Dry Tortugas 2007 Cruise

Details on NCCOS Project Explorer	**Track the NANCY FOSTER on NOAA Ship Tracker**	**Check Local Weather**

Cruise title: Comparative analysis of the function of disturbed and undisturbed coral reef and non–coral ecosystems in the Tortugas: Measuring the refugia effect of establishing a reserve.
Cruise dates: August 25–31, 2007
Cruise Number: NF–07–12–TER
Area of Operation: Tortugas Ecological Reserve; sailing from Key West, FL on the NOAA Ship NANCY FOSTER.

Cruise Objectives:

1. Divers will revisit 30 permanent sites and conduct fish surveys and benthic habitat surveys both on the coral reef and out onto the sand that borders the coral reef. These 30 sites were initially established in 2000, when the Tortugas Reserve was implemented by the Florida Keys National Marine Sanctuary, and have been revisited every year from 2001–2005.
2. Examination of impacts of shrimp trawling on soft–bottom habitats in the northern Tortugas area using drop cameras and nighttime beam trawling.
3. Quantification of the physical environment around the Tortugas banks using light profiles, installation of long–term temperature loggers, and an acoustic wave and current profiler.
4. Remote sensing for benthic habitat classification using drop cameras and acoustic bottom classification.

Personnel

NOAA/NCCOS:
Center for Coastal Fisheries and Habitat Research

- John Burke
- Brian Degan
- Don Field
- Mark Fonseca
- Brett Harrison
- David Johnson
- Amit Malhotra
- Greg Piniak
- Amy Uhrin
- Jenny Vander Pluym
- Shay Viehman
  (Chief Scientist)

NOAA/NCCOS:

- Ruth Kelty

NOAA NCCOS Center for Coastal Monitoring and Assessment's Biogeography Branch

- Kimberly Foley

National Park Service, Biscayne National Park

- Vanessa McDonough
- Shelby Moneysmith

Biogeographic Assessment of the Dry Tortugas

On this research cruise, we will continue an ongoing biogeographic assessment of the Tortugas Ecological Reserve in the Dry Tortugas, FL. The Reserve was implemented in 2001 by the Florida Keys National Marine Sanctuary; in the same year, CCFHR scientists established 30 permanent sites in the Dry Tortugas from which to examine changes in fish and coral reef communities resulting from implementation of the marine reserve. These study sites range from 54–103ft depth and are at the edges of the Tortugas Banks. Sites were selected to be at the edges of coral reefs in order to investigate energy flow across habitat boundaries. We have surveyed these sites annually from 2001 to 2005 and plan to revisit them this year.

For more information

- Ongoing Monitoring of Tortugas Ecological Reserve: Assessing the Consequences of Reserve Designation. M.S. Fonseca, Uhrin, A.V., Currin, C.A., Burke, J.S., Field, D.W., Addison, C.M., Wood, L.L., Piniak, G.A., Viehman, T.S., Bonn, C.S. *NOAA Technical Memorandum* NOS NCCOS 22, January 2006.
- Biogeographic Analysis of the Tortugas Ecological Reserve (includes link to report)
- NOAA Press Release: After Five Years of Protection, NOAA Marine Reserve Shows Increasing Numbers, Size of Fish
- Dr. Nancy Foster Scholarship Program

Photo from above Fort Jefferson, Dry Tortugas, Florida.
Photo credit: Michael O'Leary, U.S. Imaging, Inc.

Scuba

The use of SCUBA (Self-Contained Underwater Breathing Apparatus) has become an essential tool utilized by ecologists. For example, without the use of SCUBA, our scientists could not accomplish the goal of fish population assessments which are an integral component to our overall research plan.

There are, however, limits to the use of SCUBA with time-at-depth being the most critical limiting factor associated with its use. The use of oxygen-enriched gas mixes (i.e. NITROX) helps us to stay at depth longer than we could if we were to use air. Enriched gas is adding more oxygen to the mix while at the same time lowering the nitrogen content. On this cruise, we are using what is called a 32% mix: 32% oxygen, 68% nitrogen, versus what is normally found in air - 21% oxygen and 79% nitrogen - which enables us to stay at depth longer due to the lower nitrogen concentration in the mix. Nitrogen, while inert under normal atmospheric pressure, is absorbed into the diver's blood and tissues while at depth and can cause decompression sickness and narcosis.

