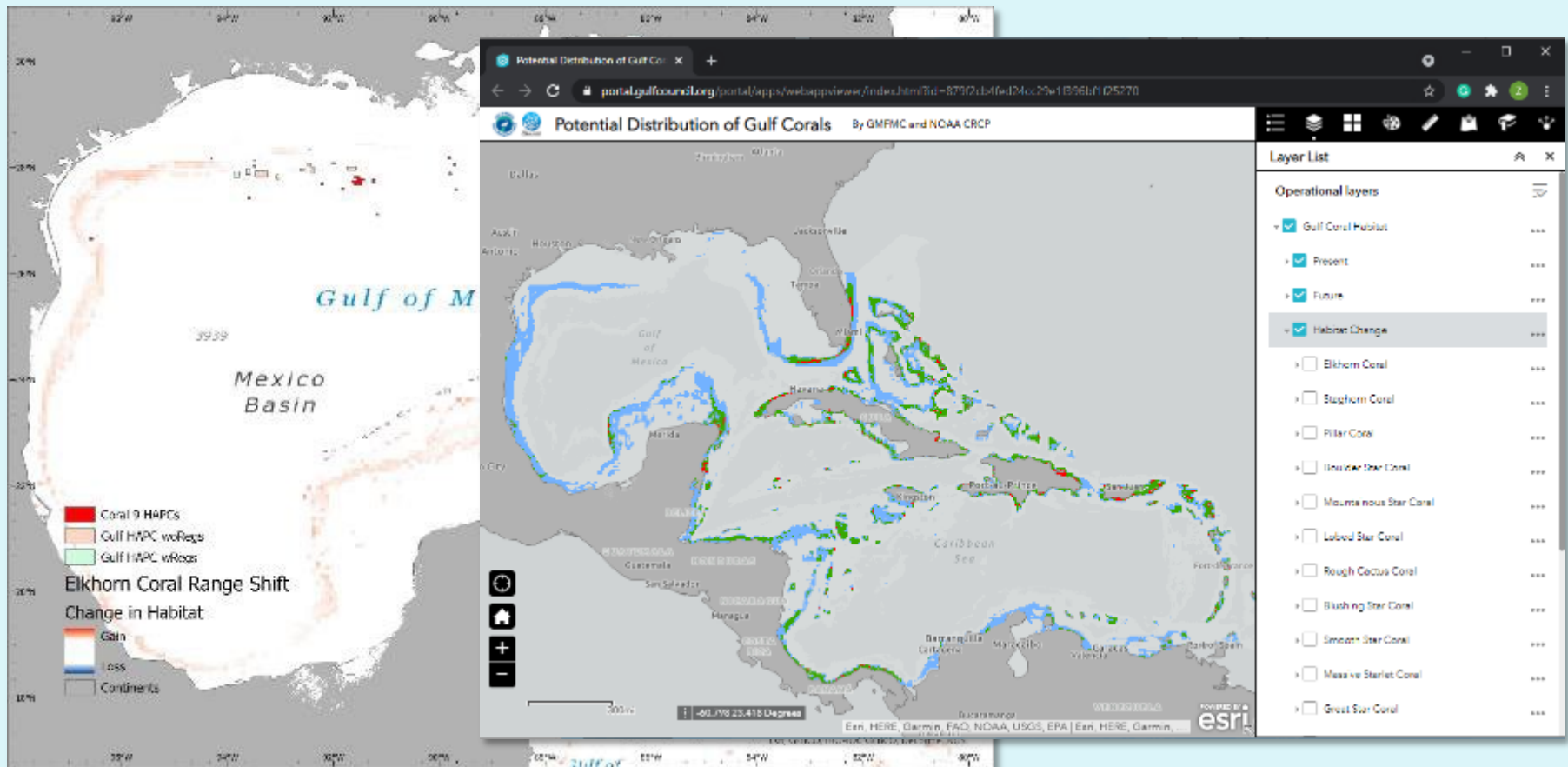


CRCP PROJECT DELIVERABLES

HIGHLIGHT

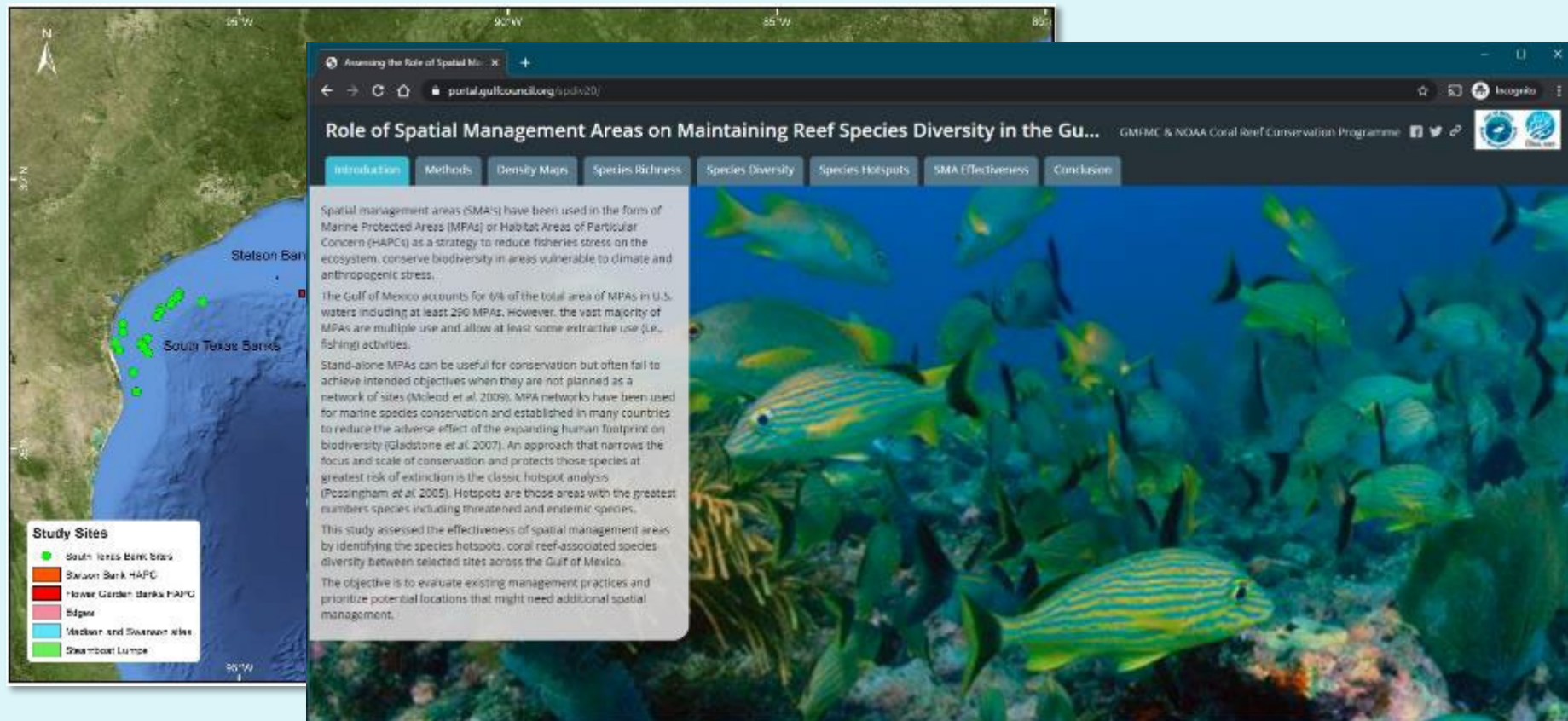
Predictive Models for Gulf Corals

Spatially explicit models for common coral species in the Gulf including the projection for future habitat range shift due to the effect of climate change. Results from the models could be explored using an interactive web application from <https://bit.ly/3sFf9s3> and detailed analysis and results are available from the [whitepaper](#).



