

4 Tetrahedron Patches Reef

This reef is now five years old, so that this is the fifth and final year of monitoring for this reef site.

Construction date: March 28 and June 28, 2002

Monitoring date: July 18, 2007

Location: Sirotkin permitted reef site.

GPS coordinates: N27 12.465 / W80 02.341 center patch (Pink)

4.1 History of the Tetrahedron Patches Artificial Reef:

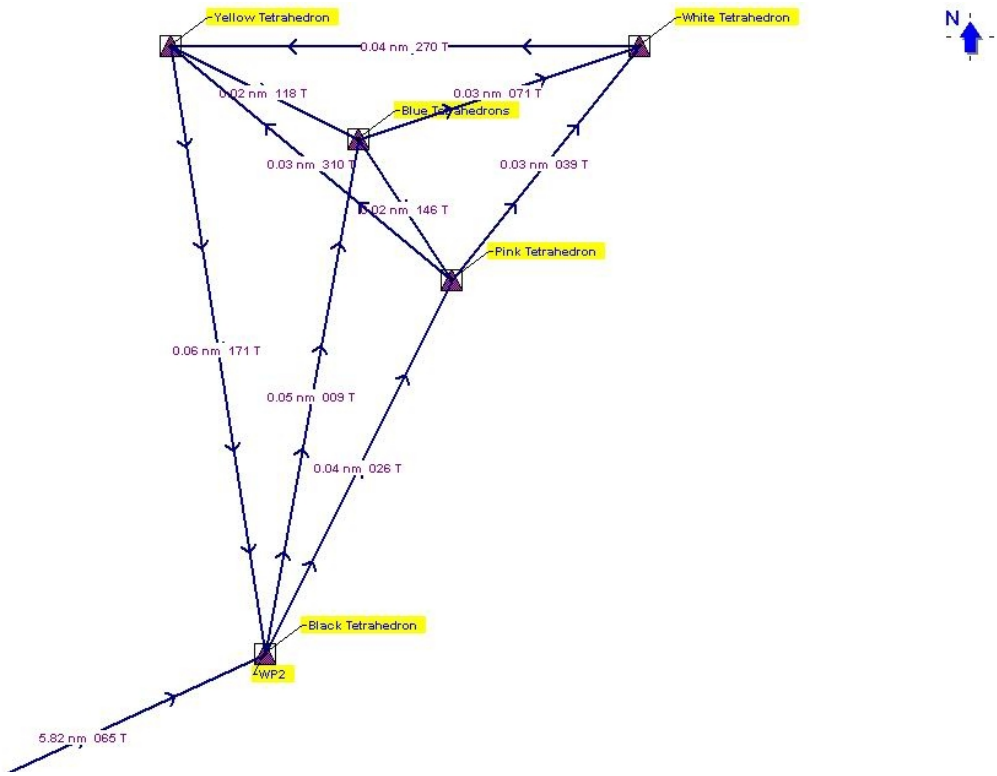
As part of a Florida Fish and Wildlife Conservation Commission construction grant (FWC Grant #00190 for \$15,000) and with additional funding from Martin County, five patch reefs using concrete tetrahedron modules were constructed in March and June 2002. The materials utilized were 4 feet and 5 feet 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 and 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.

4.2 Tetrahedron Patches Orientation:

Figure 10 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 (pink, blue, and yellow) have roughly elliptical patterns, with the major axes oriented generally east-west. The white and black 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.

Underwater photographs taken on July 18, 2007 are shown in Figure 11. The upper two photographs show two of the subsurface underwater buoys.



*Note: Plot of Martin County Tetrahedrons. Units are in feet.

