Dry Tortugas 2008 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: July 25–August 5, 2008
Cruise Number: NF–08–11–TER
Area of Operation: Tortugas Ecological Reserve; sailing from Key West, FL on the NOAA Ship NANCY FOSTER.

Cruise Objectives:

1. Divers will revisit 20 permanent sites within and outside of the Tortugas Ecological Reserve and conduct fish surveys both on the coral reef edges
2. Remote quantification of fish communities and habitat using multibeam sonar, split–beam sonar, and remote habitat classification, and drop video cameras.
3. Retrieval of temperature loggers installed in 2007.
4. Examination of impacts of shrimp trawling on soft–bottom habitats in the northern Tortugas area using drop video cameras.

Personnel

NOAA/NCCOS:
Center for Coastal Fisheries and Habitat Research

- John Burke
- Brian Degan
- Brett Harrison
- John Hackney
- Don Field
- Roger Mays
- Greg Piniak
- Chris Taylor
- Amy Uhrin
- Shay Viehman
  (Chief Scientist)

NOAA/NOS:

Coral Reef Conservation Program

- Lauren Chhay

NMFS Habitat Restoration Division

- Sean Meehan

California State University, Northridge

- Abigail Poray

Cape Fear Community College

- Erik Ebert

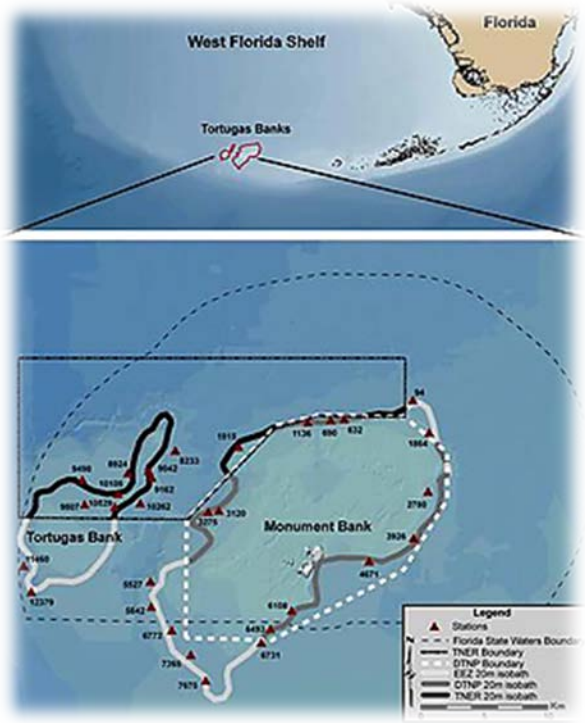
Duke University

- Karen Neely

Dry Tortugas 2008 Cruise, day one: July 25, 2008

Today's notes | Featured scientists & crew | Today's ship tour

Our work in the Tortugas Ecological Reserve (TER) addresses fundamental questions regarding the habitat basis of the reserve concept. We are examining how fish use this habitat by sampling both on and off the reef, and 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 also seek to determine the area required for healthy coral reef ecosystems to provide information on the necessary size? of reserves. In order to assess the effectiveness of marine protected areas such as the TER, scientists survey 30 permanent research stations distributed between the TER within the Florida Keys National Marine Sanctuary, the Dry Tortugas National Park, and adjacent unprotected areas. This is the eighth year of this mission.



The first day of the 2008 Dry Tortugas mission began bright and early in port at the U.S. Coast Guard Sector in Key West. The NOAA ship NANCY FOSTER arrived at Key West on July 23 after a continuous six–day transit from Woods Hole, MA. The science party, many of whom had driven 20 hours to Key West from the Center for Coastal Fisheries and Habitat Research in Beaufort, North Carolina, arrived in the late afternoon of July 24.

At approximately 8 a.m., crew and scientists began loading equipment, including a jet boat, onto the NANCY FOSTER via shipboard crane. The jet boat will be used as a diving platform. The science party then began the task of unpacking, setting up, and testing their respective gear.

At 2:30 p.m., we left port just ahead of a thunderstorm. We managed to stay ahead of the storm, and experienced calm waters the entire way out of port.

During the eight–hour steam to our sites in the Dry Tortugas, the science party unpacked scientific gear on the ship. The crew readied the three

small boats kept on deck for dive operations, and completed other necessary preparations for tomorrow's diving and operations. Crew conducted a safety meeting for the science party, which was immediately followed by a dive safety meeting and a scientific plan meeting. The dive teams for this mission will consist of two–member teams. One diver will photograph the transects; a the second will be counting fish. More detail about diving operations on board will be covered in the log for Day 2.

After dinner, the dive plan for Day 2 was posted. In addition, the morning's science divers prepared their respective gear and loaded the boats in anticipation of an early start tomorrow.

Meet the Crew and Scientists

This mission, we have a full ship. All 37 berths are occupied. The ship's crew is comprised of NOAA Corps officers, engineering officers, deck crew, electronics crew, stewards, and survey technicians. Each day we will feature three to four members of the crew and science team via short bios that explain their contributions to this mission. Today, we'd like to introduce you to Commanding Officer (CO) CDR Ralph Rogers, Chief Scientist Shay Viehman, and Principal Investigator John Burke.

CO Ralph Rogers

CO Rogers, a member of the NOAA Corps for 20 years, has been in his position aboard the NANCY FOSTER since January of 2008. The chief duties of the CO include overseeing the safety of the ship and its crew, and ensuring that the ship's mission is completed. His typical day includes a four–hour watch on the bridge coordinating with the chief scientist regarding the daily science plan, responding to any shipboard issues that arise, dealing with external issues, and coordinating the ship's schedule of future missions.

Chief Scientist Shay Viehman

Shay has been with NOAA for four years, but has been on this mission for six years. Before working for NOAA, Shay participated in this cruise while working for the National Park Service. Her interests lie in the spatial relationship between fish and habitat, particularly in how the complexity of benthic habitat affects the reef community.

During the mission, Shay acts as liaison between the ship's crew and the scientific party, working out details of the daily scientific plan to

coordinate with ship operations. She also works closely with the divemaster to create the daily dive plan.

PI John Burke

John also has worked with NOAA for 20 years, and has worked on this project since it began in 1999.He is particularly interested in juvenile fish, and the interactions between fish and habitat. He will be participating as a fish counter on his dive team.

Many thanks to CO Rogers for the tour of the bridge.

Tour the NANCY FOSTER

Bridge

Navigation and control of the NANCY FOSTER originates on the bridge. This ship is entirely electrical and features an integrated bridge.. For that reason, many of the key pieces of navigational equipment are found in duplicate. The ship has radar, electronic chart display information systems (ECDIS), echo depth sounders, gyro compasses, and differential Global Positioning System (GPS). When in transit, the ship can be placed on auto pilot.The ship's computers monitor the course and make adjustments accordingly. Operations such as docking and small boat deployment must be controlled manually. These operations can be run from four separate locations on the bridge—one in the forward bridge, one in the aft, and one each on the port and starboard bridge wings. The latter provide better views for docking and departure, or when the ship is deploying one of the dive boats over the side.

Many other pieces of equipment on the bridge monitor the progress of the ship and ship functions, including the engine system and status, and the fire panel. The bridge also has several means of communication, both within the ship and external to the ship. The CO can even text other ships via the radar system. The emergency communications panel includes several specialized pieces of equipment that receive auto updates on weather, oil spills, other ships in distress, etc. In addition, the NANCY FOSTER has four separate ways it could send a distress signal, if necessary.

The NANCY FOSTER also sends out basic hourly weather data; acts as a mobile weather platform and, in effect, serves

to improve forecasts provided to the ship. Every six hours, the ship provides detailed weather reports back to the mainland.

Dry Tortugas 2008 Cruise, day two: July 26, 2008

Today's notes | Featured scientists & crew | Today's science

Today we started our diving operations. All of our sites today occurred in the exclusive economic zone, located outside the Dry Tortugas National Park and Tortugas Ecological Reserve (TER).

We completed nine dives today, including one under the ship to secure the signal beam transducer. This piece of equipment differentiates between seafloor bottom types such as soft bottom sand versus hard bottom coral. It is dropped through the ship's moon pool, an opening that runs from the deck through the hull, giving access to the water below. This dive will enable us to use the transducer to collect data starting tomorrow. For more information on the transducer and the data it collects, see the 'Focus on the Science' on day four.