Assessing The Role of Spatial Management

The effectiveness of selected spatial management areas was evaluated and at the same time analyzed species (coral, fish, and invertebrate) diversity of these sites. Outputs from the analysis are available as a [whitepaper](#) and results can be explored using an interactive web application available from <https://portal.gulfcouncil.org/spdiv20/>



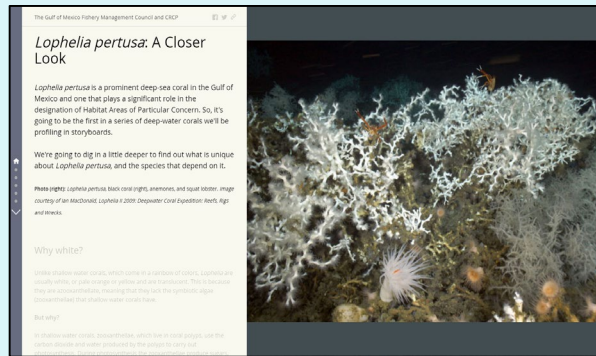
Common Gulf Corals Guide Book

Pamphlets on [ESA listed coral species](#) and a water proof guide for common coral species from the Gulf are available in hard copy and as downloadable [electronic pdf format](#) on the portal.

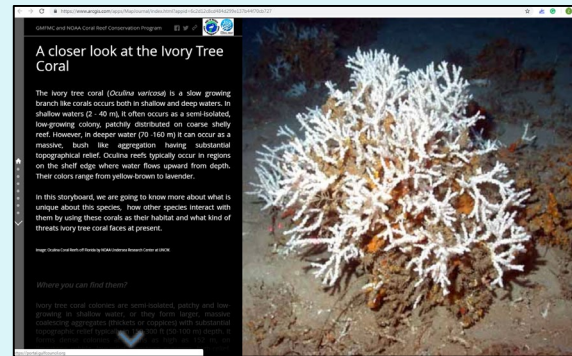


Deep Sea Coral Learning Modules

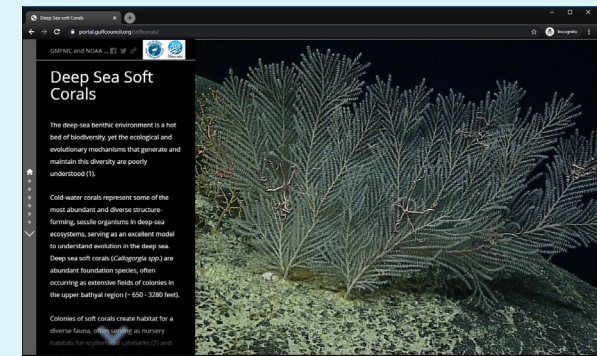
Learning modules on the deep sea coral species in the Gulf.



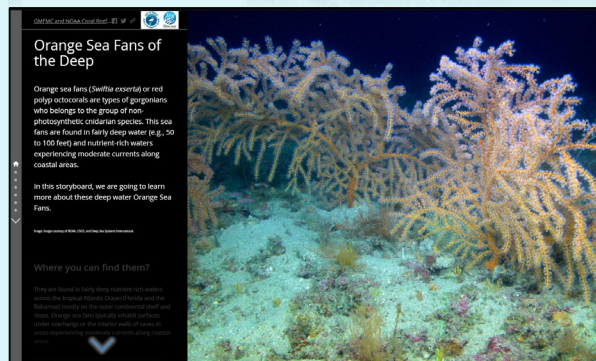
Lophelia (*Lophelia pertusa*)



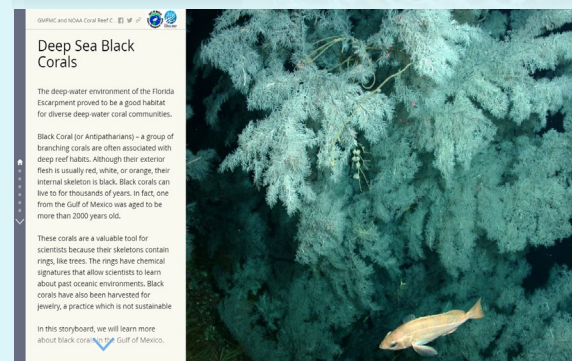
Ivory Tree Coral (*Oculina varicosa*)



Soft Corals (*Callogorgia* spp.)