Using a mix with less nitrogen reduces the potential for a diver becoming “bent” or “narc'd”; terms used in the diving community to describe these maladies. Using NITROX does not eliminate the possibility of the bends or narcosis, it simply reduces the potential for their occurrence. Using a 32% mix, for example, enables divers to stay at a depth of 80 feet for 50 minutes; using normal air, our bottom time would be limited to 40 minutes at the same depth. On the other hand, increasing oxygen content of our gas at depth can be dangerous as oxygen becomes toxic at too high a concentration. Therefore, oxygen toxicity also plays a role with the use of enriched mixes, however, by keeping the partial pressure of oxygen below critical limits during exposure, and by limiting exposure times to thirty minutes or less, the potential for oxygen toxicity is lessened.

Dry Tortugas Cruise Day 1 - August 25, 2007

Departing Key West,
photo by Brett Harrison

At 930 this morning, we departed Key West for the Dry Tortugas. The NOAA ship *Nancy Foster* had arrived at Key West earlier this morning after a continuous 2½ day transit from her home port of Charleston, South Carolina. Many of the scientists had driven 20 hours to Key West from the Center for Coastal Fisheries and Habitat Research in Beaufort, North Carolina.

During the eight hour steam to our sites in the Dry Tortugas, we unpacked scientific gear on the ship and readied the three small boats that are kept on deck for dive operations. Although storms were on the horizon around the ship during the transit, seas were calm.

Foster small boats on deck,
loaded with dive gear & ready to go.
Photo by Brett Harrison

Upon our arrival onsite, three of the *Nancy Foster*'s small boats were deployed off the deck at sites on the south side of Tortugas Bank. These three sites are outside of Dry Tortugas National Park and the Florida Keys National Marine Sanctuary's Tortugas Ecological Reserve. Almost every one of the 14 divers in the scientific party dove on shakedown dives. This was an excellent opportunity to test and become familiar with still and video cameras and underwater lights, and to refresh and calibrate fish survey skills. We will have four teams of divers this week, and shakedown dives are a good chance for scientists to rehearse the routine that will be followed underwater on later dives. Water temperature was a balmy 86° F.

Derelict lobster trap.
Credit: Amy Uhrin

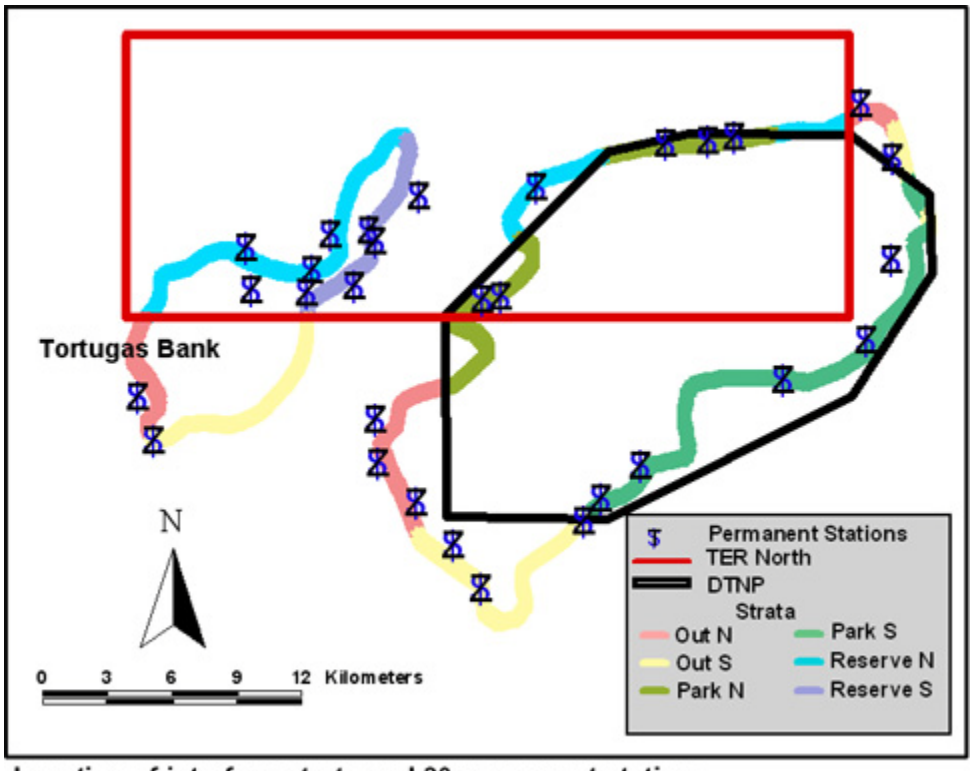
Another dive team observed marine debris on the reef. A ghost trap was seen along with some glass bottles. A ghost trap is a trap that cannot be located or recovered by the fisher because it has become detached from its buoy line and can continue to catch and kill fish. Our study sites had been randomly located at the beginning of the project in 2001 around the edges of Tortugas Banks. These are not recreational or commercial dive sites. The presence of marine debris at these rarely visited sites shows, unfortunately, how ubiquitous marine debris is.

