Clifton S. Perry Memorial Artificial Reef Monitoring Program

Protect Our Reefs
Mote and FOS POR 2007-34 Grant Report

Presented By
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Florida Oceanographic Society
Reef Research Dive Team
Clifton S. Perry* Memorial Artificial Reef
Site Location
Donaldson Complex

Latitude: 27°13.352 North
Longitude: 080°06.131 West

Martin County
3.9 nautical miles @ 030°
of St. Lucie Inlet Sea Buoy

*Named in honor of local marine environmentalist and founder of Florida Oceanographic Society
Clifton S. Perry Memorial Deployment Record

- USACOE Permit 199504128 (IP-TA)
- Deployed January – May, 2006
- Source: demolished Jensen Beach Causeway
- Materials: steel reinforced concrete slaps, pilings, guard railings, roadway sections, pile caps & sidewalk sections
• 65 - 67 ft. deep
• Maximum material height 27 ft., average 16 ft.
• Number of Pieces: 318 large complete pieces, 450 smaller concrete rubble pieces
• spatial footprint lies from SE → NW with overhangs, tunnels, much vertical relief and stacking of materials provide many crevices, voids and interspatial areas.
Proposal Objectives:

Objective 1: Establish mapping to assess the spatial layout and dimensions of the Clifton S. Perry Memorial Artificial Reef structure as well as develop a baseline monitoring data set of benthic coverage and fish size class recruitment at the structure.

- establish physical landscape and bottom characteristics,
- identify structural relief and integrity, ability to support epibenthic settlement and fish assemblage,
- assess % coverage and presence/absence of benthic taxa groups, and representative commercially important invertebrates, such as spiny lobster,
- assess fish species diversity and relative abundance,
- record meteorological & oceanographic conditions,
- site documentation using underwater video and still photography,
- elicit implications for resource management concerns relative to natural reef development processes following stochastic events, and
- serve as a resource management tool as a case study to evaluate coral reef settlement processes and change over time, and the implications for natural reef habitat sustainability as it endures a range of environmental conditions in the upper limits for sub-tropical reef survival.

Objective 2: Continue Protect Our Reefs efforts by providing volunteer support for conducting 2 reef clean-up activities during the year 2008 at the St. Lucie Inlet State Preserve coral reefs.

- 2006-2007, Dive Team partnered with Mote Marine Lab Protect Our Reefs Grant No. POR-2005B-1, Marine Debris Location, Identification, and Removal from St. Lucie Inlet Preserve State Park Coral Reef, Florida (February 28, 2007).
- FOS team proposed 2 reef clean up events/2008 at the preserve reefs. Completed Event 1 on July 19, 2008 in joint effort with the Marine Industries Association of the Treasure Coast, and local partner, the Port Salerno Commercial Fishing Dock Authority (PSCFDA).
Clifton S. Perry Mapping, Benthic and Fish Survey Monitoring Methods

- **Training**: Trainers were those experienced members of the team who had prior mapped other artificial reef complexes occurring offshore of Martin County.

  - **Mapping**: team met evenings once a month to practice hands-on sessions with a buddy for landscape spatial mapping of dimensional structures, using underwater measuring tapes, depth gauges, compasses and writing slates.

  - **Benchmarks**: The team also trained to use GPS to accurately record the location of the benchmarks deployed on the bottom to allow for accurately interpolating data into the CAD mapping program.

- **Benthic and Fish Identification**: team provided classroom-style benthic and fish identification followed by transect line monitoring methodology. Participating professional biologist and a REEF Foundation fish instructor provided the training, and also produced a training CD Rom for the members to use for reference at home while reviewing information prior to the actual dive activities.

- **Public Relations**: team instructed in protocol while working on the site, as they were representatives of the Florida Oceanographic Society Institution and *Protect our Reefs* program. The site is visited and utilized by recreational fishers who received the team well and were very cooperative when observing our diver down and FOS flags. They would move away to allow us the areas to conduct our work without incident.
New benchmark sampling points were installed at suitable locations at the North quadrant of the Clifton Perry reef.

The benchmarks were numbered and were installed on a prominent feature on the NW, N, and NE side of the material and at least 50-75 feet apart.

Once the benchmarks were secured, a lift bag was sent up with each one so that an accurate GPS coordinate was recorded at the surface following protocol.

