



Dry Tortugas National Park Research Natural Area: The 5-Year Report



Review and Discussion
June 27, 2012

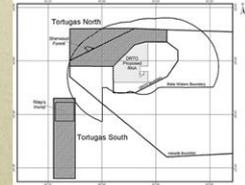
Florida Fish and Wildlife Conservation Commission
Fish and Wildlife Research Institute
Division of Marine Fisheries Management

In January 2007, the National Park Service (NPS) implemented a Research Natural Area (RNA) within Dry Tortugas National Park (DRTO) following the Florida Fish and Wildlife Conservation Commission's (FWC) review and concurrence of their plans. This report first summarizes the process that led to the creation of the RNA and the development of a Commission-directed Memorandum of Understanding (MOU) between the FWC and the NPS to facilitate cooperation to identify, prioritize, and coordinate specific activities to evaluate the performance of the RNA. The report then briefly summarizes the development of the collaborative Science Plan that was drafted by the two agencies to direct the activities set forth in the MOU. Finally, this report summarizes the Commission-mandated 5-year science report that describes the progress and outcomes of the various research and monitoring activities set forth in the Science Plan.

Author: John Hunt, William Sharp, and Jessica McCawley
Report Date: May 21, 2012

Review of RNA Implementation

- 1998: Florida Keys National Marine Sanctuary (FKNMS) and NPS stakeholder working group processes
 - **Goal:** create “ecological reserves” in the Dry Tortugas
 - Balance resource protection and marine-related stakeholder activities
 - Considered factors such as coral reef and fish spawning locations and popular fishing areas
- 2001: FKNMS Created the deepwater Tortugas Ecological Reserves
- Working Group also recommended the RNA to protect shallow-water habitats within Dry Tortugas National Park
- RNA not implemented in 2001 due to issue raised by the State of Florida regarding ownership of sovereignty submerged lands



The process that culminated with the creation of the RNA began with a concurrent stakeholder working group process convened by the Florida Keys National Marine Sanctuary (FKNMS) and the National Park Service (NPS). This process, begun in 1998, brought together scientists, managers, and stakeholders, with the goal of creating an ecological reserve in the Dry Tortugas. This process strove to create ecological reserves that balanced the need to protect the biological resources of the Dry Tortugas region while continuing to provide ample opportunities for marine-related stakeholder activities. The working group received extensive scientific information regarding finfish and spiny lobsters, ocean currents and locations of well-developed coral reefs. Members of the fishing industry provided information regarding preferred locations for their fishing activities. In 2001, the process resulted in the creation of two deepwater Ecological Reserves in the FKNMS. The working group also recommended creating a Research Natural Area (RNA) to protect shallow-water habitats within Dry Tortugas National Park (DRTN). However, because the uncertainty regarding the regulatory authority relating to the ownership of the sovereignty submerged lands between the NPS and the State of Florida, the RNA was not implemented at that time.

Review of RNA Implementation

- Issue resolved in August 2005 by the Submerged Land Management Agreement; cleared way for RNA implementation
- Management Agreement stipulated that “the service shall submit for review to the FWC any proposed NPS Special Regulations or amendments thereto”
- December 2005: Commission briefed on the Management Agreement and the proposed Special Regulations that prohibited fishing and anchoring in the RNA
- February 2006: Commission concurred with the Special Regulations regarding the establishment of the RNA



The sovereignty submerged lands issue was resolved in August 2005 by the Submerged Land Management Agreement between NPS and the State of Florida Board of Trustees of the Improvement Trust Fund, which cleared the way for the implementation of the RNA. That agreement stipulated that “the service shall submit for review to the FWC any proposed NPS Special Regulations or amendments thereto.” At its December 2005 meeting the Commission was briefed on the Management Agreement and the Special Regulations related to the RNA. Those regulations included a prohibition on fishing and anchoring and vessels in transit must have fishing gear properly stowed. At its February 2006 meeting, the Commission concurred with those regulations.

