Northeast Gulf of Mexico
MARINE RESERVE PROGRAM

Principal Investigators:

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Madison-Swanson and Steamboat Lumps

- Madison Swanson
- Twin Ridges
  Open to fishing control area
- Steamboat Lumps

Panama City
Tampa

Distances:
- 25 fm
- 50 fm
- 100 fm
The marine reserves were designed to protect gag spawning aggregations and provide locations to assess the efficacy of marine reserves to protect (spawning) aggregations.

From: Gulf of Mexico Gag Grouper, SEDAR 10, 2006
OBJECTIVES

- Establish baseline estimates of fish abundance, especially for species of groupers and snappers.

- Describe significant habitat features in the Madison-Swanson and Steamboat Lumps MPAs.

- Analyze the relationship between habitat and species assemblages.

- Track changes in fish abundance and distribution within the MPAs during the closure period.
METHODS

- Stratify areas using multibeam bathymetry and acoustic backscatter imagery.
- Randomly select sites within each stratum (5 strata in Madison-Swanson, 5 in Steamboat Lumps).
- Conduct annual video surveys with seasonal uniformity to assess habitat and fish assemblages.
- Compare MPAs with adjacent open-to-fishing area as well as Gulf-wide SEAMAP survey.
Camera Array

Four digital video cameras, 20 min of imagery analyzed
TAPE READING METHODS

- One camera randomly selected for tape reading. Views occluded by habitat or out of focus are excluded from random selection.
- 20 minute segment of imagery is read and all fish identified to lowest possible taxonomic level.
- Abundance values derived from maximum number of each species visible simultaneously.
- Habitat quantity (within ten classes) also determined.
Site Stratification within Madison-Swanson

Total Area 394 km$^2$

Surveyed Area 266 km$^2$

Gag Habitat 59 km$^2$
Twin Ridges Control Area

Gag Habitat
5 km²
Eastern GOM SEAMAP sampling blocks

Survey Area
1244 km²

South Florida
Northeast Gulf

West Longitude
North Latitude
Gag Distribution along the west Florida shelf
Gag Distribution within Madison-Swanson

North Latitude

West Longitude

Number of gag
- 0
- 1
- 2
- 3
- 4
- 5
- 6 or more

Km
RED GROUPER

The graph shows the trend of minimum count over years from 2000 to 2008. Two datasets are represented:

- **SEAMAP** (represented by blue diamonds)
- **Madison-Swanson- 3 excluded** (represented by yellow triangles)

The y-axis represents the minimum count, ranging from -0.2 to 1.6, and the x-axis represents the year, ranging from 2000 to 2008. The graph indicates a general increasing trend in the minimum count over the years.
RED GROUPER
RED GROUPEER

![Graph showing the minimum count of red groupers from 2000 to 2008. The graph includes data from SEAMAP, Steamboat, and Twin Ridges.](image_url)
SCAMP

Graph showing the minimum count over years from 2000 to 2008. The graph compares two datasets: SEAMAP and Madison-Swanson, with the latter having 3 data points excluded.
SCAMP

![Graph showing standardized minimum count over years (2000-2008)]

- **SEAMAP**
- **Madison-Swanson - 3 excluded**
SCAMP

![Graph showing minimum counts over years for SCAMP, SEAMAP, Steamboat, and Twin Ridges. The x-axis represents years from 2000 to 2008, and the y-axis represents minimum counts ranging from -2 to 8. The graph includes error bars for each data point.](image)
RED SNAPPER

![Graph showing minimum count of RED SNAPPER over years]

- **SEAMAP**
- **Madison-Swanson - 3 excluded**
RED SNAPPER

The graph shows the standardized minimum count for Red Snapper from 2000 to 2008. Two data series are represented: SEAMAP and Madison-Swanson (with 3 excluded).
## 2001 - 2005 Trends in Population Indices

<table>
<thead>
<tr>
<th></th>
<th>Madison-Swanson</th>
<th>Steamboat Lumps</th>
<th>Twin Ridges</th>
<th>Eastern GOM</th>
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<tbody>
<tr>
<td><strong>Gag</strong></td>
<td>Increase</td>
<td>Level</td>
<td>Increase</td>
<td>Increase</td>
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<tr>
<td><strong>Red Grouper</strong></td>
<td>Increase</td>
<td>Level</td>
<td>Increase</td>
<td>Increase</td>
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<tr>
<td><strong>Scamp</strong></td>
<td>Increase</td>
<td>Level</td>
<td>Increase</td>
<td>Increase</td>
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<tr>
<td><strong>Red Snapper</strong></td>
<td>Increase</td>
<td>Level</td>
<td>Increase</td>
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</table>
### 2006 - 2007 Trends in Population Indices

