6 Tetrahedron Patches Reef

Monitoring Date: June 7, 2005
Location: Sirotkin permitted reef site.
GPS coordinates: N27 12.465 / W80 02.341 center patch (Pink)
Crewmembers: Lee Harris, Kerry Dillon, Randal Bazemore, Grayson Kyte

This is the 3rd of a 5-year annual monitoring effort at this site. This report addresses four types of collected data: dive data, reef component stability, fish species & abundance, and benthic species identifications.

6.1 History of the Tetrahedron Patches Artificial Reef:

As part of a Florida Fish & Wildlife Conservation Commission construction grant (FWC Grant #00190 for $15,000) and with additional funding from Martin County, five patch reefs using concrete tetrahedron modules were constructed in March and June 2002. The materials utilized were 4 feet and 5 feet solid concrete tetrahedrons with a steel rebar lifting eye. This reef is approximately ½ mile south of an existing tetrahedron stack reef constructed in April 2001. The patch reef was built with the same total tonnage as the stack reef, and is located in similar water depth and same distance offshore of the Martin County shoreline (6.5 miles).

The tetrahedron patch reef was built on March 28 & June 28, 2002 utilizing one barge load of concrete modules for each deployment. A total of approximately 460 units were placed from an anchored barge, approximately 230 units each deployment. There are five patches or "clusters" on the reef, each separated by a sand/shell seafloor. Distances vary between the clusters and are a nominal 80 to 100 feet from outer edges of each cluster. Color-coded tie wraps were added to tetrahedron modules in each of the patch areas to aid future monitoring efforts. Sub-surface buoys also were added in 2003 at each patch to aid in monitoring.

6.2 Dive Data

Max. depth at bottom in sand = 98 ft.
Min. depth at top of shallowest tetrahedron (pink patch) = 90 ft.
Underwater visibility this day = 25 ft.
Bottom water temperature = 68° F
Surface water temperature = 79° F
Current direction & speed = < ½ knot to the north
Divers breathing mode & gases = open circuit scuba with nitrox 36%

6.3 Tetrahedron Patches Orientation:

Figure 7 shows a detailed chart and map of the five concrete tetrahedron patch reefs. To construct the desired reef layout, the barge position was maintained by anchors and was closely monitored during deployment, and modules were dropped from the same spot on the barge during the deployment of each patch reef. Three patches (central, north and northwest) have roughly elliptical patterns, with the major axis oriented generally from east to west. The east and southwest patches are roughly circular in shape. Although each patch is a separate entity with sand/shell bottom between them, a few isolated tetrahedrons exist around the perimeters of each patch.

