

**CORIS Submittal for Project 1068 – Assess/monitor affects of MPA status on reef fish populations and spawning aggregations in the Tortugas Ecological Reserves.**

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**CORIS Product Name – Annual Progress Report**

**Project Summary:**

**Goals:** Project goals were several: 1) continue collection of visual census transect data enumerating all major predators (snappers and groupers) in order to determine if protection of fishes via ecological reserve designation was having any effect on population numbers; 2) identify additional areas that were potential spawning sites for mutton snapper aggregations; continue our work comparing numbers of major predators at stations inside and outside the Tortugas North Ecological Reserve in order to compare adjacent fished and un-fished areas; conduct photographic transect surveys for habitat characterization on the stations in the TSER. A long term goal of this project was to conduct visual census work at TSER during the winter months to explore for grouper aggregations, but this has been impossible due to funding cycle issues (federal budget timelines and lack of funds until well after winter season). We hope to be able to resume this work in the future, especially in light of recently published research on multi-species spawning sites. Nonetheless, our observations of grouper numbers during the summer months, outside the spawning season, give us good background data for future comparisons.

**Significance:** This project is very significant from a management standpoint because we are trying to assess the fisheries resources of the Riley's Hump area of the Tortugas South Ecological Reserve. Since the southern reserve was established specifically with the protection of mutton snapper spawning aggregations in mind, it seems important to try and determine if the establishment of the reserve is contributing to a population increase in the species and the reestablishment of the historically large spawning aggregations. Similarly, fishermen know Riley's Hump as a place where grouper are abundant. The area has never been explored to scientifically document the existence of grouper spawning aggregations. The presence of grouper aggregations forming in the reserve would provide added justification for the designation, creation and continued existence of the Tortugas South Ecological Reserve. The comparison of snapper-grouper populations within and outside the Tortugas North Ecological Reserve directly addresses the question of whether protected areas offer enough protection to target or exploited species to enhance population abundance between fished and unfished areas.

**Hypotheses:** H<sub>0</sub>: Numbers of snappers and groupers are not increasing at Riley's Hump since the creation of the South Tortugas Ecological Reserve in 2001.

H<sub>0.2</sub>: There is no difference in snapper and grouper abundance in stations located within the TNER and stations outside the TNER.

**Results:** We conducted a research cruise to stations in the Tortugas South Ecological Reserve (TSER) (Fig. 1) and the Tortugas North Ecological Reserve (TNER) during the period July 16-21, 2008. A total of 16 scientists and volunteers went. Participants included biologists from the NMFS Beaufort Laboratory, NOS's CCFHR Beaufort facility, the SEFSC's Miami laboratory, the NOAA Coral Reef Conservation Program's headquarters staff, the Florida Fish and Wildlife Commission's Marathon Laboratory, the University of Miami's Rosenstiel School of Marine and Atmospheric Sciences, and volunteers from the Reef Environmental Education Foundation.

