

REEF FISH IN THE TORTUGAS ECOLOGICAL RESERVE

FLORIDA KEYS NATIONAL MARINE SANCTUARY

Tortugas Waters Help Sustain Keys Marine Life

The waters and islands of the Tortugas region have long been recognized for their natural beauty, diverse corals and abundant fishing opportunities. Located about 70 miles west of Key West, visitors travel by boat or seaplane to fish, explore coral reefs, and experience the islands called the Dry Tortugas. This cluster of seven islands and the surrounding waters lie within Dry Tortugas National Park. The Tortugas Ecological Reserve (TER) is a marine zone in Florida Keys National Marine Sanctuary that borders the national park. The TER abounds with deepwater coral reefs and hard-bottom habitats rich in marine life and contains known spawning grounds for mutton snapper, yellowtail and other reef fish.



A black grouper swims along the seafloor near the reef.
Photo: Florida Keys National Marine Sanctuary

Reserve Created to Protect Reefs and Spawning Grounds

After an extensive public process during the late 1990s, a working group composed of commercial fishermen, recreational anglers, scientists, economists, environmentalists and other stakeholders, proposed the boundaries of the new ecological reserve. Though the TER is conceptually a single reserve, it was designed to protect two separate areas; Tortugas North protects the northern portion of the Tortugas Banks, while Tortugas South protects Riley's Hump and its surrounding habitat. With the approval of the governor of Florida and cabinet, the TER became effective on July 1, 2001, thus expanding the original boundaries of the sanctuary to protect an additional 96 square nautical miles of marine wilderness and reef fish spawning grounds.

Ocean currents connect the rich waters of the Tortugas with those of the Keys and the west Florida shelf. The Loop Current, which originates in the Gulf of Mexico, sweeps southward through the Tortugas region, where it joins a warm current traveling up from the south. Together they form the Florida Current, the beginning of the Gulf Stream system. As the Florida Current travels northward, it carries with it a myriad of larval fishes and invertebrates that ultimately settle and inhabit the coral reefs and seagrass beds of the Keys. This connection between the Keys and the Tortugas is one of the primary reasons for establishing the Tortugas Ecological Reserve.

TER regulations are intended to protect habitat and allow the area to evolve naturally with minimal human influences. Fishing and anchoring are prohibited to help preserve biodiversity and protect coral reef habitats. Entrance into Tortugas South is limited to permitted research, and access to Tortugas North is controlled through a simple, no-fee permit process regulated by the sanctuary. Tortugas North contains both state and federal waters and is contiguous with Dry Tortugas National Park, which has been closed to commercial fishing since the 1960s. In 2007, the park created a Research Natural Area, a 46 square mile no-take, no-anchor preserve that provides protection for species affected by recreational fishing and loss of habitat. This area was designed to border Tortugas North to form a large, ecologically-diverse seascape that connects inshore juvenile fish habitats to offshore adult spawning areas.

Scientists Conduct Long-Term Census of Tortugas Reef Fish

In 1999, scientists from the University of Miami and NOAA Fisheries began conducting visual surveys of Tortugas reef fish to study how zone protection affects certain fish. More recently, the Florida Fish and Wildlife Conservation Commission and other institutions have participated in the long-term study. Together, scientists have undertaken thousands of scuba dives to collect information on reef fish size, species, abundance and habitat preference. From these data, *relative frequencies of occurrence* have been calculated for reef fish in 1999-2000 and 2008 under three different levels of protection—Tortugas Bank (open to both commercial and recreational fishing), Dry Tortugas National Park (recreational fishing only), and TER (no-take). Relative frequencies estimate the percentage of fish in each different size category, allowing scientists to determine whether there have been shifts toward higher percentages of larger-sized fish under the different levels of protection.

<http://floridakeys.noaa.gov/>



Reserve Has Greater Proportion of Larger Fish Since Establishment

Black grouper is a key reef fish in the Florida marine ecosystem. According to this study, this fish is one of several economically important species that has responded positively to the protection afforded by the ecological reserve. Scientists compared the 2008 relative frequencies for black grouper to those from the pre-zone baseline studies (see graph below). In seven years, the proportion of larger (above minimum legal size of 60 cm or 24 inches) black grouper had increased significantly within reserve boundaries. In fact, in 2008, 64% of the fish in the TER population were larger than the minimum legal catch size, while only 36% of the fish in that same area were legal-size or larger before the reserve was established. This shift may contribute to the sustainability of the species since larger fish are known to spawn more eggs than smaller ones, which contributes to the species' reproductive success and future population.

