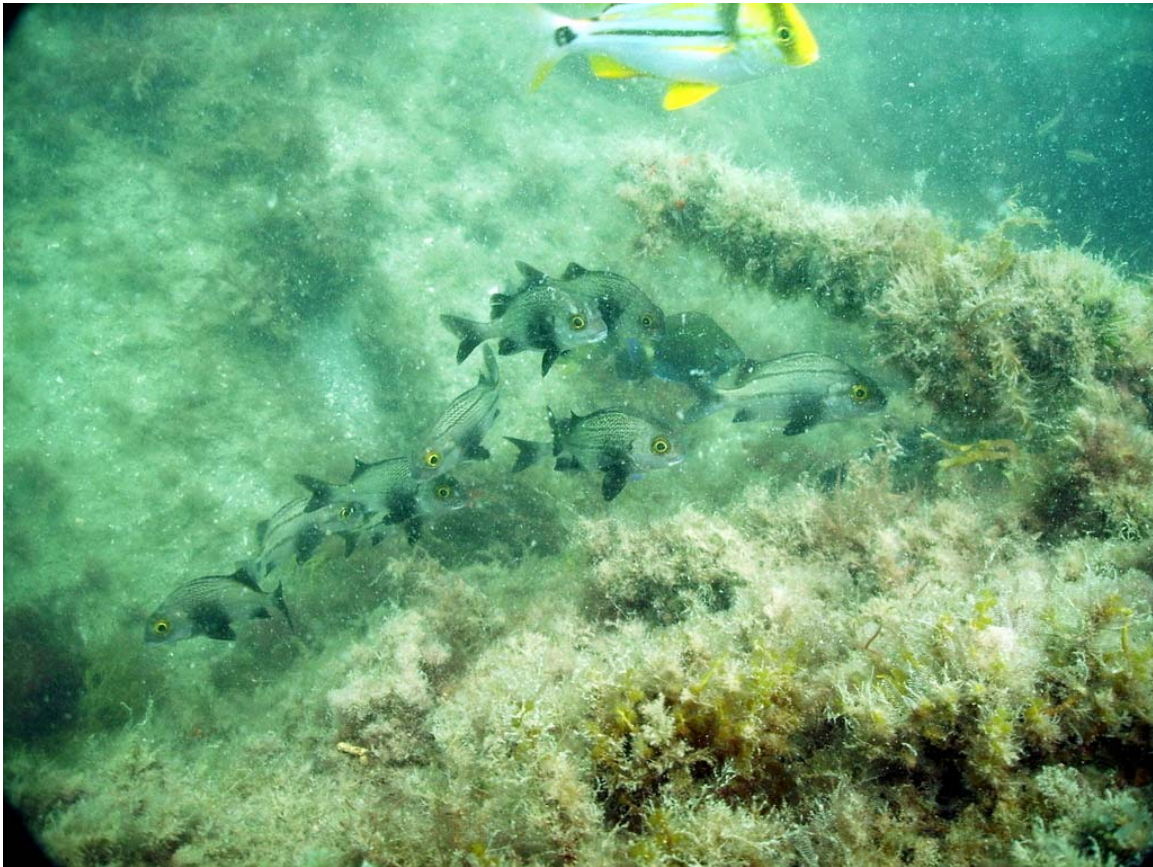


Martin County's Nearshore Mitigation Reefs

Year-7 Monitoring Report

**Part 1: Introduction and Comparison of pelagic communities on the
Nearshore Martin County Mitigation Reefs and the Adjacent Natural Reefs**

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2007 Monitoring Report

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Year-7 Monitoring Report

1 Introduction

As part of the Martin County Beach Nourishment Project, nearshore mitigation reefs were constructed in the summer of 2000 offshore Martin County in water depths of 10 to 20 feet, with the GPS coordinates presented in Table 1 and the three locations shown in Figure 1.

Table 1. Locations of Martin County Nearshore Mitigation Reefs

Reef Name	Latitude, N [1]	Longitude, W [1]	Water Depth (feet) [2]	Reef Crest Depth (feet) [2]
Mitigation Site A	27° 14.412'	80° 11.098'	10 to 20	7 to 20
Mitigation Site B	27° 13.553'	80° 10.647'	10 to 20	7 to 20
Mitigation Site C	27° 13.335'	80° 10.513'	10 to 20	7 to 20

Notes:

1. Latitude and Longitude near reef site centers.
2. Water depths and reef crest depths as originally constructed, with changes discussed in the stability section of each reef monitoring report section.

