Protecting Deep Sea Corals in the Western Gulf of Mexico

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Introduction

Unlike their more well known photosynthetic counterparts in the Florida Keys and Caribbean, deep water corals in the Gulf of Mexico enjoy very little protection and are largely unresearched. These corals occur at depths of 80 to 3000 meters and include hundreds of species with many more undiscovered[1]. The reefs and communities formed by deep water corals are nursing grounds for numerous fish species and the basis for many unique benthic communities[2]. Despite this, these fragile, unique, and poorly understood communities are unprotected and unmanaged below 200 meters. Some deep water corals can be over a thousand years old and grow at exceedingly slow rates, making them slow to recover from damage[1].

Threats

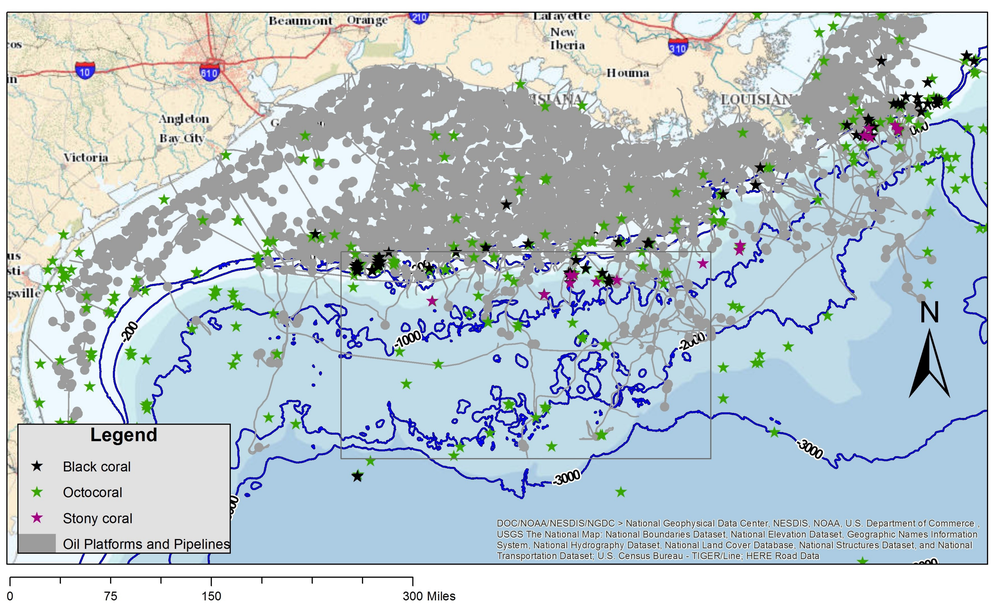
Shrimp Trawling

- The Gulf of Mexico royal red shrimp fishery has between 100-3000 active shrimp trawlers in the study area.[3]
- Trawling can occur at a max depth of 2km. Trawling at this depth involves heavy equipment that can easily destroy coral.[1]
- Trawling changes the deep seafloor substantially and can even trigger sediment gravity flows on slopes and in canyons.[4]
- The increased sedimentation can lead to coral mortality.[5]

Oil and Gas

- Oil and gas activities can destroy corals directly when pipelines, platforms, cables, etc. are placed on or near them.[1]
- Oil spills and leaks have also been directly linked to coral mortality. The effects of the deepwater horizon spill can been seen in deep coral communities farther than 20km

