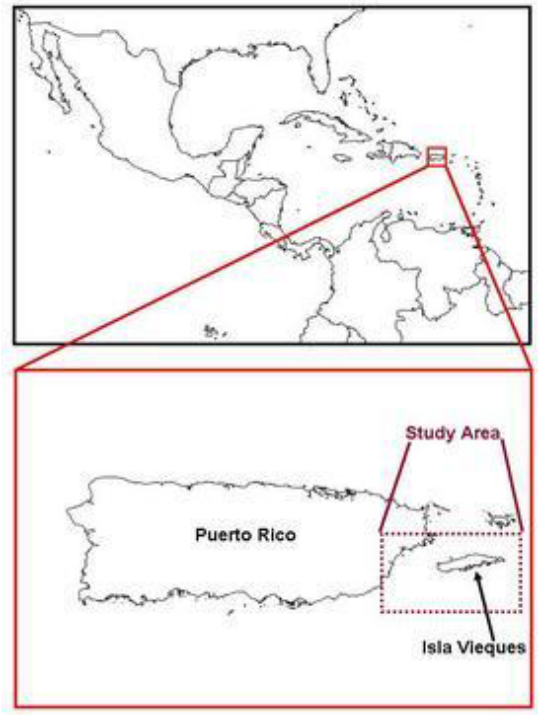
Puerto Rico/Viequest Cruise 2007 Mission Web Page



Cruise dates: April 27, 2007 – May 06, 2007

Mission: Recovery and conservation of seagrass meadows, associated fish communities, and the endangered Antillean manatee are important NOAA stewardship missions in southeastern Puerto Rico and Isla Vieques. Our work is critical to the development of forecasting models for predicting seagrass response to natural and anthropogenic stresses and to assess alternative management strategies.

The Scientific Party

NOAA, Center for Coastal Fisheries & Habitat Research

- Jud Kenworthy
- John Burke
- Guiseppe DiCarlo
- Amy V. Uhrin
- Paula Whitfield
- Brian Degan
- Erika Hansen
- Brooke Landry
- Jenny Vander Pluym

NOAA, NMFS

- John Hackney
- Todd Kellison

NOAA, Damage Assessment Center

- Kevin Kirsch
- Sean Meehan

External Contractors

- Chris Taylor
- Warren Mitchell

In addition, it is important to provide the Department of Environmental and Natural Resources (DENR) of Puerto Rico with information upon which an informed decision on establishment of a Marine Protected Area (MPA) can be made. The majority of Puerto Rican fisheries have declined dramatically in recent years due to over-fishing and degradation of coastal habitat. Based upon last year's data, fish communities and the habitats upon which they depend near Isla Vieques are healthier relative to those around mainland Puerto Rico. This is most likely attributed to sparse development on Isla Vieques which keeps recreational harvest and local demand for marine resources relatively low, as well as the previous existence of areas closed to fisheries exploitation. The rapid development expected for Isla Vieques will change those conditions which have protected localized fish communities in the past. Unless a conservation plan for the island that includes an MPA is instituted, the habitats and ecological processes required to maintain a sustainable fishery resource could degrade rapidly and the opportunity to maintain this vital resource would be lost.

CRUISE OBJECTIVES:

1. Repeat sampling of seagrass injury and disturbance sites at Naval Station Roosevelt Roads (NSRR).

2. Conduct benthic habitat surveys of Puerto Ferro, Puerto Mosquito, Ensenada Honda, and on the south and northeast coasts of Vieques to confirm existing habitat maps and resource values (i.e., nursery and adult fishery habitats).

3. Conduct multibeam sonar surveys at selected sites where habitat mapping is incomplete from previous research cruises.

4. Quantitative sampling of fish communities associated with bank, shelf, and shallow coastal habitats of Isla Vieques.

5. Conduct daytime, crepuscular, and nighttime fish hydroacoustic surveys using scientific grade, split-beam sonar.

DATA APPLICATIONS:

- Data from these studies will enable us to calibrate our existing tropical seagrass recovery model over a significantly longer time period.
- We will gain a better understanding of how to distinguish between the effects of natural and human induced disturbances in tropical seagrass communities.
- These improved models will significantly enhance the capabilities of resource

managers and economists to assess damages and develop restoration plans for disturbed seagrass communities.

