

**Fish Monitoring on the *Spiegel Grove* Artificial Reef  
April 2002 – August 2007  
Final Report**

**Prepared by the Reef Environmental Education Foundation (REEF)  
November 28, 2007**

## Background

The *Spiegel Grove* is a 510' Navy Landing Ship Dock that was intentionally sunk off Key Largo, Florida, on June 10, 2002, to serve as a recreational diving and fishing artificial reef (Figure 1). The ship lies in 130' of water; at its broadest point the deck is 84' wide, creating a wall-like habitat from 45' to the sandy bottom. Since the *Spiegel Grove* was righted by Hurricane Dennis (2005), the top deck now lies in approximately 85' depth. At the time of its sinking, the *Spiegel Grove* was the largest vessel intentionally sunk. Monroe County, the Upper Keys Artificial Reef Foundation (UKARF) and the Florida Keys National Marine Sanctuary (FKNMS) worked closely to obtain, clean, scuttle and sink the vessel, as well as raise funds for the effort. Prior to the sinking, the Reef Environmental Education Foundation (REEF) was contracted by Monroe County to conduct a study with pre- and post-deployment monitoring on the fish assemblages of the *Spiegel Grove* and adjacent reef areas for a period of 5 years. This document summarizes that effort. A separate study was conducted recently to assess the relative socioeconomic benefits of the *Spiegel Grove* that is not part of REEF's work but has important results for reader consideration as a companion to this biological study (Leeworthy et al. 2006)

REEF is an international non-profit marine conservation organization that runs hands-on grassroots activities designed to educate and engage local communities in conservation-focused activities. REEF is based in Key Largo, Florida, with a Pacific office in Seattle, Washington. The mission of REEF is to conserve marine ecosystems for their recreational, commercial, and intrinsic value by educating, enlisting and enabling SCUBA divers and other marine enthusiasts to become active stewards and citizen scientists. REEF links the diving community with scientists, resource managers and conservationists through marine-life data collection and related activities. REEF coordinates the Volunteer Survey Project, which has trained and involved over 10,000 divers and snorkelers in marine life identification and the collection of useful population and distribution data. This citizen science program has generated one of the largest marine life databases in the world, with over 100,000 surveys conducted to date.

It was anticipated that with the sinking of the *Spiegel Grove*, a change in fish community structure on the sinking site and potentially on nearby reefs would take place. In 2002, REEF implemented a 5-year monitoring plan to document fish species presence/absence, sighting frequency and estimated abundance over time at the *Spiegel Grove* site and at 7 nearby natural and artificial reef sites. The primary goal of the monitoring was to document fish recruitment to the *Spiegel Grove* site, detect changes over time in the assemblage and compare patterns between sites.













Figure 1a. The *Spiegel Grove* during its service years. Photo courtesy of the US Naval Institute, photo #90125.



Figures 1b and 1c. REEF volunteers conducting a fish survey on the *Spiegel Grove* a few weeks after the ship was deployed as an artificial reef.



Figure 1d. A school of Blackfin Snapper on the *Spiegel Grove* (taken in October 2006). Photo courtesy of Mike Ryan/Horizon Divers.



Figure 1e. A closeup of the benthic community that is encrusting the *Spiegel Grove*. Photo courtesy of Mike Ryan/Horizon Divers.