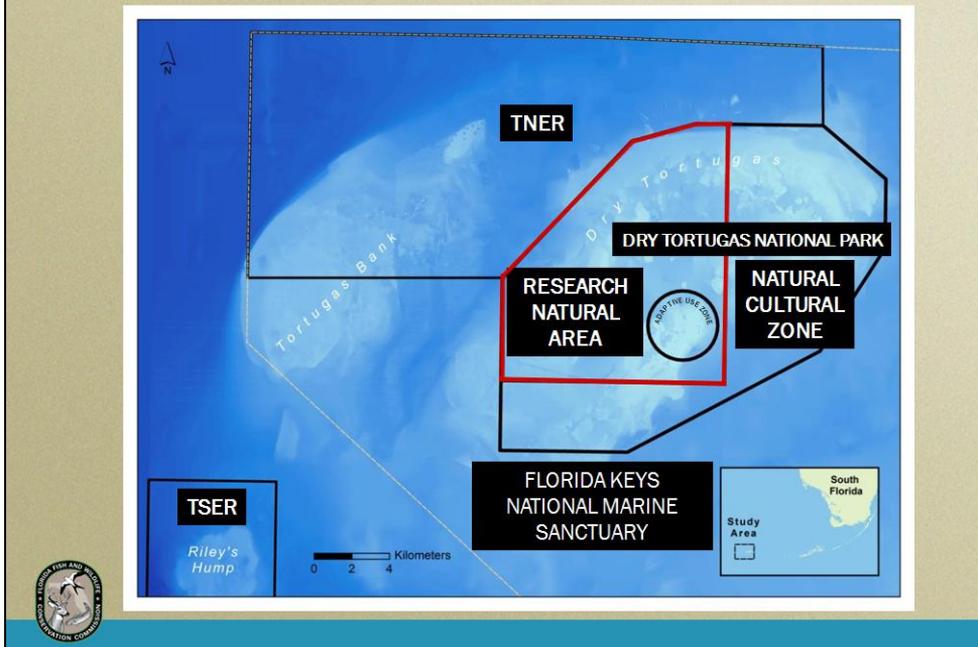
Review of RNA Implementation

- Commission stipulated that a Memorandum of Understanding be developed between the FWC and NPS to facilitate the development of a science plan to evaluate the effectiveness of the RNA
- Commission also stipulated that a 3-year interim and a 5-year comprehensive report be drafted summarizing RNA-related research and evaluate the performance of the RNA
- RNA implemented January 2007
- MOU effective February 2007



The Commission also directed staff to develop a Memorandum of Understanding (MOU) between FWC and NPS to cooperatively develop and implement a science plan to evaluate the effectiveness of the RNA toward its stated goals. The goals of the RNA were to protect shallow water marine habitat, ensure species diversity, and enhance the productivity and sustainability of fish populations throughout the region. The Commission further stipulated that FWC staff, in cooperation with NPS staff, draft a 3-year interim and 5-year final report summarizing the results of the science plan. The MOU was finalized in February 2007.

Management Zones of the Dry Tortugas



The figure above depicts the management zones of the Dry Tortugas. The Dry Tortugas National Park is located approximately 70 miles to the west of Key West and encompasses 100 mi² of marine waters and seven small islands. Marine-related activities allowed throughout DRTO include boating, snorkeling, SCUBA diving, and wildlife viewing. Commercial fishing and spearfishing are prohibited throughout DRTO. The RNA encompasses 46 mi² along the western half of DRTO. Tortugas North Ecological Reserve (TNER) lies along the northwestern boundary of DRTO and Tortugas South Ecological Reserve (TSER) is located approximately 7 miles to the southwest of DRTO and encompasses Riley's Hump, a well-known fish spawning aggregation site. Anchoring and all fishing is prohibited in these three zones (TNER, TSER and RNA). Recreational fishing and anchoring are allowed in the Natural Cultural and Adaptive Use Zones within DRTO. The remaining waters in the Dry Tortugas region are open to commercial and recreational fishing.