Orange Sea Fans (*Swiftia exserta*)



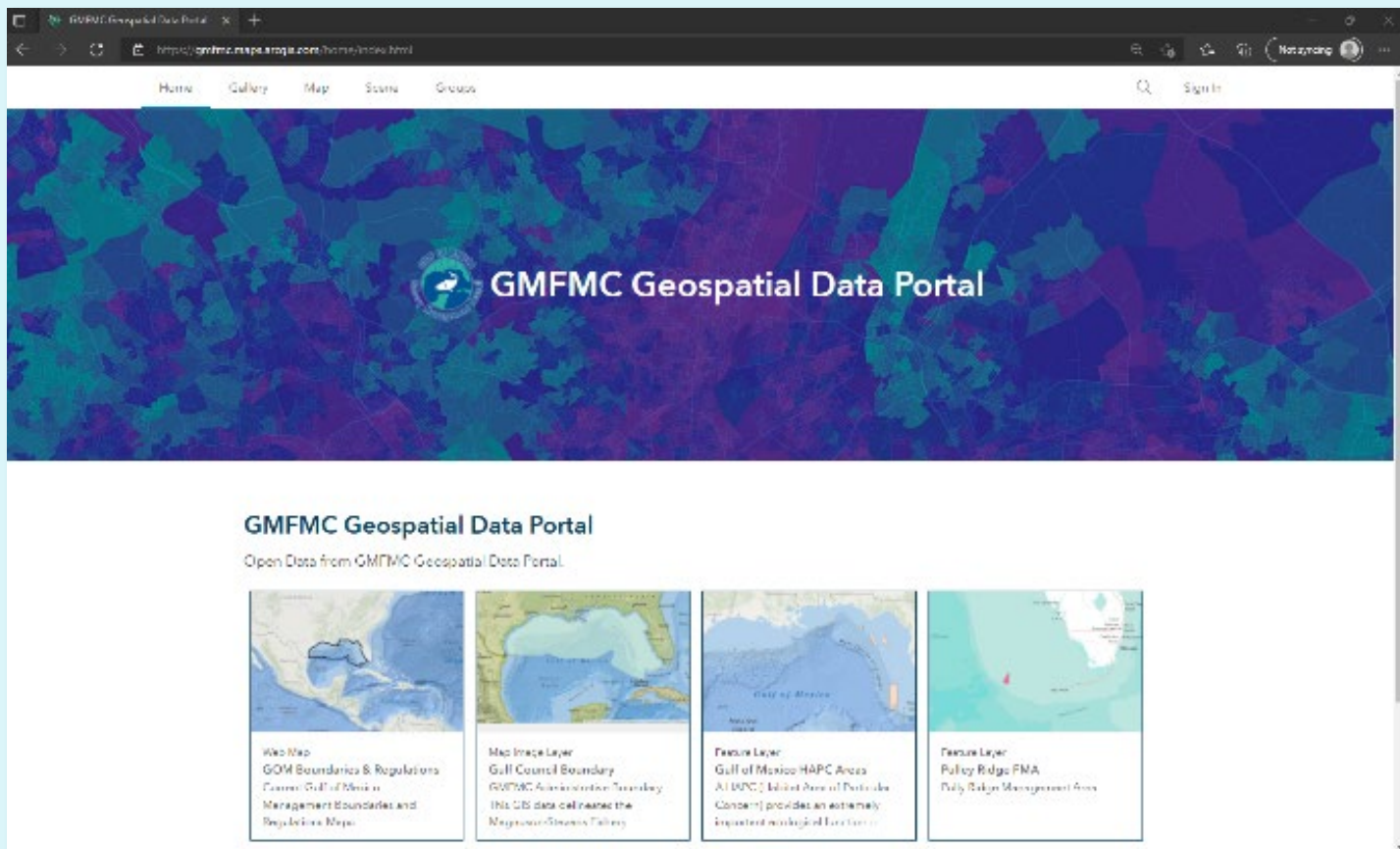
Black Corals (*Antipathes* sp.)