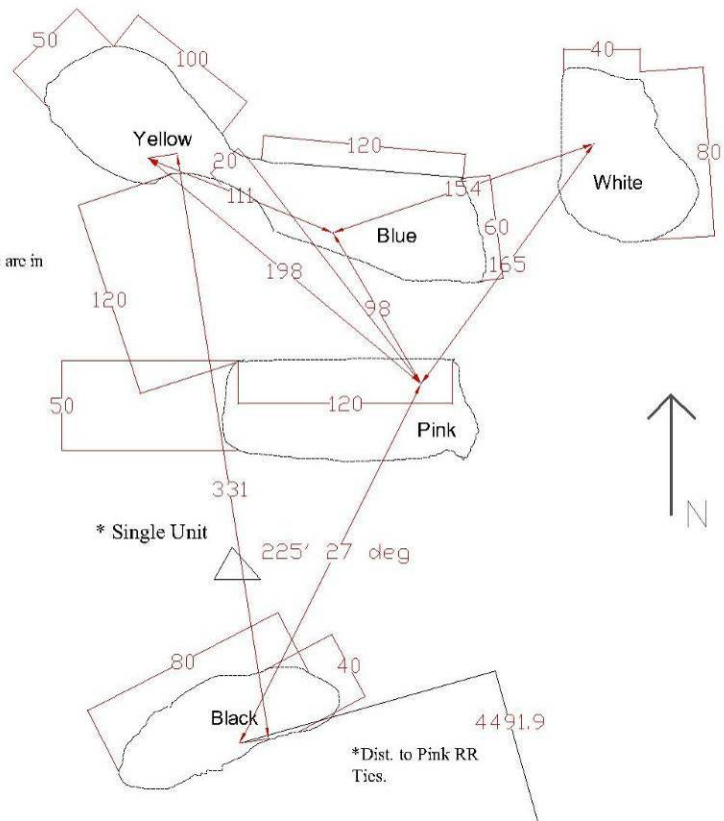


Figure 10. Charts of the Concrete Tetrahedron Patch Reefs

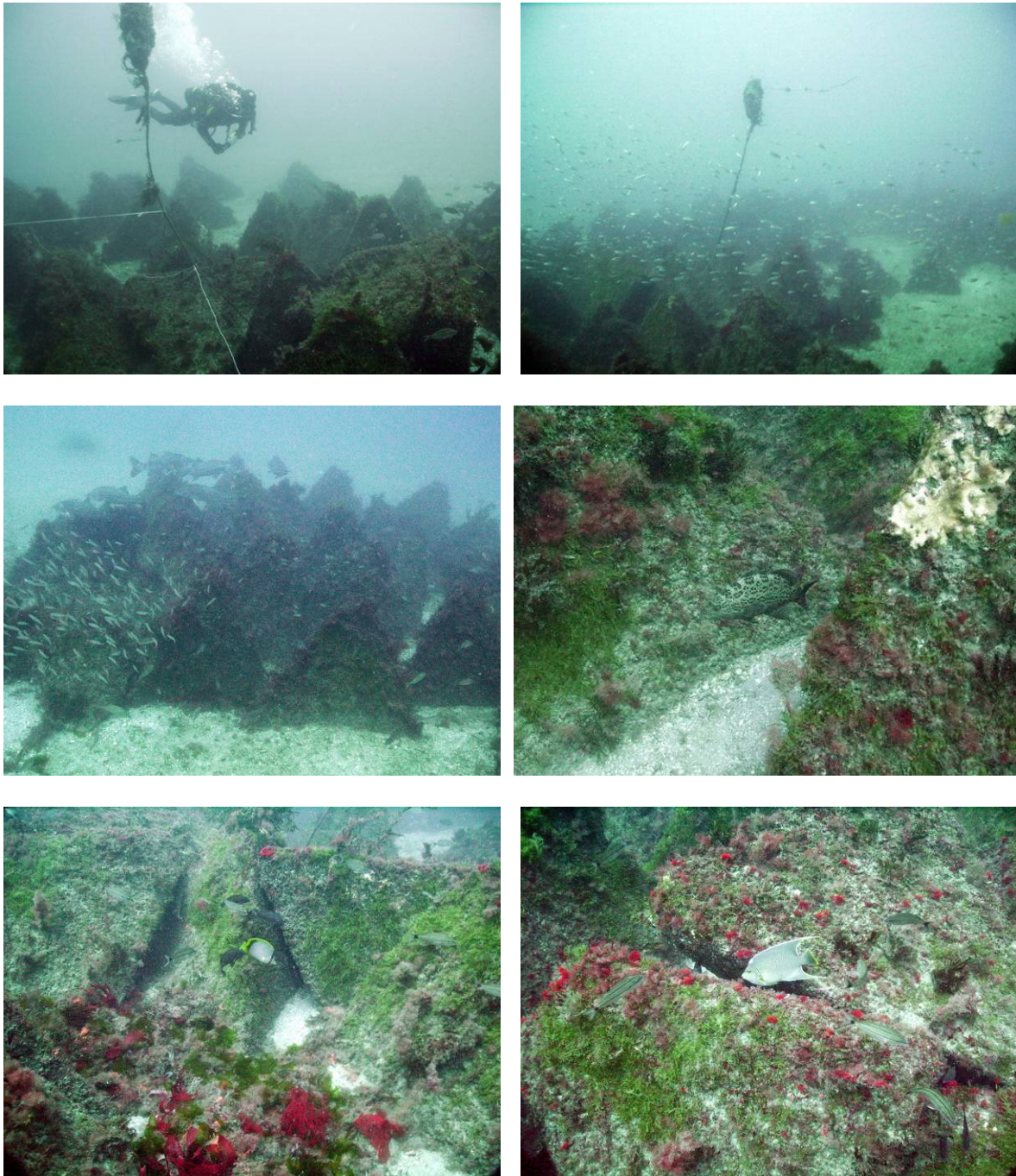


Figure 11. Tetrahedron Patch Reef Photographs

4.3 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 has not been observed, nor was any notable scouring or sinking into the bottom documented.

All of the patches have heights above the seafloor ranging from 4 to 7 feet, except for the white patch, which has a maximum profile of 3 feet. This is due to the fact that all of the patches except for the white patch have stacking of units.

The five-tetrahedron patch reefs were located in 2006 and 2007, and appeared to be have been unaffected by the hurricanes of 2004 and 2005. The Category 2 and 3 hurricanes of 2004 and 2005 did not alter the structural layout or the total benthic coverage on the tetrahedrons, although the easternmost white patch appears to have sunken deeper in the seafloor than the other patches. 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 previous monitoring reports.

4.4 Fish Species and Abundance Findings:

Fish identification and abundance were determined utilizing the guidelines setup by the Reef Environmental Education Foundation, as described previously. Table 4 presents the fish species observed and documented during monitoring on July 18, 2007, with comparisons to previous 2 years data.