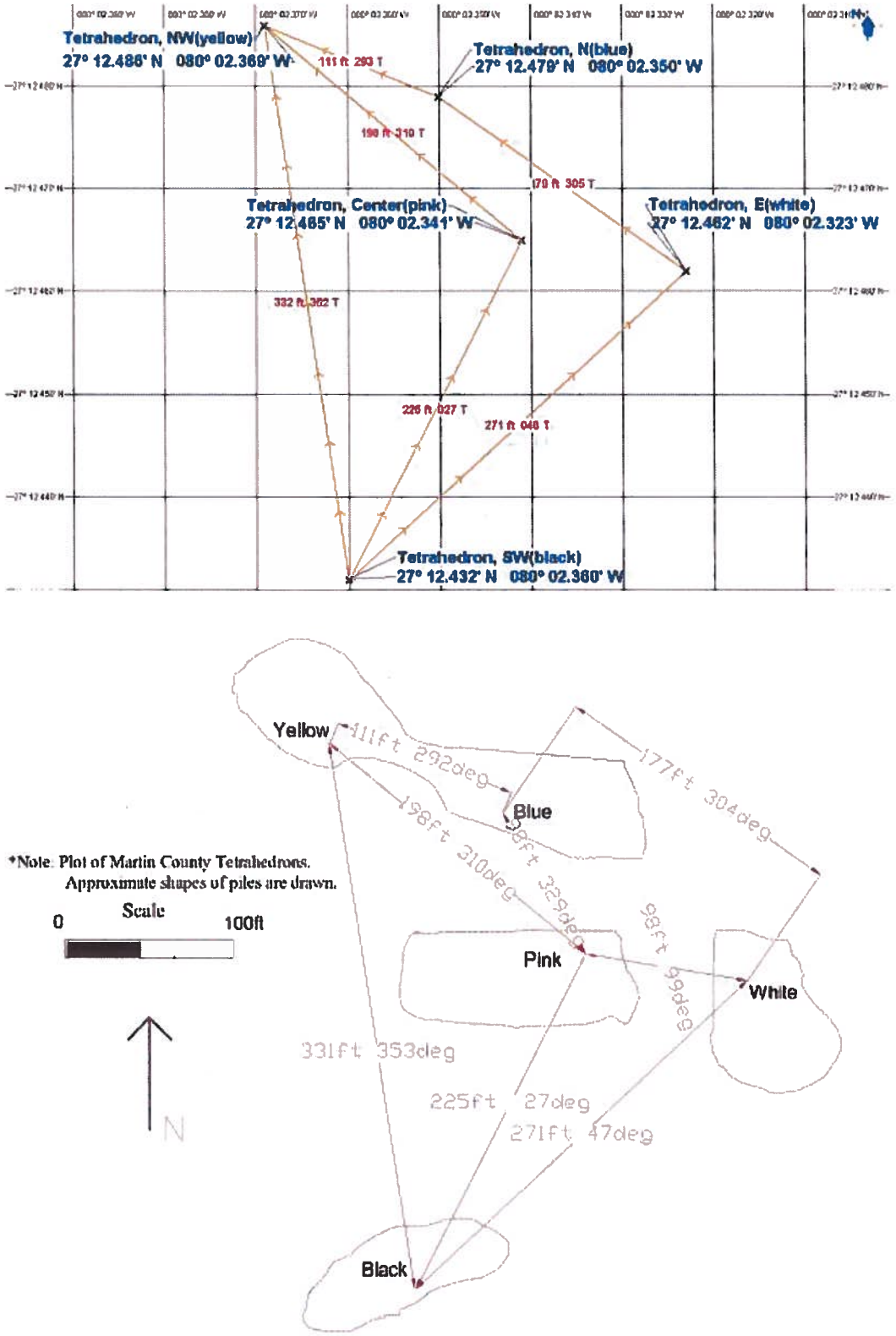

Figure 7. Charts of the Concrete Tetrahedron Patch Reefs

6.4 Reef Components Stability

The individual tetrahedron concrete modules are solid units which weigh up to 3600 lbs. each in air. At this depth of 100 feet they are designed to be stable against wave forces accompanying a 50-year storm event. Since the deployment in 2002, no significant movement or shifting of units have been observed, nor was any notable scouring or sinking into the bottom documented. During the monitoring of 2005 the white patch of tetrahedrons could not be located – three dives were made, but no evidence of anything other than flat sand/shell bottom was found. The pink patch which is just 70-80 feet to the west of the white patch was where it has been since 2002. The other three patches (black, blue and yellow) were all located where expected. On June 17 probing was performed with a 4-ft. steel rod, but could not detect any subsurface items. Fathometer readings did detect a gradual decrease in water depth from west to east. This is opposite to what was historically seen in this area, indicating that the white patch may indeed be buried. It is feasible that the two hurricanes of September 2004 (Frances, Cat. 2 and Jeanne Cat. 3), that crossed directly through this area resulted in burying of these reef units. Further searching will be performed during subsequent monitoring, to determine the locations of the missing tetrahedrons.

6.5 Fish Species & Abundance Findings:

Fish identification and abundance was determined utilizing the guidelines setup by the Reef Environmental Education Foundation, as described previously. Table 10 presents the fish species observed & documented during monitoring on June 7, 2005.

Table 10. Tetrahedron Patches Reef Fish Census

Marine Species Identified	*Quantity observed*	*Juvenile or Adult*
*Little Tunny (Bonito)	5	A
*Red Snapper	15	A
*Red Grouper	1	A
*Whitespotted Filefish	1	A
*Southern Stingray	1	A
*Striped Croaker	5	A
*Striped Croaker	2	J
*Blue Angel	1	Intermediate phase
*Spotfin Butterfly	2	A
*Rock Hind	1	J
Gray triggerfish	10's	A & J
Vermilion snapper	7	A
Vermilion snapper	5	J
Black Seabass	10's	A & J
Greater Amberjack	1	A
Sheepshead	7	A
Tomtate	100's	A
Sheepshead porgy	4	A
Bo Gregory	1	A
Scamp	1	A
Fry (unidentified species)	1000's	J (1/4" long)
Gag Grouper	1 A, 2 J	A (approx. 20 lbs.) J (approx. 5 lbs.)

* - These species were not seen during 2004 monitoring

6.6 Benthic Species Identification

Benthic species listed in Table 11 were identified using the roving diver technique, as described previously.