It had been a long day and night operations were brief. John Burke, Amy Uhrin, and David Johnson lowered a video camera off the ship to observe soft sediment communities of algae and *Halophila* seagrass at several locations on the northern boundary of Fort Jefferson National Park. We are studying the effects of trawling on the soft sediment communities in areas that are trawled and areas that are not. Shrimp trawling is not allowed within the Park. During night operations, scientists deployed a small beam trawl off of the *Nancy Foster* to compare faunal communities of fish, shrimp, and other creatures in the same areas that the video camera surveyed earlier in the evening.

A spiny lobster on the reef.
Photo by Brian Degan

We had a great start to our busy week. We have 30 dive sites to fit in, and two were completed this evening. Because our dive sites are fairly deep, ranging in depth from 54–104 feet, divers can get in only a limited number of dives per day. One team of divers stays up to do night operations, which makes for a long day. We are all excited to be aboard the *Nancy Foster* and think this is going to be a great trip.

Today's website contributor and cruise Chief Scientist, Shay Viehman, checks out a red grouper.
Photo credit: Kim Foley



Location of interface strata and 30 permanent stations.

Dry Tortugas Cruise Day 2 - August 26, 2007

Continuing work at the Tortugas Ecological Reserve, part of the Long Term Agreement between the National Marine Sanctuary Program and the National Centers for Coastal Ocean Science.

Diver Mark Fonseca conducting a video survey of coral cover for comparison with our other technique of using digital still photos.
Photo credit: Shelby Moneysmith

At the end of our 30 m transect out onto the sand, we encounter a seagrass, called paddlegrass (*Halophila decipiens*). Finding these plants in 85 feet of water is a good sign, pointing towards a healthy ecosystem.
Photo credit: Shelby Moneysmith

In 1999 Dr. Nancy Foster, then the Assistant Administrator of the National Ocean Service, initiated a formal research agreement between two of NOS's program offices: the National Marine Sanctuary Program (NMSP) and the National Centers for Coastal Ocean Science (NCCOS). A shared goal of both NMSP and NCCOS is to effectively manage NOAA's National Marine Sanctuaries using the best available science and to utilize NOAA research capabilities, embodied in NCCOS, to assist in meeting this goal.

As we sail through the Tortugas Ecological Reserve, we are aware that our vessel is named after the late Dr. Foster whom many of us knew personally. We think that she would be proud of the breadth and magnitude of research carried out on board her namesake, in support of the agreement which she created.

A major goal of the Tortugas Ecological Reserve (TER) is to protect special habitats of adult fish and to reduce fishing effort in critical areas. It is expected that this will help conserve spawning stocks of these fishes. In general, the more time an adult fish spends inside the boundary of the TER, the greater degree of protection it is afforded. Size and scale then become important elements of Reserve design. At some threshold size, most species will not be spending enough time under protection if the Reserve is too small. The Tortugas Ecological Reserve (TER), implemented in July, 2001, is the largest reserve (800 nm^2) under U.S. jurisdiction in the western central Atlantic

Ocean and offers the best opportunity to study the benefits of reserves to fisheries species and to habitat health.

Along one of our transects, divers encounter a juvenile red grouper. Photo credit: Brian Degan.

While preparing to leave the bottom, a school of barjacks visits the divers. Photo credit: Brian Degan.

Our work in the TER addresses fundamental questions regarding the habitat basis of the Reserve concept. We are examining habitat utilization of fishes working both on and off the reef, focusing on the deep edge of the reef where it transitions into sand. We do this because habitat edges are often sensitive to ecological change. We seek to determine the functional scale of coral reef ecosystems to provide information on the necessary scale of reserves. One method is visual surveys and diver aided–net collections in a variety of habitats.