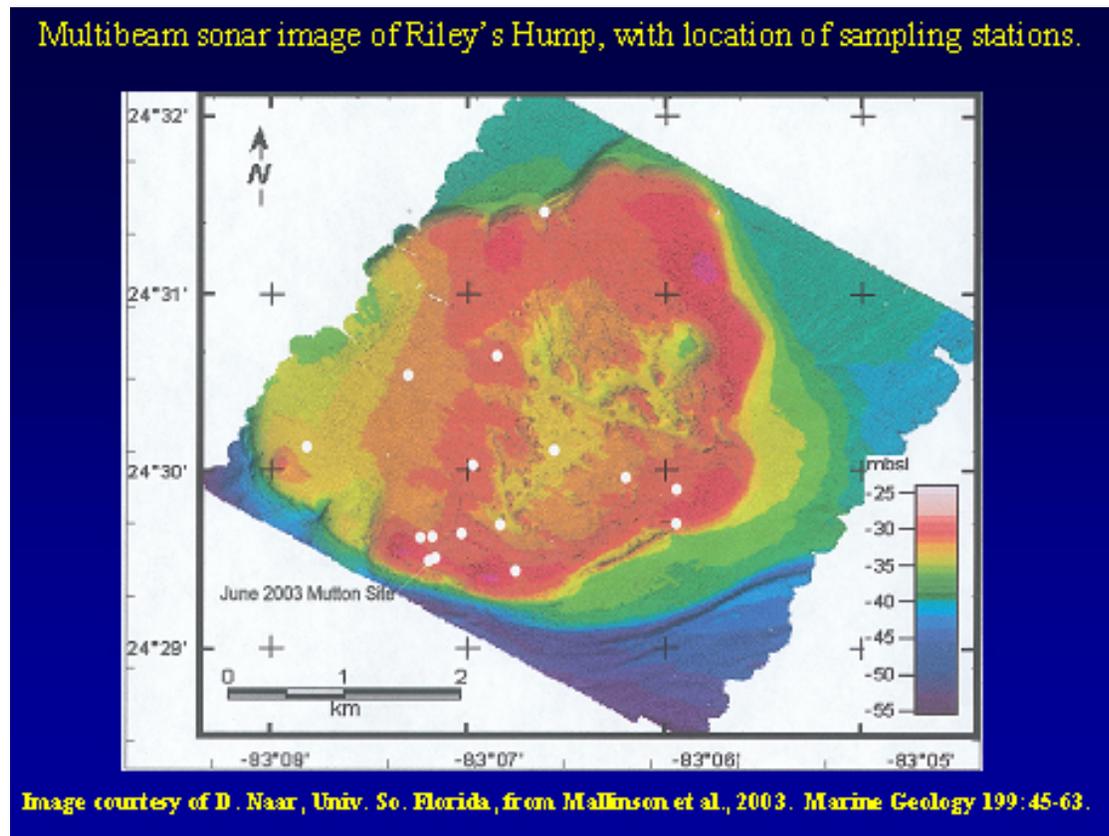


Fig. 1. Multibeam image of Riley's Hump, northeast corner of Tortugas South Ecological Reserve.

We completed 122 visual fish census sampling transects on the 16 stations of the south reserve and we completed 35 fish census transects on the nine sampling sites in the north reserve. This sampling effort is an increase over previous years' work (Table 1). We completed digital photographic habitat transects on 15 of 16 south reserve stations. Equipment problems prevented us from continuing our laser measurements of snapper and groupers using a videocamera laser mount apparatus this year. We continued our search for spawning aggregations of mutton snapper using visual census transects as well as drift dive transects covering large areas of bottom.

Table 1. No. Visual Census Transects, Tortugas Ecological Reserves Study, 2002-2008

<u>Year</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>
TSER	168	69	48	65	73	106	122
TNER	---	---	18	36	34	32	35

We also initiated exploration for probable spawning aggregation sites and spawning aggregations (mutton snapper) by deploying a split beam transducer and echosounder using a custom tow-fish, towing the acoustic fish for approximately 3 to 4 hours on two of the nights. Though preliminary, the analysis of these data show some consistent patterns with respect to the distribution of fish observed during each of the two surveys. Only fish >1m from the bottom and greater than -45dB (approximately 20cm) are included in this report due transducer orientation. On 17 July, fish were observed near the south side of the bank (Figure 2). The fish were generally in 30-40 m depths and not near any of the dive stations (except see fish within several hundred meters of Station 6, Figure 2). In contrast, on 19 July, high concentrations of fish were located near Stations 18, 15 and especially Station 12, the station we have previously seen large numbers of mutton snapper on. These fish were well off the bottom and easily detectable.

