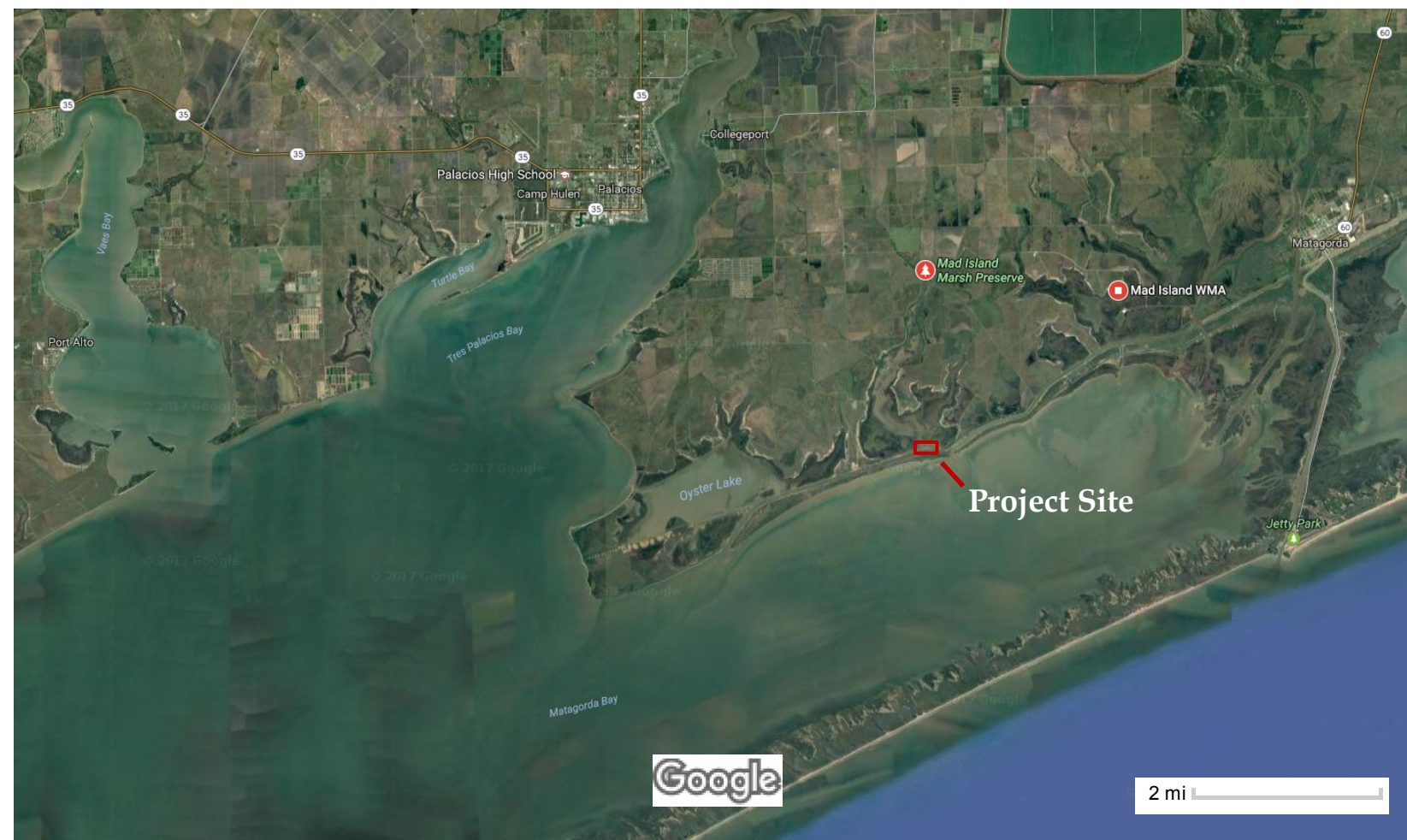




Coastal Environments, Inc. (CEI) designed, permitted, constructed and installed 1800 ft of ReefBlk_{SM} units along the Clive Runnels Family Mad Island Marsh Preserve shoreline fronting the Gulf Intracoastal Waterway (GIWW), Matagorda Bay, Matagorda County, Texas for initiating a bioengineered oyster reef for shoreline protection and enhancement of biodiversity.



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CEI Project Responsibilities:

- ✓ Designed, constructed and installed 1800 ft of bioengineered oyster reef for shoreline stabilization and enhancement of biodiversity
- ✓ Conducted environmental surveys to determine site suitability
- ✓ Acquired all required permits
- ✓ Conducted site visits for interested parties
- ✓ Initially monitored spat setting on ReefBlk_{SM} Units for TNC of Texas
- ✓ Monitoring observations: fifty percent of reef units covered with 2-cm spat in three months; ninety percent of reef units encrusted with 7.5-cm oysters in six months

ReefBlk_{SM}: Pre-eminent Oyster Reef Builders



Characteristics of Bioengineered Oyster Reefs and ReefBlk_{SM} Units

- ✓ Firm substrate upon which to grow and sustain a living oyster reef
- ✓ Quickly and easily installed from a shallow-draft vessel
- ✓ Attenuates wave action and storm surge
- ✓ Reduces rate of shoreline edge erosion
- ✓ Improves water quality by filtering estuarine water
- ✓ Reef growth provides shell materials for forming shell islands and beaches
- ✓ Restores a natural landform historically common in estuarine areas
- ✓ Self-sustaining community with high biodiversity
- ✓ Habitat for other shellfish and finfish
- ✓ Great foraging area for shore and wading birds
- ✓ Source of oyster larvae for public and private oyster grounds
- ✓ Enhances area's commercial and recreational fishing resources

