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USA: Florida: Molasses Coral Reef Restoration Project

Overview

On August 4, 1984, the M/V Wellwood, a 122-meter Cypriot-registered freighter, ran aground on Molasses Reef about 6 nautical miles southeast of Key Largo in Monroe County, Florida. The grounding destroyed 5,805 square meters of living corals and injured 644 square meters of coral reef framework. The Molasses Coral Reef Restoration Project, implemented by the National Oceanic and Atmospheric Administration (NOAA), involved the restoration of fourteen separate reef sites damaged during the 1984 incident. The restoration included the placement of twenty-two dome shaped reef modules made of concrete and limestone that were designed to replicate the spur and groove formation of the grounding site and to provide substrate for new coral colonization. These reef modules were anchored to the natural reef using a special concrete mixture, tremie, and great care was taken to ensure that repaired areas demonstrated similar reef crest elevations and structural characteristics as those of the adjacent reef.

Quick Facts

Project Location:

Molasses Coral Reef, Florida, 25.0151854, -80.37850980000002

Geographic Region:

North America

Country or Territory:

United States of America

Biome:

Coastal/Marine

Ecosystem:

Coral Reef, Seagrass & Shellfish Beds

Area being restored:

1.6 acres

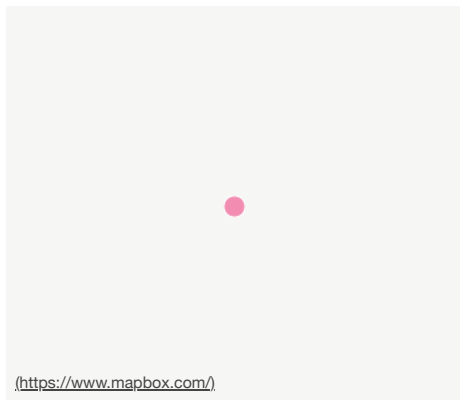
Project Lead:

National Oceanic and Atmospheric Administration (NOAA)

Organization Type:

Governmental Body

Location



(<https://www.mapbox.com/>)

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TIMEFRAME

Project Stage:

Completed

Start Date:

2002-05-31

End Date:

2002-07-22

DEFINING THE PROBLEM

Primary Causes of Degradation

Urbanization, Transportation & Industry

Degradation Description

On August 4, 1984, the M/V Wellwood, a 122-meter Cypriot-registered freighter traveling in 6 meters of water, ran aground on Molasses Reef about 6 nautical miles southeast of Key Largo in Monroe County, Florida. The Wellwood remained grounded for 12 days, injuring the coral more as time went on. Damage occurred as a result of initial attempts to power off the reef, from tugboat prop wash abrasion, from extended periods of shading under the vessel, and from cable abrasion during several failed attempts to remove the vessel from the reef. The injury toppled or injured thirteen large coral heads and left bottom paint embedded in exposed coral skeletons. The grounding destroyed a total of 5,805 square meters of living corals and injured over 75,000 square meters of reef habitat, including 644 square meters of coral reef framework.

Additional injury to the reef occurred as a result of Hurricanes Elena and Kate in 1985 and the active 1998 storm season (Groundhog Day Storm, Hurricane Georges). The 1998 storm season also removed many of the juvenile coral recruits and the colonies that had been transplanted in 1985 from nearby Pickles Reef.

PLANNING AND DESIGN

Reference Ecosystem Description

Molasses Reef is a bank reef. Bank reefs are elongated structures located near the abrupt change in bottom slope that marks the seaward edge of the Floridian Plateau. They occur mostly at a depth of 5 to 10 meters (Jaap, 1984). Distinctive characteristics of these reefs include vertical zonation of coral communities by depth, the presence of seaward spur and groove formations, and in many cases the presence of *Acropora palmata* (Jaap, 1984; Wheaton and Jaap, 1988). The large size often attained by multibranched *A. palmata* colonies attracts large schools of snappers, grunts, and other species of fish that seek structure for shelter. *A. palmata* uses fragmentation recruitment to exploit spatial resources, and broken branches would grow rapidly to form new colonies (Wheaton and Jaap, 1988). Communities at Molasses Reef from inshore to offshore are seagrass flats, reef flat (mostly rubble), spur and groove, buttress zone, mixed hardgrounds and sediments, and slope platform (Chiappone, 1996b). The seagrass flats, which rarely exceed 3 to 4 meters in depth, are covered by the seagrasses *Thalassia testudinum* and *Syringodium filiforme* and sand-filled blowouts.