Acronyms used on map and in presentation:

DRTO: Dry Tortugas National Park
FKNMS: Florida Keys National Marine Sanctuary
NCZ: Natural Cultural Zone
RNA: Research Natural Area
TNER: Tortugas North Ecological Reserve
TSER: Tortugas South Ecological Reserve

Memorandum of Understanding



The MOU identified six specific areas of RNA performance to be evaluated:

- 1) Quantify changes in abundance and size-structure of exploited fish species within the RNA relative to adjacent areas
- 2) Monitor the immigration and emigration of targeted fish species
- 3) Monitor changes in species composition and catch rates of exploited species throughout the surrounding region
- 4) Evaluate the effects of the RNA on bottom habitat
- 5) Assess the reproductive potential of exploited species
- 6) Incorporate social sciences into the research and monitoring program



The MOU identified six specific areas of RNA performance to be evaluated. These areas were: 1) to quantify changes in abundance and size-structure of exploited finfish species within the RNA relative to adjacent areas; 2) to monitor the immigration and emigration of targeted finfish species in the RNA; 3) to monitor changes in species composition and catch rates of exploited fish species throughout the surrounding region; 4) to evaluate the effects of the RNA on the bottom habitat; 5) to assess the reproductive potential of exploited fish species; and 6) to incorporate social sciences into the research and monitoring program.

The RNA Science Plan

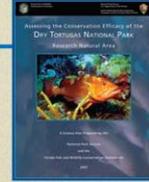
- Developed in 2007 to identify, develop, and prioritize projects identified in the MOU
- Development included two facilitated meetings with scientists and managers
 - FWC (FWRI, DMFM)
 - NPS (Dry Tortugas National Park, South Florida Caribbean Network, Water Resources Division)
 - National Oceanic and Atmospheric Administration (FKNMS, National Ocean Service)
 - U.S. Geological Survey
 - University Scientists
- Public workshop convened and attended by agency scientists and managers, representatives of non-governmental organizations, and stakeholders



The RNA science plan was developed during early 2007 to develop and prioritize specific projects related to the performance topics set forth in the MOU. To ensure that the Plan's activities would be the best suited to address those performance topics, the FWC and the NPS facilitated two science coordination meetings that included scientists and managers from the FWC, NPS, the FKNMS, and the United States Geological Survey (USGS). The initial draft of the Science Plan was distributed to agency scientists and the to public for a 30-day review period. Following that review period, a public meeting was held during May 2007 that was attended by agency scientists and managers, representatives of non-governmental organizations, and stakeholders. The comments and the cooperating agencies responses to those comments were included in the final Science Plan document.

The RNA Science Plan Priorities

- Three of the RNA performance topics identified in MOU were prioritized by NPS and FWC science managers for funding and implementation



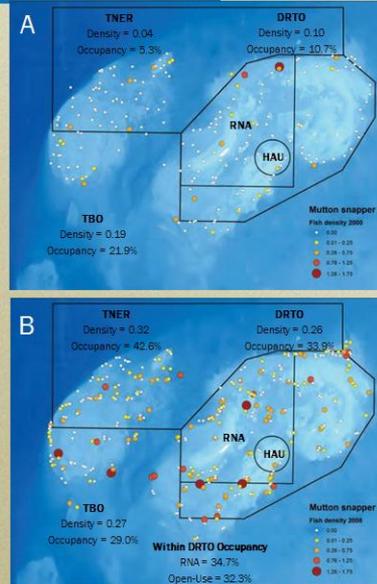
- 1) **Quantify changes in abundance and size-structure of exploited fish species within the RNA relative to adjacent areas**
- 2) **Monitor the immigration and emigration of targeted fish species**
- 3) Monitor changes in species composition and catch rates of exploited species throughout the surrounding region
- 4) Evaluate the effects of the RNA on bottom habitat
- 5) **Assess reproductive potential of exploited species**
- 6) Incorporate social sciences into the research and monitoring program



Upon completion of the Science Plan, NPS and FWC science managers set as their primary goal finding the means to fund and otherwise support research projects focused on the immediate high-priority RNA performance topic areas identified during its development process. Their efforts to address this goal resulted in the initiation or expansion of projects associated with the RNA performance topics outlined and bolded in the slide above. The projects associated with those three topics were designed to detect changes in adult fish populations, evaluate juvenile fish within the seagrass beds of the RNA, conduct acoustic tagging studies of fish movements, and model larval-transport. Consequently, the projects associated with these topics are the most complete and have yielded results upon which RNA performance can presently be best evaluated. In this 5-year report, we provide the key results from the three topic areas, followed by a summary evaluation of the significance of these results as they relate to RNA performance.