Today's station dives went well. Divers completed their surveys, and maintained good communication. Operations progressed smoothly for both the science team and the crew. During one survey, scientist Sean Meehan observed a Nassau Grouper that appeared to be approximately seven pounds. This is significant because this species' population, like other groupers, is considered to be in decline, partly due to pressures from overfishing. Finding a grouper of that size, particularly in an area open to fishing, is a sign that the protections now in place for this species are working. Marine debris was also noted by several divers today. Much of it appeared to be related to fishing. A great deal of line and a derelict lobster trap were two items spotted by our divers.

Last night, the survey team began the nightly operations mapping high–resolution bathymetry using multibeam sonar, and using split–beam sonar to survey fish communities. The multibeam sonar shows the complexity of the seafloor. It also provides a 3–D relief of the seafloor similar to a topographic map of land. Sonar operations, primarily carried out overnight, will impact selection of future dive sites for this project. Conductivity/Temperature/Depth (CTD) measurements will be taken throughout the cruise to determine the sound velocity profile (sound dissemination and variability) through the water column. These data are necessary to run multibeam operations. We will cover our survey operations in more detail in the 'Focus on the Science' portion of day four.

Tomorrow, we anticipate another full day of diving. We will

also begin drop camera operations and signal beam transducer operations.

Meet the Crew and Scientists

XO LT Dan Simon

XO Simon has been in the NOAA Corps for seven and a half years, and joined the crew of the NANCY FOSTER in February, 2008. The XO is the voice of the captain. He executes the captain's commands; and is involved at some level in all major operations on board. His primary duties include all personnel and safety issues. A typical day on this mission includes making the rounds each morning to ensure everything is working properly, manning lines for small boat launches, acting as coxswain for some small boat operations, a four–hour watch on the bridge, and completing a few hours of administrative work. He is also a diver and will likely participate in a few dives with the science party.

Chief Engineer Tim Olsen

Chief Engineer Olsen has been with NOAA for six years and has been with the NANCY FOSTER since 2003. As Chief Engineer, his primary duty is to ensure all mechanical, electrical, and propulsion systems are in working order. His typical day during this mission will entail two four–hour watch shifts in the engine room, during which he logs data such as temperature and pressure for all equipment that is currently running. He also coordinates all shipboard work and repairs and ensures regularly scheduled maintenance is occurring during the watch. In addition, he will assist with small boat operations.

Dive Master Roger Mays

Roger has been the Unit Dive Supervisor (UDS) for the CCFHR since January 2007. He is also the divemaster on site for this mission. Roger's primary duties as divemaster are to ensure the safety of all divers during all dives. He coordinates with Shay to create the daily dive plan. Shay lays out the science she hopes the teams will accomplish each day, and Roger reviews the plan for efficiency and safety.

Focus on the Science

Diving

Diving is an integral part of our mission, and safety is an integral part of our diving operations. Our chief scientist, divemaster, and crew work very closely to achieve the science and safety goals of each dive.

Our dive operations employ many safety measures to protect both our mission and our divers. We always employ the buddy system when diving. Frequent communication between divers helps ensure they remain safe and in the appropriate vicinity of each other. Divers each have a second breathing apparatus called the *standard octopus*. The mouthpiece allows divers to pass air to each other, should one diver run out of air. If dive conditions are considered unsafe, or if divers become separated mid–dive, .a dive will be cancelled. The coxswains on each boat have a *diver recall* that is used in an emergency. When a bell is sounded underwater, the diver knows he or she should stop, collect their gear, and return to the surface. If a siren is sounded, divers must leave their gear and return to the surface immediately. Neither recall excuses divers from the required three–minute safety stop that is necessary to prevent decompression sickness when diving at these depths. The NANCY FOSTER also is equipped with emergency oxygen to treat dive–related illness until the victim is transferred to a land–based dive chamber. Our aim is a clean safety record for this mission. The science is second to the safety of the science team and crew.

Aside from safety, our highest priority is to effectively meet the science mission through our diving operations. Daily dive plans are posted each evening; the plan tells the divers which teams will visit which stations, the maximum depth at that station, and which boat they will use to reach their site. The science party is divided into five dive teams. Each morning,

members of the science party scheduled to dive that day meet for a daily dive brief. The brief covers safety, the general plan for the dives, and any issues or changes that have come up after the previous day's dives. Prior to each dive, divers are responsible for readying their dive gear and loading it into the appropriate boat. After each dive, they must clean their gear and file data. Each boat makes two to three trips per day, so divers must remove their equipment to prepare for the next dive team using that boat.

Divers will each complete two to three dives per day. During this mission, divers will be visiting the 30 established stations for this project. Sites are in the TER, which is closed to fishing; the DTNP, which is limited to recreational fishing; and the U.S. exclusive economic zone which is open to all fishing, including commercial. Each of the established transects cover the transition from reef to sand, since the mission is interested in the interactions between fish and habitat. Thus, at each station, one diver is responsible for photographing the seafloor habitat, and the second diver is responsible for counting and identifying fish along the same transect.

Dive teams are deployed on small boats from the NANCY FOSTER three times each day: Dive teams deploy at 800, 1200, and 1400. Once on the boats, the dive teams locate their assigned station by using GPS. Scientists drop a marker buoy in the sand near the transect and descend to the site. On the bottom, the divers look for the manta, which is used to mark the site. Both divers start at the station and complete their first survey up onto the reef, perpendicular to the reef edge. Once completed, divers do another survey at the site, but this time heading the opposite direction into the sand, again perpendicular to the reef edge.

The fish counter begins first and attaches their measuring tape to the manta. As they swim the transect, they unroll the tape and count and identify fish. The photographer follows a short distance behind, taking a photo of the seafloor at each meter mark of the tape. The photographers also take panoramic shots of each station at the beginning and ending points of each transect. Photos are standardized; the vantage point of each photo is straight down from above. A metal rod attached to the camera housing ensures a standard distance from the seafloor.

Once back on the NANCY FOSTER, the teams download their images and file the fish census sheets in station–specific folders. These data will be analyzed at a later date.

Dry Tortugas 2008 Cruise, day three: July 27, 2008

Today's notes | Featured scientists & crew | Today's ship tour

Today our crew conducted diving operations in the Tortugas Ecological Reserve (TER). A major goal of the TER is protecting critical coral reef fish and habitats that could help conserve fish spawning stocks. In general, the more time adult fish spend inside the TER, the greater the degree of protection. Therefore, size and scale are important elements of Reserve design. If the Reserve is too small, most species will not spend enough time under protection. At 800 square nautical miles, the TER is the largest reserve under U.S. jurisdiction in the western central Atlantic Ocean. Implemented July 2001, it offers an excellent opportunity to study reserves' benefits reserves to fisheries species and habitat health.

We completed nine dives today, with dive teams deploying at 8 a.m., 12 p.m., and 2 p.m. This will be our standard diving schedule for the next several days. In addition, we started using our groundtruthing drop video camera (QTC) this afternoon. Unfortunately, the best pre–cruise gear testing does not preclude us from running into unanticipated issues in the field. During our first drop camera operation this afternoon, our camera inexplicably flooded and was ruined. We will try again tomorrow with the backup video camera.

Today's station dives were successful. Several scientists reported seeing *Halophila* seagrass in the sand at reef edges on their sites. The level of seagrass cover observed is what one could expect to see in an area experiencing increased fish biomass. It may indicate that the TER is progressing toward its goal of replenishing fish stocks. Due to this seagrass cover, divers have observed more fish in the sand flats during the day, a time when many reef fish shelter from predators in the reef. Reef fish tend to utilize the flats more often at night when herbivorous fish forage in the sand flats, and piscivores (fish that eat other fish) come out to hunt.

The team observed more marine debris at some of today's reef stations. Most debris consisted of discarded gear related to fishing, such as monofilament line. This is notable because it may indicate fishing is occurring in the TER, and fishing here is illegal.

Last night, the survey team continued mapping high–resolution bathymetry using multibeam sonar, and using split–beam sonar to survey fish communities. Several Conductivity/Temperature/Depth (CTD) measurements were also taken to augment the multibeam operations. We will cover our survey operations in more detail in the 'Focus on the Science' portion of day four.

Meet the Crew and Scientists

LT Sarah Mrozek

LT Mrozek has worked in the NOAA Corps for seven years, and joined the crew of the NANCY FOSTER in June of 2007. Sarah's primary duties as an operations officer focus on coordinating with the chief scientists for all research missions run from the ship. At any one time, she coordinates activities with the chief scientist from the previous, current, and next mission. She is responsible for working with the chief scientist of the current mission to draft the ship's daily plan such that it meshes ship operations with the science plan. Her typical day begins with the 4 a.m. to 8 a.m. bridge watch. Later in the day, she assists with small boat operations, coordinating with chief scientists for various missions, and drafting the daily plan for the following day. As one of the NANCY FOSTER's five diving officers, LT Mrozek will join the science party for a couple of dives.