Growth of Oysters on ReefBlk_{SM} Units 2005 - 2017



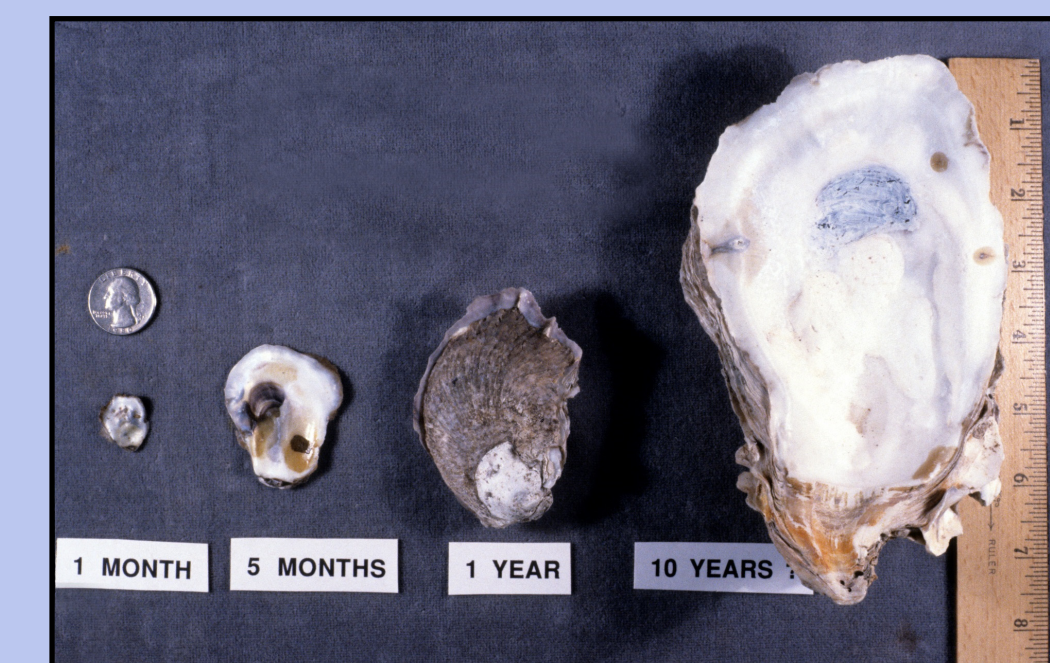
Installation - 2005



ReefBlk_{SM} - 2007



ReefBlk_{SM} - 2017



Rate of Oyster Growth

Massive prehistoric and historic oyster reefs were common along the Northern Gulf Coast until the beginning of the twentieth century when commercial harvesting of living oysters and dredging of relict shells for construction reduced their volume and diminished their valuable functions. Seeing the importance of oyster reefs and their role in protecting marsh, Coastal Environments, Inc. (CEI) designed and tested one of the first successful bioengineered oyster reef systems in the 1990s.

Coastal Environments, Inc. was contracted by The Nature Conservancy of Texas (TNC) to design, prepare permit applications, acquire permits and construct a shoreline protection feature in coastal Texas for the purpose of initiating oyster reef growth; reducing edge erosion along existing shorelines and enhancing fisheries habitat along the Mad Island Marsh Preserve's GIWW shoreline. Funding for construction of the 1800-ft reef was provided by The Nature Conservancy of Texas in partnership with the USFWS.

CEI was responsible for the entire project which included: fabrication and transportation of a total of 360 ReefBlk_{SM} units to the site; transportation and loading of oyster shells into the ReefBlk_{SM} units; transportation of all heavy equipment, marine vessels, crew quarters and supplies; and personnel to construct and install the oyster ReefBlk_{SM} units. CEI fabricated the metal frames, fitted plastic mesh oyster bags into the metal frames, filled the bags with oyster shells and sealed them with stainless-steel hog rings. Nine bags, each about 6-in thick when filled with oyster shells, were fitted inside a double-welded metal frame 2-ft high by 5-ft long. The frame and bags constituted a ReefBlk_{SM} unit.

The units were placed on a 12-ft wide filter fabric that served as a base and minimized subsidence. Specialized equipment used for the installation included: one 30-ft twin-engine workboat with a small hydraulic crane mounted on the deck, one 20-ft shallow-draft fiberglass barge, and one four-wheel drive hydraulic front end loader.

The ReefBlk_{SM} units function as substrate for oyster spat attachment and allow growth of an intertidal oyster reef that provides both shoreline protection and habitat for estuarine organisms. As oyster growth progresses and the reef unit becomes denser, the bioengineered structure dampens and dissipates wave energy and protects the estuarine marsh from erosion.



Stabilization of Mad Island Marsh Preserve Shoreline by Bioengineered Oyster Reefs: 2005 - 2017

ReefBlk_{SM} installed along eroding shoreline.



Marsh restored in front of previously eroding shoreline.



Sediment accretion behind ReefBlk_{SM} units.



Oyster growth on ReefBlk_{SM} unit



Vegetative planting along accreted shoreline.



Cast-off reef shell onto shoreline.