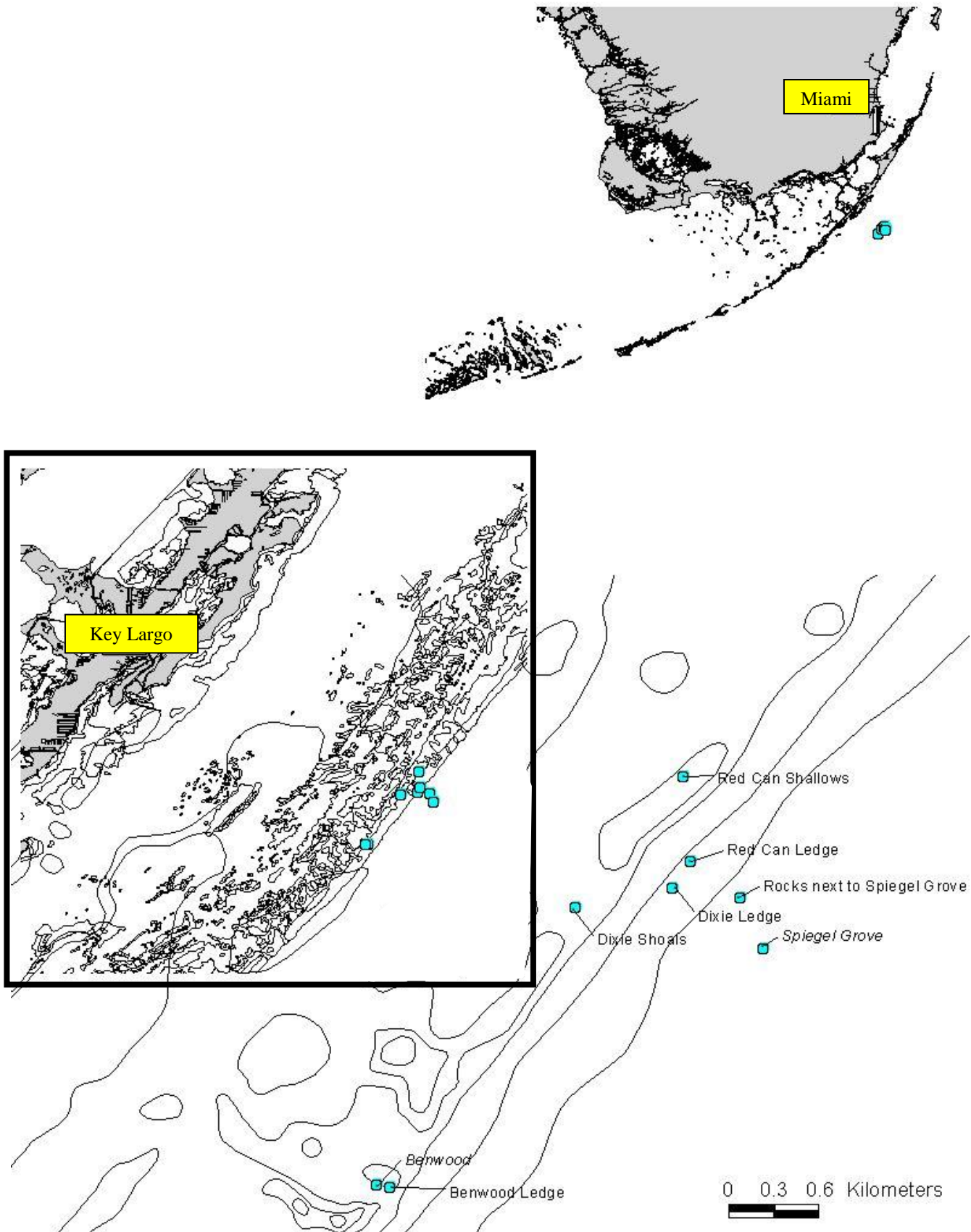


Figure 2. Location of the *Spiegel Grove* and seven reference sites surveyed during the monitoring events.

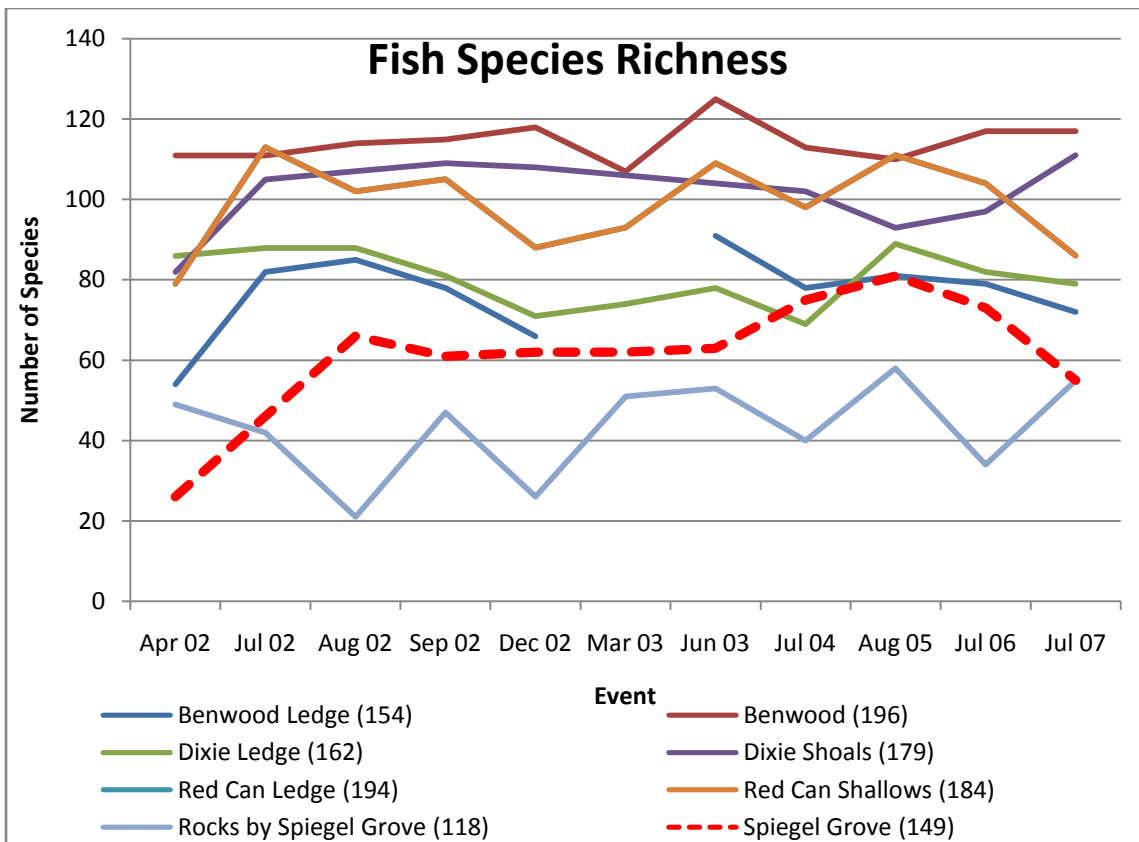


Figure 3. Change in fish species richness at the *Spiegel Grove* and seven reference sites through time, as recorded during REEF monitoring events. Total species richness given in the legend.