1st Assistant Engineer Tom Cleary

1st Assistant Engineer Cleary has worked for NOAA for seven years and has been with the NANCY FOSTER since 2005. His primary duty on board is to keep everything running that uses or makes power, overseeing the engineering department's day–to–day operations, and scheduling work orders. His typical day entails two four–hour watch shifts in the engine room, during which he logs data, such as temperature and pressure, for all currently running equipment. Tom also assists with launch and repairs for small boat operations, which has been a time consuming task considering the repairs required thus far. In between the above duties, he must also keep up with regularly scheduled maintenance and repairs.

Brian Degan

Brian joined NOAA's CCFHR lab in 2001, but has worked with this research group since 2004. Brian eats, sleeps, and breathes fish. His primary duties during this mission revolve around diving. He is a fish counter for his dive team, and has volunteered to refill the tanks between dives. Brian also assists with other duties, such as fish ID, as needed, and is one of our go–to staff for any dive gear issues.

Tour the NANCY FOSTER

Engine Room

The engine room is integral to the success of this mission. It provides the propulsion, electricity, air conditioning, water, compressed air for diving, and mechanical equipment we use on a daily basis. Most mechanical, electrical, and propulsion systems are physically located in the engine room, below the main deck. The main engine, main rudder, generators, water maker, dive compressor, and other equipment, are located in the engine room. Power supplies for other equipment such as the shipboard cranes and two z–drives (electrical propellers that rotate for 360–degree steering) are also located here.

The engine room is actually a maze of several rooms, each with multiple pieces of equipment efficiently squeezed into a small space. Two engineering shops are accessed through the engine room. One is located on the main deck, and one is located below. For more efficient use of the hold, several ballast tanks were converted to storage and passageways for the engineering department.

To enter the engine room, crew must wear ear protection due to the noise emitted by equipment such as the main engine. With all the running equipment, the engineering hold is always hot. Typical temperatures hit 120 degrees F during the day. The engineering officers each stand two four–hour watches each day, during which they monitor various equipment, work on regularly scheduled maintenance, and complete work orders.

A particularly interesting piece of equipment found in the engine room is the water maker. When the main engine is running, the NANCY FOSTER can make approximately 1800 gallons of fresh water each day. When the ship is not underway, she can produce a reduced volume of fresh water by running generators. The process for making fresh water consists of simple condensation and evaporation. Waste hot water from the engine cooling system runs past a condenser and evaporator, which are located above a reservoir of cold seawater. As the seawater evaporates, it leaves behind the salt. It then is subjected to cooler temperatures. As it condenses, water drips into a collection tank to provide the ship with water for drinking, cooking, bathing, and laundry. The science team and crew use approximately 1200 gallons of fresh water each day.

Many thanks to CME Olsen for the tour of the engine room and associated compartments.

Dry Tortugas 2008 Cruise, day four: July 28, 2008

Today's notes | Featured scientists & crew | Today's science

Today we visited seven sites in the Dry Tortugas National Park, the Tortugas Ecological Reserve, and the U.S. exclusive economic zone (EEZ). If we keep up our current pace, we should complete our 30 long–term survey sites by the end of the day tomorrow. One highlight from today's dives was a 5–foot, 6–inch long goliath grouper spotted by Abby Poray, and a 4–foot long goliath grouper spotted by Brett Harrison. Another interesting find today was several stands of black coral.

Our pace thus far is the result of our exceptional dive teams, the extraordinary helpfulness, skill, and flexibility of the ship's officers and crew, and the weather conditions. In terms of good weather and fairly calm seas, our luck has held. However, we'd like discuss diving conditions at our sites, and explain how these conditions affect our progress and success. Our ideal conditions are clear waters with low current, but it is rare that we experience this during a dive, even with calm seas and clear weather.

The Current

Current can affect a dive in several ways, depending upon the strength of the current and at what point in the water column we experience the current. If current is strong at the high or midway point of the water column, it can greatly affect our ability to drop down exactly on our stations. This occurs even when our coxswains factor in the current when dropping divers at the site. Divers then must work harder to find the station underwater. Low visibility compounds this issue. When a diver contends with moderate to high current, they expend energy and air more quickly than normal. It also increases the likelihood of 'losing' your buddy underwater. During our surveys, the photographer and fish counter ideally stay only a few feet apart. If separated by current, the divers must abort the dive and attempt it again later.

Current can be strong enough to require that divers must ascend and descend by pulling themselves along the anchor line. In past years, we aborted dives because current was so strong at the bottom that the divers were unable to complete their surveys safely. In addition, current in the water column can cause us to drift significant distances from the station during our ascent. This can make it more difficult for the coxswain to track the divers' progress, and to be on hand with the boat to pick them up.

Visibility

Visibility is generally good at our sites. However, several factors can reduce visibility at our stations. When visibility is poor, our fish counters may not obtain an accurate count, or

accurately identify species. Several of our sites are extremely silty, meaning the sand or mud on the bottom is very fine and easily stirred up. During these conditions, divers must be particularly careful both to stay well off the bottom, and to stay very close to each other. Another cause of reduced visibility is floc. This white combination of organics, mucus, and sediment floats in the water column. Several of the sites visited today were very turbid due to floc.

Wave action

Thus far, we have experienced fairly calm seas. When waves are high, it is more difficult to climb in and out of our small boats, both from the ship and from the water. At a site experiencing high waves and strong currents, dive buoys we set out before divers enter the water can actually be pulled under the surface. This makes it more difficult for our coxswains to spot divers on the surface after the dive.

Meet the Crew and Scientists

Senior Survey Technician Missy Partyka

ST Missy Partyka has worked on the NANCY FOSTER since January 2007 when she joined NOAA. She accepted a job as a survey technician on the ship after she participated in a research cruise onboard. Her primary responsibilities include the survey lab space, planning the multibeam survey lines the ship will run, processing collected survey data, and collecting other water quality data. Missy is one of the five working divers for the NANCY FOSTER and she also the ship's medical person in charge (MPIC). Her typical day begins at noon when she completes a two–hour review of the previous night's survey data with the ship's other survey technician. The results of this review determine lines that will be run that night. In the afternoon, she assists with small boat operations before turning in the night's survey plan to the bridge. Surveys begin after dinner and run throughout the night. Her shift ends at midnight.

The science team wishes to congratulate Missy on her upcoming wedding.

Survey Technician Melody Ovard

ST Melody Ovard joined NOAA about a year and a half ago, and has worked on the NANCY FOSTER for six months. Her primary duty on the ship is multibeam collection for the science party. Other duties include assisting with small boat operations, running the ship's store, and dive cylinder inspection. Her typical day begins at midnight when she relieves Missy. At 7 a.m., multibeam operations end, and she

prepares for the first round of small boat operations. Before her shift ends, she meets with Missy to review the previous night's multibeam operations. Melody is also one of the NANCY FOSTER's working divers, and joined the science team underwater today.

Chris Taylor

Chris joined NOAA February 2008.This is his first cruise to the TER. His focus is on marine fisheries ecology with an emphasis on remote sensing applications for fish and habitat relationships. Chris's specialty is hydroacoustics. Hydroacoustics uses sonar technology for the study and application of sound in water. Chris uses hydroacoustic techniques to a assess distribution and abundance of fish populations. His primary duty is survey planning and collecting fisheries hydroacoustic data. Chris works closely with the NANCY FOSTER's survey technicians to integrate multibeam and fish distribution data collected using hydroacoustics. His typical day begins when the last dive team returns to the boat at 5 p.m. and runs until midnight. He is relieved for a few hours before beginning his next shift from 4 a.m. to 8 a.m. He does get out of the dry lab every now and again by joining the dive teams on a few dives.

Erik Ebert

Erik is an undergrad student at Cape Fear Community College (CFCC) in North Carolina. Prior to the cruise, our chief scientist contacted the director of the marine technology program at CFCC request that an advanced student join this mission to assist with survey operations. Erik was the student nominated for this opportunity to apply his skills in the field. His primary duties are to assist Chris with echo sounding, and to help NANCY FOSTER's survey technicians with other marine instrumentation. He has also learned the fine points of multibeam sonar, a new skill. Erik's typical day begins at midnight when he relieves Chris for a four–to five–hour shift. During Day One of this mission, Erik assisted with setting up the split–beam transducer for hydroacoustic operations. Erik is not a diver, but he has had the opportunity to snorkel above several of our stations.