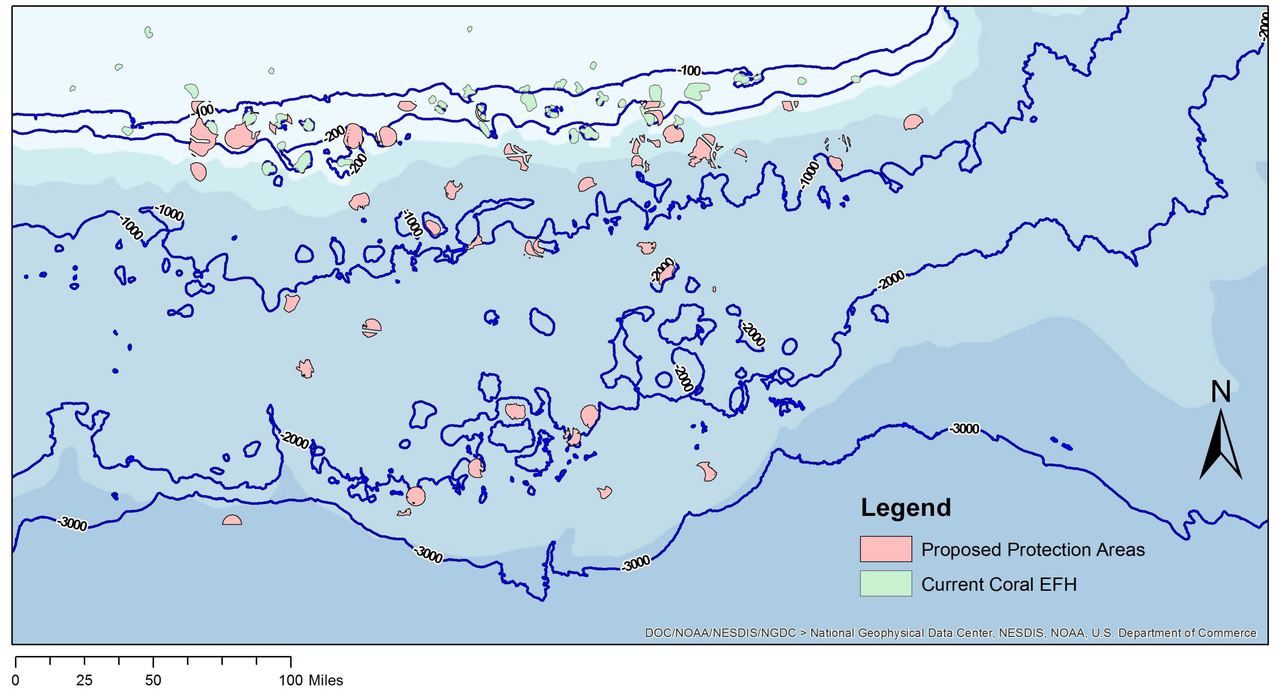
Extent of Oil Activities and Deep Sea Coral Locations



Rectangle contains area of study (24 to 28N and 90 to 94W). Buffers were created around platforms with a distance of 5km; 3km for pipelines; and 3km for spills and other incidents (shipwrecks, pipe leaks, etc.).

Results

Map of Proposed Deep Sea Coral Protected Areas



Methods

With location data for coral, oil, and shrimping data in the Gulf and detailed bathymetry data from NOAA, I used several geoprocessing tools to create polygons around each coral that considers elevation and proximity to oil activities. Because in general currents, contaminants, and sediments move down, corals located down slope from threats are in more danger than those up slope. Putting in the coral locations and a sea floor surface raster into the path distance tool outputs a cost raster for the corals. The path distance tool has an option to adjust the cost based on slope; the vertical factors option takes the cost to any given point and multiplies it based on its slope. The sec-cos option makes negative slopes (movement downhill) cost more and positive slopes (uphill) cost less. I then reclassified the raster into 1 class with a narrow range of values around the coral, then converted this raster into a polygon. The polygon was then clipped back so that it only extends 5km from a coral and does not overlap any energy activity. The distances for these buffers were selected based on several articles describing the extent of anthropogenic sediment travel and the effects of oil. I limited them to a certain distance to keep the new protected areas similarly sized to preexisting protected areas. **The product is a representation of what effective protected areas around currently unprotected corals could look like.** Specific regulations for the areas could vary.

Limitations

This process illustrates very clearly the extent of oil and gas operations in the gulf and their already large impact on the deep water corals. The zones themselves however are subject to several limitations based on the way the default path distance tool works. While the path distance tool does a decent job of creating an area around a coral that takes into account elevation, it outputs a cost distance raster with cost based on surface distance. This works, but overemphasizes flat areas and despite adjusting for vertical factors still does not extend far enough up steep slopes, despite the adjustment. This creates appropriate zones for corals on topographic highs and gentle slopes, slightly larger than intended zones on flat surfaces, and undersized zones for corals on steep slopes and steep sided basins, where increased sedimentation from anthropogenic disturbances has the potential to be the highest. I also was unable to find specific data for where shrimp trawling occurs and was unable to include it in making the polygons. The only available data said was only specific to say that between 100 -3000 shrimping vessel are active in the area.

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