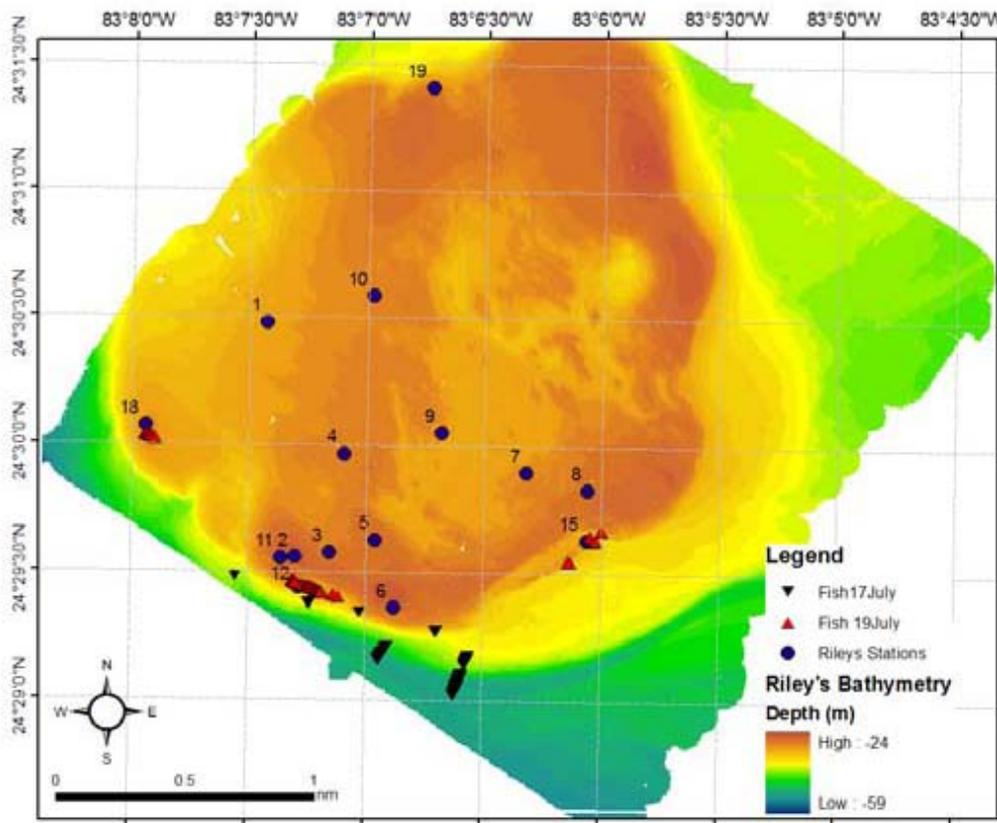


Figure 2. Locations of fish observed during hydroacoustics surveys on 17 (black triangles) and 19 July (red triangles). Dive stations and bathymetry are also added for spatial reference. (Figure provided courtesy C. Taylor and B. Degán, CCFHR, NOS, NOAA, Beaufort NC.)

With additional scrutiny of the acoustic data in Echoview, it may be possible to extract more fish tracks for fish in closer proximity to the bottom and possibly correct for the beam angle and estimate fish sizes with greater accuracy. We acquired large quantities of acoustic data that will be analyzed this winter to define new sites to explore in the future with potential as essential fish habitat for spawning aggregations, both snappers and groupers (Fig. 3).

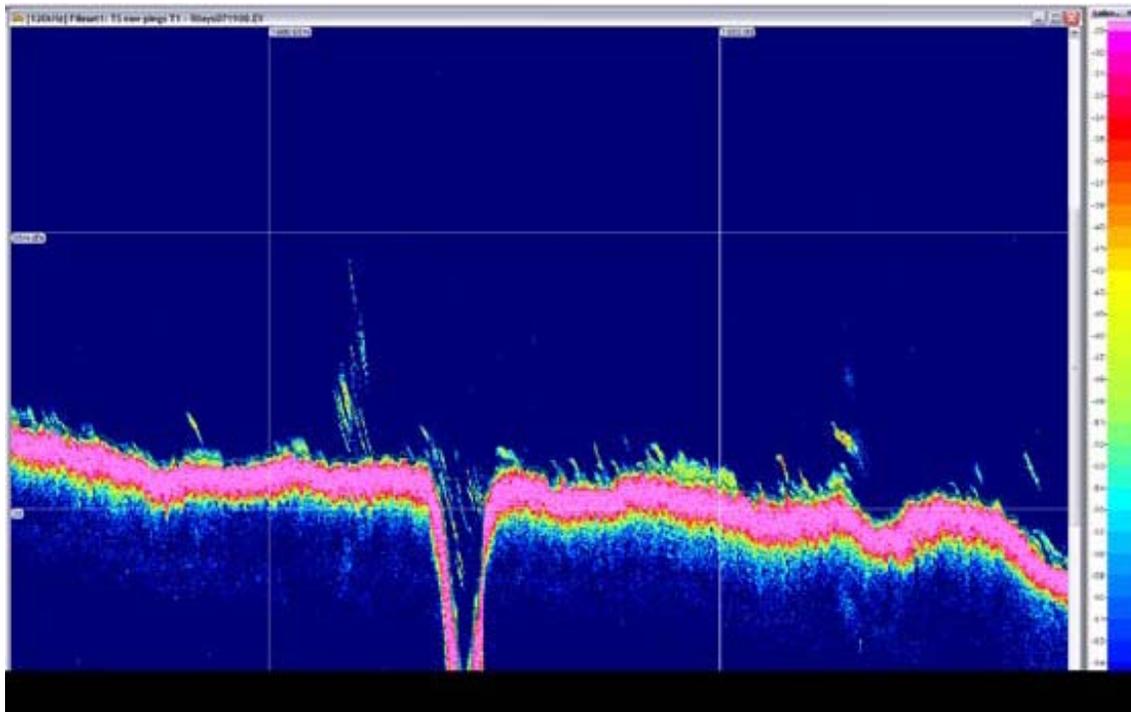


Figure 3. Excerpt of echogram from 19 July 2008 hydroacoustic survey. Time is represented along horizontal axis, and depth is vertical axis. Pink color represents high acoustic energy of the bottom. Color scales from blue to pink indicating strength of echoes. Fish traces are observed well off the bottom and roughly -45 dB, which is within the range of expected fish sizes, though biases may be included due to transducer orientation. Note downward trail of fish echoes. (Figure provided courtesy C. Taylor and B. Degan, CCFHR, NOS, NOAA, Beaufort NC.)