The following spatial landscape map illustrates the layout and benchmarks that have been completed thus far by the FOS dive team at the Clifton S. Perry Memorial Artificial Reef complex. A CAD computer program was utilized to create the final mapping characterization.
Side Scan Sonar

Structure spatial layout approx. 300 square feet
Benthic Identification Data Collection

For Mote Protect Our Reef Grant 2008
Benthic Survey Monitoring Method

- Divers conducted rapid ecological assessment (REA) method to collect data using visual estimation for relative abundance of major taxonomic groups (% coverage),
- Percent coverage of substrate dependent animals and plants features per m$^2$ were scored as one of five possible cover classes:

  1 = less than 5% cover  
  2 = 5-25% cover  
  3 = 26-50% cover  
  4 = 51-75% cover  
  5 = 76-100% cover

- Divers recorded benthic organisms to the major taxonomic levels or categories, i.e. cnidarians, sponges, macro-algae, tunicates, and sessile and mobile invertebrates,
- Organisms difficult to categorize in the field were photographed and identified later by an experienced marine ecologist.
- Qualitative video and still images were also used to verify direct in-field observations.
Clifton Perry Memorial Reef Benthic Coverage Assessment

Date: 6/21/08

% Coverage Codes:
10 = none 12 = less than 5% 13 = 5-25% 14 = 26-50% 15 = 51-75% 16 = 76-100%

Recorder: Cindy Lott
Time In: 8:35am
Time out: 10:00am

Benchmark Location #: 44
Depth: 63 ft
Azimuth degrees: 270°
Temperature: 79° F

### TAXA GROUP DATA (% COVERAGE IN APP. 1 SQUARE YARD)

<table>
<thead>
<tr>
<th>Distance (ft)</th>
<th>Coral</th>
<th>Sponges</th>
<th>Macro-algae</th>
<th>Tunicates</th>
<th>Invertebrates</th>
<th>Rubble/Sand</th>
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<td>28</td>
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<td>3</td>
<td>19</td>
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<td>4</td>
<td>0</td>
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<td>2</td>
</tr>
</tbody>
</table>

### Other Observations

Note here any section along transect where point of zonation change occurs:

- Comments:
  - 40 ft: sea cucumber
  - 60 ft: sea cucumber

Species Present:
- Corals: Pennate hydroid; unidentified zoanthid; Antipathes sp. (black coral)
- Sponges: Unidentified white sponge
- Macro-algae: Phaeophyta (Brown): Dictyota sp.
- Chlorophyta (Green): Caulerpa brachypus; Codium sp.
- Rhodophyta (Red): Kallymenia sp.
- Tunicates: Tridemnum sp.; Ascidia nigripes (black sea squirt)
- Invertebrates: Actinopygia sp. (5-tooth seacucumber); unidentified sea cucumber; Hermodice carunculata (bubble worm)
Representative Benthic Taxa Group Observed

**Cnidaria**

- white telesto (*Carijoa riisei*)
- algae hydroid (*Thyroscyphus ramosus*)
- orange telesto (*Telesto fruticulosa*)
- feather hydroid (*Gymnangium longicauda*)
- tube-dwelling anemone (*Ceriantharia*)
- green zooanthids (*Parazoanthus tunicans*) on feather bush hydroid
- ivory bush coral (*Oculina diffusa*)
- branch hydroid (*Sertularella speciosa*)
- stinging bush hydroid (*Macrorhynchia robusta*)
Porifera (sponges)

- white lumpy encrusting sponge (*Ptilocaulis* sp.) & brown variable tube sponge (*Anthosigmella varians*), red coralline algae in upper left photo
- bell sponge (*Ircinia campana*)
- black ball sponge (*Ircinia strobilina*)

**Representative Benthic Taxa Group Observed**

- orange encrusting sponge (*Diplastrella* sp.) & white zoanthids (*Parazoanthus* sp.)
- red encrusting sponge (*Cliona deletrix*)
- unidentified tube sponge

**Typical benthic coverage:**
Encrusting peach/red colored encrusting sponges (*Clathria* sp.) surrounding a gray sea pork tunicate (*Eudistoma* sp.)