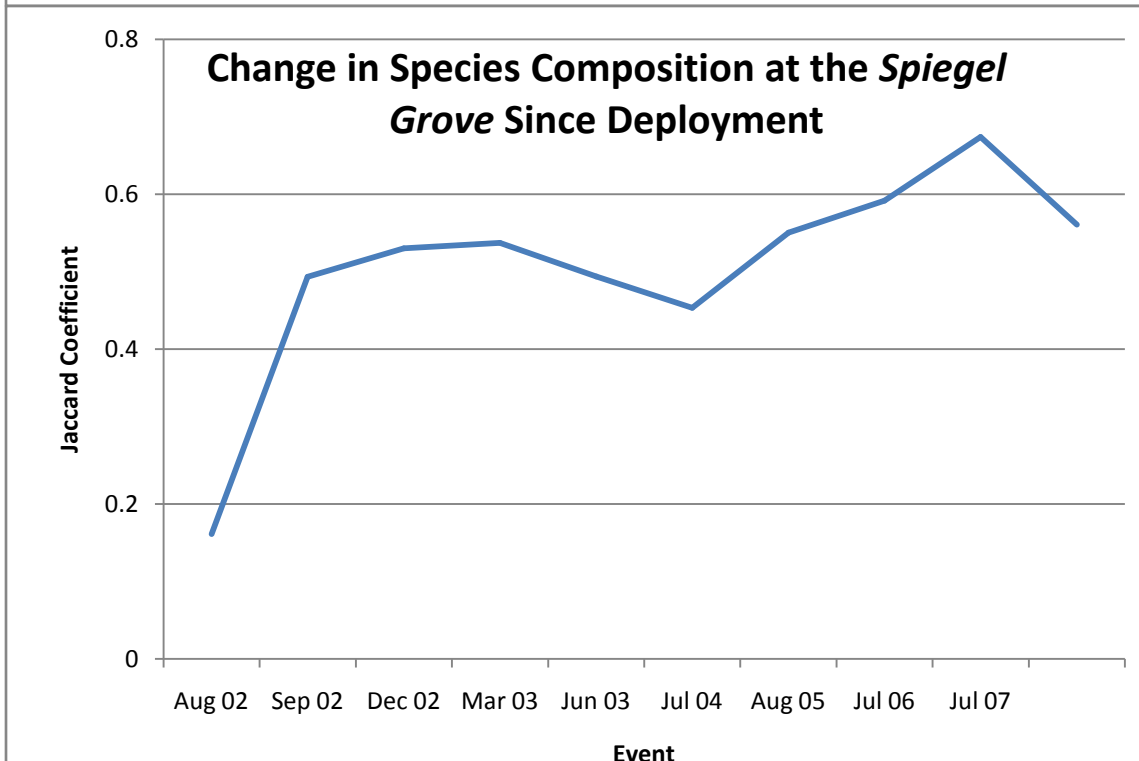


Figure 4. Change in fish species composition at the *Spiegel Grove* through time, as measured by the Jaccard Coefficient of each monitoring event compared with species recorded during the previous monitoring event.

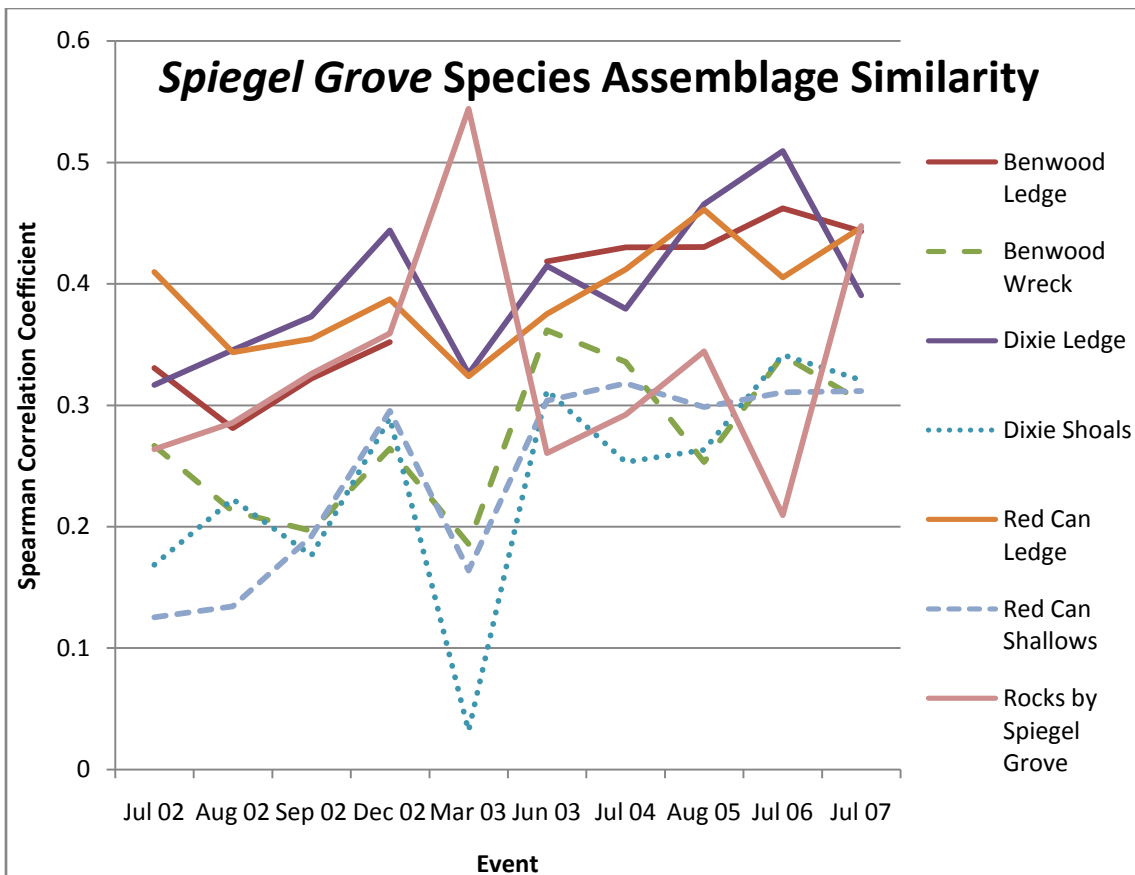


Figure 5. Similarity in species composition between the *Spiegel Grove* and the reference sites. Values are mean Spearman similarity coefficients for monitoring events 1-10 (pre-deployment monitoring not included), based on rank abundance scores. Species seen in at least 90% of surveys at each site were included in the analysis.