- Comparative analysis of our fish data with similar surveys conducted in southwestern Puerto Rico will significantly improve our understanding of the complex connections and interactions between adjacent coastal ecosystems and the ecological services they provide.
- All data collected will serve the DENR of Puerto Rico with a comprehensive assessment of the natural resources around the Isla Vieques which will be used to draft a management plan for the rich mosaic of benthic marine habitats upon which a diverse animal community depends.
- Multibeam survey data will improve mapping capabilities of the Vieques Watershed Database and Mapping Project.

Puerto Rico Cruise Day 1 - April 27, 2007

After a minor delay, we set sail shortly after 10am and arrived on station around 4pm. We then proceeded according to plan, and so the crew and scientists prepared to launch three small boats for late afternoon dive operations.. Here we see scientist John Burke and Able-Bodied Seaman, Dave Leaphart, checking fuel levels in one of the small boats.

Two dive teams traveled around the southwest corner of Vieques to make a final test of our fish survey methodologies and to practice dive rescue skills.

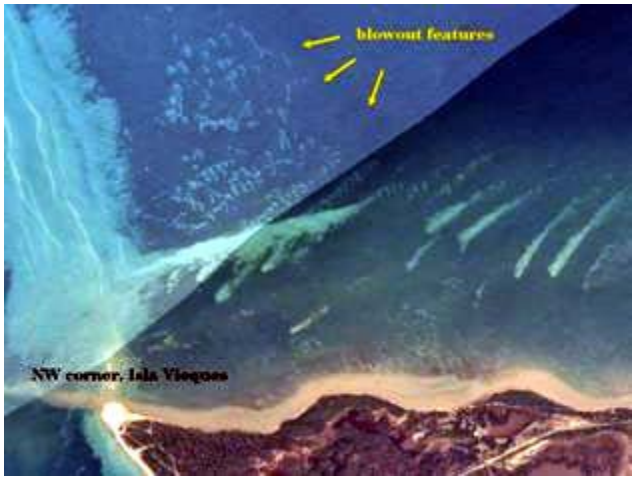
The third dive team traveled to the northwest corner of Isla Vieques to revisit three of our seagrass blowout disturbance sites. The teams marked shoots of seagrass, by piercing the base of the leaf bundles with a hypodermic needle. Here we see scientist Giuseppe DiCarlo marking shoots of seagrass. As the leaves grow and elongate, the hole-punch will migrate up the blades, and a leaf growth rate can be calculated given the distance that the hole has moved. The shoots that were marked today will be harvested on the last day of the cruise.

Paula Whitfield and Brian Degan prepare scuba gear on deck

Giuseppe DiCarlo marking shoots of seagrass. As the leaves grow and elongate, the hole-punch will migrate up the blades, and a leaf growth rate can be calculated given the distance that the hole has moved.

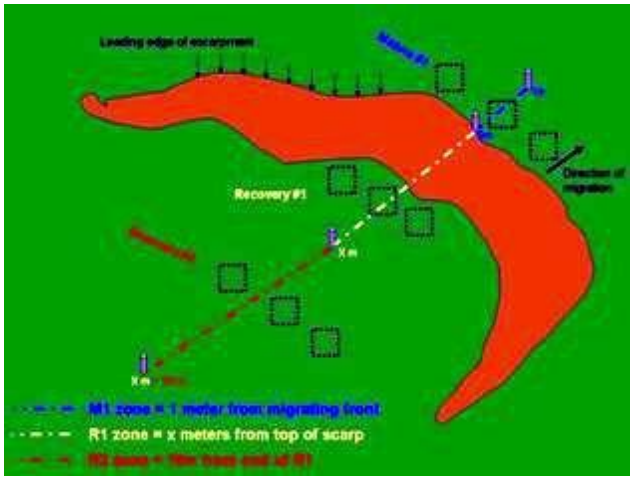
Results To Date of Seagrass Blowout Study

We want to determine if in fact these sand "blowouts" are continuously migrating or if they represent a punctuated disturbance – a single disturbance event that is followed by a period of recovery. By learning about the dynamics of natural seagrass beds in space and time, we will be able to forecast responses to extreme events (e.g., hurricanes) and set realistic expectations for restoration of high energy seagrass habitats.