Upper photo: green macro-algae *Caulerpa* sp., w/ invasive *C. brachypus* fronds upper right.
Representative Benthic Taxa Group Observed

Green macro-algae (Chlorophyta)  
*Codium isthmocladum*

Red macro-algae (Rhodophyta)  
*Botryocladia* sp.  
*Kallymenia* sp.

Brown macro-algae (*Dictyota* sp.)

Typical coverage: feather hyrdoids, orange & white encrusting sponges (*Ptilocaulis* spp.)

Typical benthic coverage: Right: red macro-algae, gray & brown tunicates (Didemnid ae)  
Upper center: gray sea pork tunicate (*Eudistoma* sp.)  
Lower right: white encrusting sponge (*Ptilocaulis* sp.)
Representative Benthic Taxa Group Observed - Invertebrates

- 3-rowed sea cucumber (*Isostichopus badionotus*)
- Pen shell (*Pinna carnea*)
- Black Atlantic seahare (*Aplysia moro*)
- Unidentified sea cucumber (*Holothuroidea*)
- Arrow crab (*Stenorhynchus seticornis*)
- Rock boring urchin (*Echinometra lucunter*)
- Atlantic wing oyster (*Pteria colymbus*)
- White egg clutch, poss. deposited by seahare (*Aplysia sp.*)
- Typical close up view within crevices of bivalves, barnacles, hydroids, etc.
Invertebrates

Representative Benthic Taxa Group Observed

Tunicates

poss. “social tunicate” (*Ployandrocarpa tumida*), note rock boring urchin in background

Left: arrow crab (*Stenorhynchus seticornis*)
Center: feather duster worm (*Sabellidae*)

Left: encrusting peach encrusting sponges (*Clathria sp.*)
Right: gray mat tunicate (*Trididemum solidum*)

decorator crab (*Majjidae*), hanging upside down

sea pork tunicate tunicate (*Eudistoma spp.*)
Representative Benthic Taxa Group Observed

Tunicates

- blue/yellow light bulb tunicate (*Clavelina* sp.)
- berry tunicate (*Eudistoma* sp.)
- yellow social tunicate (*Symplegma viride*)
- mottled social tunicate (*Polyandrocarpa tumida*)
Mean Benthic Taxa Group % Coverage/Benchmark

[Bar chart showing % coverage for various taxa groups across different benchmarks BM1 to BM7]

Benchmark Summary Data

• BM1 & BM2 – highest diversity/% coverage and most spatially complex.
• BM4 – highest macro-algae % coverage /highest spatial relief for sunlight irradiance.
• BM6 & BM7 – lowest relief, most distant from central complex, least species diversity.
• Rubble/sand and macro-algae predominant coverage overall.
• Cnidarians (hydroids), Invertebrates (sea cucumbers/sea urchins), and Tunicates (encrusting) recruiting as frontier species; sponge coverage infrequent.
• 2014 observations showed macro-algae and hydroids maintain as dominant coverage with new sponge and tunicate species recruitment as shown on the following benthic species summary list.
Clifton Perry Memorial Reef –Benthic Taxa Groups Observed (65 species)
(May 2008-March 2009; December 2014)

MACROALGAE
Chlorophyta
- green grape alga *Caulerpa racemosa*
- feather alga *Caulerpa sertularioides*
- invasive alga *Caulerpa brachypus*
- finger alga *Codium isthmocladum* 2009/2014

Phaeophyta
- Y-branched alga *Dictyota* spp.
- scroll alga *Padina sanctae-crucis*

Rhodophyta
- coralline alga *Amphiroa* spp.
- red tube alga *Galaxaura* spp.
- red bush alga *Laurencia poiteau*
- red sheet alga *Kallymenia* sp.
- red cartilaginous alga *Gracilaria* sp.
- numerous unidentified red encrusting spp.
- numerous unidentified filamentous spp. algae

PORIFERANS
- white lumpy encrusting sponge (*Ptilocaulis* sp.) 2009/2014
- orange encrusting sponge (*Diplastrella* sp.)
- brown variable sponge (*Anthisgimella varians*) 2009/2014
- encrusting peach encrusting sponges (*Clathria* sp.)
- encrusting red encrusting sponges (*Cliona deletrix*) 2009/2014
- black pillow “stinker” sponge (*Ircinia* sp.) 2014
- bell sponge (*Ircinia campana*) 2014
- blue star encrusting sponge (*Halisarca* sp.) 2014