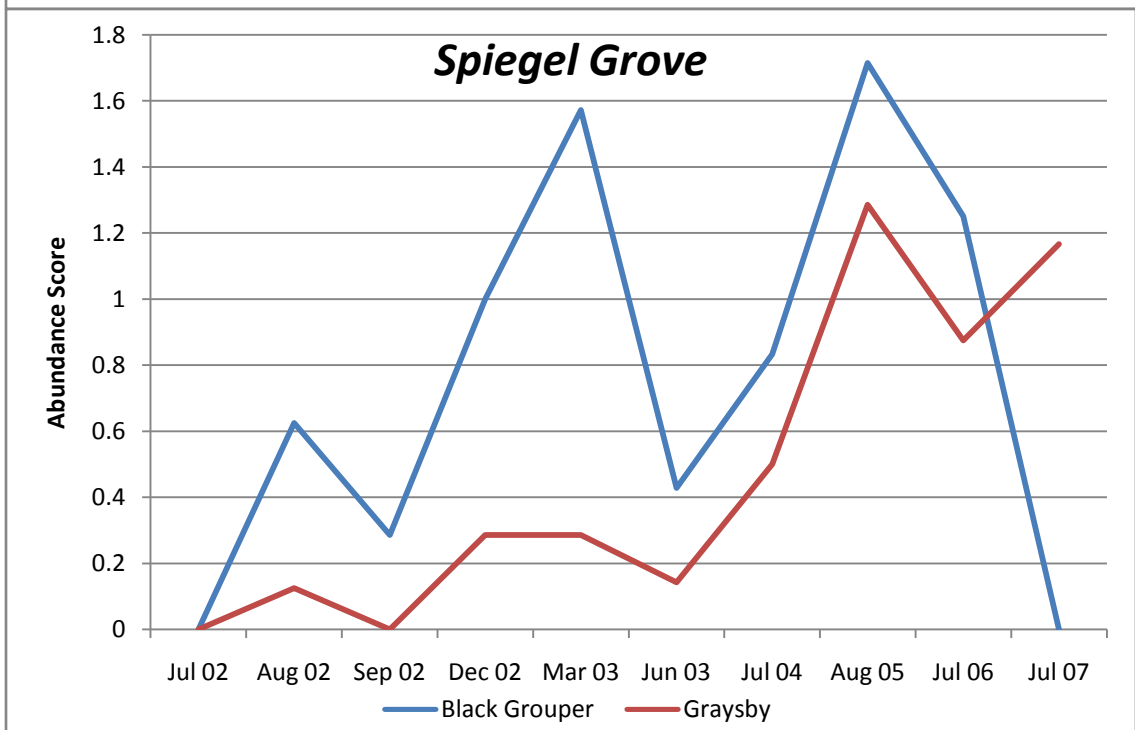


Figure 6a. Change in abundance score at the *Spiegel Grove* following deployment in June 2002.

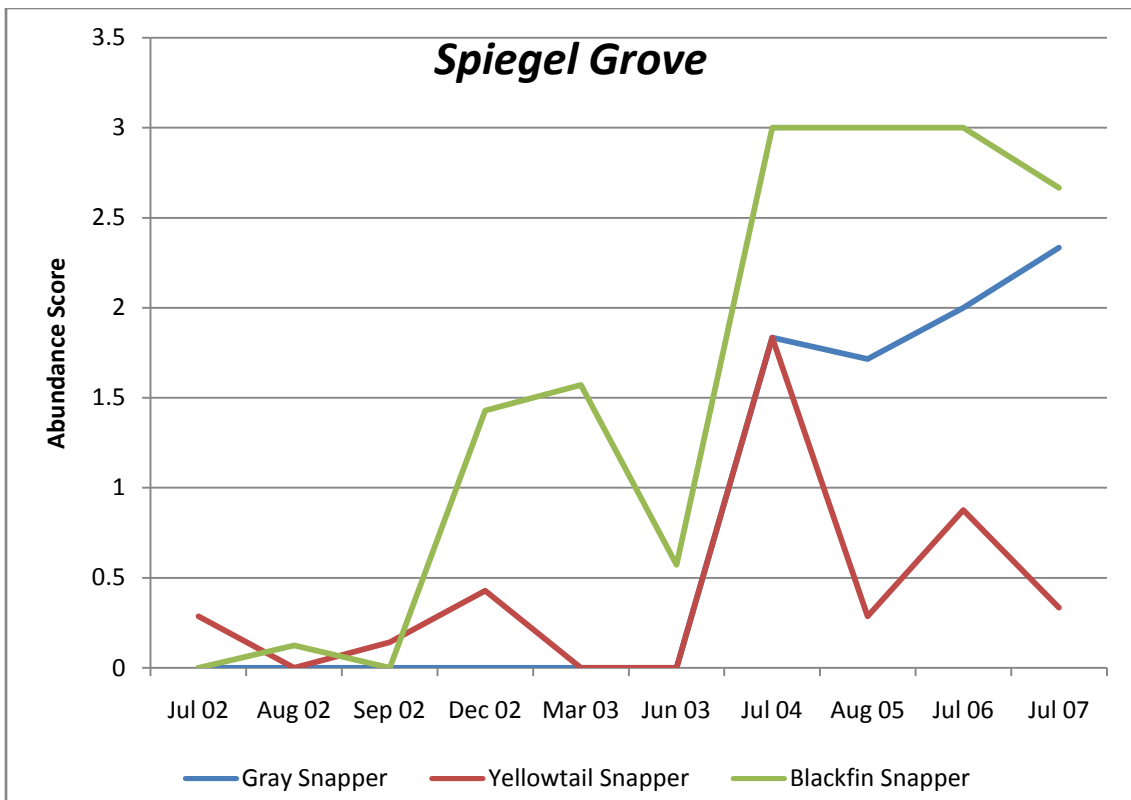


Figure 6b. Change in abundance score at the *Spiegel Grove* following deployment in June 2002.