Our first dive today was on a beautiful reef spur. It rose up from a depth of 85 feet at the sand to 69 feet on top of the reef. The reef itself was very up and down, with bridges of reef that formed tunnels through the reef. From a distance, the tunnels would link up with the open water behind. The reef looked like a large creature, with a set of huge light green eyes peering down at you. The spur was about 70 feet wide, before dipping down to a sand channel and it was teeming with fish: red grouper, gray angelfish, and a myriad of smaller, cryptic, brightly colored reef fish.

Diver Don Field relaxes at the 20 foot safety stop. Divers must hang for 3 minutes at this depth to allow their bodies to lose excess nitrogen. Photo credit: Shelby Moneysmith

Chief Bosun Greg Walker hangs in bosun's chair to re–align a towing block on the A–frame. Photo credit: Amy Uhrin.

Our second dive of the day was at a less remarkable site. Low relief pavement rose slightly out of the sand but was colonized by many soft corals, some small hard corals, and much algae. Far fewer large fish were seen at this location, which is not surprising given the lack of physical structure which attracts them.

The deck crew and officers load and off–load the three smaller vessels at least twice a day, rotating the dive teams out to the site with clock–like precision. The Captain swings the *Nancy Foster* around on a dime to give us a lee wind so the small boat is not being banged against the hull while we board. It is a very impressive operation and we are getting spoiled, having the boats brought along side for effortless embarking and disembarking. The seas are very calm and we are hoping our shortened cruise (the *Nancy Foster* was delayed a week with computer problems) will have such great working conditions every day.

Today's website contributor—M. Fonseca: checking his dive computer as he descends to the study site; note the small reserve scuba tank, this is standard practice for teams to carry an emergency supply to the seafloor. Photo credit: Shelby Moneysmith.

For more information

- Ongoing Monitoring of Tortugas Ecological Reserve: Assessing the Consequences of Reserve Designation. M.S. Fonseca, Uhrin, A.V., Currin, C.A., Burke, J.S., Field, D.W., Addison, C.M., Wood, L.L., Piniak, G.A., Viehman, T.S., Bonn, C.S. *NOAA Technical Memorandum* NOS NCCOS 22, January 2006.
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Dry Tortugas Cruise Day 3 - August 27, 2007

Cleaner shrimp on anemone.
Photo credit: Kim Foley

Our cruise provides coastal managers with scientific information and tools to make informed stewardship decisions about one of NOAA's protected areas—the Florida Keys National Marine Sanctuary's Tortugas Ecological Reserve. The 800 nm² Tortugas Ecological Reserve (TER) was designated in July 2001 to protect fish and coral reefs from fishing. It is NOAA's responsibility to ensure that the closure is doing what it was designed to do—protect and rebuild fish stocks. In doing this, NOAA strives to balance society's environmental, social, and economic goals.

Today we completed an additional six dives, collecting data that will allow us to compare fish and fish habitat between areas within and outside protected areas. We also collected data on algae and seagrass communities to compare the condition of trawled areas outside TER to areas within TER that are protected from trawling.

Divers Jenny Vander Pluym and Brian Degan reel in the transect tape after completing a survey.
Photo credit: Vanessa McDonough

By 8:10 am, the *Nancy Foster*'s capable crew had launched the first of our dive teams in a small boat, and the other teams followed in quick succession. The sun was shining at the surface, but down at 100 feet the visibility was limited to 35 feet. As we approached the reef, a group of about 30 grouper scattered. These slow growing, large fish are named for their habit of gathering in groups to mate, often a few days before or after full moons in the summer. With the full moon only two days away, it is likely that we had interrupted such a gathering.

Our bottom time is limited at 100 ft, so we immediately went to work. A diver laid out a 30 meter transect tape, recording the types and sizes of fish observed one meter to either side of the tape, and taking a picture of the bottom every meter. A second team followed, documenting all coral, algae, and invertebrates in each of four 1 meter square quadrats randomly spaced along the transect line. This information tells us about the condition of the fish and the habitat. In addition to the grouper seen at the start of the dive, we were treated to a five foot goliath grouper that swam across the transect line. In much of the U.S., groupers that large are rare outside of protected areas.

Ruth Kelty counts fish, Greg Piniak takes benthic photos, and Brett Harrison videos the transect.
Photo credit: Kim Foley

Between dives, all three boats and their dive teams returned to the *Nancy Foster*. The scientists downloaded photos, entered data, and prepared the cameras, tanks, and data sheets for the second dive. Our second dive was on the edge of 'The River', a wide swath of sand that runs between the two bank formations in Dry Tortugas. The reef topography was low with but a few coral heads or soft corals growing higher than one meter above the sand. Fish were mostly small, as is often the case when there is not a lot of physical structure. A curious black grouper watched us work, swimming along the transect line, and toward our cameras.