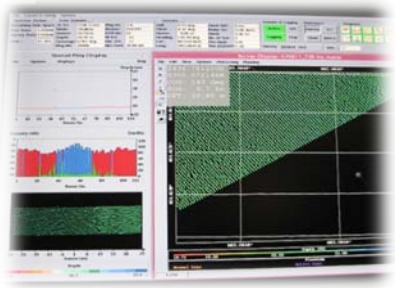
Focus on the Science

Survey Operations

During this mission, we will primarily run two types of surveys: multibeam sonar and hydroacoustic echo sounding. The data collected will be used to choose additional station sites for this project. Scientists will also use the data to assess the broad distribution of fish and habitat types in and out of the TER.

Multibeam sonar

The multibeam sonar equipment is composed of two main components-a transceiver and a receiver. The transceiver pulses sound into the water column, and the receiver picks up the echo that bounces off the seafloor. Both components are encased in a 4–by–2–foot shell mounted to the hull of the NANCY FOSTER. A common misconception is that multibeam sonar sends multiple sonar pings. In reality, the equipment gained its name because its receiver is comprised of multiple receivers. The sound echo strikes each receiver at varying times, translating one pulse of sound into multiple beams.



The time it takes for sound to leave and return to the multibeam is interpreted as depth. Because water density water directly influences the speed of sound, survey technicians must calibrate the multibeam sonar every six hours. They use an instrument called a data sonde to measure conductivity, temperature, and depth (CTD). The conductivity measurement is internally converted to a measure of salinity. Depth is calculated based on a pressure gauge inside the sonde, and temperature is measured directly via a thermistor. It continuously takes CTD data as it is lowered towards the seafloor. A computer processes the data to determine changes in the speed of sound throughout the water column. The computer automatically calibrates the multibeam in response to the CTD data.

The multibeam data are read by software and turned into surfaces much like an image. The images are essentially a topographic map of the seafloor. This is referred to as bathymetry. Our scientists can interpret bathymetric maps to locate areas of reef or hard substrate or other regions of interest to the current study.

Hydroacoustics

The principle employed in hydroacoustics is similar to echolocation employed by bats and dolphins for navigation. A high frequency sound, mostly undetectable by fish, is emitted by the split–beam transducer, located under the hull of the NANCY FOSTER. The sound reflects off fish in the water column and bounces back to the transducer. Similar to the multibeam sonar, the split–beam transducer picks up a signal from the seafloor, and from anything else in the water column that is not a fish. These signals are also converted to images called echograms, which are viewed on a laptop computer and stored as digital data. The resulting images immediately show distribution of fish, and provide a rough estimate of the number of fish. Scientists will more vigorously analyze the data later to achieve results that are more accurate.

By overlaying fish distribution data over the bathymetric map, we can begin to determine fish and habitat interactions. These two types of data are interpreted together to determine potential new sample sites for this project. We may also find that large numbers of fish are associated with

fairly flat areas of seafloor, such as seagrass beds or sand. These data, in combination with the dive observations, provide valuable information on the associations of fish and habitats in and outside the TER. We may find a large density of fish biomass associated with a high relief area of the seafloor, which could be reef. This could encourage us to dive that spot, to check its appropriateness as a potential sample site for this project. Once we finish diving our existing sites, we will begin to dive at new sites identified through this process. The great benefit of these technologies is that they provide a broad assessment of fish distribution and biomass over the habitat of interest at a large scale. Diving is restricted to much smaller areas, but it gives us a very detailed picture of abundance, species, and habitat types at a specific station.

Many thanks to the survey team for their assistance and explanations.

Dry Tortugas 2008 Cruise, day five: July 29, 2008

Today's notes | Featured scientists & crew | Today's ship tour

Today we visited our final eight sites, spread between the Dry Tortugas National Park (DTNP) and within the U.S. exclusive economic zone (EEZ). This is a record for our team. We have never finished surveying all of our long–term sites this quickly.

Highlights of today's dives include sighting another goliath grouper in the DTNP, as well as a long–spined sea urchin with spines over a foot long. In the EEZ, we discovered more fishing–related marine debris. These three finds are significant for several reasons. Goliath grouper, like all grouper species, are relatively rare. Our observations of grouper of this size in DTNP, which is open to recreational fishing, is a promising sign. Sightings of long–spined sea urchins is also promising, for they are reef grazers that help keep reef algae in check. This contributes to healthy reef ecosystems. During the 1980s, over a span of only 15 months, the species was nearly wiped out in the Caribbean and Florida due to a combination of factors, including disease. The species is slowly starting to make a comeback.

We will cover the issue of marine debris in detail in an upcoming log. For now, suffice it to say that marine debris is a universal problem. It even occurs in places with no human population, such as the Northwestern Hawaiian Islands. All the debris we have seen thus far is fishing–related. Derelict fishing gear is detrimental to the ecosystem, particularly to the reef structure.

Tomorrow we will start diving new sites on the west side of the Tortugas Bank. We identified these sites during our multibeam and hydroacoustic operations. We look forward to discovering what biological treasures they have in store for us.

Meet the Crew and Scientists

Able–Bodied Seaman (AB) Greg Walker

AB Walker has worked with both NOAA and the NANCY FOSTER for three years. As Chief Boatswain, Greg is in charge of all deck operations and the five–man deck crew. His primary duties include launch and recovery of small boats, deployment of oceanographic equipment for the science party onboard, and leading the safety committee onboard. He is responsible for all safety training for the ship, training the deck crew and coxswains, the budget and all supply orders for his department, and coordinating with the Operations Officer regarding the daily plan. His typical day begins at 7:30 a.m. with pre–checks and other preparations for the first round of small boat launches at 8 a.m. Recovery of the boats typically takes place an hour and a half later. Greg oversees two other rounds of launch and deployment during the day. Between launches, he is responsible for checking the shipboard computerized maintenance system, *AMOS*, and for completing any scheduled maintenance for deck equipment.

Don Field

Don has worked for NOAA for 25 years. He joined the CCFHR lab eight years ago. His main research interests lie in remote sensing of submerged coral reefs and seagrass habitats. During this mission, his primary duty is as a fish counter on one of the dive teams. His typical day starts with the daily dive meeting at 7:30 a.m. He usually dives twice a day. During this mission, he is the fish counter for his dive team, and is involved in the drop camera operations.

Amy Uhrin

Amy has been with both NOAA and the CCFHR for a little over eight years. She is a seagrass ecologist and her focus in the lab is the study of disturbances on seagrass beds. She looks at natural disturbances, such as those caused by hurricanes and storms. She also examines disturbances caused by animal activities called *bioturbation*, and those caused by humans, such as vessel groundings and damage by fishing gear. Restoration and recovery of disturbed seagrass beds is another focus of her research. Amy's primary duty on this mission is acting as the photographer on one of the dive teams. When asked to describe her typical day, Amy responded, "Eat, sleep, and dive, not necessarily in that order. The diving schedule goes something like this: photograph, rinse, repeat." She typically dives twice a day, with gear prep and data downloading occurring before and after each dive.

Tour the NANCY FOSTER

Deck Operations

We would not be able to achieve our objectives during this mission without the dedicated deck crew of the NANCY FOSTER. The deck crew ensures that deck operations run smoothly. Today our tour of the ship will take us to the deck where we will learn about the deck operations that help us achieve our mission.

Please note that the weather decks are named in the following manner: Decks above the main deck are referred to as levels. Decks below the main deck are actually within the hold. For instance, the engine room is on 01 deck, below the main deck.

Main Deck

Most of our dive–related activities occur on the main deck. In addition to the science party's diving equipment, several key pieces of equipment are located on this deck. The large *knuckle boom* sits here. This crane has a weight capacity of 10,000 pounds, and is primarily for loading and unloading equipment and small boats. The knuckle boom transfers small boats to and from the water several times a day. The *A–frame* and *J–frame* are located in the aft section of the main deck. The former has a weight capacity of 25,000 pounds. It primarily deploys oceanographic equipment, such as *bongo nets* to skim for plankton. The J–frame has a depth capacity of 5,000 meters,

but its weight capacity depends upon the gage of cable used. It is also used to deploy oceanographic equipment. We use it primarily for CTD casts and drop–camera operations. We do not anticipate using the A–frame during this mission.