Table 11. Tetrahedron Patches Reef Benthic Species Census

Benthic Species Identified	*Abundance*	*Comments*
Green Algae		
Codium decorticatum	2-10	
Codium spp.	11-100	
Caulerpa racemosa	11-100	
Brown Algae		
Sargassum spp.	> 100	Long strands 5 – 7 feet long attached
Spatoglossum spp.	2-10	
Red Algae		
Halymenia spp.	1	
Botryocladia spp.	11-100	
Amphiroa spp.	2-10	
Dasya spp.	2-10	
Laurencia spp.	2-10	
Sponges		
Orange encrusting sponge	2-10	
Unidentified encrusting sponges	11-100	
Cnidarians		
Unidentified anemone	11-100	
Unidentified hydroids	11-100	
Feather hydroids	11-100	
Tunicates		
Clavelina spp.	11-100	
Polyandrocarpa spp.	11-100	
Urchins		
Echinometra lucunter	2-10	
Sea cucumbers		
Isostichopus badionotus	1	
Mollusks		
Pinshell oyster (atrina seminuda)	> 1000	
Crustacean		
Barnacles (balanus)	> 1000	
Several unidentified species of crabs	1	
Spiny Lobster (Panulirus argus)	1	

6.7 Tetrahedron Patches Reef Summary

Four of the five tetrahedron patch reefs were located, and appeared to be unaffected by the hurricanes of 2004. The hurricanes of 2004 did not alter the structural layout or the total benthic coverage on the tetrahedrons. Sargassum is still overgrown on most of the tetrahedrons with long strands extending upward. Alga, sponges, tunicates and other attaching benthic organisms have flourished on the concrete surfaces as was noted in the 2004 monitoring report. The fifth patch (white patch) was not located, and the water depths observed in that area indicate that this patch may have been buried with sand movement due to the hurricanes. This will be further investigated during the next monitoring survey.

The total fish species identified decreased slightly during the 2005 monitoring down to 20 from the 2004 monitoring total of 21. There were 10 species identified in 2005 that were not seen in 2004. The most significant of these being the sport & food fish species Red Snapper & Red Grouper. Another significant species is Striped Croaker, a species which is currently on the Federal list of species of special concern. This species natural range is limited to the central East Coast of Florida waters and has previously been identified on the nearshore mitigation artificial reefs of Martin County. Another noteworthy event in 2005 was the presence of 1000's of fry about ¼" long each. In 2004, 100's of fry were documented at ½" long. There were 11 species not seen in 2005 that were previously documented at this site, the most notable were gray snapper and porkfish, both of which are very common statewide.

7 Railroad Tie Stack Reef

Monitoring Date: June 8, 2005
Location: Approximately 7 miles offshore St. Lucie Inlet - Martin County, Florida
GPS coordinates: N27° 12.201 / W80° 02.310 at the summit of the reef site
Crewmembers: Lee Harris, Kerry Dillon, Randal Bazemore, Grayson Kyte
This is the 2nd of a 5-year annual monitoring effort at this site. This report addresses four types of collected data: dive data, reef component stability, fish species & abundance, and benthic species identifications.

7.1 History of the Railroad Tie Stack Artificial Reef:

This is the first artificial reef site to be built in Martin County from donated concrete railroad ties. As part of a grant from the Florida Fish & Wildlife Commission (FWC Grant #02108 for $25,000) and with additional funding from Martin County, the Railroad Tie Stack Reef was constructed in March, May and June 2003. This reef was built utilizing discarded concrete railroad ties donated by the Florida East Coast Railroad Company. Each railroad tie is approximately 11' x 14" x 10" and weighs 600 to 700 lbs. each. Approximately 1500 tons of concrete railroad ties were placed in three deployments from an anchored barge in 93 feet of ocean water. Deployment dates were March 13, May 9, & June 23, 2003.

7.2 Dive Data

Max. Depth at bottom = 91 ft. Min. depth at top center of summit = 73 ft.
Size of structure = 120 ft. long by 50 ft. wide by 18 ft. high
Underwater visibility this day = 50 ft.
Bottom water temperature = 69° F
Surface water temperature = 80° F
Current direction & speed < ½ knot to the north
Divers breathing mode & gases = open circuit scuba with nitrox 36 & 35%

7.3 Reef Components Stability

The railroad ties that comprise this reef are interlocked with each other at numerous contact points. The reef structure is quite complex with many interstitial voids in which marine life can hide from predators. Even on bright sunny days with good visibility many dark recesses were observed which required use of a light just to peer into the areas.

Martin County was the recipient of two hurricanes in Sept. 2004, Frances Cat. 2 and Jeanne Cat 3. These storms had little effect on the two concrete railroad tie reefs in Martin County. When viewed in 2005 the overall shape of the pile seemed exactly as it was each year since construction, a cone shaped mountain of concrete railroad ties. The local nickname of this site is "The Matterhorn". The only measurable change was that the depth of the uppermost summit is now 73 feet (in 2004 it was measured as 69 feet), and the maximum bottom depth measured in 2005 was 91 feet (in 2004 it was 93 feet).

7.4 Fish Species & Abundance Findings:

Fish identification and abundance were determined utilizing the guidelines setup by The Reef Environmental Education, as described previously. The fish species census is shown in Table 12.