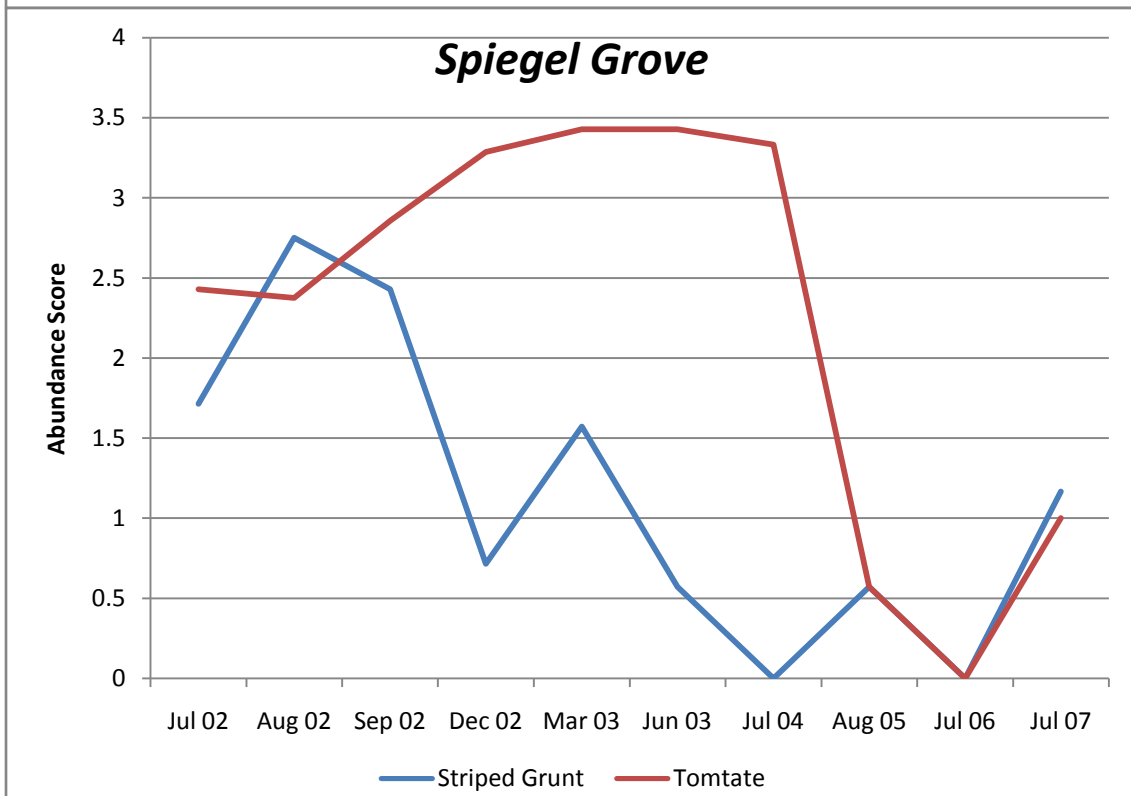


Figure 6c. Change in abundance score at the *Spiegel Grove* following deployment in June 2002.

**Table 1. Monitoring sites.**

Site (surveying depth in feet)	Latitude / Longitude
Benwood Ledge (60-100')	25 03.155 N / 80 19.970 W
<i>Benwood Wreck</i> (30')	25 03.160 N / 80 20.020 W
Dixie Ledge (60-100')	25 04.213 N / 80 18.971 W
Dixie Shoals (20')	25 04.145 N / 80 19.315 W
Red Can Ledge (60-100')	25 04.308 N / 80 18.909 W
Red Can Shallows (25')	25 04.610 N / 80 18.935 W
Rocks next to <i>Spiegel Grove</i> (125')	25 04.180' N / 80 18.730 W
<i>Spiegel Grove</i> (130')	25 04.000 N / 80 18.650 W

**Table 2. RDT Survey Effort during 5 years of REEF Monitoring.**

Event	Benwood		Dixie		Red Can Ledge	Red Can Shallows	Rocks by	
	Ledge	<i>Benwood</i>	Ledge	Shoals Shallow			<i>Spiegel Grove</i>	<i>Spiegel Grove</i>
Apr 02	6	6	7	6	7	6	6	6
Jul 02	7	7	7	7	7	7	7	7
Jul 07	6	6	6	6	8	6	6	6
Aug 02	7	6	7	7	7	7	7	8
Sep 02	7	7	7	7	7	7	7	7
Dec 02	6	7	7	7	7	6	4	7
Mar 03	0	6	7	7	7	7	6	7
Jun 03	7	7	7	7	7	7	7	7
Jul 04	6	6	6	7	7	7	7	6
Aug 05	7	7	7	7	7	8	8	7
Jul 06	7	8	7	7	7	7	7	8
<b>Total</b>	<b>57</b>	<b>63</b>	<b>65</b>	<b>65</b>	<b>68</b>	<b>65</b>	<b>62</b>	<b>76</b>

**Table 3. Comprehensive list of fish species documented during REEF Roving Diver Technique Surveys at the *Spiegel Grove*. Sighting frequency (%) is given for species seen during monitoring events between April 2002 and July 2007. Species documented during other times by REEF surveyors are listed at the end of the table ("other").**

Common Name	Scientific Name	%SF
Bluehead	<i>Thalassoma bifasciatum</i>	78.9
Sharpnose Puffer	<i>Canthigaster rostrata</i>	76.3
Blue Tang	<i>Acanthurus coeruleus</i>	75.0
Reef Butterflyfish	<i>Chaetodon sedentarius</i>	73.7
Bicolor Damselfish	<i>Stegastes partitus</i>	73.7
Creole Wrasse	<i>Clepticus parrae</i>	67.1
Ocean Surgeonfish	<i>Acanthurus bahianus</i>	65.8
Bar Jack	<i>Caranx ruber</i>	63.2
Sergeant Major	<i>Abudefduf saxatilis</i>	61.8
Purple Reeffish	<i>Chromis scotti</i>	60.5
Tomtate	<i>Haemulon aurolineatum</i>	60.5
Trumpetfish	<i>Aulostomus maculatus</i>	59.2
Striped Parrotfish	<i>Scarus iseri</i>	57.9
Sunshinefish	<i>Chromis insolata</i>	56.6
Redband Parrotfish	<i>Sparisoma aurofrenatum</i>	55.3
Hogfish	<i>Lachnolaimus maximus</i>	53.9
Blue Runner	<i>Caranx crysos</i>	53.9
Great Barracuda	<i>Sphyraena barracuda</i>	50.0
Black Grouper	<i>Mycteroperca bonaci</i>	48.7
Greenblotch Parrotfish	<i>Sparisoma atomarium</i>	48.7
Blackfin Snapper	<i>Lutjanus buccanella</i>	48.7
Harlequin Bass	<i>Serranus tigrinus</i>	47.4
Yellowtail Reeffish	<i>Chromis enchrysur</i>	44.7
Brown Chromis	<i>Chromis multilineata</i>	43.4
Spotted Goatfish	<i>Pseudupeneus maculatus</i>	43.4
Round Scad	<i>Decapterus punctatus</i>	39.5
Bluelip Parrotfish	<i>Cryptotomus roseus</i>	38.2
Doctorfish	<i>Acanthurus chirurgus</i>	38.2
Rock Beauty	<i>Holacanthus tricolor</i>	34.2
Butter Hamlet	<i>Hypoplectrus unicolor</i>	34.2
Blue Chromis	<i>Chromis cyanea</i>	32.9
Scrawled Filefish	<i>Aluterus scriptus</i>	32.9
Orangespotted Filefish	<i>Cantherhines pullus</i>	31.6
Striped Grunt	<i>Haemulon striatum</i>	31.6
Goldspot Goby	<i>Gnatholepis thompsoni</i>	30.3
Gray Angelfish	<i>Pomacanthus arcuatus</i>	28.9
Graysby	<i>Cephalopholis cruentata</i>	28.9
Queen Angelfish	<i>Holacanthus ciliaris</i>	27.6
Masked Goby/Glass Goby	<i>Coryphopterus personatus/hyalinus</i>	27.6
Gray Snapper	<i>Lutjanus griseus</i>	27.6
Cottonwick	<i>Haemulon melanurum</i>	25.0
Redtail Parrotfish	<i>Sparisoma chrysopterum</i>	25.0

