Reef Fish Spawning Aggregations in the Florida Keys

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Fish Spawning Aggregations

- Brief reproductive events
- Vital part of life cycle for many reef fish species
- Typically happen in conjunction with lunar phases
- Easily exploited; high risk of over-exploitation
- Identifying FSA locations is a critical first step
Location, location, location!

Key West
Dry Tortugas
Florida
Cuba
Bahamas
Key Largo
Various approaches to FSA research in the Keys

**Acoustic Tagging**

1. Fish movements – migratory patterns
   - Tagging of recreationally and commercially important species
   - Position receiver array to detect movement between protected areas

2. Evaluation of marine protected areas network

**Acoustic Mapping**

1. Assess and compare depth and habitat characteristics of the FSAs
   - Creation and analysis of bathymetric maps
   - Are there similar characteristics across sites?

2. Assess reef fish utilization of the sites
   - Split-beam sonar surveys
   - Diver surveys
Commerically and Recreationally Important Species

*Lutjanus analis*
Mutton snapper

*Mycteroperca bonaci*
Black grouper

*Lutjanus griseus*
Gray snapper

*Ocyurus chrysurus*
Yellowtail snapper

*Mycteroperca bonaci*
Black grouper

Photo credit: K. Kilfoyle

Photo credit: K. Kilfoyle

Photo Credit: Jiangang Luo

Photo credit: K. Kilfoyle
The Study Area - Acoustic tagging
### Observations of Mutton snapper (*Lutjanus analis*) on Riley’s Hump

<table>
<thead>
<tr>
<th>Date and Station</th>
<th>Numbers observed</th>
<th>Moon phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>28 May–1 June 1999</td>
<td>1 fish in 3 of the 11 dives</td>
<td>Full moon May 30*</td>
</tr>
<tr>
<td>31 July–3 Aug 2000</td>
<td>1 fish in 5 of the 6 dives</td>
<td>New moon July 30*</td>
</tr>
<tr>
<td>17 July 2001 Station 2</td>
<td>10</td>
<td>3 days before new moon*</td>
</tr>
<tr>
<td>27 May 2002 Station 2</td>
<td>75 -100</td>
<td>1 day after full moon*</td>
</tr>
<tr>
<td>15 June 2003 Station 2</td>
<td>75 -100</td>
<td>1 day after full moon*</td>
</tr>
<tr>
<td>15 June 2003 Station 12</td>
<td>200 +</td>
<td>1 day after full moon*</td>
</tr>
<tr>
<td>4 July 2004 Station 12</td>
<td>300</td>
<td>2 days after full moon*</td>
</tr>
<tr>
<td>3 July 2007 Station 12</td>
<td>100 +</td>
<td>3 days after full moon**</td>
</tr>
<tr>
<td>12 June 2009 (1415-1715 hrs)</td>
<td>~4000</td>
<td>5 days after full moon***</td>
</tr>
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** Mike Burton’s Trip report
*** FWC current study
Acoustic Tagging

Since 2008:
Yellowtail (18)
Mutton snapper (56)
Black grouper (26)
VR2 Array in the Dry Tortugas

64 receivers in the array
L. analis – 69.2 cm

May

June

July

83°05' 83°00' 82°55' 82°50'

24°40' 24°35' 24°30'

TNER RNA DRTO

TSER

Spawning Corridor
Receiver activity at SPA of mutton snapper with full moons shown.
Acoustic Mapping and FSAs in the Keys
Study Locations

- **Upper Keys**
  - Initiated in 2007
  - FSA sites previously “fished out”

- **Lower Keys**
  - Initiated in 2009
  - Status of FSA sites unknown

- **Middle Keys**
  - Initiated in 2011
  - Mapping currently in progress
Best available bathymetry

**NOAA Chart 11463**
- Contours only

**NGDC gridded bathymetry**
- Digital, 90m resolution

= Carysfort Lighthouse
Examining locations

- Utilized both single and split beam transducers mounted to the boat
- GPS tracked position and noted specific sites of interest
How to determine a “site of interest”

Return to mapped site during predicted spawning moons

Use splitbeam transducer to closely examine known aggregation area

If large amount of biomass is displayed on monitor, send in divers.
Preliminary Results from Acoustic Mapping
NGDC bathymetry (left) vs. QTCV bathymetry (right)

SER = Shelf Edge Reef
FOR = Forereef
IOR = Incipient Outlier Reef
Looking for special geographic features

SER = Shelf Edge Reef
BRT = Back Reef Trough
FOR = Forereef
IOR = Incipient Outlier Reef
UST = Upper Slope Terrace
Preliminary Results in Lower Keys

**Lower Keys**

- Aggregations found near steep slopes and locally high rugosity on outlier reefs

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Western Dry Rocks grey snapper aggregation

- Local high relief
- Steep slope
- Outlier reef

Parallel transect 1 km south of above (no aggregation observed)

- Smoother top
- Less steep slope
- Outlier reef

Legend:
- **Red** Hardbottom
- **Gray** Sediment
Aerial Surveys

Objectives:
- Examine boating pressure on known sites
- Used to identify potential FSAs
May 2011 Aerial Surveys
17th am 17th pm
18th am 18th pm

Western Dry Rocks FSA

Sand Key SPA

KEY WEST

Kilometers

4 2 0 4
Aerial Surveys Recording Boating Pressure

Photo credit: Robert Glazer

Morning Flights

Afternoon Flights
What we will provide to the management process

- **Acoustic Tagging:**
  - A better understanding of how commercially and recreationally important species utilize no take areas

- **Acoustic Mapping:**
  - Provide a better understanding of FSAs throughout Keys proper by providing accurate benthic maps and assessing biomass and utilization of these sites
Thank you photo montage

These projects were executed with the cooperation of many agencies and individuals: John Hunt, Paul Barbera, Ben Binder, Rod Bertelsen, Michelle Dancy, Marie Tellier, Ali Johnson, Erick Ebert, Ori Tzadik, Dave Eaken, Don DeMaria, Sarah Walters, Angela Collins, Jack Javech, Mike Burton, Jim Locascio, Jamie Giganti, Jeff Simonds, Elizabeth Overstreet, the Spree Crew, the Dry Tortugas Park staff, the University of Puerto Rico, the crew of the “Peter Gladding”, The Florida Keys National Marine Sanctuary, Bahama Star Air and many, many more...