

Figure 1 for location and Tables 1, 2 and 3 for reef data. Annual monitoring at these artificial reef deployments was required for the first five years following material placement and was successfully completed in 2006.

3.0 Results

The following sections summarize the monitoring results for each artificial reef monitored in 2008 and 2009. A brief history and description of each artificial reef is followed by structural details and biological survey results along with selected photographs of each artificial reef. Each of the following artificial reefs was monitored by the authors and support staff during 2008 and 2009.

3.1 Clifton Perry Memorial Artificial Reef

- Reef Location: Donaldson Reef
- Materials: Concrete, steel
- Maximum Depth: 65 feet
- Reef High Point: 46 feet
- Year Created: 2004
- Monitoring Date: 7/24/2008; 9/28/2009

3.1.1 History of the Clifton Perry Memorial Reef

Nine barge loads of concrete and steel materials were deployed at the Clifton Perry Memorial Reef site in the winter and spring of 2005. The reef materials came from the dismantled Frank Wacha draw bridge that spanned the Indian River Lagoon at Jensen Beach. The new reef was named in honor of one of the Florida Oceanographic Society's (FOS) original founders. FOS was the first non-profit environmental advocacy group in the area and Mr. Perry's early efforts in the organization helped establish the original artificial reef deployments offshore of Martin County.

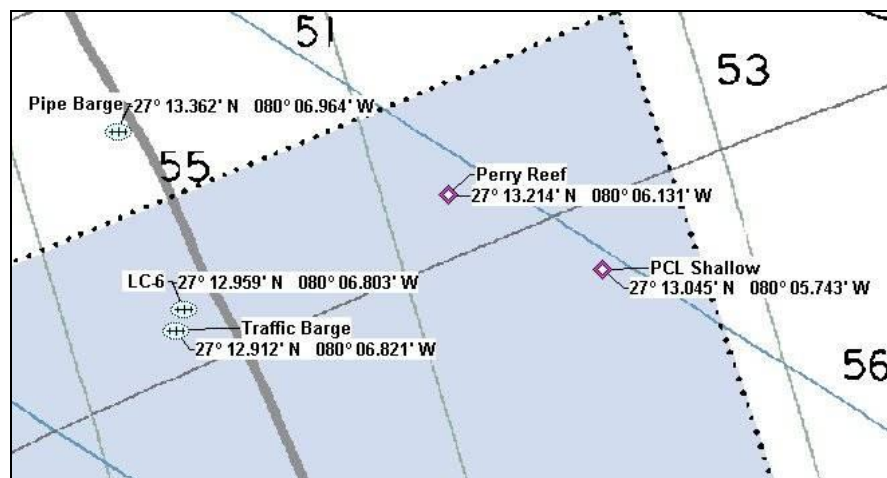


Figure 7. Chart view of NE corner of Donaldson Reef with locations of Perry and PCL Shallow reefs.

3.1.2 Structural Summary

This reef is located in the northeastern corner of the Donaldson Artificial Reef Site and lies in 67 feet of water. Figure 7 shows a chart with the location of the Perry reef within the permitted artificial reef area. The reef lies in an elliptical array on an east-southeast to west-northwest axis. The overall footprint gathered from GPS data is 330 feet by 280 feet, or approximately 2 acres. Reef measurements collected since 2005 indicate that this reef has settled vertically in several locations. The maximum vertical profile measured in 2005 was 25 feet at a prominent spot with a large concrete pile sticking up at a steep angle toward the NE from the seafloor. The maximum vertical profile in 2009 was 19 feet at this same location. This change occurred prior to 2006 and was most likely the result of storm effects from Hurricanes Frances, Jeanne and/or Wilma. The top of the reef at this location was at a depth of 40 feet in 2005 in 67 feet of seafloor depth. In 2006 and 2007 that same spot was at a depth of 47 feet. The average profile at this reef site is currently about 12-15 feet above the seafloor at other areas of stacked materials. There has been settlement of some of the reef units, with a change in maximum reef height of seven feet (from 27 to 20 feet). The horizontal footprint of the reef appears unchanged since deployment.





Figure 8. Photographs of the Clifton Perry Memorial Reef.

3.1.3 Biological Survey Results

Roving diver survey results show an increasing trend in both species diversity and total biomass on the Clifton Perry Memorial Reef since its deployment in 2005. Seabasses, snappers, jacks and grunts account for the greatest diversity of fish species observed each year to date. Baitfishes such as Atlantic bumper and round scad were particularly abundant above the reef structure. The numerous interstitial spaces within the reef were utilized extensively by fishes and invertebrates ranging in size from post-larval fishes and arthropods to mature goliath grouper. The reef itself supported a uniformly dense assemblage of sessile invertebrates and marine algae including sea urchins, barnacles, tunicates, hydroids, sea anemones, tube worms, encrusting sponges and sea cucumbers. Several crabs and gastropods were also observed. Table 5 lists the fish species observed, their relative abundance and size class (adult or juvenile) for the past three years.