Table 3 Cont.

Common Name	Scientific Name	%SF
Porkfish	<i>Anisotremus virginicus</i>	23.7
Yellow Jack	<i>Caranx bartholomaei</i>	23.7
Mackerel Scad	<i>Decapterus macarellus</i>	23.7
Spotfin Hogfish	<i>Bodianus pulchellus</i>	22.4
Chalk Bass	<i>Serranus tortugarum</i>	22.4
Scamp	<i>Mycteroperca phenax</i>	21.1
Spanish Hogfish	<i>Bodianus rufus</i>	21.1
Spotfin Butterflyfish	<i>Chaetodon ocellatus</i>	19.7
Bridled Goby	<i>Coryphopterus glaucofraenum</i>	19.7
Yellowtail Snapper	<i>Ocyurus chrysurus</i>	18.4
Red Grouper	<i>Epinephelus morio</i>	17.1
White Grunt	<i>Haemulon plumieri</i>	17.1
Bandtail Puffer	<i>Sphoeroides spengleri</i>	17.1
Cocoa Damselfish	<i>Stegastes variabilis</i>	15.8
Princess Parrotfish	<i>Scarus taeniopterus</i>	15.8
Yellowhead Wrasse	<i>Halichoeres garnoti</i>	15.8
French Angelfish	<i>Pomacanthus paru</i>	14.5
Boga	<i>Inermia vittata</i>	14.5
Greater Amberjack	<i>Seriola dumerili</i>	14.5
Planehead Filefish	<i>Stephanolepis hispidus</i>	14.5
Almaco Jack	<i>Seriola rivoliana</i>	14.5
Slender Filefish	<i>Monacanthus tuckeri</i>	13.2
Rainbow Runner	<i>Elagatis bipinnulata</i>	13.2
Yellowtail (Redfin) Parrotfish	<i>Sparisoma rubripinne</i>	13.2
Seaweed Blenny	<i>Parablennius marmoreus</i>	11.8
Cero	<i>Scomberomorus regalis</i>	11.8
Tobaccofish	<i>Serranus tabacarius</i>	11.8
Barred Hamlet	<i>Hypoplectrus puella</i>	10.5
Horse-Eye Jack	<i>Caranx latus</i>	10.5
Midnight Parrotfish	<i>Scarus coelestinus</i>	10.5
Mutton Snapper	<i>Lutjanus analis</i>	10.5
Lancer Dragonet	<i>Paradiplogrammus bairdi</i>	10.5
Goliath Grouper (Jewfish)	<i>Epinephelus itajara</i>	9.2
Yellowmouth Grouper	<i>Mycteroperca interstitialis</i>	9.2
Stoplight Parrotfish	<i>Sparisoma viride</i>	9.2
Cubera Snapper	<i>Lutjanus cyanopterus</i>	9.2
Cherubfish	<i>Centropyge argi</i>	7.9
Coney	<i>Cephalopholis fulva</i>	7.9
Black Margate	<i>Anisotremus surinamensis</i>	7.9
Blue Angelfish	<i>Holocanthus bermudensis</i>	6.6
Spotted Drum	<i>Equetus punctatus</i>	6.6
Black Hamlet	<i>Hypoplectrus nigricans</i>	6.6
Lane Snapper	<i>Lutjanus synagris</i>	6.6
Silversides, Herrings, Anchovies		6.6
School Bass	<i>Schultzea beta</i>	6.6

Table 3 Cont.