CNIDARIANS
- diffuse ivory bush coral *Oculina diffusa* 2009/2014
- glass anemone *Bartholomea annulata*
- large ivory coral *Oculina varicosa*
- lesser starlet coral *Siderastrea radians*
- mat anemone *Zoanthus pulchellus*
- white mat anemone *Palythoa caribaeorum*
- white, yellow green zoanthids (*Parazoanthus* sp.) 2009/2014
- feather hydroid (*Gymnangium longicauda*) 2009/2014
- feather hydroid (*Gymnangium longicauda*) 2009/2014
- branching hydroid (*Sertularella speciosa*) 2014

CNIDARIANS (con’t.)
- feather bush hydroid (*Dentitheca dendritica*) 2009/2014
- algae hydroid (*Thyroscyphus ramosus*) 2009/2014
- Stinging bush hydroid (*Macrorhynchia robusta*) 2014
- tube dwelling anemone (*Ceriantharia* sp.)

BRYOZOANS
- Seaweed bryozoan (*Caulilibugula dendrogapta*) 2014

POLYCHAETES
- bearded fireworm *Hermodice carunculata*
- feather duster worm *Sabellidae* spp. 2009/2014

CRUSTACEANS
- arrow crab *Stenorhyncus seticornis* 2009/2014
- banded coral shrimp *Stenopus hispidus*
- Florida spiny lobster *Panularis argus*
- decorator crab (*Majidae*)

ECHINODERMS
- unidentified sea cucumber *Holothuroidea*
- three-rowed sea cucumber *Isostichopus badionotus* 2009/2014
- common purple urchin *Arbacia punctulata*
- common rock urchin *Echinometre lucunter* 2009/2014
- long-spined sea urchin *Diadema antillarum*
- short-spined white sea urchin *Tripnuestes ventricosus*
- slate-pencil sea urchin *Eucidaris tribuloides* 2009/2014
- variegated urchin *Lytechinus variegatus*

TUNICATES
- berry tunicates *Distaplia* spp. 2009/2014
- white/violet/gray tunicate *Eudistoma* spp. 2009/2014
- black solitary tunicate *Ascidia nigra*
- smooth tunicate *Eudistoma* spp.
- gray green mat tunicates (*Trididemum solidum*)
- light bulb tunicates (*Clavelina* spp.) 2009/2014
- orange flat tunicate (*Botrylloides* sp.)
- yellow encrusting social tunicate (*Symplegma viride*) 2014
- Mottled social tunicate (poss. *Polyandrocarpa tumida*) 2014

OTHER
- Atlantic black seahare (*Aplysia moro*)
- Atlantic murex (*Chicoreus* sp.) 2014
- pen shell (*Pinna carnea*) 2014
Fish Identification & Monitoring Data

Mote Grant 2008
Data listed at the top of each form is used for organizing data in the FOS fish database.

- Fish ID sheets are organized by benchmark.

- If multiple data sheets are entered for the same day, an average of fish abundance is calculated for that monitoring day.

### Abundance Codes

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>Solitary (1 fish)</td>
</tr>
<tr>
<td>F</td>
<td>Few (2-10 fish)</td>
</tr>
<tr>
<td>M</td>
<td>Many (11-100 fish)</td>
</tr>
<tr>
<td>A</td>
<td>Abundant (100+ fish)</td>
</tr>
</tbody>
</table>

Fish are organized by Family with an “other” category. The abundance is measured using four categories:

- **S** = Solitary (1 fish)
- **F** = Few (2-10 fish)
- **M** = Many (11-100 fish)
- **A** = Abundant (100+ fish)
Roving Diver Monitoring Methodology

Monitoring Fish Species Diversity and Relative Abundance:

- Site fish species diversity and relative abundance was evaluated using the REEF protocol called The Roving Diver Technique. The method is currently utilized by the REEF Environmental Education Foundation, REEF Great Annual Fish Count. It is a visual survey method specifically designed for collecting volunteer data.

- Trained SCUBA divers examined the artificial reef structure and recorded and identified fish to the lowest possible taxonomic level. Fish taxa difficult to identify in the field were photographed for later identification by an experienced marine ichthyologist. The goal of the RDT surveys was to observe as many as fish species as possible.