Family/ Common Name	Species	2009		2008		2007	
		Abundance	Size	Abundance	Size	Abundance	Size
Elasmobranchs							
Nurse shark	<i>Ginglymostoma cirratum</i>	S	A				
Southern stingray	<i>Dasyatis americana</i>	F	A				
Muraenidae							
Spotted moray	<i>Gymnothorax vicinus</i>			S	A		
Ogcocephalidae							
Shortnose batfish	<i>Ogcocephalus nasutus</i>	S	A				
Centropomidae							
Common snook	<i>Centropomus undecimalis</i>	M	A	A	A,J	A	A
Serranidae							
Belted sandfish	<i>Serranus subligarius</i>	A	A,J	M	A		
Black seabass	<i>Centropristis striata</i>	M	A	M	A		
Goliath grouper	<i>Epinephelus itajara</i>	M	A,J	F	A		
Scamp	<i>Mycteroperca phenax</i>	M	A,J	S	J		
Grammistidae							
Whitespotted soapfish	<i>Rypticus maculatus</i>	M	A	F	A		

Family/ Common Name	Species	2009		2008		2007	
		Abundance	Size	Abundance	Size	Abundance	Size
Apogonidae							
Twospot cardinalfish	<i>Apogon pseudomaculatus</i>			M	A		
Rachycentridae							
Cobia	<i>Rachycentron canadum</i>	F	A				
Carangidae							
Almaco jack	<i>Seriola rivoliana</i>	F	A/J				
Amberjack	<i>Seriola dumerili</i>			M	A		
Atlantic bumper	<i>Chloroscombus chrysurus</i>	A	A				
Blue runner	<i>Caranx chrysos</i>	M	A	M	A	M	A,J
Round scad	<i>Decapterus punctatus</i>	A	A,J	A	A,J	M	A
Yellow jack	<i>Caranx bartholomaei</i>	S	J				
Lutjanidae							
Gray snapper	<i>Lutjanus griseus</i>	M	A	M	A	M	A,J
Lane snapper	<i>Lutjanus synagris</i>	M	A	M	A,J	M	A,J
Vermillion snapper	<i>Rhomboplites aurorubens</i>			M	A		
Yellowtail snapper	<i>Ocyurus chrysurus</i>	F	A,J				
Haemulidae							
Black margate	<i>Anisotremus surinamensis</i>	F	A			M	A,J
Pigfish	<i>Orthopristis chrysoptera</i>	M	A	M	A	A	A
Porkfish	<i>Anisotremus virginicus</i>	M	A	M	A,J	M	A,J
Tomtate	<i>Haemulon aurolineatum</i>	A	A,J	A	A,J	M	A,J
White grunt	<i>Haemulon plumieri</i>	F	A				
Sparidae							
Pigfish	<i>Orthopristis chrysoptera</i>	M	A				
Pinfish	<i>Lagodon rhomboides</i>	M	A				
Sheepshead	<i>Archosargus probatocephalus</i>	M	A	M	A	M	A,J
Sheepshead porgy	<i>Calamus penna</i>	M	A	M	A	F	A
Sciaenidae							
Cubbyu	<i>Equetus umbrosus</i>	A	A,J	A	A,J		
Striped croaker	<i>Bairdella sanctaeluciae</i>					M	A
Ephippidae							
Atlantic spadefish	<i>Chaetodipterus faber</i>	M	A			M	A
Chaetodontidae							
Reef butterflyfish	<i>Chaetodon sedentarius</i>	F	A	F	A		
Spotfin butterflyfish	<i>Chaetodon ocellatus</i>	F	A				
Pomacanthidae							
Blue angelfish	<i>Holocanthus bermudensis</i>	F	A	S	J		
French angelfish	<i>Pomacanthus paru</i>	S	A,J				
Gray angelfish	<i>Pomacanthus arcuatus</i>	F	A,J				
Queen angelfish	<i>Holocanthus ciliaris</i>	S	A				
Pomacentridae							
Beaugregory	<i>Pomacentrus leucostictus</i>	M	A,J	M	A,J	M	A,J
Bicolor damselfish	<i>Pomacentrus partitus</i>					M	J
Sergeant major	<i>Abudefduf saxatilis</i>	F	A				
Yellowtail reeffish	<i>Chromis enchrysurus</i>	M	A,J	M	J		
Labridae							
Bluehead	<i>Thalassoma bifasciatum</i>	F	A				
Puddingwife	<i>Halichoeres radiatus</i>			F	A		
Slippery dick	<i>Halichoeres bivittatus</i>	M	A,J	M	A		
Spanish hogfish	<i>Bodianus rufus</i>	F	A	F	A		

Family/ Common Name	Species	2009		2008		2007	
		Abundance	Size	Abundance	Size	Abundance	Size
Sphyraenidae							
Great barracuda	<i>Sphyraena barracuda</i>	F	A				
Guaguanche	<i>Sphyraena guachancho</i>	A	J			M	A
Acanthuridae							
Doctorfish	<i>Acanthurus chirurgus</i>	F	A				
Tetraodontidae							
Bandtail puffer	<i>Sphoeroides spengleri</i>	F	A	M	A		
Diodontidae							
Porcupine fish	<i>Diodon hystrix</i>	F	A				
	Total	46		28		16	

Abundance Key: S=single, F=few (2-10), M=many (11-100), A=abundant (>100)

Size Key: A=adult, J=juvenile, A/J=intermediate

Table 5. Clifton Perry Memorial Reef fish census.

3.2 Texas Reefmaker Units

- Location: Donaldson Reef
- Materials: Reef modules (steel and concrete)
- Maximum Depth: 54 feet
- Reef High Point: 40 feet
- Year Created: 2005
- Monitoring Date: 6/19/2008

3.2.1 History of the Texas Reefmaker Units

In 2005 Martin County received a grant from FFWCC to enhance existing artificial reef sites by deploying sixty Reefmaker “Florida Special” units adjacent to existing reef materials in the Donaldson and Sirotkin reef sites. These modules are large three-sided pyramids fabricated using concrete and steel (Figure 10). Fifteen Reefmaker artificial reef modules were deployed within the Donaldson Reef Site along the southern face of the Texas Reef on May 20, 2005. The location of the Texas Reef Reefmaker units is shown in Figure 9.