Brett Harrison installs a manta to attach a temperature logger.
Photo credit: Kim Foley

We also deployed a temperature logger that will provide a long term record of water temperatures. Prolonged periods of warm water can cause corals to expel their symbiotic algae. Commonly called bleaching, this phenomenon is expected to occur more frequently with rising sea surface temperatures. Bleaching is a growing threat to U.S. coral reef ecosystems.

With another six reef sites examined, the scientists turned their attention to the soft sediment communities in TER. Unlike the reefs, which are dominated by the hard structures for which they are named, the soft sediment communities are dominated by low relief algae and seagrass. Outside TER, these areas are trawled for the pink shrimp that live close to the bottom. While we need to dive on the reef to accurately record the abundant and diverse species found there, the soft sediment communities are simple enough that observations with a video camera can be used to observe major changes in these communities. Working aboard the ship, rather than by SCUBA, allows us to cover larger areas more quickly. We also used a beam trawl to sample the fish and invertebrate populations.

Today's website contributor, Ruth Kelty, surveying fish.
Photo credit: Kim Foley

Dry Tortugas Cruise Day 4 - August 28, 2007

Today's website contributors, Greg Piniak (foreground) and Brett Harrison, conducting a transect survey.
Photo credit: Kim Foley

Today began with a lunar eclipse just before sunrise—a treat for those willing to wake up early enough to see it. Many of the scientists and crew were awake to see the eclipse, due to our early dive operations. We have been concentrating operations on West Tortugas Bank, which contains many of our sites within the Reserve. Today we are moving operations east to Dry Tortugas National Park. We will be working a long day by running three dive cycles rather than the usual two. We can increase our workload now that everyone is up to speed, comfortable and working well together. It is a good opportunity to make up for time lost in port due to mechanical issues with the ship.

A colony of sun zoanthids.
Photo credit: Amy Uhrin


Two red grouper giving each other "the eye".
Photo credit: Shay Viehman

Morning dives took place on the southwest corner of the east bank at three unprotected sites. While not as picturesque as some of the sites in the Reserve, this morning's sites had moderate relief and plenty of fish. One of the ship's officers, ENS Lecia Salerno, helped out as an extra safety diver on one of our deeper dives. The morning work went smoothly, the weather cooperated, and there was little current. One team had trouble retrieving its anchor at the end of the dive, but that only served as a welcome excuse for two more of the ship's divers—Lt Sarah Mrozek and Lt (jg) Mike Davidson—to get in the water and give a hand. It is worth mentioning how well the ship's crew works together to make everything happen for us. They are an integral part of all operations and are to be equally credited for our successes.

Our team (Kelty, Foley, Harrison and Piniak) was out of the rotation for the afternoon dives. We were looking forward to some rest before taking our turn on night operations. The Park contains some amazing dives, but this afternoon's sites are not among them. We are always very careful with our buoyancy to avoid damaging the reef, but this afternoon's dive requires care for a different reason. Some of the sites along the northern edge of the Park contain very soft muds, and the slightest disturbance of the bottom causes the sediment to swirl up into the water, reducing visibility in the blink of an eye. The three teams that did dive these sites kept out of the mud. They found low–relief rubble on the bottom, but the coral cover, though low, was higher than expected. Several teams saw black coral and some interesting zoanthids. One of the dive teams had a loggerhead turtle swim overhead.

The drop camera.
Photo credit: Kim Foley

Scientist Amit Malhotra manages data collection during drop camera operations.
Photo credit: Amy Uhrin

Evening operations of drop camera work and beam trawl are headed up by scientists John Burke and Amit Malhotra. Drop camera deployment consists of lowering a camera to within a foot or two of the bottom and observing and recording 200 meter transect sections. This is a delicate operation that requires our 170 foot ship to maintain steerage along a distinct line at a snail's pace of less than 1 knot. Thanks to a skilled and well–coordinated captain and crew, we have again captured quality data.

Last night's beam trawl was highly successful as well, capturing many species of flounder, crab, small fishes, shrimp, and more. We even captured a mantis shrimp—named for its similarities to the praying mantis in speed and hunting prowess. Mantis shrimp employ their front claws in lightning–quick attacks which have earned them the nickname "thumb splitters."