We assisted with a FWC study investigating spatial and temporal rates of movement of acoustically tagged snappers and groupers in the Tortugas region, including annual spawning migratory movements between Riley's Hump (RH), the Tortugas Ecological Reserves (TERs) and the Dry Tortugas National Park (DRTO), including the Research Natural Area (RNA). A VemcoVR28 tracking system, a 4-channel receiver that provides transmitter position and bearing, was towed on two of the nights for up to 3 hours at a time to confirm the presence of tagged fish (8 mutton snapper, 2 red grouper, and 1 Nassau grouper were successfully tagged with VEMCO V16-4H coded transmitter tags at Riley's Hump). Our cruise corresponded to a post-tagging time of two weeks, and several acoustic recaptures were recorded. We plan to use the VR28 tracking system on future cruise collaborations with FWC to expand the geographic coverage of the VR2s in the region and more thoroughly document the usage of the ecological reserves by these important species.

We retrieved three of three temperature loggers deployed in 2007, on stations on the north, south and east ends of Riley's Hump, the prominent sea bottom feature of the TSER. We redeployed new temperature loggers on all three stations. All three loggers were deployed by attaching them with cable ties to a 4 to 5 ft length of reinforced steel bar, painted with high visibility yellow spray paint, hammered into the seafloor at the precise coordinates of the sampling station. We now have a four year time series of seafloor temperature data, unfortunately split in the middle by the loss of all loggers during the hurricanes of 2005 (Katrina, Rita, Wilma) most of which went right over the top of the Dry Tortugas. We anticipate this data to be a valuable input into NOAA's climate science program.

We continued to document recovery of the spawning aggregation of mutton snapper by censusing station 12 during the summer spawning months. In 2008 we did not see hundreds of mutton snapper on any single dive, but we did see elevated numbers on most stations, including those stations distant from Station 12 where we usually don't see them occur. The largest number of mutton snapper seen on a single dive in 2008 was approximately 40 fish seen on one dive on station 12, July 19, two days after the full moon (Fig 4). The increasing sightings of mutton snapper at most stations, not just the primary spawning site, still lead us to believe this cluster of fish is a spawning aggregation, and it continues to reform each year to some degree. While we were disappointed not to see the 'tornado of several hundred fish' described in last years report, we are still convinced that the aggregation continues to be viable.



Fig. 4. Mutton snapper 'aggregation' at Riley's Hump, July 2008.

We were unable to conduct any winter time work for exploration of grouper aggregations on Riley's Hump, simply due to the vagaries of the funding system. Money from the NOAA Coral Reef Conservation Program is unavailable until the spring, and attempts to carry over money into the next fiscal year have been disapproved by NOS, the managers of the NOAA Coral Reef Conservation Program. We would like to get back out to the TSER in the future for wintertime work because we are seeing increasing numbers of black and yellowfin grouper during the summer months, which encourage us to think the reserve is having the intended effect at rebuilding exploited stocks.

We assessed predator abundance in the Tortugas Ecological Reserves over 157 randomly oriented 30 m visual census transects, and preliminary results indicate that abundance of key species (e.g., mutton snapper, black grouper) is increasing when compared with the pre-reserve time period (prior to 2001), there is evidence that the previously overexploited mutton snapper spawning aggregation is successfully reforming each summer, and both of these results indicate that marine protected areas protect and replenish exploited populations.

Fish abundance data from this and previous years is currently being inputted and error-checked for future analysis. The time series of annual sampling post-reserve implementation in the TSER, and five years of annual sampling in the TNER, will be analyzed, and statistical comparisons of abundance of major individual species and species groups will be made between the pre-reserve (2001) time period and later years, both by individual station and/or by station groupings (e.g., edge stations vs. interior stations for the TSER, reserve vs. non-reserve stations for the TNER). We anticipate a peer reviewed publication to result from this work by mid-year 2013.

### **Publications/Presentations resulting from research**

Shulzitski, K, M. McCartney, and M. L. Burton. 2009. Population connectivity among Dry Tortugas, Florida and Caribbean populations of mutton snapper, inferred from multiple microsatellite loci. *Fish. Bull.* 107:501-509.

Burton, M.L., K. J. Brennan, R. C. Munoz, and R. O. Parker, Jr. 2005. Preliminary evidence of increased spawning aggregations of mutton snapper (*Lutjanus analis*) at Riley's Hump two years after establishment of the Tortugas South Ecological Reserve. *Fish. Bull.* 103:404-410.

Rileys Hump, South Tortugas Ecological Reserve: A preliminary comparison of snapper grouper populations before and after marine reserve designation. Poster presentation, Gulf and Caribbean Fisheries Institute Meeting, November 2004, Tortola, British Virgin Islands.

Rileys Hump, South Tortugas Ecological Reserve: A preliminary comparison of snapper grouper populations before and after marine reserve designation. Talk and power point

presentation to Florida Keys National Marine Sanctuary Advisory Committee, Marathon,  
Florida, April 2004.