Small Boat Operations

Small boat operations enable us to complete an integral part of our mission—diving. At the onset, we sent out three boats three times a day. However, we temporarily lost one boat to a steering issue, so we now send out two boats three times a day. The boat that returns first usually will directly turn around to deploy the third dive team. Each small boat deployment requires at least five people on deck: two to operate the forward lines, two to operate the aft lines, and one to operate the crane. While it is required that a member of the deck crew operate the crane during each launch, any of the crew can assist with line handling. With six to eight launches each day, we are keeping the crew very busy. During crane operations, anyone on deck must wear a hard hat. In addition, anyone operating lines, deploying gear over the side of the ship, or climbing into the small boats from the ship must wear a personal floatation device (PFD). Once the small boats are moved from their storage positions to the side of the boat, the coxswain climbs aboard and rides in the boat as it is lowered by the crane to the sea surface. The science party boards the boat only after it has been lowered to the water and the deck crew gives them the OK.

Level 01

Several key pieces of equipment are located on Level 01. The winch that runs the A–frame is located on this level, as is the *marquee winch* that is used to run the J–frame. The control station that operates both winches is located on this level as well. In addition, the *NACE crane* is located on this level. It primarily loads and offloads gear, oceanographic equipment, trash, and the gangway. Lastly, the rescue boat is stored on this level and uses the NACE crane for a man overboard or rescue operation.

Level 02

Level 02 has significantly less outdoor square footage than the main deck or 01 level. For the purpose of this tour, we will only focus on the area encircling the indoor crew cabins. Six life raft stations are located on this level, three each on the port and starboard sides of the ship. In the unlikely event of the directive to abandon ship, the deck crew would be in charge of deploying the life rafts. An anchor windlass is also located at the bow of this level. It is used to lower the port and starboard anchors.

The deck crew also maintains the 11 life rings that are located between these three areas. Three of the deck crew are day workers, the remaining three deck personnel and the deck cadet are also responsible for assisting with the bridge watch as lookouts.

Dry Tortugas 2008 Cruise, day six: July 30, 2008

Today's notes | Featured scientists & crew | Today's ship tour

Today we began diving new sites on the West Tortugas Bank. Our divers reported that most sites are productive, and they observed some interesting fish species at several of these sites. Our observer divers stayed on the ship today, as the dive conditions at these new sites are still an unknown.

We are continuing to consider additional safety features to keep this mission accident–free. This evening, following dinner, the science party divers attended new dive safety training. Afterward, several of us watched the sunset from 'steel beach' on the 03 level just behind the bridge. The seas were glassy calm, and the sunset colors looked like the inside of a conch shell.

Dolphins often hunt alongside the ship at night. They corral fish, particularly flying fish, into the side of the boat to stun them or to corner them. As Missy Partyka deployed the data sonde to continue the night's multibeam operations, we had the opportunity to observe dolphins alongside the ship, a first for several of the science party. It appeared to be a small pod of spotted dolphins, including a mother and calf. Several of the mammals were interested in Missy's sonde, but they soon gave up their investigations in favor of fishing. The crew tells us dolphins have managed to scare fish up onto the deck of the NANCY FOSTER in the past, and that some nights they hear the sound of fish hitting the hull in their efforts to escape. It was an interesting sight. A few fish were stunned against the hull, but most were just cornered as they frantically tried to change directions before hitting the ship. During this incident, we saw several species of fish, including flying fish and ballyhoo.

Meet the Crew and Scientists

Chief Steward Lito Llena

CS Llena joined NOAA six years ago and has been with the NANCY FOSTER for the past two years. His primary responsibility on board is providing three squares (plus plenty of tasty snacks) for the crew and scientists. He is also responsible for proving clean linens to the science party members upon their arrival on the ship. His typical day begins at 5 a.m. He works until 12:30 p.m. and then has a few hours to rest before preparing

dinner. Preparations begin at 2 p.m. Lito's day ends at 6 p.m., or immediately after the dinner dishes and associated cleaning are complete.

2nd Cook Dennis Moore

2C Moore joined NOAA 26 years ago, and has cooked on the NANCY FOSTER for six years. Like Lito, his primary duty on board is providing meals to the crew and science party. His typical day is the same as Lito's, as they work together for the entire shift. Dennis and Lito also plan the menus for each mission.

Brett Harrison

Brett has worked with both NOAA and the CCFHR for one year. On this mission, his primary duties include fish counting for his dive team, marine debris monitoring, and supporting other operations such as the drop camera work. His typical day begins with the 7:30 a.m. dive meeting. He then proceeds with equipment prep and data downloads for two dives. In the evening, he conducts drop camera operations. He ends his day with Oreos and milk.

Tour the NANCY FOSTER

The Galley

Located on the main deck, the galley is the most important place on the ship three times a day. There are four main pieces of obligatory kitchen equipment here: a large refrigerator, a large freezer, a stove, and a sink. The galley also contains a dishwasher and a griddle. In addition, a walk–in refrigerator and freezer are located on the 01 deck.

To prepare daily meals for 30–plus people during a two–week mission. For simplicity, Lito and Dennis plan a four–cycle menu, with each cycle lasting seven days. Thus, they can easily plan in advance which grocery items they will need on any given week. On the first day in port between cruises, they head into town to buy items they can not find in bulk, like milk and cereal. A wholesale food company delivers bulk items to the ship while it is in port.

Mess Hall

While underway, meals are served at 7 a.m., 11 a.m., and 4:30 p.m. Each meal is available for one hour. The mess hall seats 16. Our shipboard population is 37, so we eat in shifts. There are no assigned schedules, nor assigned seating. When you see an open seat, you come in and eat. To allow others the same opportunity, you vacate our seat as soon as you finish. The galley and mess hall are connected by a pass–through, which is used to serve up our meals. Aside from seating, the mess hall boasts a large screen TV for entertainment, though this is

usually not turned on until later in the evening. Also in the room are an ice machine, drink machine, salad bar, ice cream freezer, dry goods locker, and two small refrigerators. Thus, the crew and science party have food available to them even outside of the set meal schedule. This is the place to find folks for a midnight snack or a friendly game of dominoes or cribbage after dinner.

Many thanks to CS Llena *and* 2C Moore *for their tour of the galley and mess hall.*

Dry Tortugas 2008 Cruise, day seven: July 31, 2008

Today's notes | Featured scientists & crew | Today's ship tour

Our transect protocol has changed slightly with the transition to new dive sites. Instead of documenting both the reef and sand transect at each site, we are now documenting only the reef transect. The reef–sand interface and sandy areas generally are too deep for our dive plan. Today's sites, repeatedly described as 'very pretty,' boasted diverse flora and fauna. At one site, the divers spotted seven species of grouper. At the same site, filefish circled another dive team as it ascended to the surface.

We were near enough to Fort Jefferson to have a few feathered visitors stop by today. A brown noddy took up residence on the knuckle boom. It became agitated when we dared move his roost to put a small boat in the water. For part of the afternoon, we had a swallow resting on the A–frame. Then, just before sunset, we got our best glimpse yet of Fort Jefferson and the lighthouse. We also noted a shrimp boat trawling in the area. Shrimping is allowed outside the TER, and studying its effects on soft–bottom habitat is one of our research studies.

Drop camera operations resumed this evening with the backup camera. We had some design challenges with the drop camera; however, we finished three of our 10 sites. We will resume drop camera operations on Day 11 during daylight hours, and will cover drop camera operations in more detail in that day's 'Focus on the Science.'

During the midnight CTD cast, we passed through two large patches of floating *Sargassum* seaweed. *Sargassum*

is a refuge for many species of juvenile fish, and these patches were no exception. In addition to the typical flying fish observed during CTD casts, we saw ballyhoo, a small pufferfish or cowfish, juvenile flying fish, an orange sargassum swimming crab, and a tripletail. Tonight, several flying fish were particularly interested in the data sonde cable deployed off the ship.

Meet the Crew and Scientists

Navigation Officer Harold (Trey) Emmons III

ENS Emmons joined NOAA in August 2006 and has served on the NANCY FOSTER since December 2006. His primary duties onboard include standing bridge watch twice a day, and acting as the ship's navigational officer. The latter involves plotting all routes and track lines for the ship. Secondary duties include assisting with small boat operations, and acting as the ship's weather officer and environmental compliance officer. As the weather officer, Trey keeps an eye on the weather, especially during hurricane season. If the ship needs to change course due to impending weather, he helps make that decision. As the environmental compliance officer, he is in charge of all hazardous materials onboard and of those brought onboard by the scientists. His typical day on this mission starts with standing watch from 12:00 a.m. to 4:00 a.m., napping until 10:30 a.m., and then getting up for lunch. After lunch, he either completes his full 12:00 p.m. to 4:00 p.m. watch, or he acts as a coxswain for part of the afternoon and then returns to finish his watch. After dinner, he has a little free time before he heads to bed until his midnight watch starts.