Ancient Corals (*Leiopathes* spp.)

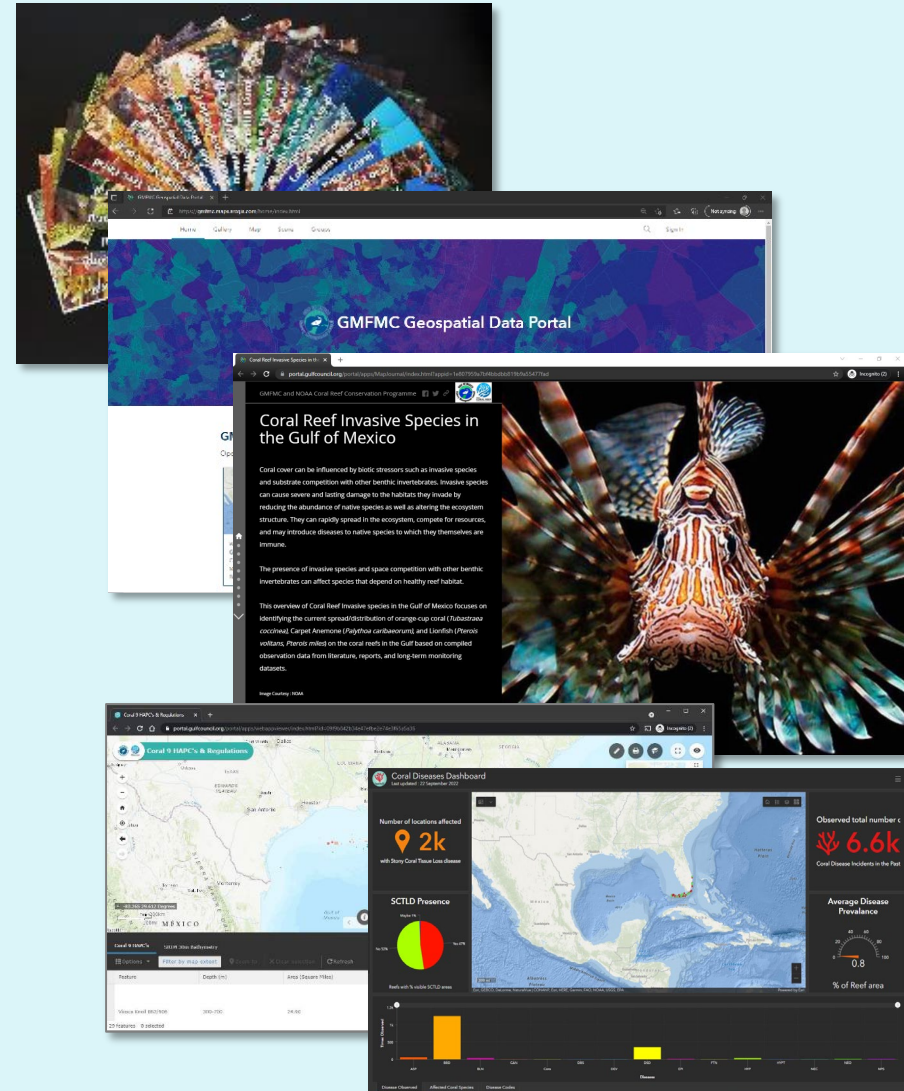
Improved Web Services

Publicly accessible Geospatial Data Portal at
<https://gmfmc.maps.arcgis.com/>



Outreach Materials Summary

- Coral Guide booklet
- Coral Portal & Geospatial Data Hub
- Learning modules & whitepapers
- Interactive web applications



Future Activities

- Continue work on the new CRCP grant activities which focus on the identification of factors influencing coral health, associated fisheries, and the development of key indicators to assess the coral reef vulnerability in the Gulf.
- Producing new learning modules, decision support tools, web applications, and white papers from ongoing activities.



Questions & Discussion