Common Name	Scientific Name	%SF
Vermillion Snapper	<i>Rhomboplites aurorubens</i>	6.6
Beaugregory	<i>Stegastes leucostictus</i>	5.3
Dusky Damselfish	<i>Stegastes adustus</i>	5.3
Blue Goby	<i>Ptereleotris calliurus</i>	5.3
Sailors Choice	<i>Haemulon parra</i>	5.3
Green Razorfish	<i>Xyrichtys splendens</i>	5.3
Lantern Bass	<i>Serranus baldwini</i>	5.3
Schoolmaster	<i>Lutjanus apodus</i>	5.3
Clown Wrasse	<i>Halichoeres maculipinna</i>	5.3
Slippery Dick	<i>Halichoeres bivittatus</i>	5.3
Blackcap Basslet	<i>Gramma melacara</i>	3.9
Twospot Cardinalfish	<i>Apogon pseudomaculatus</i>	3.9
Eyed Flounder	<i>Bothus ocellatus</i>	3.9
Sand Perch	<i>Diplectrum formosum</i>	3.9
Nurse Shark	<i>Ginglymostoma cirratum</i>	3.9
Sand Tilefish	<i>Malacanthus plumieri</i>	3.9
Longfin Damselfish	<i>Stegastes diencaeus</i>	2.6
Yellowtail Damselfish	<i>Microspathodon chrysurus</i>	2.6
Spotted Moray	<i>Gymnothorax moringa</i>	2.6
Whitespotted Filefish	<i>Cantherhines macrocerus</i>	2.6
White Margate	<i>Haemulon album</i>	2.6
Bucktooth Parrotfish	<i>Sparisoma radians</i>	2.6
Rainbow Parrotfish	<i>Scarus guacamaia</i>	2.6
Spotted Scorpionfish	<i>Scorpaena plumieri plumieri</i>	2.6
Creole-fish	<i>Paranthias furcifer</i>	2.6
Dog Snapper	<i>Lutjanus jocu</i>	2.6
Puddingwife	<i>Halichoeres radiatus</i>	2.6
Bigtooth Cardinalfish	<i>Apogon affinis</i>	2.6
Pygmy Filefish	<i>Monacanthus setifer</i>	2.6
Unicorn Filefish	<i>Aluterus monoceros</i>	2.6
Orangespotted Goby	<i>Nes longus</i>	2.6
Juvenile Grunt	<i>Haemulon sp.</i>	2.6
Hamlet - Juvenile	<i>Hypoplectrus sp.</i>	2.6
Bonnetmouth	<i>Emmelichthyops atlanticus</i>	1.3
Scrawled Cowfish	<i>Lactophrys quadricornis</i>	1.3
Flamefish	<i>Apogon maculatus</i>	1.3
Reef Croaker	<i>Odontoscion dentex</i>	1.3
Sharptail Eel	<i>Myrichthys breviceps</i>	1.3
Yellow Goatfish	<i>Mulloidichthys martinicus</i>	1.3
Colon Goby	<i>Coryphopterus dicrus</i>	1.3
Pallid Goby	<i>Coryphopterus eidolon</i>	1.3
Nassau Grouper	<i>Epinephelus striatus</i>	1.3
Red Hind	<i>Epinephelus guttatus</i>	1.3
Yellowfin Grouper	<i>Mycteroperca venenosa</i>	1.3
Caesar Grunt	<i>Haemulon carbonarium</i>	1.3

Table 3 Cont.

Common Name	Scientific Name	%SF
Smallmouth Grunt	<i>Haemulon chrysargyreum</i>	1.3
Indigo Hamlet	<i>Hypoplectrus indigo</i>	1.3
Tan Hamlet	<i>Hypoplectrus sp.</i>	1.3
Balloonfish	<i>Diodon holocanthus</i>	1.3
Mahogany Snapper	<i>Lutjanus mahogoni</i>	1.3
Reef Squirrelfish	<i>Holocentrus coruscus</i>	1.3
Black Durgon	<i>Melichthys niger</i>	1.3
Gray Triggerfish	<i>Balistes carolinensis</i>	1.3
Ocean Triggerfish	<i>Canthidermis sufflamen</i>	1.3
Bermuda Chub/Yellow Chub	<i>Kyphosus sectatrix/incisor</i>	1.3
Redspotted Hawkfish	<i>Amblycirrhitus pinos</i>	1.3
Sharksucker	<i>Echeneis naucrates</i>	1.3
Atlantic Spadefish	<i>Chaetodipterus faber</i>	1.3
Dash Goby	<i>Gobionellus saepepallens</i>	1.3
Rusty Goby	<i>Priolepis hipoliti</i>	1.3
Black Jack	<i>Caranx lugubris</i>	1.3
Atlantic Bonito	<i>Sarda sarda</i>	1.3
Banded Butterflyfish	<i>Chaetodon striatus</i>	other
Barred Cardinalfish	<i>Apogon binotatus</i>	other
Blue Hamlet	<i>Hypoplectrus gemma</i>	other
Blue Parrotfish	<i>Scarus coeruleus</i>	other
Bluestriped Grunt	<i>Haemulon sciurus</i>	other
Creville Jack	<i>Caranx hippos</i>	other
Foureye Butterflyfish	<i>Chaetodon capistratus</i>	other
French Grunt	<i>Haemulon flavolineatum</i>	other
Fringed Filefish	<i>Monacanthus ciliatus</i>	other
Gag	<i>Mycteroperca microlepis</i>	other
Glassy Sweeper	<i>Pempheris schomburgkii</i>	other
Green Moray	<i>Gymnothorax funebris</i>	other
Hawksbill Sea Turtle	<i>Eretmochelys imbricata</i>	other
Honeycomb Cowfish	<i>Lactophrys polygonius</i>	other
Hovering Goby	<i>Ptereleotris helenae</i>	other
Lesser Electric Ray	<i>Narcine brasiliensis</i>	other
Little Tunny	<i>Euthynnus alletteratus</i>	other
Loggerhead Sea Turtle	<i>Caretta caretta</i>	other
Longlure Frogfish	<i>Antennarius multiocellatus</i>	other
Longspine Squirrelfish	<i>Holocentrus rufus</i>	other
Orange Filefish	<i>Aluterus schoepfii</i>	other
Orbicular Batfish (Exotic)	<i>Platax orbicularis</i>	other
Permit	<i>Trachinotus falcatus</i>	other
Porcupinefish	<i>Diodon hystrix</i>	other
Queen Parrotfish	<i>Scarus vetula</i>	other
Redlip Blenny	<i>Ophioblennius atlanticus</i>	other
Redtail Scad	<i>Decapterus tabl</i>	other
Saddled Blenny	<i>Malacoctenus triangulatus</i>	other

Table 3 Cont.