<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Gag</strong></td>
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<td>Level</td>
<td>Level</td>
<td>Decrease</td>
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<tr>
<td><strong>Red Grouper</strong></td>
<td>Decrease</td>
<td>Increase</td>
<td>Decrease</td>
<td>Decrease</td>
</tr>
<tr>
<td><strong>Scamp</strong></td>
<td>Decrease</td>
<td>Decrease</td>
<td>Decrease</td>
<td>Decrease</td>
</tr>
<tr>
<td><strong>Red Snapper</strong></td>
<td>Decrease</td>
<td>Level</td>
<td>Level</td>
<td>Decrease</td>
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Length of gag inside the MPAs

<table>
<thead>
<tr>
<th>YEAR</th>
<th>N</th>
<th>MEAN</th>
<th>MIN</th>
<th>MAX</th>
<th>SE</th>
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<tr>
<td>2001</td>
<td>4</td>
<td>734.50</td>
<td>683</td>
<td>835</td>
<td>34.16</td>
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<tr>
<td>2003</td>
<td>40</td>
<td>653.63</td>
<td>238</td>
<td>933</td>
<td>21.54</td>
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<tr>
<td>2004</td>
<td>5</td>
<td>688.20</td>
<td>568</td>
<td>773</td>
<td>43.07</td>
</tr>
<tr>
<td>2005</td>
<td>58</td>
<td>708.88</td>
<td>542</td>
<td>960</td>
<td>12.48</td>
</tr>
<tr>
<td>2006</td>
<td>14</td>
<td>658.43</td>
<td>493</td>
<td>830</td>
<td>26.64</td>
</tr>
<tr>
<td>2007</td>
<td>2</td>
<td>713.00</td>
<td>688</td>
<td>738</td>
<td>25.00</td>
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</tbody>
</table>
SUMMARY

- Steamboat Lumps MPA does not contain significant grouper/snapper habitat. The ridge and fish pits area total 1.8 km$^2$.

- Grouper/snapper abundances were low and did not change over time within the Steamboat Lumps MPA.

- A general decrease in groupers and red snapper was observed in the Madison-Swanson MPA, Twin Ridges and along the eastern Gulf of Mexico shelf in 2006-2007.
SUMMARY

- Poaching occurs in both Madison-Swanson and Steamboat Lumps.

- Gag habitat within Madison-Swanson is only 5% of shelf-edge habitat sampled by SEAMAP survey.

- Gag habitat within Steamboat Lumps is only 0.1% of shelf-edge habitat sampled by SEAMAP survey.
ACKNOWLEDGEMENTS

- Funding provided by MARFIN (2001) and Coral Reef Conservation Program (2001-2007)
- R/V Caretta, R/V Gandy, NOAA Ship OREGON II
- Kevin Rademacher, Paul Felts, Brandi Noble, Stacey Harter, Marta Ribera, Chris Gardner, Chris Palmer, Linda Lombardi, John Brusher, and Bill Walling
Aerial Effort Survey
Quantifying Fishing Activity Within and Adjacent to NE Gulf of Mexico Marine Protected Areas

- Conducted by Steven G. Smith and Natalia Zurcher, University of Miami, Rosenstiel School of Marine and Atmospheric Science

- 3200 nm² along the outer continental shelf between Tampa and Panama City were surveyed each day from an aircraft flying at 1000 ft, georeferenced photos were taken of all vessels detected. MPAs were 6.9% of survey area.

- Flights were stratified by (i) spawning seasons of target species; (ii) commercial and recreational open/closed fishing seasons for red snapper and groupers; and, (iii) midweek and weekend/holiday time periods.

- 49 flights were made; 24 between January and April, 25 between May and September.
Quantifying Fishing Activity Within and Adjacent to NE Gulf of Mexico Marine Protected Areas

- 457 vessels detected in January through April
  - 74.6% were commercial vessels, 11.8% were recreational, 13.6% were others.

- 537 vessels detected in May through September
  - 58.5% were commercial vessels, 34.8% were recreational, 6.7% were others.

- 74.5 - 76.5% of commercial vessels seen were fishing.

- 67.9 - 70.4% of recreational vessels seen were fishing.

- Majority of “other” vessels were freighters (72-79%).