We continue to make adjustments, learning from the previous nights' trawling to increase our effectiveness. The pressure is on our team tonight to keep up the good work.

Dry Tortugas Cruise Day 5 - August 29, 2007

Don Field completes a fish survey at the end of the 30th transect.
Photo credit: Shelby Moneysmith

A view of the NF–2, one of the small boats from which dive operations are executed (note the "diver down" flag), with the Nancy Foster *in the background.*
Photo credit: Shelby Moneysmith

Day five of the cruise began with beautiful weather. Many eager cruise participants were ready to kick off the day before the sun rose. Cruise operations began as usual with three dive teams deploying in the morning right after breakfast. The morning's sites included two shallower sites (54 and 61 ft), and one deeper site (97 ft). On the bottom, one team saw mutton snapper and several species of grouper, which disbanded as the team of scuba divers began their survey. Another team observed many juvenile groupers. Increased abundance of juvenile groupers is a positive sign, indicating healthy levels of reproduction of these heavily harvested fishes.

Many of today's sites were within Dry Tortugas National Park. This year, the Park has established a no–take Research Natural Area (RNA). As the name implies, the RNA will be used for non–extractive research and monitoring activities. Five of CCFHR's 30 sites lie within the RNA boundary. This gives us the opportunity to compare reef communities at these sites before and after implementation of the no–take RNA. Unlike Tortugas Ecological Reserve, a limited amount of fishing is permitted in the Park outside of the RNA. Establishment of the RNA is intended to benefit fish and invertebrate populations not only within the RNA, but within the rest of Dry Tortugas National Park, and surrounding waters.

Mark Fonseca collects a sample of macroalgae that will be assessed for the presence of ciguatera–causing dinoflagellates.
Photo credit: Shelby Moneysmith

During the day's dive operations, teams completed the usual fish, photo, and video surveys. In addition, they added a new task to collect macroalgae. At each site, a diver collected a random sample of macroalgae from the seafloor and placed it in a resealable plastic bag filled with seawater. Back on the *Nancy Foster*, the bag of macroalgae was shaken up to release any small organisms that might be living upon the algae. The water was filtered through a small sieve so that only organisms of small size were collected. The filtered water will be returned to scientists at CCFHR to look for tiny organisms called dinoflagellates, some of which produce the toxin that is responsible for ciguatera poisoning. These CCFHR scientists are interested in assessing the spatial distribution of ciguatera–causing dinoflagellates in Florida.

Our surveys require not only knowledgeable and competent divers, but also a wide range of equipment. On a typical dive, team members are equipped with still cameras, video cameras, dive computers, pop–floats ('safety sausages') and reels, a back–up air supply, clipboards, and tools. The gear is split up among team members. The video and still cameras used to collect video and photo footage are housed in watertight cases. During today's dives, two teams were reminded of the challenges that can arise when using electronic equipment underwater. Because an underwater housing unit is not foolproof, divers must make sure it is well sealed. They must be attentive to any signs of leakage, such as bubbles at the seals or condensation inside the housing. Unfortunately, today we had leaks in both still and video camera housings, a rare occurrence. Divers returned the malfunctioning gear to the surface, where it was dried and assessed for repairs.

David Johnson deploys the drop camera.
Photo credit: Amy Uhrin

A flame box crab (*Calappa flammea*) collected in the beam trawl.
Photo credit: Brett Harrison

With seven dives completed today, all 30 of the survey sites have been visited. All survey activities were reviewed to determine which sites needed revisiting to obtain a complete set of data. Problems with equipment, environmental conditions (i.e., strong current or poor visibility), or limited bottom time are all factors that can account for incomplete surveys at some sites. We will revisit these sites tomorrow to complete the surveys.

Between dive operations this afternoon, the science party and ship's crew surveyed more drop camera sites. Drop camera surveys are used to ground truth the acoustic seafloor classification and characterize the habitat sampled by beam trawls during evening and night operations. Deployment and recovery of the drop camera and beam trawl from the ship requires extensive support from the ship's crew members. Like all previous nights, the crew will work late into the night operating the A–frame from the ship's stern in hopes of finishing up the beam trawl sites. This operation takes quick and concise communication from the lab, bridge and deck.

Today's website contributors are Vanessa McDonough and Shelby Moneysmith from Biscayne National Park. Both have served as photographers during dive operations.