Common Name	Scientific Name	%SF
Spotfin Goby	<i>Gobionellus stigmalocephus</i>	other
Spotted Eagle Ray	<i>Aetobatus narinari</i>	other
Spotted Trunkfish	<i>Lactophrys bicaudalis</i>	other
Squirrelfish	<i>Holocentrus ascensionis</i>	other
Tarpon	<i>Megalops atlanticus</i>	other
Tattler Bass	<i>Serranus phoebe</i>	other
Threespot Damselfish	<i>Stegastes planifrons</i>	other
Tiger Grouper	<i>Mycteroperca tigris</i>	other
Whitefin Sharksucker	<i>Echeneis neucratoides</i>	other
Wrasse Bass	<i>Liopropoma eukrines</i>	other
Wrasse Blenny	<i>Hemiemblemaria simulus</i>	other
Yellow Garden Eel	<i>Heteroconger luteolus</i>	other
Yellowcheek Wrasse	<i>Halichoeres cyanocephalus</i>	other

**Table 4. Top 25 most frequently sighted species at the *Spiegel Grove* and seven reference sites. Values given are Sighting Frequency (%SF). If a value is not given, the species was not one of the 25 most frequently sighted species at that site.**

species	Benwood Ledge	<i>Benwood</i>	Dixie Ledge	Dixie Shoals	Red Can Ledge	Red Can Shallows	Rocks by <i>Spiegel Grove</i>	<i>Spiegel Grove</i>
Balloonfish							41.9	
Banded Butterflyfish				87.7		98.5		
Bar Jack		96.8				87.7		63.2
Bermuda/Yellow Chub		95.2						
Bicolor Damselfish	94.7	96.8	96.9	95.4	94.1	98.5	87.1	73.7
Bigtooth Cardinalfish							58.1	
Black Grouper					79.4			48.7
Blackfin Snapper							67.7	48.7
Blue Chromis	96.5		95.4	90.8	89.7	95.4	43.5	
Blue Runner								53.9
Blue Tang	87.7	96.8	93.8	96.9	94.1	100.0	69.4	75.0
Bluehead	96.5	98.4	96.9	96.9	97.1	98.5	88.7	78.9
Bluestriped Grunt		96.8						
Bridled Goby			84.6	89.2		92.3	56.5	
Brown Chromis		98.4	87.7	87.7				43.4
Butter Hamlet	93.0		80.0		83.8			
Clown Wrasse				95.4	79.4	98.5		
Cocoa Damselfish				87.7		87.7		
Coney	78.9							
Creole Wrasse								67.1
Doctorfish							61.3	
Foureye Butterflyfish	89.5	93.7	80.0	89.2	83.8	86.2		
French Grunt		98.4						
Gray Angelfish	80.7							
Graysby	82.5		87.7		85.3		66.1	
Great Barracuda								50.0
Green Razorfish				89.2		93.8		
Greenblotch								
Parrotfish	75.4		84.6					48.7
Harlequin Bass	86.0		93.8	98.5	92.6	100.0	51.6	47.4
Hogfish	80.7			93.8	83.8	95.4	67.7	53.9
Mahogany Snapper		93.7						
Masked/Glass Goby	91.2		96.9		97.1		59.7	
Mutton Snapper					86.8		56.5	
Ocean Surgeonfish	87.7	98.4	90.8	92.3	89.7	96.9		65.8
Porkfish		96.8						
Purple Reeffish			81.5				85.5	60.5
Queen Angelfish			83.1			87.7	50.0	
Queen Parrotfish		93.7						

Table 4, Cont.

species	Benwood Ledge	<i>Benwood</i>	Dixie Ledge	Dixie Shoals	Red Can Ledge	Red Can Shallows	Rocks by Spiegel Grove	<i>Spiegel Grove</i>
Red Grouper							62.9	
Redband Parrotfish	96.5	95.2	98.5	96.9	92.6	100.0		55.3
Reef Butterflyfish	93.0		98.5		97.1		58.1	73.7
Rock Beauty	98.2		92.3	90.8	94.1	93.8		
Schoolmaster		95.2						
Sergeant Major		93.7						61.8
Sharpnose Puffer	93.0	96.8	95.4	90.8	91.2	96.9	80.6	76.3
Slippery Dick			81.5	92.3		96.9		
Spanish Hogfish	80.7	96.8	93.8	92.3	95.6	83.1	38.7	
Spotfin Butterflyfish				87.7	80.9	89.2		
Spotted Goatfish	93.0	95.2		86.2	88.2	83.1		43.4
Spotted Moray							38.7	
Stoplight Parrotfish		96.8		96.9		98.5		
Striped Grunt							66.1	
Striped Parrotfish	96.5		84.6	89.2	85.3	83.1		57.9
Sunshinefish			95.4		85.3		93.5	56.6
Tobaccofish	93.0		95.4		95.6			
Tomtate								60.5
Trumpetfish		95.2						59.2
Twospot Cardinalfish							69.4	
White Grunt	94.7	98.4		92.3				
Yellow Goatfish		96.8						
Yellowhead Wrasse	98.2	98.4	95.4	95.4	95.6	98.5	59.7	
Yellowtail Reeffish								44.7
Yellowtail Snapper	78.9	96.8						

**Table 5. Similarity in species present among monitoring events, measured by percent overlap in species present. Values given are mean Jaccard Coefficient (J') values for monitoring times 1-10 (pre-deployment monitoring in April 2002 not included).**

Site	J'
Benwood Ledge	0.58
<i>Benwood</i>	0.68
Dixie Ledge	0.59
Dixie Shoals Shallow	0.65
Red Can Ledge	0.57
Red Can Shallows	0.60
Rocks by <i>Spiegel Grove</i>	0.42
<i>Spiegel Grove</i>	0.48

**Table 6. Similarity in species composition among monitoring events, measured by Spearman correlation. Values given are mean Spearman Coefficient values for monitoring times 1-10 (pre-deployment monitoring not included), based on rank abundance scores. Species seen in at least 90% of surveys at each site were included in the analysis.**

Site	Mean Spearman Coefficient
Benwood Ledge	0.73
<i>Benwood</i>	0.82
Dixie Ledge	0.75
Dixie Shoals Shallow	0.75
Red Can Ledge	0.70
Red Can Shallows	0.71
Rocks by <i>Spiegel Grove</i>	0.59
<i>Spiegel Grove</i>	0.57