Annual monitoring of these artificial reef deployments was required for the first five years following material placement, and monitoring was successfully performed in 2001, 2002, 2003, and 2004 (see Table 2 and previous monitoring reports). Due to the two major hurricanes that made direct landfall in this area in September 2004 (Cat2 Hurricane Frances and Cat3 Hurricane Jeanne), and Hurricane Wilma passing through in October 2005, the 2005 monitoring was not possible, due to the lack of underwater visibility in the nearshore waters.

Diving was performed offshore Martin County in 2005 after the hurricanes, but the tremendous amount of silt and debris (including palmettos encountered offshore in 10-m water depths) prevented monitoring efforts. Numerous attempts were made throughout 2005, but visibility sufficient to dive, let alone to successfully perform the monitoring, did not occur until the spring of 2006, with monitoring performed for the 2006 Year-6 report in May, June and December 2006.

Table 2. Annual Monitoring Dates for Martin County Mitigation Reefs

(Reefs deployed in summer 2000)

Reef Name	2007 Monitoring	2006 Monitoring	2004 Monitoring	2003 Monitoring	2002 Monitoring
Mitigation Site A	8/18	5/21, 6/30, 12/27	6/1	5/13	7/23
Mitigation Site B	8/18	5/22	5/26 & 29	5/13	7/23
Mitigation Site C	7/11	5/21, 12/27	5/26 & 30	5/13	7/23

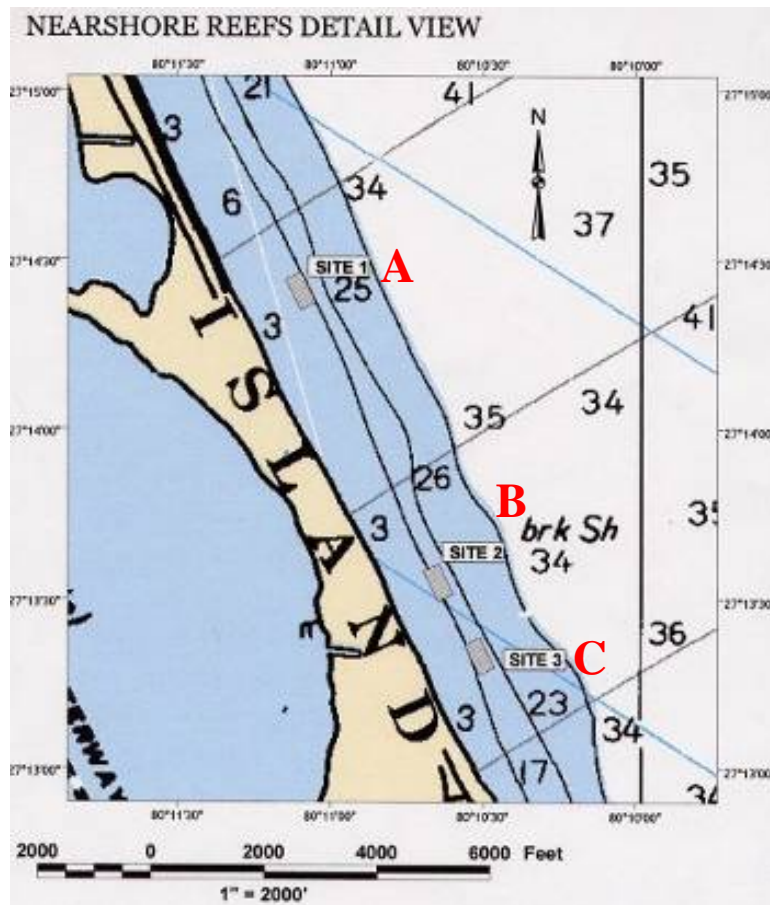


Figure 1. Location of Martin County’s Mitigation Reef Sites (Morgan & Ecklund)

2 Reef Materials

As part of the contract with the Florida Department of Transportation (FDOT) to construct the new Evans Crary Bridge in Stuart, Florida (for Highway A-1-A crossing from Sewalls Point to Hutchinson Island that was completed in 2000), the contractor was required to dismantle and dispose of the old bridge components. The contractor was required to transport these steel and concrete bridge components offshore to construct artificial reefs.

Some of the bridge components were used to create the three shallow water mitigation reefs close to the Stuart and Jensen Beach shorelines in water depths of 10-20 feet, while the larger bridge sections and the majority of the materials were deployed in the Ernst permitted reef site in water depths of 60-70 feet. The Ernst permitted reef site is located approximately 5 miles offshore Martin County, Florida, with GPS Coordinates: N27 09.346 / W80 03.368 (center of the reef at the high section of the reef materials). This artificial reef sites is the southernmost reef shown in Figure 2.