Related Links

- Biscayne National Park: Science in the Park
- Research and Monitoring in the Florida Keys National Marine Sanctuary

Dry Tortugas Cruise Day 6 - August 30, 2007

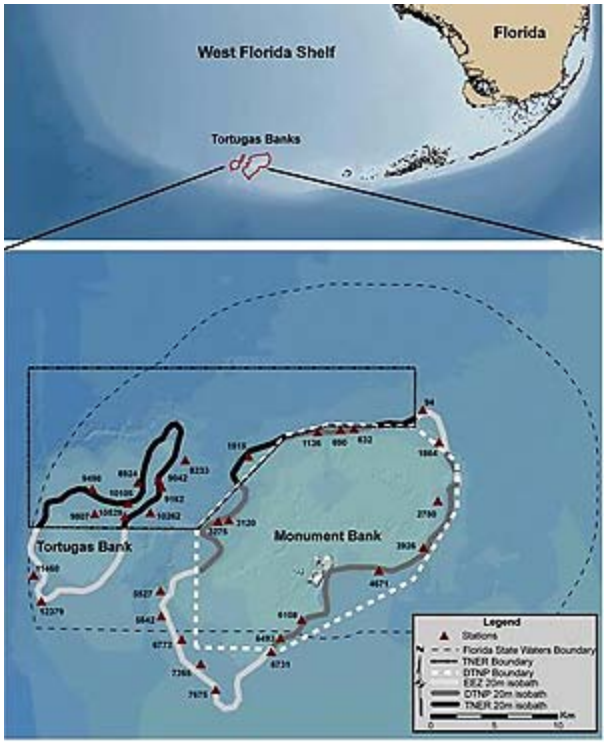
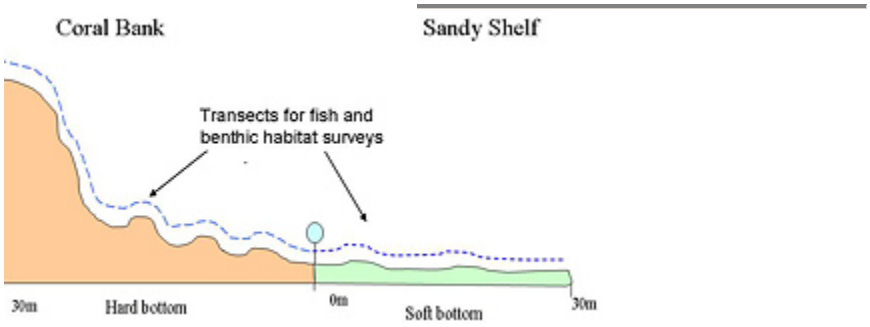


Chart of the Tortugas Banks' management zones and the interfaces between bank and shelf. Ten stations were randomly selected from the interfaces in three management zones: Dry Tortugas National Park, Tortugas Ecological Reserve, and the U.S. Exclusive Economic Zone

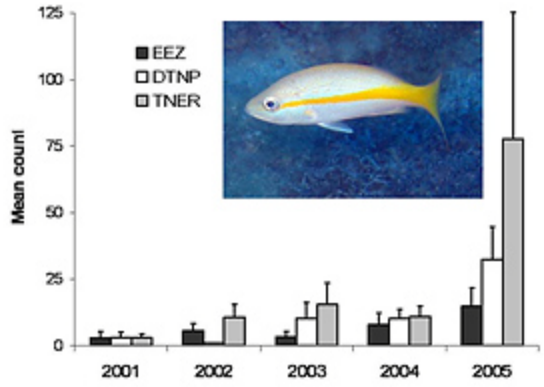


Cross-section of an interface station

Tortugas Ecological Reserve is a bold attempt to manage our coastal resources in a sustainable way. The Reserve encloses the northern portion of Tortugas Banks, located at the southern margin of the West Florida Shelf and 60 nautical miles west of Key West. The remote location and proximity to ocean currents that merge to form the Florida Current, make the Tortugas an excellent location for a reserve whose biological production can spill over to other areas. It is believed that the reproductive output from the Tortugas can rejuvenate fish populations in the Florida Keys, where intense fishing pressure has reduced most exploited stocks far below their sustainable level.

To evaluate the impact of the Reserve on exploited fishes, we have conducted surveys in three areas that differ in the fishing pressure they receive. Since the Reserve's establishment in 2001, ten stations have been established and sampled in each of three management areas. The three areas are Tortugas North Ecological Reserve (TNER, where all fishing is prohibited), Dry Tortugas National

Park (DTNP, where commercial fishing and spearfishing are prohibited), and the Exclusive Economic Zone (EEZ) of the U.S. (where both commercial and recreational fishing are allowed). By comparing how populations vary over time in these areas, we can gauge the performance of the Reserve. Our sampling is focused on an ecologically sensitive habitat of the benthic landscape, the transition between the coral banks and the sandy shelf, allowing us to monitor both reef and shelf communities. These communities are linked ecologically; many of the fishes that shelter on the reef during the day feed on the sandy shelf during the night.