Table 4. Tetrahedron Patches Reef Fish Census

<i>Common</i>	<i>Scientific</i>	<i>Adult or Juvenile</i>	<i>2007</i>	<i>2006</i>	<i>2005</i>
Atlantic Spadefish	<i>Chaetodipterus faber</i>	A			
Bandtail Puffer	<i>Sphoeroides spengleri</i>	J	F		
Bank Seabass	<i>Centropristis ocyurus</i>	J&A	M		
Beau Gregory	<i>Stegastes leucostictus</i>	A			S
Belted Sandfish	<i>Serranus subligarius</i>	A	M		
Black Seabass	<i>Centropristis striata</i>	J&A	M	M	M
Blue Angelfish	<i>Holacanthus bermudensis</i>	J&A	F	F	S
Blue Seabass	<i>Cephalopholis argus</i>	A			
Cocoa Damselfish	<i>Stegastes variabilis</i>	J	M		
Common Snook	<i>Centropomus undecimalis</i>	A	F		
Cubby	<i>Pareques umbrosus</i>	J&A	M		
French Angelfish	<i>Pomacanthus paru</i>	J	S		
Fry	<i>Jenkinsia lamprotaenia</i>	J&A	A		A
Gag Grouper	<i>Mycteroperca microlepis</i>	A	S		F
Gray Snapper	<i>Lutjanus griseus</i>	J&A			
Gray Triggerfish	<i>Balistes capriscus</i>	J&A		M	M
Greater Amberjack	<i>Seriola dumerili</i>	J&A		F	S
Highhat	<i>Equetus acuminatus</i>	A			
Lane Snapper	<i>Lutjanus synagris</i>	J&A	M		
Leopard Searobbin	<i>Prionotus scitulus</i>	J	S		
Little Tunny (Bonito)	<i>Euthynnus alletteratus</i>	A			F
Mackerel Scad	<i>Decapterus macarellus</i>	A			
Mutton Snapper	<i>Lutjanus analis</i>	A			
Nurse Shark	<i>Ginglymostoma cirratum</i>	A			
Pigfish	<i>Orthopristis chrysoptera</i>	A	M		