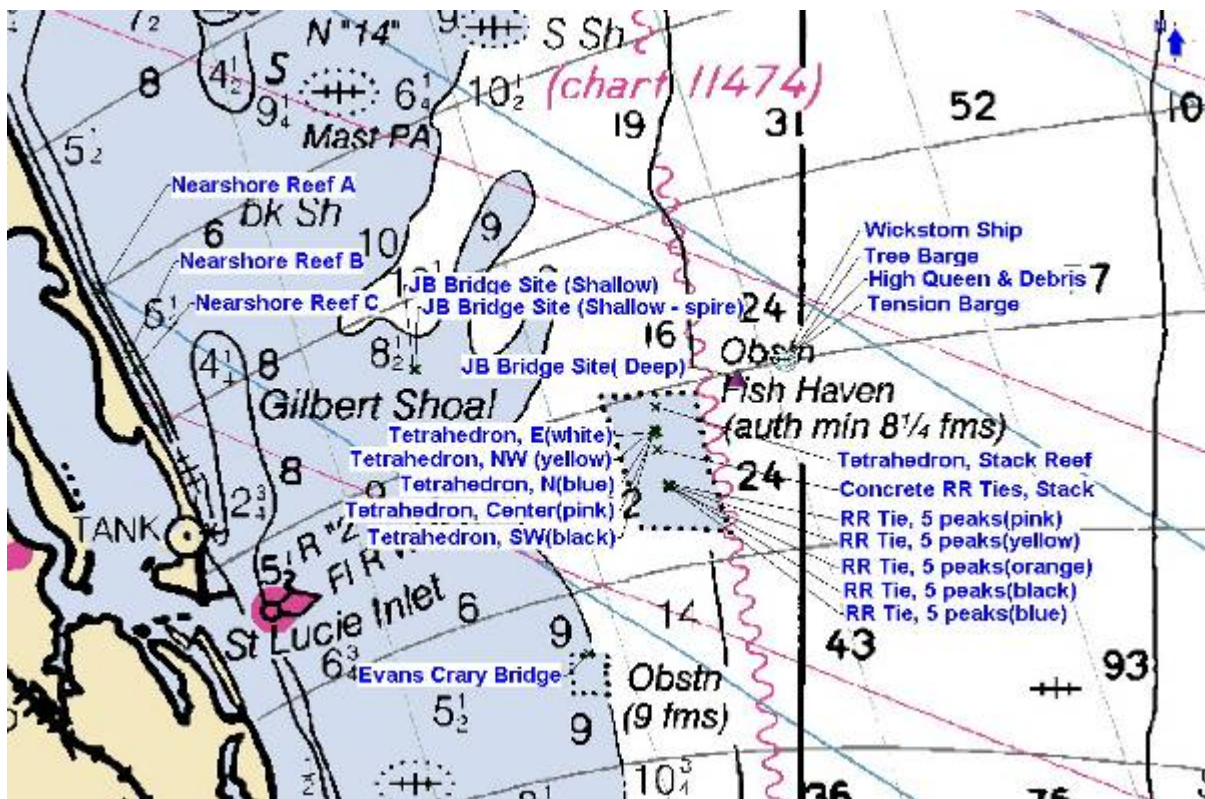


Figure 2. Artificial Reefs deployed 2000 to 2005 offshore Martin County

3 History of the Nearshore Mitigation Reefs

3.1 Nearshore Mitigation Reef Site A

Location: approximately 900 feet offshore; south of the Holiday Inn and Jensen Public Beach, Martin County, Florida

GPS Coordinates: N27 14.412 / W80 11.098 (center of the reef site)

Mitigation Reef A is the northernmost of the nearshore reef sites, and is farthest from the St. Lucie Inlet. Site A had the fewest barge loads of materials; so that the reef is smaller and less dense than the other two-nearshore reef sites. Nearshore Reef A was constructed on 8/2, 8/16, and 9/15/2000 with three total barge loads of the following materials:

- 70 concrete piles from 20 – 40 ft. long each
- 16 concrete pilecaps approx. 30 ft. x 4 ft. x 5 ft. each
- steel/concrete roadway sections approx. 40 ft. x 5 ft. x 4 ft. each

Nearshore Reef A is approximately 900 feet offshore of the beach, with water depths to natural bottom 14 to 22 feet. After the initial deployment, the shallowest spot to the top of the reef components was measured as 6 feet, with the average water depth above reef components being 12 – 15 feet.