Mean counts of yellowtail snapper (*Ocyurus chrysurus*) from Tortugas North Ecological Reserve (TNER), Dry Tortugas National Park (DTNP), and the Exclusive Economic Zone (EEZ). (J.S. Burke, NOAA CCFHR, unpublished data)

A goliath grouper at one of our sampling sites. Photo credit: Brett Harrison.

Today's website contributor is John Burke, a Research Fisheries Biologist at the Center for Coastal Fisheries and Habitat Research, pictured here preparing to board a small boat after a fish survey. Photo credit: Amy Uhrin.

Our results suggest a rapid positive response by commercial species to the protection provided by the Reserve. Yellowtail snapper provide the best evidence for positive impact of the Reserve. This species is common in the area, grows rapidly, matures early, and is specifically targeted by commercial fishermen. Our counts over the five years of this survey show that yellowtail numbers have increased significantly, and that their abundance in the Reserve is significantly greater than in the Park or the EEZ.

This year's survey indicates that the condition of many commercial fish stocks is improving locally. The abundance and size of exploited species at our survey sites are increasing. Increases are evident for scamp grouper, mutton snapper, red and black groupers, as well as yellowtail snapper. Several rare species absent from previous surveys were observed. The goliath grouper, a threatened species which can reach a length of six feet and 800 pounds, was observed at several of our stations. The threatened Nassau grouper was observed for the first time at two stations.

The full impact of the Reserve is likely to take decades to unfold. It will provide an excellent opportunity to further our knowledge of the workings of marine ecosystems. The Reserve has been designed to protect both reef and shelf habitats while preserving their ecological linkage. Exploited fish populations may be enhanced by improved habitat conditions in their shelf feeding grounds. We hope to determine the contribution of habitat improvement relative to reduction in fishing mortality as determinants of Reserve success. Tortugas Ecological Reserve is an opportune location to find answers to such questions, as monitoring continues to document its long term benefits.

Dry Tortugas Cruise Day 7 - August 31, 2007

NF–4 departing the *Nancy Foster* to head to a dive site. Photo credit: S. Viehman

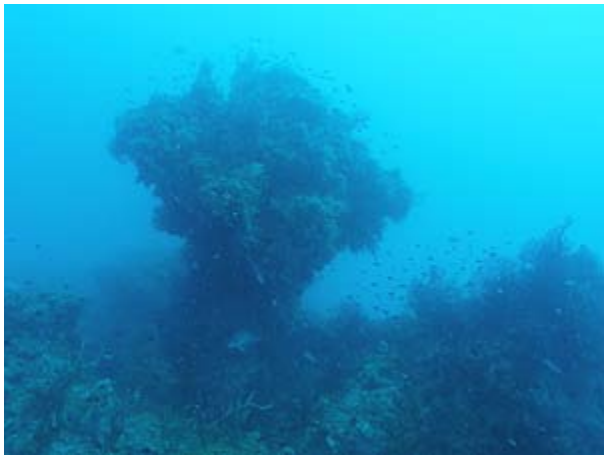
We have had a successful trip despite reduced days at sea because of unanticipated ship repairs. We were fortunate to have calm seas and an enthusiastic, hard-working group of scientists and ship's crew.

Most of our final day was spent in an eight hour transit back to Key West from the Dry Tortugas. We unloaded all of our considerable scientific gear from the ship and began a 20 hour drive back to CCFHR in Beaufort, NC. We will analyze the data from the reef fish surveys, benthic habitat surveys, beam trawls, and acoustic benthic habitat classification to gain a better understanding of the effectiveness of the Florida Keys National Marine Sanctuary's Tortugas Ecological Reserve in the six years since it was established. Among the goals of the Reserve are protecting ecosystem structure, function, and integrity, improving non–consumptive opportunities, improving fishery yields, and increasing knowledge and understanding of marine systems.

Red grouper.
Photo: K. Foley

Black coral.
Photo: S. Viehman

Reef sponges.
Photo: S. Viehman



Unusual reef structure with many small fish.
Photo: S. Viehman