Junior Engineer Michael Baker

JE Baker joined NOAA in April 2008 and has worked on the NANCY FOSTER ever since. His primary duty as junior engineer is to fix anything that is broken onboard, from boats to engines to plumbing. A typical day for Michael revolves around small boat repairs, and routine maintenance of other equipment on the ship. He generally works from 7:30 am to 3:30 pm.

Abby Poray

Abby has worked for NOAA in the past, and is currently pursuing her masters in marine biology at California State University, Northridge. She participated in four previous Tortugas cruises, and, due to her experience, she was invited to join this one. She primarily acts as a photographer for her dive team, and assists the chief scientist with any necessary organizational projects. Her typical day begins with the daily dive brief and includes two dives, the associated dive log and data downloads.

Tour the NANCY FOSTER

Life on the Ship

Aside from the duties previously described in the crew and science party bios, you may wonder what it is like to live and work on the NANCY FOSTER.

The NANCY FOSTER is typically at sea for over a hundred days during the field season. Individual missions last from a few days to two weeks.

The ship contains several work areas that we have not specifically toured, including a machine shop on the main deck and two shops on the 01 level.

Scientists typically spend most of their time in one of the two labs onboard, the wet lab, and the dry lab. Multibeam sonar is always run from the dry lab. During this mission, scientists also run the hydroacoustic operations from this lab, download data from photo cards, complete data log entries, plan the next day's activities, and check email. In the wet lab, survey photographers set up and test their gear, and the crew run drop camera operations from here. It is also where we hold our daily dive briefs, and prepare our collected algae samples.

Staterooms vary from single occupancy for the CO and some other officers and crew, to four–person bunkrooms for the science party. The rooms contain beds or bunks, sinks, and lockers. Officers and crew also have a computer, desk, and television in their staterooms. Given the varying schedules of the crew and science party, someone is always sleeping, so courtesy dictates that we do not slam doors or have loud conversations in the passageways. Multiple heads are available as is a small laundry room with two sets of high–efficiency washers and dryers.

While the pace is often busy, science parties and the crew sometimes make time to relax. Near sunset, one can always find a contingent on 'steel beach' relaxing in lawn chairs reading, watching the sunset, or watching stars. The crew also has a workout room, and an entertainment room with a large collection of movies. As previously mentioned, the mess hall is a popular place to play cards or board games, or to watch television or movies in the evenings. Movies also are piped into the dry lab where survey activities take place.

Dry Tortugas 2008 Cruise, day eight: August 01, 2008

Today's notes | Featured scientists & crew | Today's science

Diving operations continued today in new sites that were clear and nice. The sighting that drew the most excitement today was a species we did not expect to see. During ascent, our chief scientist, Shay Viehman, and her dive buddy, Karen Neely, spotted a manta ray. Two members of the team already were in the boat, and jumped back in for a better look. A manta with a four–foot wingspan came fairly close to the divers, and even turned a few somersaults in the water column. Two morays swam with the manta ray.

Keep reading to view a slide show of some coral and associated species we have seen thus far. Check back for Day Nine's installment, which will feature a similar slide show of our close encounters of the fish kind.

Meet the Crew and Scientists

Junior Officer Kevin Adams

Although ENS Adams has worked with NOAA for two and a half years, he joined the NOAA Corps in February 2008. Following completion of training school in June, he joined the NANCY FOSTER crew. His chief duties include navigation and driving the ship. As a Junior Officer, Kevin cannot yet stand watch solo. To take on this additional duty, he is completing the necessary tasks to become an *Officer of the Deck* (OOD). His typical day begins with joining Trey on the 12 a.m. to 4 a.m. watch, going to bed, and then assisting with small boat operations in the afternoon. Kevin began coxswain training during this mission, and has been out driving the small boats most days.

Boatswain Group Leader Gordon Pringle

BGL Pringle began working on the NANCY FOSTER February 2008, but joined NOAA in 1972. He has worked on four other NOAA vessels over the years, one of them twice. His primary duties include acting as the Chief Boatswain if Greg Walker is not available, operating the winches or cranes, deck maintenance, and assisting on deck for small boat operations. He is also responsible for ordering necessary supplies for any given mission. Gordon's typical day revolves around small boat operations, either by operating the knuckle boom or by line tending. He is a day worker, so this does not leave much time during his work hours for deck maintenance or other duties.

Sean Meehan

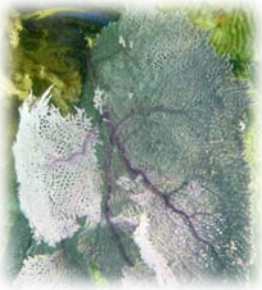
Sean has worked at NOAA for eight years. Normally, Sean is a restoration specialist in NOAA's Restoration Center in St. Pete, FL, where he focuses on restoration issues from NC to TX. His time is split between damage assessment and remediation, emergency restorations and responses, and work with the community–based Restoration Center. The latter provides grants for community restoration projects on essential fish habitats. Sean is also the marine debris point of contact for the Restoration Center and the southeast U.S. Sean has been collaborating with scientists from the Applied Ecology and Restoration Research branch at Beaufort since 1997. On this mission, his primary duties are acting as a fish counter for his dive team, and acting as a divemaster along with Roger Mays. He also lends a hand with filling dive cylinders, planning, and assisting with any dive issues, such as equipment problems. His typical day includes the daily dive debriefing, two dives, working with either the chief scientist or divemaster, and refilling cylinders.

Focus on the Science

Coral Species Observed

We have seen a variety of coral and other related flora and fauna on this mission. Today's science feature will highlight some of these species. Check back for tomorrow's log to see a similar feature on the fish species we have encountered.

 Acropora	 ***Dichocoenia***	 ***Colpophyllia***
 Diploria	 ***Montastraea***	 ***Pseudopterogorgia***
 Palythoa	 ***Agaricia***	 ***Halimeda***

Siderastrea	*Sargassum*	*Porites*
 *Gorgonia*	*Pseudopterogorgia*	*Solenastrea*

Dry Tortugas 2008 Cruise, day nine: August 02, 2008

Today's notes | Featured scientists & crew | Today's science

Today we continue to dive new sites selected from the multibeam and split beam acoustic sonar data that was collected during our survey activities. These sites, on the western edge of the banks, are new to us, so divers must be very observant of their maximum depth. The complexity of some sites means divers must be careful to keep their site marker off the coral. Site markers often are sent to the surface with a lift bag, either to avoid coral entanglement, or to keep the marker from getting stuck in complex reef.

As with every night during this mission, we are also continuing night multibeam operations and fish hydroacoustic surveys.

Keep reading to view a slide show of some fish species we have seen thus far.

Meet the Crew and Scientists

LT Matthew Wingate

LT Matthew Wingate has worked with NOAA for 13 years. He is onboard the NANCY FOSTER as an augmenter for this mission only. The ship requested an augmenter who is an Officer of the Deck (OOD) to serve as bridge watch, and a coxswain on small boats. Matthew splits the 4 p.m. to 8 p.m watch with Sarah. She takes the morning shift. He takes the afternoon shift. This allows both to assist with small boat operations and other duties. Matthew's typical day starts at 6:15 a.m. He spends a couple hours working and catching up on emails for his normal duties on land. His normal duties have not disappeared during his short tour on the NANCY FOSTER. He usually acts as coxswain for two groups of divers in the morning before returning to the ship to complete work related to his normal job. Afterward, he heads up to the bridge for his watch.

AB Jeremy Brock

AB Jeremy Brock joined NOAA and the NANCY FOSTER crew in February of this year. His primary duties are to stand the bridge watch twice a day, to assist with equipment maintenance and aesthetic maintenance, and to operate the J–frame, the marquee winch, and the knuckle boom. He also assists with line tending and as a coxswain for small boat operations. Jeremy's typical day begins with the 8 a.m. to 12 p.m. bridge watch, where he acts as lookout and conducts safety rounds. In the afternoon, he is on call. While on call he has assisted with CTD casts, operating the knuckle boom, tending lines, and acting as coxswain. He stands a second bridge watch from 8 pm to midnight.