Dry Tortugas National Park also showed a greater proportion of larger black grouper, 37.3% in 2008 compared to 8% in 1999. In the third area, the "open access" Tortugas Bank where commercial and recreational fishing takes place, relatively little change took place in the larger size classes of the black grouper population, 18.8% in 2008 compared to 25% in 1999. Overall, the percentage of larger black grouper was highest in the reserve—64% compared to 37% in the park and 18% in the open area. Yellowtail snapper and red grouper also showed similar trends under the three types of protection.

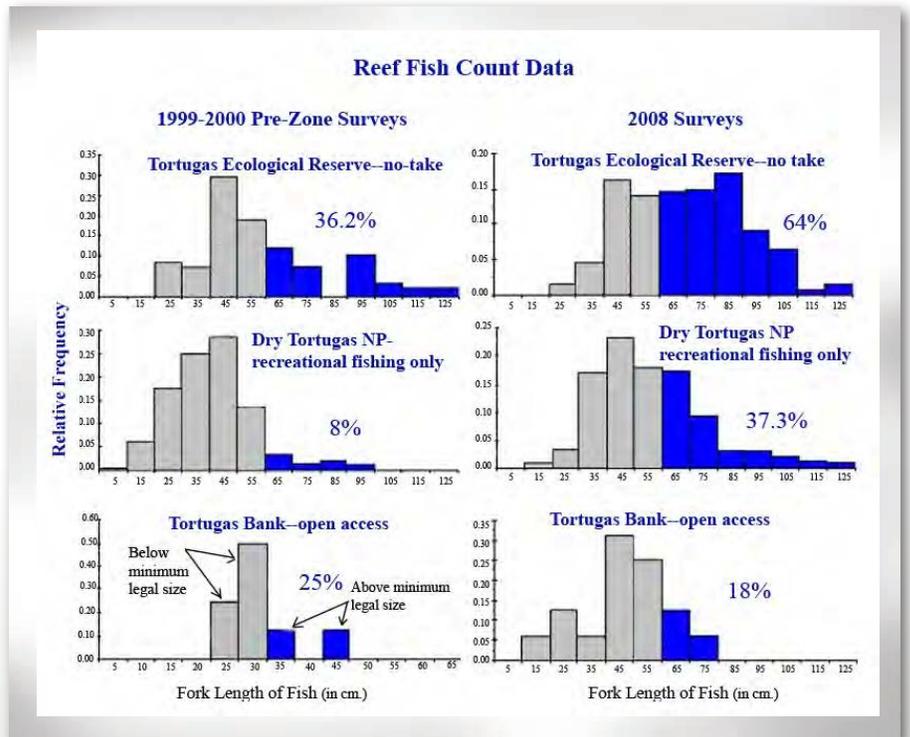
Reserve benefits for target fish species appear to be influenced by the degree of protection afforded in an area, with more protection producing greater benefits. Results from this study document that the large and ecologically diverse TER has had positive effects on populations of some targeted groupers and snappers, in conjunction with concurrent changes to State and Federal fishing regulations.

Acoustic Studies Determine Size of Home Ranges

Scientists also conducted acoustic studies to determine the home range size for several reef fish species. An animal's home range includes the area in which it stays during certain stages of its life cycle or for a portion of the year. Red and black groupers, yellowtail, mutton and gray snappers were fitted with acoustic devices to track their movements. The resulting data revealed that the home range for black groupers was approximately 0.70 square miles, while the range for red grouper was 1.2 square miles and 1.56 square miles for yellowtail. All three species remained relatively close to their "home" habitats, except during peak feeding and spawning times, when their habitat preferences varied. These habitat variations, which may involve leaving the protected areas, may make the species more vulnerable to fishing during those periods of their life cycle.

Reef Fish Populations Benefit from Large Ecological Reserve

The long-term census study shows that the TER has had positive effects on several reef fish by increasing the proportion of mature, larger-sized fish. Information from acoustic studies about the average size of home ranges of fish indicates that some reef species are afforded protection by the relatively expansive TER and adjoining Research Natural Area in the park. Highly protected zones that encompass large areas and include contiguous habitats are essential for supporting a healthy and diverse coral reef ecosystem with sustainable fish and invertebrate populations. For more information on zone monitoring and coral reef fish in the Tortugas, visit NOAA Southeast Fisheries Science Center's website at <http://www.sefsc.noaa.gov/species/fish/reeffish.htm>.



The majority (64%) of black grouper were larger than legal size in the TER in 2008. Figure: University of Miami Rosenstiel School of Marine and Atmospheric Science