Overhanging ledges are formed in some of the deeper holes by the rhizomes and roots of the seagrasses. The queen conch, *Strombus gigas*, inhabits this area, as do isolated brain and star coral colonies of *Diploria clivosa* and *Montastraea* complex, respectively; *A. palmata*; the sea fan *Gorgonia ventalina*; and the sea whip *Pterogorgia anceps*.

Octocorals and stony corals become more prevalent in the transition from a relatively flat, high-energy, shallow reef to an elevated three-dimensional system where the increased depth and spatial diversity increase the availability of niches. In this transitional zone, *A. palmata* occurs on top, and *Agaricia agaricites* (lettuce coral) is prolific on the vertical faces of the spurs (Wheaton and Jaap, 1988). Octocorals become more abundant, with the number of species doubling compared to the preceding shallower zone. Sheets of *Palythoa caribbea* are replaced by small, isolated mats, and *M. complanata* remains moderately abundant.

The Wellwood grounded in the offshore transition zone between the spur and groove reef and the deeper, low-relief hardground. The habitat consisted of numerous large heads of boulder corals and had a diverse community of hard and soft corals and other benthic organisms. The principal coral species present at the site included *Montastrea* complex, *A. palmata*, *D. cylindrus*, *A. agaricites*, *Diploria* spp., *C. natans*, *P. astreoides*, *Favia fragrum*, *Meandrina meandrites*, and *Dichocoenia stoksii*. Cover also included a healthy gorgonian community, including many sea fans (*G. ventalina*) and sea rods, the zoanthid *P. caribbea*, and fire coral, *Millepora* spp.

Although not permanent residents of Molasses Reef, several endangered species of turtles and marine mammals are known to occur in or travel through the area during seasonal migrations. Federally endangered species of sea turtles that might be visitors to the reef include the leatherback turtle (*Dermochelys coriacea*), green turtle (*Chelonia mydas*), Kemp's ridley turtle (*Lepidochelys kempii*), and hawksbill turtle (*Eretmochelys imbricata*). In addition, the loggerhead turtle (*Caretta caretta*), listed federally as threatened, can also be a seasonal visitor. Endangered or threatened marine mammals that might occur in the area include the West Indian manatee (*Trichechus manatus*), a species indigenous to the FKNMS, as well as the humpback whale (*Megaptera novaeangliae*), right whale (*Balaena glacialis*), blue whale (*Balaenoptera musculus*), finback whale (*Balaenoptera physalus*), Sei whale (*Balaenoptera borealis*), and sperm whale (*Physeter macrocephalus*).

Project Goals

To stabilize and ultimately restore the reef to the greatest extent practicable, to a state similar to what existed before the injury occurred. Because Molasses Reef is a Sanctuary Preservation Area and a high profile tourist destination, another goal of project practitioners was to design an aesthetically pleasing restoration solution.