3.2 Nearshore Mitigation Reef Site B

Location: approximately 1,000 feet offshore of the Buttonwood Condominium just north of Tiger Shores (Virginia Forest Beach), Martin County, Florida

GPS Coordinates: **N27 13.553 / W80 10.647** (center of the reef site)

Nearshore Reef B was constructed on 7/28, 8/2, 8/10, 8/28 & 9/5/2000 with five total barge loads of the following materials:

- 115 concrete piles from 20 – 40 ft. long each
- 20 concrete pilecaps approx. 30 ft. x 4 ft. x 5 ft. each
- steel/concrete roadway sections approx. 40 ft. x 5 ft. x 4 ft. each

Nearshore Reef B is approximately 1000 feet offshore of the beach, with water depths to natural bottom 16 – 24 ft. deep. The shallowest spot to the top of the reef components was measured as 7 feet in 2004. In 2006 the shallowest spot located was 8 feet.

3.3 Nearshore Mitigation Reef Site C

Location: approximately 1,000 feet offshore of Tiger Shores (Virginia Forest Beach), just north of the Stuart Public Beach, Martin County, Florida

GPS Coordinates: **N27 13.335 / W80 10.513** (center of the reefsite)

Nearshore Reef C was constructed on 7/19, 22, 25, 28 & 8/16 2000 with five total barge loads of the following materials:

- 120 concrete piles from 20 – 40 ft. long each
- 24 concrete pilecaps approx. 30 ft. x 4 ft. x 5 ft. each
- 19 steel/concrete roadway sections approx. 40 ft. x 5 ft. x 4 ft. each

Of the three Martin County mitigation reefs, Site C had the largest quantity of concrete and steel materials deployed. This site was built with 5 total barge loads using fully loaded barges. Although site C had the most total amount of material deployed, it is more spread out, and so the footprint area is larger. Nearshore Reef C is approximately 1000 feet offshore of the beach, with water depths to natural bottom 15 – 24 ft. deep. The shallowest spot to the top of the reef components immediately after deployment in 2000 was 7 feet, with the average water depth above reef components being 12 – 15 feet. In 2006 the shallowest spot located was 9 feet.

4 Comparison of Pelagic Communities

4.1 Mitigation Reef Fish Census

Fish census data for the mitigation reefs were taken during each of the annual surveys to assess the relative fish species diversity and quantities. Fish census surveys were conducted using the Roving Diver underwater visual assessment method (Schmitt and Sullivan 1996). Data were recorded on waterproof slates during the reef assessments. The relative abundance for each species was recorded based on the numbers observed, which were described by the following categories:

- 'A' for abundant, (over 100 individuals);
- 'M' for many (from 11 to 100) individuals;
- 'F' for few, (from 2 to 10 individuals); and
- 'S' for a single individual of that species.

The following tables and present the annual fish census data for each of the three mitigation reef sites.

Table 3. Mitigation Reef A Fish Census Data

Common Name	Scientific Name	Adult or Juvenile	2007 Number	2006 Number	2004 Number	2003 Number	2002 Number
Atlantic Spadefish	<i>Chaetodipterus faber</i>	J&A	F	M	M		M
Balloonfish	<i>Diodon holocanthus</i>	A	F				
Baracuda	<i>Sphyraena barracuda</i>	J&A		M	S		
Beaugregory	<i>Stegastes leucostictus</i>	J&A	M	S	F	F	F
Black Margate	<i>Anisotremus surinamensis</i>	J&A	M	M	M		
Bermuda Chub	<i>Kyphosus sectator</i>	A				S	
Blue Angelfish	<i>Holacanthus bermudensis</i>	A		F	S		
Blue runner	<i>Caranx crysos</i>	A	M		A	M	M
Blue Tang	<i>Acanthurus coeruleus</i>	J	F				
Cardinalfish	<i>Apogon spp.</i>	J			F		
Common Snook	<i>Centropomus undecimalis</i>	A	A	F	F	M	F
Cubbyu	<i>Pareques umbrosus</i>	J&A	M	F			
Doctorfish	<i>Acanthurus chirurgus</i>	A			S	F	S
Drawf Goatfish	<i>Upeneus parvus</i>	A			S		
Freckled Soapfish	<i>Rypticus bistrispinus</i>	A	S				
French Angelfish	<i>Pomacanthus paru</i>	J&A			F		
French Grunt	<i>Haemulon flavolineatum</i>	A	F				
Fry	<i>Jenkinsia lamprotaenia</i>	J&A	A	M	A		
Gag Grouper	<i>Mycteroperca microlepis</i>	J		S	F		
Goliath Grouper	<i>Epinephelus itajara</i>	J&A	S	S		F	