Porkfish	<i>Anisotremus virginicus</i>	A	F		
Red Grouper	<i>Epinephelus morio</i>	A		S	S
Red Snapper	<i>Lutjanus campechanus</i>	A		S	M
Reef Butterflyfish	<i>Chaetodon sedentarius</i>	A	F		
Rock Hind	<i>Epinephelus adscensionis</i>	J			S
Scamp	<i>Mycteroperca phenax</i>	J	F	S	S
Sheepshead	<i>Archosargus probatocephalus</i>	J&A	M	M	F
Sheepshead Porgy	<i>Calamus penna</i>	A	M	M	F
Southern Flounder	<i>Paralichthys lethostigma</i>	A			
Southern Stingray	<i>Dasyatis americana</i>	A			S
Spotfin Butterflyfish	<i>Chaetodon ocellatus</i>	A	S	F	F
Spotfin Hogfish	<i>Bodianus rufus</i>	A			
Spottail Pinfish	<i>Diplodus holbrookii</i>	A			
Spotted Scorpionfish	<i>Scorpaena plumieri</i>	A	S		
Spotted Soapfish	<i>Rypticus subbifrenatus</i>	A	S		
Striped Croaker	<i>Bairdiella sanctaeluciae</i>	J&A		M	F
Striped Grunt	<i>Haemulon striatum</i>	A			
Tomtate	<i>Haemulon aurolineatum</i>	J&A	A	M	A
Two Spot Cardinalfish	<i>Apogon binotatus</i>	A	M		
Vermilion Snapper	<i>Rhomboplites aurorubens</i>	J&A	M	F	M
Whitespotted Filefish	<i>Cantherhines macrocerus</i>	A	S		S
Yellowtail Snapper	<i>Ocyurus chrysurus</i>	A	S		
Total Number of Species:			27	13	20

4.5 Benthic Species Identification

Benthic species listed in Table 5 were identified using the roving diver technique, as described previously. Species identified in 2007 were similar to that observed in 2005 and 2006.

Table 5. Tetrahedron Patches Reef Benthic Species Census

<i>Benthic Species Identified</i>	<i>2007 Abundance</i>	<i>2006 Abundance</i>	<i>Comments</i>
Green Algae			
<i>Codium decorticatum</i>	2-10	2-10	
<i>Codium spp.</i>	11-100	11-100	
<i>Caulerpa racemosa</i>	11-100	11-100	
Brown Algae			
<i>Sargassum spp.</i>	> 100	> 100	Long strands 5 – 7 feet long attached
<i>Spatoglossum spp.</i>	2-10	2-10	
Red Algae			
<i>Halymenia spp.</i>	1	1	
<i>Botryocladia spp.</i>	11-100	11-100	
<i>Amphiroa spp.</i>	2-10	2-10	
<i>Dasya spp.</i>	2-10	2-10	
<i>Laurencia spp.</i>	2-10	2-10	
Sponges			
Orange encrusting sponge	2-10	2-10	

Unidentified encrusting sponges	11-100	11-100	
Cnidarians			
Unidentified anemone	11-100	11-100	
Unidentified hydroids	11-100	11-100	
Feather hydroids	11-100	11-100	
Tunicates			
<i>Clavelina spp.</i>	11-100	11-100	
<i>Polyandrocarpa spp.</i>	11-100	11-100	
Urchins			
<i>Echinometra lucunter</i>	2-10	2-10	
Sea cucumbers			
<i>Isostichopus badionotus</i>	1	1	
Mollusks			
Pinshell oyster (<i>Atrina seminude</i>)	> 1000	> 1000	
Crustacean			
Barnacles (<i>Balanus</i>)	> 1000	> 1000	
Several unidentified species of crabs			
Spiny Lobster (<i>Panulirus argus</i>)	1	2	