Greg Piniak

Greg has been with NOAA and the CCFHR for four and a half years. His career focus is coral reef ecology. This includes monitoring and working to understand human impacts on coral reef ecosystems. His primary duty has been as a photographer for his dive team. Greg has also been involved in a quality control pilot study, comparing split beam data with a QTC View (Quester Tangent) benthic classification system. On the first day of the cruise, Greg and two other divers swam beneath the ship, where Greg showed the divers how to install the transducer. His typical day begins with the 7:30 a.m. dive meeting and continues with two dives each day. Prior to dives, he is prepares his camera gear, and after the dives he downloads the data. As part of the data processing, Greg will also be involved in post–mission analysis of the benthic photo data.

Focus on the Science

Fish Species Observed

We have observed many types of fish during this mission. Today's science feature will highlight some species we have seen.

Dry Tortugas 2008 Cruise, day ten: August 03, 2008

Today's notes | Featured scientists & crew | Today's science

We completed our last full day of diving today. We are hitting the home stretch for this cruise. After tomorrow morning's dive rotation, we will focus on drop camera operations at soft bottom areas in the northeastern Tortugas Ecological Reserve.

Several of our dive teams were fortunate to be visited by a pod of dolphins today. The first dive team saw six spotted dolphins, which followed their small boat back to the NANCY FOSTER.

The same dolphins then followed the next dive team out to their site, where even more dolphins joined them. The second dive team saw 15 dolphins, one of which appeared to be a common dolphin that was at least temporarily joining the spotted dolphin pod.

During the day, we conducted sonar operations while the small boats were deployed to dive sites. After the divers returned to the ship, split t–beam sonar was used to survey the dive sites. We conducted multibeam operations throughout the night to fill in data gaps and begin the wrap up of our survey operations.

Meet the Crew and Scientists

Junior Engineer Steven Williams

JE Steven Williams has worked with both NOAA and the NANCY FOSTER for three years. His primary duties include standing watch in the engine room twice a day, and fulfilling welding and fabrication needs for the ship. He is also responsible for the ship's inventory. A typical day begins at midnight with a four–hour watch. He assists with small boat repairs during the day, and then completes the noon to 4 p.m. watch in the engine room.

General Vessel Assistant James Heffernan

GVA James Heffernan has been with both NOAA and the NANCY FOSTER since May of this year. As GVA, James is responsible for acting as lookout for the midnight to 4 a.m. bridge watch, and for assisting with miscellaneous tasks. Typically, this involves, operating the J–frame or marquee winch for scientific operations and loading gear, assisting with small boat operations and some cleaning of the ship. During this mission, James' typical day begins with his midnight to 4 a.m. watch, and continues with line tending and other assistance for small boat operations during the afternoon.

Karen Neely

Karen is a recent Ph.D. graduate from Duke University. As such, she has known CCFHR scientists for several years. She was asked to join this cruise because she is a fish biologist. Her research focuses on fish and habitat interactions. She is particularly interested in Caribbean fish assemblages and their level of dependence upon live coral. Her primary duty was as a fish counter on her dive team. Her typical day began with the daily dive brief and progressed with two dives. During the dives, she was responsible for identifying the species she observed, noting the size of the fish, and noting how far above the reef each fish was found. Following this mission, Karen will be moving to a new job in the British territory of the Falkland Islands, which is located off the coast of Argentina.

Focus on the Science

When you consider that habitats that transitioning from reef to sand are common in reef ecosystems, you may wonder why we conduct research in the Dry Tortugas. This particular ecosystem was chosen based upon several factors. The primary focus of this project is the ecological and economic consequences of establishing a large marine protected area. This project will provide scientists, managers, and the public with a variety of data to assess the effects of establishing the Tortugas Ecological Reserve (TER). It will also evaluate how several new technologies might be used to assess the long–term effects of marine protected areas in general. The Dry Tortugas region was chosen, in part, because the TER was created shortly after the research project began. This allowed researchers to conduct baseline sampling for a before/after comparison of TER ecology. In addition, the coral reefs of the Dry Tortugas are ecologically unique. They provide an important downstream source for many species of larvae, such as fish, to much of the upstream Florida Keys. Parts of the Dry Tortugas are protected by the TER and the Florida Keys National Marine Sanctuary. Previous research by CCFHR scientists show that soft bottom habitat, such as that surrounding the coral reefs, is a vital contributor to the coral reef food chain. Many fish forage on items such as seagrass, macroalgae, and microalgae in soft bottom habitat that surrounds coral reefs. As such, it is an important component of the coral reef ecosystem. Thus, a combination of factors influenced the decision to conduct this project in the Dry Tortugas. To observe this type of foraging, see slideshow image six from the Day Three log.

Practically every day during this mission, our divers have observed some form of marine debris at various sites. While we have mentioned these observations briefly, today we will describe this issue in more detail. Marine debris is any persistent solid material that is manufactured or processed and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment. Every year, marine debris injures and kills marine life, interferes with navigation safety, causes adverse economic impacts to shipping and coastal industries, and poses a threat to human

health. During this mission, much of the debris we observed is related to fishing activities. This type of debris is referred to as derelict fishing gear. Although the TER is closed to fishing, fishing–related debris was observed within its boundaries. In addition to derelict fishing gear, we also saw various plastic materials floating at the surface. During this mission, we observed two types of derelict fishing gear. We saw a number of derelict fishing lines of varying length and thickness. As the fishing lines move with wave action, they can become tangled in the reef structure, which can damage these slow–growing structures. We also saw lobster trap debris (see first image on Day 5). In lobster season (August through March) 480,000 commercial lobster traps currently are used statewide in Florida's waters). An estimated 38,400 of these traps are fished on hardbottom and coral reef habitats in the Atlantic Ocean. During normal fishing operations, lobster traps typically shift in place as they settle, causing relatively minor impacts to the seafloor. However, derelict lobster traps have been shown damage the reef structure and other associated stationary organisms, such as sponges. Frequent winter storms, not to mention periodic hurricanes, can exacerbate the damage caused by both types of derelict gear.

After the cruise, we will analyze marine debris data we collected to determine if the debris within the TER is greater than, or less than debris sighted during previous years.

Dry Tortugas 2008 Cruise, day eleven: August 04, 2008

Today's notes | Featured scientists & crew | Today's science

This morning saw an end to our highly successful diving operations. In all, we surveyed our 30 long–term sites, and also visited 50 new sites. We have not yet determined if the new sites will be revisited in future Dry Tortugas sampling. Observations of note today include a school of 60–80 permit. Permit are uncommon in Florida, can grow to lengths of three and a half feet, and are usually solitary. Thus, our observation of a school of permits in the Dry Tortugas caused much excitement among our fish biologists. Immediately following our last dive, we began fish hydroacoustic surveys at sites that previously showed high fish populations.

After traveling from the morning dive and fish acoustic survey sites, our focus shifted to drop camera operations. This afternoon, our dive teams transitioned to drop camera teams, and began doubling up to complete two–hour shifts. We began drop camera operations around 3 p.m. and completed operations and gear breakdown at approximately 10 p.m. For further detail on drop–camera operations, please see today's "Focus on the Science."

We have now completed the data collection portion of our cruise. Rather than collect more multibeam bathymetry data tonight, the survey technicians will process multibeam data collected during this mission and copy the data to our portable hard drives.

After completing drop camera operations, we began our overnight journey back to Key West, with an estimated arrival time of 8:30 Tuesday morning.

Meet the Crew and Scientists

Deck Utility Man Ben Nolan

AB Ben Nolan joined NOAA and the NANCY FOSTER crew in February. His primary responsibilities on board are crane operations, acting as coxswain for small boat operations, and preventative maintenance. He also serves as a winch and small boat operations instructor within his department, teaching these skills to new crewmembers. His typical day runs from 7:30 a.m. to 3:30 p.m. As a day worker, he is not responsible for engine room or bridge watches. During this mission, he splits his time between small boat operations and maintenance. On any given day, he may be called upon to assist with the daily checks for the small boats, operate the knuckle boom to deploy a small boat, or tend lines. In between those duties, he works on maintenance projects as identified by the shipboard maintenance system, AMOS.

Cadet James English

CDT James English is a student at SUNY Maritime College in the Bronx, NY He is spending his sea term, May 3 through August 17, on the NANCY FOSTER where he combines studies with duties to earn credit. His primary duties include serving as lookout and weather observer during the 4 a.m. to 8 a.m. bridge watches, while also completing his schoolwork. He has learned several skills while on board and has assisted with activities, such as line tending for small boat operations, or running the J–frame to deploy scientific equipment. After breakfast, he assists with line handling for small boat operations, as necessary, and then naps or studies until his second bridge–watch. In the evening, he is often found practicing celestial navigation skills for his classes.