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Gray Angelfish	<i>Pomacanthus arcuatus</i>	A			S	S	
Gray Snapper	<i>Lutjanus griseus</i>	J&A	M	F	M	M	M
Gray Triggerfish	<i>Balistes capriscus</i>	A			F	S	
Hairy Blenny	<i>Labrisomus nuchipinnis</i>	A	M	F			
Highhat	<i>Equetus acuminatus</i>	J&A		F	S		F
Hogfish	<i>Orthopristis chrysoptera</i>	J				S	
King Mackerel	<i>Scomberomorus cavalla</i>	A	S	S			
Lane Snapper	<i>Lutjanus synagris</i>	J&A	F		S	F	F
Nurse Shark	<i>Ginglymostoma cirratum</i>	A	S				
Ocean Surgeonfish	<i>Acanthurus bahianus</i>	A	F				
Porkfish	<i>Anisotremus virginicus</i>	J&A	M	M	M	M	M
Red Porgy	<i>Pagrus major</i>	A			F	F	
Sailors Choice	<i>Haemulon parra</i>	A			F		
Scorpionfish	<i>Scorpaenopsis oxycephala</i>	A		F			
Sergeant Major	<i>Abudefduf saxatilis</i>	J&A	S			S	S
Sheepshead	<i>Archosargus probatocephalus</i>	A	S	F		M	F
Sheepshead Porgy	<i>Calamus penna</i>	A	M				
Slipper Dick	<i>Halichoeres bivittatus</i>	J	M			F	
Southern Flounder	<i>Paralichthys lethostigma</i>	A		F			
Spanish Mackerel	<i>Scomberomorus maculatus</i>	A	M				
Spiny Lobster	<i>Panulirus argus</i>	A	F	F			S
Spotfin Butterflyfish	<i>Chaetodon ocellatus</i>	A	S				
Spottail pinfish	<i>Diplodus holbrookii</i>	J&A	F	M	M	F	S
Spotted Moray Eel	<i>Gymnothorax moringa</i>	A			S		
Stonecrab	<i>Menippe mercenaria</i>	A					S
Stripped Croaker	<i>Bairdiella sanctaeluciae</i>	J&A	M	F			
Tarpon	<i>Megalops atlanticus</i>	A	F				
Tomtate	<i>Haemulon aurolineatum</i>	J&A	A	M			A
White Margate	<i>Haemulon album</i>	A				M	M
Yellowfin Mojarra	<i>Gerres cinereus</i>	A	M				
Yellowtail Snapper	<i>Ocyurus chrysurus</i>	J	S				
	Total Number of Species:		32	22	23	18	16

Table 4. Mitigation Reef B Fish Census Data

Common Name	Scientific Name	Adult or Juvenile	2007 Number	2006 Number	2004 Number	2003 Number	2002 Number
Atlantic Spadefish	<i>Chaetodipterus faber</i>	A	F	M	F	M	M
Barracuda	<i>Sphyraena barracuda</i>	A		S	S		S
Beaugregory	<i>Stegastes leucostictus</i>	J					F
Black Margate	<i>Anisotremus surinamensis</i>	J&A	F		F	F	
Blue Damsel		J	M				
Blue Runners	<i>Caranx crysos</i>	J&A	M	F	A		
Common Shook	<i>Centropomus undecimalis</i>	J&A	M		M	S	F
Cubbyu	<i>Pareques umbrosus</i>	J&A	M				
Doctorfish	<i>Acanthurus chirurgus</i>	J&A			M		F
French Angelfish	<i>Pomacanthus paru</i>	J&A	S	S	S		S
Fry	<i>Jenkinsia lamprotaenia</i>	J		A	A		
Goliath Grouper	<i>Epinephelus itajara</i>	J			S		
Gray Triggerfish	<i>Balistes capriscus</i>	A		S			S
Gray Snapper	<i>Lutjanus griseus</i>	J&A	A		M	F	M
Hairy Blenny	<i>Labrisomus nuchipinnis</i>	A	M				F
Highhat	<i>Equetus acuminatus</i>	J					F
Lane Snapper	<i>Lutjanus synagris</i>	J&A	F	F	S		F
Nurse Shark	<i>Ginglymostoma cirratum</i>	A	S				
Porcupinefish	<i>Diodon hystrix</i>	A			S		
Porkfish	<i>Anisotremus virginicus</i>	J&A	M	M	M	M	M
Round Scad (Cigar Minnows)	<i>Decapterus punctatus</i>	A	A				
Sailor's Choice	<i>Haemulon parra</i>	A			M		
Sergeant Major	<i>Abudefduf saxatilis</i>	A	F				S
Sheepshead	<i>Archosargus probatocephalus</i>	A		F	F	M	F
Slippery Dick	<i>Halichoeres bivittatus</i>	J&A	F			F	
Southern Flounder	<i>Paralichthys lethostigma</i>	A			S		
Spanish Grunt	<i>Haemulon macrostomum</i>	A		F			
Spiny Lobster	<i>Panulirus argus</i>	A					S
Spottail Pinfish	<i>Diplodus holbrookii</i>	A	F			M	M