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PROJECT ACTIVITIES

Description of Project Activities:

This project involved the installation of 22 dome-shaped reef modules at 14 separate reef sites damaged in the 1984 grounding. The reef modules consist of a reinforced concrete slab, topped with a hollow dome of concrete and limestone, and each module weighs approximately 3500 pounds. The modules were anchored to natural reef by a process of pumping tremie concrete (a specialized concrete mixture designed to maintain consistency and harden in marine applications) beneath and around the base of the module, thereby embedding it into the natural reef structure. In some places, the damaged site was too shallow or had too small a surface area for securing a module, and the reef had to be excavated in order to provide a suitable area for module placement. In these instances, all excavated materials were removed from the project site and disposed of in a landfill or as otherwise directed. There were other cases in which damaged sites had to be built up or filled in to elevate the bottom sufficiently for module installation. At these sites, the tremie mixture was used to bind limestone material into a matrix and fill sunken areas before the modules could be installed. A careful assessment of the adjacent undamaged reef was conducted at all fourteen project sites prior to module installation. Practitioners sought to integrate modules as seamlessly as possible into the natural reef and to ensure that restoration techniques resulted in a repaired reef with similar ambient structure and aesthetic qualities as those of the reef prior to the ship's grounding. At the direction of NOAA personnel, each site was "dressed" to mimic natural relief by pressing limestone rock into the finished concrete surface or securing rock with mortar around the modules. This use of filler material helped to minimize concrete surface exposure and thereby create a more natural repair surface.

PROJECT OUTCOMES

Ecological Outcomes Achieved

Eliminate existing threats to the ecosystem:

The reef restoration modules have withstood not only winter storms, but the effects of four hurricanes passing by the Florida Keys in 2005 alone. The most encouraging news is that juvenile hard and soft corals are settling on the reef restoration modules, both on natural limestone and concrete surfaces. Surveys of fish, as well as lobster and other invertebrates, demonstrate that the design of the reef restoration modules provides ample habitat for an array of species to survive and thrive. The Reef Environmental Education Foundation (REEF) conducted 267 roving fish surveys and 246 belt transect surveys during the first year of a five year monitoring project. Surveys were conducted at the Wellwood Restoration Site and two nearby Reference Sites. Total species richness at each site during Year1 surveys was 145 at the Restoration Site, 165 at the North Reference and 176 at the South Reference. Average species richness per monitoring event was 83 at the Restoration Site, 119 at the North Reference and 125 at the South Reference. The top 25 species from each of the reference sites were also recorded at the Restoration Site; however there were several species of grunt and snapper that were in high abundance at the reference sites that were rare at the Restoration site. The Restoration Site transects were dominated by herbivorous parrotfish and surgeonfish; these families were present in similar abundances at the reference sites. The average size of

surgeonfish and parrotfish increased over time at the Restoration Site. The proportion of surgeonfish at the Restoration Site greater than 20cm, increased to 17% after one year, up from 4% in the months immediately following restoration. Similarly, while large parrotfish were rare during the first 5 monitoring events, 23% of the individuals recorded at the Restoration Site during the July 2003 (one year) effort were greater than 30cm.

Socio-Economic & Community Outcomes Achieved

Economic vitality and local livelihoods:

Molasses Reef and Ecological Sanctuary Preservation Area contain some of the most aesthetically valuable and heavily visited reefs in the continental United States. It is part of the Florida Reef Tract, the third largest barrier reef system in the world. As such, its restoration and

KEY LESSONS LEARNED

LONG-TERM MANAGEMENT

Long-Term Management

Immediately after the grounding event, NOAA funded several monitoring efforts at the most heavily injured grounding sites in order to document the recovery and status of the impact area. This has included monitoring coral community recovery, fish population recovery, and algal community recovery. In addition, NOAA has developed a post-restoration monitoring plan and thus, monitoring will continue after the project completion.

FUNDING

Sources and Amounts of Funding

\$6.275 million USD The Wellwood Shipping Company (the owner of the vessel) and the Hanseatic Shipping Company (the shipping management company) settled with the federal government for \$6.275 million paid over 15 years. The amount includes a civil penalty, as well as response, assessment, and restoration costs.

LEARN MORE

Other Resources

National Oceanic and Atmospheric Administration (NOAA)
<http://sanctuaries.noaa.gov/special/wellwood/default.html>

CONTACTS

Primary Contact

Organizational Contact



(<http://www.facebook.com/SocietyforEcologicalRestoration>)
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