RNA Topic 1: Quantify changes in abundance and size-structure of fish species

- *Status of reef fish of the Tortugas region based on fishery-independent visual and trap survey assessments*
 - 2000-2011: Assessments of the coral reef fishes in the Tortugas region were conducted by a collaborative team of research divers from the Univ. Miami, NOAA, NPS, and the FWC
 - Since RNA implementation, abundance and size-structure of legal-sized red grouper, mutton snapper, yellowtail snapper, and hogfish has increased in TNER & DRTO compared to nearby areas open to fishing



The primary project associated with RNA Performance Topic 1 involved fishery-independent assessments of the coral reef fish community in the Tortugas region. This project was conducted by a collaborative team of researchers from the University of Miami, NOAA, NPS, and the FWC. Region-wide dive surveys were conducted during 1999, 2000, 2004, 2006, 2008, and 2010. DRTO-specific surveys were conducted in 2002, 2009, and 2011.

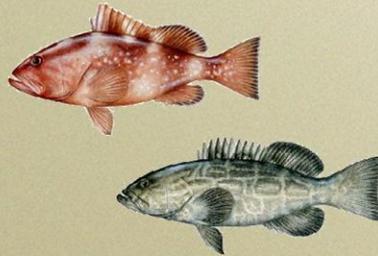
These surveys revealed that fish abundance, as measured by occupancy rates and density, increased after the implementation of the RNA in both the TNER and DRTO. Additionally, the average sizes of red grouper, mutton snapper, yellowtail snapper, and hogfish have increased since the RNA was implemented. The abundance of spawning-sized fish also increased within the RNA relative to other areas.

As an example of those changes, the figures above depict the distribution and the average density of mutton snapper. Panel 'A' are the results for 2000, the year before the TNER was implemented, and panel 'B' summarizes results from 2008, the year after the RNA was implemented. The average densities and occupancy rates of mutton snapper in the TNER, DRTO, and the open-use area of Tortugas bank (TBO) are compared. Note that though the RNA was not established in 2000, its future boundary lines are shown for reference in Panel A.

RNA Topic 1: Quantify changes in abundance and size-structure of fish species

- *Nursery function of seagrasses within the Dry Tortugas National Park Research Natural Area*

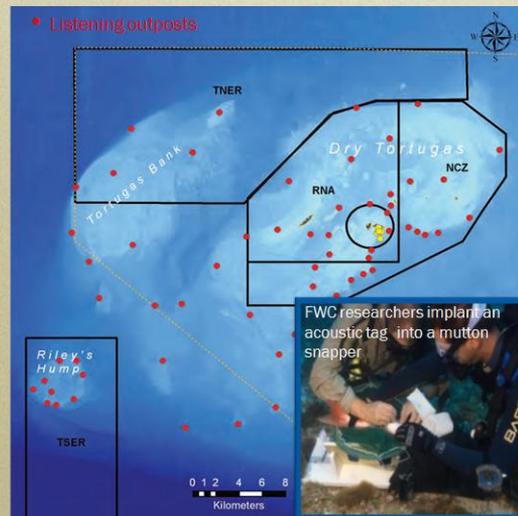
- Surveys were conducted of fish associated with seagrass inside and outside the RNA
- Juvenile red and black groupers were most frequently collected in the shallow seagrass beds of the RNA
- Seagrass beds within the RNA likely function as an important nursery habitat for juveniles of these exploited reef fish species in the Tortugas region



RNA Performance Topic 1 also included a study aimed at evaluating the importance of the seagrass beds within DRTO in providing essential habitat for the juvenile stages of exploited reef fish species. To accomplish this, FWC researchers sampled the seagrass beds inside and outside the RNA and compared the fish communities associated with both areas. They found that juvenile-stage red and black groupers were most frequently collected in the shallow seagrass beds within the RNA. These results suggests that the seagrass beds within the RNA function as an important nursery habitat for these two species in the general Dry Tortugas region.