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Spotted Goatfish	<i>Pseudupeneus maculatus</i>	A					F
Spotted Moray Eel	<i>Gymnothorax moringa</i>	A			S		S
Stripped Croaker	<i>Bairdiella sanctaeluciae</i>	A	A				
Tomtate	<i>Haemulon aurolineatum</i>	J&A	A				A
Two Spot Cardinalfish	<i>Apogon binotatus</i>	A	M				F
White Margate	<i>Haemulon album</i>	A					S
White Spotted Soapfish	<i>Serranus annularis</i>	A		S			
	Total Number of Species:		19	12	17	8	21

Table 5. Mitigation Reef C Fish Census Data

Common Name	Scientific Name	Adult or Juvenile	2007 Number	2006 Number	2004 Number	2003 Number	2002 Number
Atlantic Bumper	<i>Chloroscombrus chrysurus</i>	A			M		
Atlantic Spadefish	<i>Chaetodipterus faber</i>	J&A	M		F	M	M
Barracuda (4 ft.)	<i>Sphyræna barracuda</i>	A	F		S	S	S
Beaugregory	<i>Stegastes leucostictus</i>	J&A	M	M	F	S	F
Black Margate	<i>Anisotremus surinamensis</i>	J&A	M	M	M	M	
Blue Runners	<i>Caranx crysos</i>	A	M		M	A	S
Common Shook	<i>Centropomus undecimalis</i>	J&A	F	S	F	F	S
Cubbyu	<i>Pareques umbrosus</i>	J&A		M			
Doctorfish	<i>Acanthurus chirurgus</i>	J&A					F
Fry	<i>Jenkinsia lamprotaenia</i>	J			A	M	
Gag Grouper	<i>Mycteroperca microlepis</i>	J&A	S		S	S	
Goliath Grouper	<i>Epinephelus itajara</i>	A		F			S
Gray Angelfish	<i>Pmacanthus arcuatus</i>	J&A				S	
Gray Triggerfish	<i>Balistes capriscus</i>	A	F		S	S	S
Green Moray Eel	<i>Gymnothorax funebris</i>	A				S	
Gray Snapper	<i>Lutjanus griseus</i>	J&A	M	F	M	F	M
Hairy Blenny	<i>Labrisomus nuchipinnis</i>	J&A	M	F			S
Highhat	<i>Equetus acuminatus</i>	J&A	M	F	S	F	F
Lane Snapper	<i>Lutjanus synagris</i>	J&A	M		S	M	
Mackerel Scad	<i>Decapterus macarellus</i>	A				M	
Mutton Snapper	<i>Lutjanus analis</i>	A				S	
Nurse Shark	<i>Ginglymostoma cirratum</i>	A	S		F		
Porcupinefish	<i>Diodon hystrix</i>	A			S		
Porkfish	<i>Anisotremus virginicus</i>	J&A	M	M	A	A	M
Red Pogy	<i>Pagrus major</i>	A			F	F	
Reef Croaker	<i>Odontoscion dentex</i>	A	M		M		
Round Scad (Cigar Minnows)	<i>Decapterus punctatus</i>	A	A	A			
Sailors Choice	<i>Haemulon parra</i>	J					M
Scamp	<i>Mycteroperca phenax</i>	J	S		S		

Schoolmaster	<i>Lutjanus apodus</i>	A					S
Sergeant Major	<i>Scorpaena grandicomis</i>	A					F
Sheepshead	<i>Archosargus probatocephalus</i>	A	M		F	F	F
Spiny Lobster	<i>Panulirus argus</i>	A		F			S
Spottail pinfish	<i>Diplodus holbrookii</i>	A	F	F	S	F	S
Spotted Scorpionfish	<i>Scorpaena plumieri</i>	J&A	F			S	
Stripped Croaker	<i>Bairdiella sanctaeluciae</i>	A		A			
Tomtate	<i>Haemulon aurolineatum</i>	J&A	M	M			M
Townshend Angelfish	<i>Pomacanthus</i>	A		S			
White Margate	<i>Haemulon album</i>	A				F	
	Total Number of Species:		20	16	21	22	19

Figure 3 shows the variations in the total number of species recorded for each of the three mitigation reef sites for each of the annual fish counts. This graph shows a stable fish population inhabiting the mitigation reefs.