John Hackney

John has worked with NOAA and the CCFHR for four years. His work revolves around stock assessments of U.S. southeastern fisheries. He works closely with recreational head boats, surveying a sub–sample of their catch and creating population diagrams of the species caught. During this mission, his primary duty was a photographer for his dive team. Like our other divers, his typical day begins with the daily dive brief and continues with two dives over the course of the day. As a photographer, he is also responsible for downloading his data after each dive and renaming photos according to the project's naming protocol.

Focus on the Science

Drop camera

Fishing with trawls can damage bottom habitat and, in addition to the target species, can catch a variety of unwanted animals and plants, called bycatch. An intensive trawl fishery targeting pink shrimp is located north of the Tortugas banks on the surrounding soft–bottom shelf. Much of the TER consists of soft–bottom shelf habitat. This area was open to trawling before designation of the reserve in 2001. The area north and adjacent to the reserve is still open to trawling and is intensively fished. The shrimp trawling grounds are relatively deep, between 110 and 150 feet. The bottom here is unconsolidated mud, sand, and shell. Closure of the TER to trawling provides the opportunity to investigate the impact of the shrimp fishery on this deep soft–bottom benthic community.

To evaluate the impact of trawling, we compare sites inside and outside the reserve. We use a small experimental beam trawl (see 2007 cruise log for more on beam trawling) and a submersible video system or drop camera. The experimental trawl collects samples of benthic plants and animals inside and outside the reserve. The drop camera provides images of the bottom allowing a visual comparison of benthic landscapes in and out of the reserve. Sampling is conducted within 10 stations around the TER boundary, which were chosen at random in the early years of this study.. In each of these stations, sampling is conducted at three sites. One site is located two kilometers outside the reserve where trawling is permitted. Another is located two kilometers inside the reserve. This area has been closed to trawling since 2001. The third site lies on the boundary of the TER. Results of the trawl study are highly variable. In some years, more shrimp were found inside the TER than outside. Clear differences were evident in video tape recordings of the ocean floor inside and outside the reserve.

Due to time constraints this year, we did not conduct trawl sampling. We concentrated instead on sampling with the drop camera. We also sampled with the split–beam sonar to collect biomass estimates of animals that we will compare among our sample sites. We want to learn if bottom habitats at the three sites are different, and whether the sites within the TER show signs of recovery. For instance, we hope to observe coral or algae growth in areas that were previously damaged by trawling.

As reported in our Day Three web page, our camera flooded during our first attempt at drop camera operations. On Day 7, on our first night of resumed operations with our backup camera, we were only able to complete three stations due to technical gear issues with the camera lighting. For those reasons, we devoted much of today to drop camera operations during daylight hours. The drop camera is lowered into the water from the main deck of the NANCY FOSTER. The drop camera frame consists of a lead weight, underwater video camera, lights, and two laser pointers, which provide scale on the video tape. As an officer on the bridge puts the NANCY FOSTER into a controlled drift over a site, the drop camera frame, shackled to the end of a steel cable, is lowered toward the sea floor by a winch attached to the J–frame. A video cable feeds the footage from the camera to the deck and

then into the wet lab. Additional video cable is unrolled and clipped to the winch cable by the deck crew as the camera frame is lowered. The winch operator adjusts the camera height above the bottom, under direction of the scientists, who are watching the camera output in real time on video screen.. Once the camera height is correct and the bridge has adjusted the speed of the NANCY FOSTER's drift, the benthic landscape is recorded on video tape for five minutes. A GPS antenna fixed to the NANCY FOSTER provides continuous signal to a GPS system that records the track of each drift. This GPS data and the camera output are simultaneously run through a video stamper. The stamper labels each frame of the video tape with GPS coordinates corresponding to the location where it was recorded so the data can be geo–referenced. Because the camera is dropped from the side of the ship, no part of the ship is directly located above that camera. Therefore, the crew is unable to affix an antenna directly above the camera. As a result, we will need to add a GPS correction during post–processing. We also use a computer program called ArcGIS to overlay the GPS coordinates of our sites on a map. These data are exported as a file and referred to during post–processing. After the cruise, these researchers will analyze these for evidence of trawling impacts on the bottom and on the plants and animals living there. Our methods enable us to compare and contrast data from all stations, as well as those from similar sites (such as all 10 sites within the TER).

Dry Tortugas 2008 Cruise, day twelve: August 05, 2008

Today's notes | Featured scientists & crew | Today's science

We arrived at the U.S. Coast Guard Station in Key West this morning. Some members of the science party left to pick up our vehicles at the Florida Keys National Marine Sanctuary office in downtown Key West. A NANCY FOSTER small boat needed repair, so we will return to Beaufort with a different small boat than the one we brought to FL. The scientist remaining on the ship unloaded our scientific gear. Once the vehicles arrived, we packed the gear carefully and tightly into the vehicles. Finally, we cleaned the lab areas and staterooms, per standard checkout procedure on the ship.

The science party will bunk on board for one last night, and begin our 20–hour drive back to Beaufort early tomorrow morning. We wish to extend our gratitude to the officers and crew of the NANCY FOSTER, our science party, the visiting scientists, and our Webmaster, for their work on this successful mission. The scientists would like to express their appreciation to Lauren Chhay for composing the daily cruise logs. We also wish to thank our readers for following our progress online via these logs.

Meet the Crew and Scientists

ET Mike Peperato

ET Mike Peperato joined NOAA and the crew of the NANCY FOSTER two and a half years ago. His primary responsibilities are maintenance, troubleshooting, and installation of most electronic systems on board. Specifically, he maintains the navigation systems such as radar, the

internal and external communications systems, the global maritime distress and safety system (GMDSS), the electronic survey equipment, the CTD data sonde, and the audio visual equipment. He is also responsible for both computers and the network on board. His typical day includes a series of daily equipment checks. He must ensure that the ship's GMDSS, radar, satellite phone, internal phones, external communications, GPS, fathometer, and survey equipment are working properly. If any issues are uncovered, he troubleshoots the problems and works to solve them. At the beginning of the mission, he spent many hours completing the necessary updates and security checks on the science party's laptops so they could access the ship's network. Mike is a day worker, so his hours begin around 7:30 a.m. and end by 4:30 p.m., depending upon the needs of any particular mission.

JE Abe Goldberg

JE Abe Goldberg has been with NOAA since October 2006. He is an engineering augmenter from July 17 through August 25.His normal assignment is on board the ALBATROSS IV, which operates out of Woods Hole, MA. His primary duty on board the NANCY FOSTER is supporting the mechanics.. A typical day on this mission begins with obtaining a list of daily duties from the Chief Engineer. Often, he is also assigned to assist an engineering crewmember for the day. His duties have included small boat repairs, maintenance on the ship's engines, fabrication in the metal shop, and cleaning. As a day worker, Abe does not stand watch in the engine room.

Lauren Chhay

Lauren has worked with NOAA's Coral Reef Conservation Program (CRCP) for two and a half years. She was invited to join this mission to write and upload the daily mission logs. Normally, Lauren works out of the CRCP headquarters in Silver Spring, MD where she is responsible for communications and outreach duties, including acting as Webmaster for the CRCP web site. Her primary duty during this mission is to write the daily logs, collect photos from the dive teams for the web, and send the completed logs and photos to the project's Webmaster, T.J. Dorch, in Silver Spring. She has also been participating in diving operations as a NOAA observer diver. Her typical day consists of several writing sessions broken up by a dive, interviews of the crew and science party, processing photos for the logs, and trying to fit in some of her regular duties. During any given day, she is working on text, images, or planning for two or three days' worth of logs.

Focus on the Science

Data Analysis

Although today is the last day of our mission, a great deal of work remains. Once the science party returns to CCFHR, the process of analyzing all collected data begins. Oversight of the data

analysis, and creation of publications are the responsibility of principal investigators of this project. Staff transcribes field data sheets into computer files and check for errors. Photos from transects will be analyzed using point count analysis software. They will also be carefully checked for errors. Various statistical techniques will be applied to test hypotheses about the effects of the Reserve on fish and benthic communities.

While the various types of data will advance the overall project, and will be incorporated into several types of reports and publications. Our goal is to put the data we collected into the hands of reef managers in a format that is useful to them. One way we will do this is through annual reports. Our research permits from the Florida Keys National Marine Sanctuary and Dry Tortugas National Park, like all permits from these agencies, require that a report be submitted detailing research results. We will also continue to publish this data in NOAA publications and in peer–reviewed journals.