RNA Topic 2: Monitor immigration & emigration of targeted species in the RNA

- Regional connectivity of fishes within the Tortugas region of Florida
 - Riley's Hump is a well known mutton snapper spawning aggregation site
 - Mutton snapper were acoustically tagged within the RNA & Riley's Hump and tracked with a network of underwater 'listening outposts'

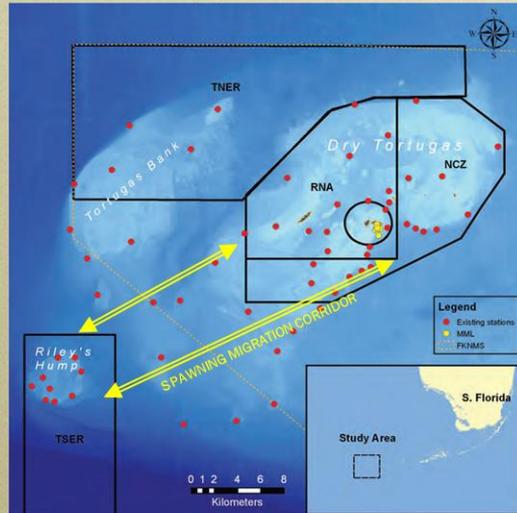


RNA Performance Topic 2 involved monitoring immigration and emigration of fish species in the RNA to more completely understand the regional connectivity, that is, how fish populations move throughout the greater Tortugas region. An understanding of such movement patterns is critical to evaluate how effectively a no-take marine reserve will help sustain fish populations when their spawning occurs within its boundaries or when strong connectivity exists between fish populations within the reserve's boundaries and fish spawning aggregations located elsewhere. Thus, NPS and FWC science managers prioritized this research to evaluate how the RNA is meeting its stated goals.

FWC researchers used tag and recapture methods to track fish movements in the region. One such tagging method involved implanting hydro-acoustic tags in fish, which could then be tracked using a network of underwater "listening stations" positioned throughout the region. The study presented here focuses on the movement of mutton snapper between the RNA and Riley's Hump in the TSER. Riley's Hump has been a well-known mutton snapper spawning site, but years of intensive fishing at Riley's Hump prior to it being protected had substantially reduced the number of fish spawning there.

RNA Topic 2: Monitor immigration & emigration of targeted species in the RNA

- *Regional connectivity of fishes within the Tortugas region of Florida*
- Identified a migratory corridor used by mutton snapper between the RNA and a spawning aggregation at Riley's Hump
- Some mutton snapper moved from the RNA to Riley's Hump as many as four times per spawning season



Acoustic telemetry clearly identified a migratory corridor for adult mutton snapper between the RNA, through areas open to fishing and into Riley's Hump within the TSER. Of the 51 mutton snapper that were tracked, 15 made seasonal movements to Riley's Hump during their spawning season. These fish typically took two days to move from the RNA to Riley's Hump. Some fish made as many as four round trips per spawning season. Twelve of these fish were either resident within the RNA or migrated through the RNA.

RNA Topic 2: Monitor immigration & emigration of targeted species in the RNA

- *Regional connectivity of fishes within the Tortugas region of Florida*

- Number of mutton snapper observed at Riley's Hump during expected spawning times at full moon increased after the implementation of the RNA

- In 2009, a large aggregation of mutton snapper and repeated spawning events were documented for the first time in Florida

Date	Number of Fish Observed
May 27, 2002 ¹	75-100
June 15, 2003 ¹	75-100
June 15, 2003 ¹	200+
July 4, 2004 ¹	300
July 3, 2007 ²	100+
June 11, 2009 ³	~ 4,000