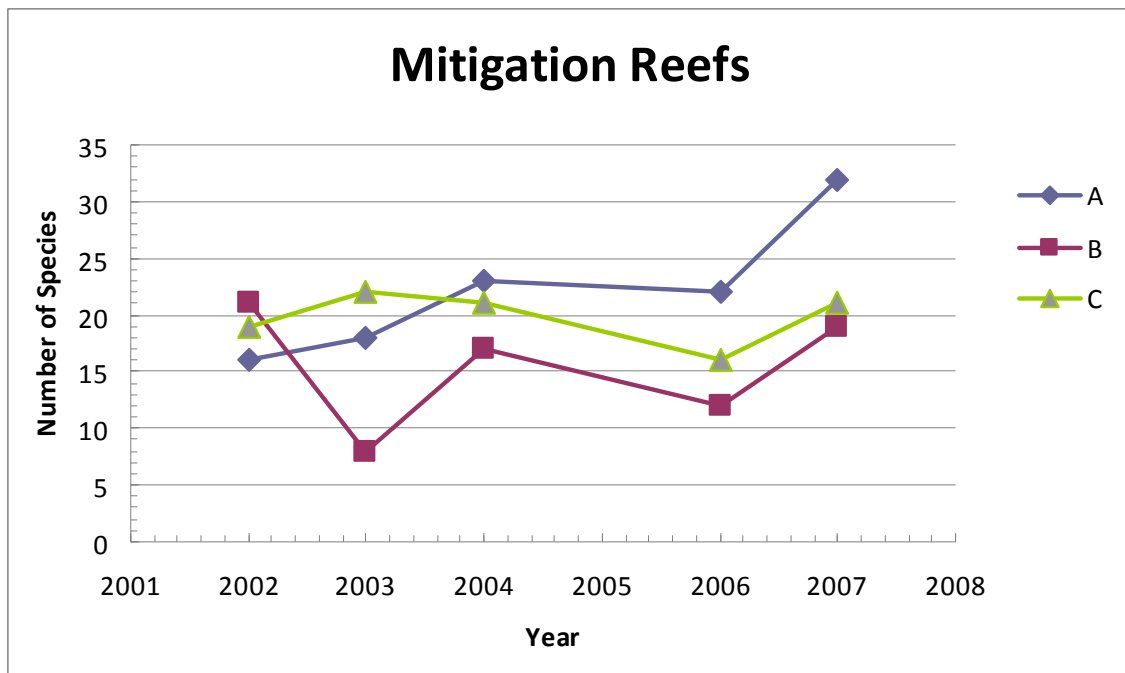


Figure 3. Variations in Numbers of Species for the Mitigation Reefs

4.2 Natural Reef Fish Census

In 2007 additional fish census were taken for the natural reef areas adjacent to the mitigation reefs during the same dates as the mitigation reef fish census, also using the Roving Diver method. The following tables present the fish census data taken at the adjacent natural reefs in 2007. No prior year's data are available, as only the mitigation reefs were monitored on an annual basis.

Table 6. Fish Census Data for the Natural Reef near Mitigation Reef-A

Common Name	Scientific Name	Adult or Juvenile	2007 Number
Bandtail Puffer	<i>Spherooides spengleri</i>	J	S
Black Margate	<i>Anisotremus surinamensis</i>	J	F
Blue runner	<i>Caranx crysos</i>	A	F
Cubbyu	<i>Pareques umbrosus</i>	J&A	F
Doctorfish	<i>Acanthurus chirurgus</i>	J	F
Flounder	<i>Paralichthys</i>	A	F
French Angelfish	<i>Pomacanthus paru</i>	J	F
French Grunt	<i>Haemulon flavolineatum</i>	J	F
Gray Angelfish	<i>Pomacanthus arcuatus</i>	J	S
Gray Snapper	<i>Lutjanus griseus</i>	A	F
Hairy Blenny	<i>Labrisomus nuchipinnis</i>	A	S
Irish Pompano	<i>Diapterus auratus</i>	A	S
Lane Snapper	<i>Lutjanus synagris</i>	J	M
Ocean Surgeon	<i>Acanthurus bahianus</i>	J	F
Porkfish	<i>Anisotremus virginicus</i>	J&A	F
Queen Angel	<i>Holocanthus ciliaris</i>	J	S
Sergeant Major	<i>Abudefduf saxatilis</i>	J	S
Slipper Dick	<i>Halichoeres bivittatus</i>	J	M
Spottail Cardinal Fish	<i>Pseudamia Amblyuroptera</i>	A	M
Spottail pinfish	<i>Diplodus holbrookii</i>	A	M
Spotted Moray Eel	<i>Gymnothorax moringa</i>	A	S
Spotted Scorpionfish	<i>Scorpaena plumieri</i>	A	F
Trunk Fish	<i>Polygonius</i>	A	S
Yellowtail Snapper	<i>Rhomboplites aurorubens</i>	J	S
	Total Number of Species:		24