- Each recorded fish species was assigned one of four abundance categories based on how many were seen during the dive [single (1), few (2-10), many (11-100), and abundant (>100)]. All data was recorded on REEF survey sheets printed on waterproof paper and transferred to REEF Fish Survey Scansheets, which were returned to REEF and optically scanned into a database.

- The F.O.S reef research dive team has completed a series of REEF fish identification training, and currently conduct REEF fish census activities for the St. Lucie Inlet State Preserve annually each July, since 2002.
Database Entry Method

The raw data from the underwater data collection sheet was entered into a database created in Microsoft Excel.
The table lists the common names of the fish species listed horizontally across the worksheet with the date of each monitoring date listed vertically. If multiple monitoring events took place on the same date at the same benchmark, an average was taken between the data collected on those sheets for that particular monitoring date. An example of a data sheet is shown below.

<table>
<thead>
<tr>
<th>Date of Survey</th>
<th>Blue Angel</th>
<th>French Angel</th>
<th>Gray Angel</th>
<th>Queen Angel</th>
<th>Great Barracuda</th>
<th>Southern Sennet</th>
<th>Hairy Blenny</th>
<th>Reef Butterfly fish</th>
<th>Spot fin Butterfly fish</th>
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<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Two Divers collect data on two different sheets. Data recorded blow in database.

Since two sheets of data were collected on the same date, data was averaged. The average species abundance is shown on the following graphs.
Results from Benchmark #2

On Benchmark #2, there have been two separate monitoring dates. Below shows the how the fish observed varied between the two monitoring dates.

Survey Dates 6/21/08 and 7/26/08 show a large change in fish at benchmark #2 within one month. In June, cocoa Damselfish, spotted goatfish, black grouper, black margates, almaco jacks, gray snapper, schools of baitfish, and spanish mackerel were observed, and not seen on the July monitoring date. On 7/26/08, all four types of Angelfish were seen, and no angelfish were observed on the June monitoring date. Likewise spotted drum, goliath grouper, white grunts, almaco jacks, blue tangs, doctor fish, blue head wrasses, and Spanish hogfish were also seen on the July monitoring date but not in June. On both dates there was the highest abundance of tomtate grunts and common snook, while there was also a strong presence of sheepshead, cubbyu, and slippery dick fishes for both monitoring events. Generally hairy blennies, reef butterfly fish, spotfin butterfly fish, beaugregory, and porkfish, were seen in an abundance of solitary to few for both monitoring dates.
Fish Abundance Summary

BM1, BM2, BM3 and BM4 – most species rich: tomtate grunts, common snook most abundant, with bottom species such as hairy blennies and belted sandfish, angels, etc. (BM 1,2, 4 most structure/relief; BM 3 along west edge with no structure)

BM 6 and BM 7 – least species rich: tomtates and baitfish most abundant. (these two areas along SE and NE edge of complex with no structure)

BM1 and BM2 – having complex structure showed higher benthic % coverage diversities with trend for higher fish speciosity at these same areas, while BM6 and BM7 having primarily low relief, rubble/sand/macro-algae coverage with little other benthic species diversity, also showed lower fish speciosity.

Other observances: Almaco jack observed on Benchmarks during June event, not observed during July event.

Tomtate, common snook, and baitfish residential at all benchmarks throughout monitoring events.
Identifying Fish Observed on Clifton Perry Memorial Reef

Family: Angelfishes
- French Angelfish
- Gray Angelfish
- Blue Angelfish (Adult)
- Blue Angelfish (Juvenile)
- Blue Angelfish (Adult) 2014

Family: Barracuda
- Great Barracuda

Family: Blenny
- Hairy Blenny
Identifying Fish Observed on Clifton Perry Memorial Reef

Family: Damselfishes

- Sergeant Major
- Cocoa Damselfish
- Beaugregory

***Both fish look very similar, key is to look for the spot on the caudal peduncle.

Family: Drum

- High Hats
- Reef Croaker
- Striped Croaker
Identifying Fish Observed on Clifton Perry Memorial Reef