¹ Burton et al. 2005. ² Michael Burton, NOAA, pers. comm. ³ FWC study

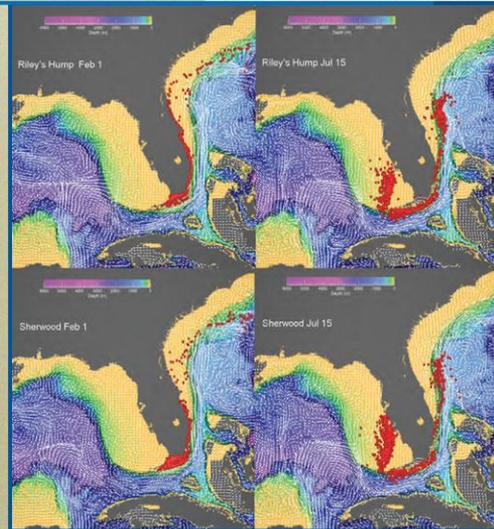


The table on the slide above summarizes observations of mutton snapper at Riley's Hump in recent years during the expected spawning time. Observations through 2007 suggested that the mutton snapper spawning aggregation had begun to increase after the establishment of the Tortugas Ecological Reserves in 2001. In 2009, a large aggregation of mutton snapper estimated to include approximately 4,000 mutton snapper were observed and repeated spawning events were documented for the first time in Florida. Further, though this research primarily focused on mutton snapper utilizing one known spawning site, it is worth noting that other potential ecologically and economically important species, such as black grouper, also use Riley's Hump as a spawning aggregation site. The FWC is now focusing its regional connectivity research on black grouper using its acoustic telemetry methodology.

RNA Topic 5: Assess reproductive potential of exploited fishes by evaluating egg production & larval dispersal

- *Larval transport modeling to assess the reproductive potential of reef fish spawning in the Tortugas region*

- Model indicates that spawning at Riley's Hump supplies new reef fish recruits to the Florida Keys and along the east and west coasts of Florida



RNA Performance Topic 5 involved assessing the reproductive potential of exploited fishes by evaluating egg production and larval dispersal. This Performance Topic included developing a model to simulate the drift of larvae produced during spawning events. In order to predict the potential fate of fish eggs and larvae as accurately as possible, the model incorporated different spawning seasons, locations, and water depths for various reef fish species.

The model predicts that reef fish spawning in the Tortugas region, including Riley's Hump, supplies new reef fish recruits to the Florida Keys, to coastal bays along the West Florida Shelf, and along the east coast of Florida north of Miami.

Summary Evaluation of RNA Performance

- These projects indicate that the RNA has provided substantial benefits to the reef fish communities of south Florida
 - Adult reef fish increased in abundance and size in the RNA
 - Seagrass beds in the RNA serve as nursery areas for exploited reef fish species
 - RNA has complemented the existing reserves in rebuilding mutton snapper spawning aggregation at Riley's Hump
 - Fish larvae from these spawning aggregations settle throughout south Florida



The results of research projects associated with the high priority RNA Performance Topics identified by NPS and FWC science managers are consistent with the RNA's goals. These projects indicate that: 1) adult reef fish increased in abundance in the RNA; 2) the seagrass beds in the RNA serve as nursery habitat for juveniles of important reef fish species; 3) the RNA has complemented the existing reserves in rebuilding mutton snapper spawning aggregation at Riley's Hump; and 4) that larval transport models indicate that fish larvae from these spawning aggregations settle throughout south Florida, including the Dry Tortugas. Taken collectively, these projects indicate that the RNA has provided substantial benefits to the reef fish communities of south Florida.

Remaining RNA Performance Topics

- RNA Topic 3: Monitor changes in species composition and catch rates of exploited species throughout the surrounding region
 - NPS and University of Miami developed a creel survey for visitors to DRT0
 - A vessel permit system is in place and will be used to aid creel surveys
- RNA Topic 4: Evaluate the effects of RNA implementation on marine benthic biological communities
 - FWC, USGS, and NPS are each leading one ongoing project
 - Will require long-term effort for full evaluation



The remaining RNA Performance Topics involve projects still in development or are studies in which RNA performance can only be judged over the long term. Performance Topic 3 involves monitoring the changes in species composition and catch rates of exploited fishes in the Dry Tortugas region. To accomplish this, NPS staff and researchers at the University of Miami have developed a creel survey designed to collect this information from DRT0 visitors. This survey has not been implemented. However, a vessel permit system that will greatly aid survey efforts has been implemented.