- Data was collected for scientific purposes only, no enforcement actions resulted from this survey.
January – April - 24 flights

**Commercial**
- Fishing only
  - \( n = 261 \)
  - 1.9\% in MPA

**Recreational**
- Fishing only
  - \( n = 38 \)
  - 5.3\% in MPA

**Non-Fishing Vessels**
- All vessels
  - \( n = 62 \)
  - 11.3\% in MPA

May – September - 25 flights

**Commercial**
- Fishing only
  - \( n = 234 \)
  - 1.7\% in MPA

**Recreational**
- Fishing only
  - \( n = 127 \)
  - 3.1\% in MPA

**Non-Fishing Vessels**
- All vessels
  - \( n = 36 \)
  - 5.5\% in MPA
Commercial Recreational Non-Fishing Vessels

January – April - 24 flights

May – September - 25 flights

n = 261
1.9% in MPA

n = 38
5.3% in MPA

n = 62
11.3% in MPA

n = 365
1.7% in MPA

n = 127
3.1% in MPA

n = 234
5.5% in MPA

Recreational vessels
May - Sept

Fishing
Transit
Mad-Swan
GMFMC Questions
1) How do you define a successful MPA, and what criteria do you use to measure success?

A successful MPA is one which achieves its goals. In this case, the goals were “to protect gag spawning aggregations and provide locations to assess the efficacy of marine reserves to protect (spawning) aggregations.” (From: Gulf of Mexico Gag Grouper, SEDAR 10, 2006). Using these criteria, the Madison-Swanson MPA has had mixed results. After several years of increase, gag abundance within Madison-Swanson has declined since 2005. A similar decline from 2004-2006 has also been observed along the west Florida shelf. The two MPAs have not provided consistent protection to gag.
2) Have you seen any change in the male to female gag ratio, both within the reserves and within the general gag population that might be attributable to the reserves? How do you attribute the change to any areas outside the reserve?

Our survey uses non-destructive sampling and therefore we do not have reliable estimates of gag sex ratios. Sex determination based upon underwater visual observations are notoriously unreliable and therefore, we cannot address this question. However, it should be noted Gag populations are driven by episodically high year classes which can skew sex ratios.
3) Have you seen any changes in abundance, size or distribution of gag outside the reserves that can be attributed to the reserves? If so, how is it attributed to the reserves and not other regulatory actions that have changed over the past 7 years?

The index of abundance for gag along the west Florida shelf has decreased since 2004. We have no evidence of a spillover effect. However, the aerial survey of fishing boats shows a concentration of fishing activity just outside the Madison-Swanson border.
4) Are there any measurable impacts of marine reserves that can be incorporated into stock assessments? If so, how do you measure the impacts?

5) Do you feel that marine reserves are an effective way to control fishing mortality on a stock?

6) Is there any evidence that marine reserves increase yields? Outside the reserve and for the total stock?

These questions are beyond the scope of our research. However, they have been addressed by several authors. See Halpern, 2003 for a review. The general consensus is MPAs can be effective management tools provided the protected areas are large enough and enforcement levels prevent significant poaching.
7) Do you feel that MPAs can have large scale (i.e., stock-wide) benefits, or are the benefits primarily localized to the immediate area in and near the MPA location?

MPAs can have large scale benefits, particularly for species with strong site fidelity to well defined habitat types. Coupling these characteristics with a hermaphroditic life history which exposes individuals to fishing pressure for several years before sufficient numbers of both sexes are present in the population and preference for depths at which release mortality is very high due to barotraumas adds to the potential benefits of areal closures. There are caveats however, and the strongest one assumes the closed areas are of sufficient size to protect enough individuals to maintain genetic diversity and produce enough propagules to populate the stock’s range.
8) Do you think poaching in Madison-Swanson adversely affected the results and, if so in which years was that a big problem?

Yes. The aerial survey indicated 2% of commercial fishing vessels and 3%-5% of recreational boats were fishing within MPAs. We have spent >100 days at sea since January 2001 in and near the NEGOM MPAs. During this time we saw gradual increases in poaching during the first three years then a sharp decline after some high profile enforcement actions. In the last two years, poaching has again been on the increase. During 2007 we witnessed more poaching than in any previous year. It should be pointed out that fishing on a spawning aggregation can quickly remove a large number of gag from the MPAs and as aggressive males are often the first fish caught, even minor levels of poaching can preclude spawning activity in a large number of grouper.
Gulf of Mexico gag landings and dead discards by the commercial and recreational fisheries in pounds gutted weight.

From: SEDAR 10 Advisory Report, page 9, figure 2
Gag populations driven by episodic large year classes

Model results, SEDAR 10

Otolith results, PC Lab
Gag sex ratio by age

50% male at age 10.8

From: SEDAR 10, Data Workshop, Gag reproduction, page 25, figure 12
Percentage of males is very small due to age of transition from female to male and age structure of population. Recruitment of large year classes to fishery can shift sex ratio towards females as all young fish in these year classes enter the fishery as females.
Gag percentage male by year

From: SEDAR 10 SAR2 Section III 3.2, page 28, figure 7