Family: Moray
- Spotted Moray
- Green Moray

Family: File Fish
- Orange Spot File fish

Family: Goatfish
- Spotted Goatfish

Family: Grouper
- Goliath Grouper
- Black Grouper

Family: Snapper
- Yellow Snapper

Family: Grunts
- Pork Fish
- Tomtates
Identifying Fish Observed on Clifton Perry Memorial Reef

**Family: Jack**
- Bar Jack
- Blue Runner

**Family: Porgy**
- Belted Sandfish
- Sheepshead porgy
- Sheepshead
- Silver Porgy

**Family: Seabass**
- Sheepshead

**Family: Wrasse**
- Blue Head
- Slippery Dick
- Spanish Hogfish

**Family: Surgeonfish**
- Ocean Surgeonfish
- Blue Tang
- Doctor Fish
Identifying Fish Observed on Clifton Perry Memorial Reef

Other:

- Southern Sting Ray
- Bandtail Puffer fish
- Baitfish on the wreck
- Snook
- Sand diver
- Lizard fish
- Soapfish
Fishes Observed on Clifton Perry Memorial Reef 2014

Family: Angelfishes
- Blue Angelfish (Adult)

Family: Grunts
- tomtales

Family: Jacks
- amberjack?

Family: Shark
- nurse shark
Fishes Observed on Clifton Perry Memorial Reef 2014

Family: Sea Bass

- Black grouper
- Goliath grouper

Family: Porgy

- Sheepshead porgy

Family: Snapper

- Yellowtail
### Clifton Perry Memorial Reef – Fish Observed By Family

May 2008-March 2009; December 2014

<table>
<thead>
<tr>
<th>Family</th>
<th>Subspecies</th>
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<tbody>
<tr>
<td>Angelfish</td>
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<td>Gray Angelfish</td>
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<td></td>
<td>Queen Angelfish</td>
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<td>Barracuda</td>
<td>Great Barracuda 2009/2014</td>
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<tr>
<td></td>
<td>Southern Sennet</td>
</tr>
<tr>
<td>Blenny</td>
<td>Hairy Blenny</td>
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<tr>
<td>Butterflyfish</td>
<td>Reef Butterflyfish 2009/2014</td>
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### Clifton Perry Memorial Reef – Fish Observed By Family

May 2008-March 2009; December 2014

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The aim of the Clifton S. Perry artificial reef monitoring was to map and evaluate the physical and spatial/dimensional characteristics of the structure, as well as obtain baseline data for the epibenthic community and fish assemblages recruitment. The data would be assessed for implications of natural coral reef community recovery following a stochastic event, especially for those subtropical coral reefs occurring in the upper latitude limits for their survival.

Data revealed greater recruitment of epibenthic taxa group species, as well as fishes, at the center structural areas which provided both vertical relief and spatial/dimensional complexities. Areas lacking vertical relief or spatial/dimensional features, as well as occurring away from the central complex along the structure’s edge, showed fewer benthic and fish species presence.

These data may implicate faster recovery for epibenthic and fish recruitment onto a natural reef following a stochastic event, provided vertical relief and spatial complexity can be restored.
Goliath grouper video (0:28 min)
The following dive team members volunteered their time, equipment, boats and levels of expertise to monitor the Clifton S. Perry. They wish to thank the Mote Marine Lab and Protect Our Reefs license plate program for funding their dive expeditions to accomplish the results of this report.

Cindy Lott, principal investigator and benthic instructor & assessment leader
Merle Stokes, grant activities coordinator
Bill Scammell, CAD map engineer (now deceased)
Kerry Dillon, commercial diver/deployment observer, mapping instructor
Jerilyn Krug, fish data and assessment manager
Mike Phelan, REEF fish ID instructor (now deceased)

Mapping and Monitoring Members:
Wayne Turner, boat captain        Robbie Turner
Ken Flerx, boat captain           Debbie Flerx
Lou Romano, boat captain          Fran Krawetz
Bud Bierlein                      Doug Raynor
Ed Cahill                         Frank Evans
Paul Shirley                      Robert Gawel
                                    John Maurer

Photos for report provided by:
Merle Stokes, Jerilyn Krug, Lou Romano, Wayne Turner, and Kelly Dillon
2014 update photos by Chris Ellert and Kerry Dillon
And there are mermaids!!
IF YOU BELIEVE....