Performance Topic 4 involves projects aimed at evaluating the effects of RNA implementation on marine benthic biological communities. Because it was expected that any effect of the RNA in this topic area would be slow to occur and only detectable over a longer time period than the five years covered by the MOU, researchers from the FWC, the NPS, and the USGS are continuing collaborative studies in this topic area. The science managers' main goal was to ensure that appropriate studies were conducted to provide a well-defined baseline profile of the conditions within RNA at its establishment.

Remaining RNA Performance Topics

- RNA Topic 6: Incorporate social sciences into the research and monitoring program
 - Survey visitor demographics, attitudes, perceptions, and experiences of park resources of visitors who enjoy recreational activities within DRT0
 - East Carolina University and NPS collaborated to develop the quantitative survey questionnaires and methodology
 - Survey will occur in summer 2012



RNA Performance Topic 6 involves incorporating social sciences into the research and monitoring program. Specifically, it seeks to survey visitor demographics, attitudes, perceptions, and experiences of park resources of visitors who enjoy recreational activities within DRT0. Researchers from East Carolina University and NPS have collaborated to develop quantitative survey questionnaires and methodology. These surveys are expected to be conducted during the summer of 2012.

Questions



Next Steps

- MOU expired February 2012, but multi-agency research and monitoring efforts continue in DRTO
- Later this year, the NPS will present the status of the RNA to the Board of Trustees
- NPS requests the FWC continue to support the Special Regulations established for the RNA
- Effective law enforcement important for continued success of the Tortugas region protected areas



The MOU between FWC and NPS expired in February 2012, but collaborative research continues in the RNA and surrounding Dry Tortugas region. Among the ongoing projects are: 1) the multi-agency fishery-independent surveys of the finfish communities in the Dry Tortugas; 2) the FWC study assessing the regional connectivity of black grouper in the Dry Tortugas Region; 3) a collaborative study between the NPS and East Carolina University to conduct human dimension surveys; and 4) the FWC monitoring project to assess the coral communities surrounding the designated dive sites within the RNA.

Later this year, in accordance with the established Management Agreement, the NPS will report on the status of the RNA to the Board of Trustees of the Internal Improvement Fund. The NPS has requested that the FWC continue to support the Special Regulations established for the RNA.

Effective law enforcement is an important component for the continued success of the Tortugas region's protected areas. The FWC has been a primary enforcement presence in the Tortugas region and there is concern that the diminished enforcement capacity resulting from reduced NOAA funds may reduce future effectiveness of these reserves. A priority for the next few years should be an effort to enhance enforcement capacity in the Tortugas region in a collaborative fashion among all partners, FWC, NPS, and NOAA.

Staff Recommendations

- Staff recommends the Commission continue to support the Special Regulations established for the RNA that prohibit fishing and anchoring
- Staff recommends Commission continue to support collaborative research between the FWC and NPS evaluating the continued performance of the RNA
- New MOU not necessary at this time



Staff recommends the Commission continue to support the Special Regulations in the RNA that prohibit fishing and anchoring. Staff also recommends the continued support of the collaborative research between the FWC and the NPS that will evaluate the continued performance of the RNA into the future. Staff makes these recommendations because the RNA, combined with the deepwater ecological reserves, has played a substantial role in enhancing some exploited reef fish species in the region, like mutton snapper, and there is evidence that these benefits extend beyond the borders of the RNA and ecological reserves. Staff feels it is important to continue to study the RNA, its interaction with the ecological reserves, and the effectiveness of the RNA on protecting and bolstering Florida's marine resources.

The MOU between FWC and NPS expired in February, 2012. However, staff is not recommending creating another MOU with the NPS at this time because our FWC staff scientists have been very successful working collaboratively with the NPS, FKNMS, NOAA and research institutions to investigate the priority topics identified in the RNA science plan. With the Commission's continued support FWC staff will continue their collaborative research efforts into the future. Staff will return to the Commission with additional results of the collaborative research on the RNA when completed.