Table 7. Fish Census Data for the Natural Reef near Mitigation Reef-B

Common Name	Scientific Name	Adult or Juvenile	2007 Number
Atlantic Spadefish	<i>Chaetodipterus faber</i>	A	M
Beaugregory	<i>Stegastes leucostictus</i>	J	M
Black Margate	<i>Anisotremus surinamensis</i>	J	F
Blue Runners	<i>Caranx crysos</i>	A	F
Cubbyu	<i>Pareques umbrosus</i>	J	F
French Angelfish	<i>Pomacanthus paru</i>	J	F
Gray Angelfish	<i>Pomacanthus arcuatus</i>	J	F
Gray Snapper	<i>Lutjanus griseus</i>	J&A	F
Hairy Blenny	<i>Labrisomus nuchipinnis</i>	J	F
Lane Snapper	<i>Lutjanus synagris</i>	J	M

Nurse Shark	<i>Ginglymostoma cirratum</i>	A	S
Porkfish	<i>Anisotremus virginicus</i>	J&A	M
Red Lizardfish	<i>Synodus synodus</i>	A	S
Sergeant Major	<i>Scorpaena grandicornis</i>	A	S
Sheepshead	<i>Archosargus probatocephalus</i>	A	F
Slippery dick	<i>Halichoeres bivittatus</i>	J	A
Spottail pinfish	<i>Diplodus holbrookii</i>	A	F
Spotted Moray Eel	<i>Gymnothorax moringa</i>	A	S
Spotted Scorpionfish	<i>Scorpaena plumieri</i>	A	S
Tomtate	<i>Haemulon aurolineatum</i>	J	M
Twospot Cardinalfish	<i>Apogon pseudomaculatus</i>	A	M
Yellowtail snapper	<i>Ocyurus chrysurus</i>	J	M
Total Number of Species:			22

Table 8. Fish Census Data for the Natural Reef near Mitigation Reef-C

Common Name	Scientific Name	Adult or Juvenile	2007 Number
Atlantic Spadefish	<i>Chaetodipterus faber</i>	A	M
Bar Jacks	<i>Carangoides ruber</i>	J	S
Beaugregory	<i>Stegastes leucostictus</i>	J	M
Black Margate	<i>Anisotremus surinamensis</i>	J	F
Cubby	<i>Pareques umbrosus</i>	J	S
French Angelfish	<i>Pomacanthus paru</i>	J	F
Gray Angelfish	<i>Pomacanthus arcuatus</i>	J	S
Gray Snapper	<i>Lutjanus griseus</i>	A	F
Hairy Blenny	<i>Labrisomus nuchipinnis</i>	J	S
Lane Snapper	<i>Lutjanus synagris</i>	J	M
Ocean Surgeonfish	<i>Acanthurus babianus</i>	A	F
Porkfish	<i>Anisotremus virginicus</i>	J&A	M
Red Lizardfish	<i>Synodus synodus</i>	A	S
Round Scad (Cigar Minnows)	<i>Decapterus punctatus</i>	A	S
Sergeant Major	<i>Scorpaena grandicornis</i>	A	S
Sheepshead	<i>Archosargus probatocephalus</i>	A	F
Slippery dick	<i>Halichoeres bivittatus</i>	J	A
Spottail pinfish	<i>Diplodus holbrookii</i>	A	F
Spotted Scorpionfish	<i>Scorpaena plumieri</i>	A	S
Tomtate	<i>Haemulon aurolineatum</i>	J	F
White Grunt	<i>Haemulon plumieri</i>	A	S
Yellowtail snapper	<i>Ocyurus chrysurus</i>	J	M
Total Number of Species:			22

The total number of fish species recorded in 2007 for the artificial mitigation reefs and adjacent natural reefs are similar as shown in Table 8.

Table 9. Comparison of 2007 Fish Data for the Natural Reefs vs. Mitigation Reefs

Mitigation Reefs	Natural Reefs
Mitigation Reef A = 32	Natural Reef near Mit-A = 25
Mitigation Reef B = 19	Natural Reef near Mit-B = 22
Mitigation Reef C = 21	Natural Reef near Mit-C = 22