For this study, the twelve crescent-shaped blowout features examined are examples of Type I disturbances – that is, open, uncolonized areas within a larger, colonized substrate. The blowouts appear to have been created as a result of high energy waves and sediment transport during Hurricane Hugo (1989). In other Caribbean locations where similar crescent-shaped blowouts occur, it has been suggested that the blowouts continuously "migrate" across the seafloor. These blowouts are actually fairly shallow depressions in the seagrass bed – only about a foot deep. The leading edge of the blowout is a sharp drop-off where water motion has eroded away seagrass and sediment from the mature (undisturbed) portion of the bed, leaving behind a short "cliff" that slopes down into a bare area devoid of seagrass. Over time, algae and seagrass will begin to colonize the bare area. Given enough time, the once bare crescent will refill with

seagrass. However, erosion continues at the leading edge migrating the entire feature towards the oncoming waves across the seafloor.

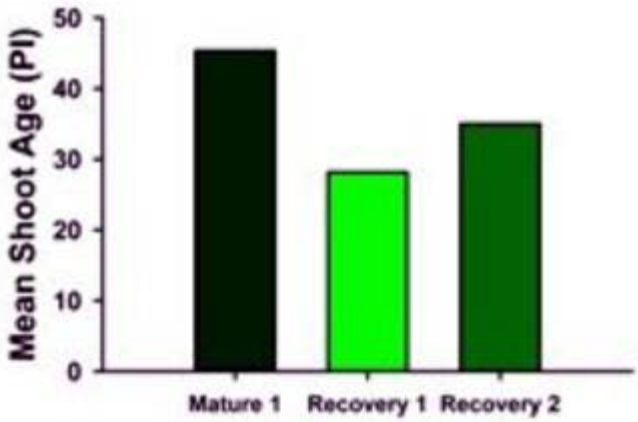


In 2004, we collected seagrass from three different zones at each blowout:

- **Mature 1**, on top of the escarpment at a distance of 1m from the leading edge
- **Recovery 1**, located in the trailing edge of the blowout where the first occurrence of seagrass was observed out to a point where visual observation indicated a transition to more dense vegetation
- **Recovery 2**, also located in the trailing edge of the blowout and extending a distance of 10 m from Recovery 1 .

We determined the age of each seagrass shoot collected by a commonly used metric in seagrass biology termed a plastochrone interval, or PI. The PI is the sum of all the green and white blades present on a shoot + the total number of leaf scars present on the stem of the shoot. A leaf scar is an actual scar left behind on the vertical stem of the shoot when a leaf is shed.

The PI represents the average time interval between the initiation of two successive leaves on a shoot - a measure of seagrass shoot “age”. Although the PI is subject to seasonal variability, it provides an accurate estimate of time at interannual time scales. It is a relative measure used for comparison.



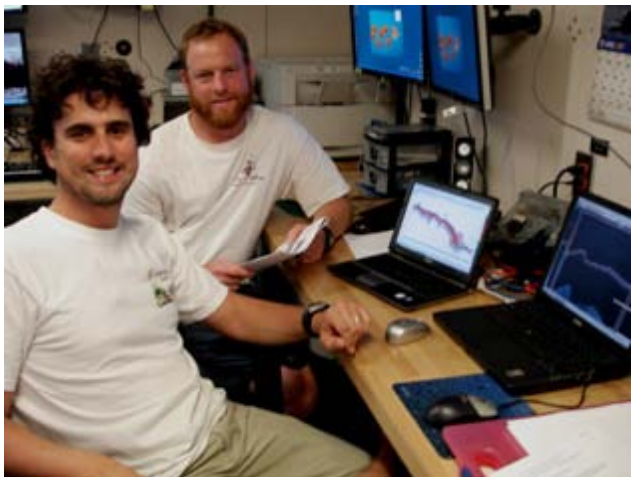
We have found that the mean age for shoots in the Mature 1 zone is significantly higher than for either of the Recovery zones. We have also found that shoot ages in the two Recovery zones are not different from each other. This confirms our expectations. Mature 1 shoots are older because they have not yet been disturbed. Shoots in the Recovery zones are younger because they represent new shoot growth in response to having been disturbed.

By plotting shoot ages versus distance from the escarpment using a statistical method called regression, we can find out when the escarpment formed and we can examine the trend of the line that is formed in this plot. A straight line would suggest continuous migration while a line that is nonlinear would suggest otherwise. We are in the process of conducting these regressions.

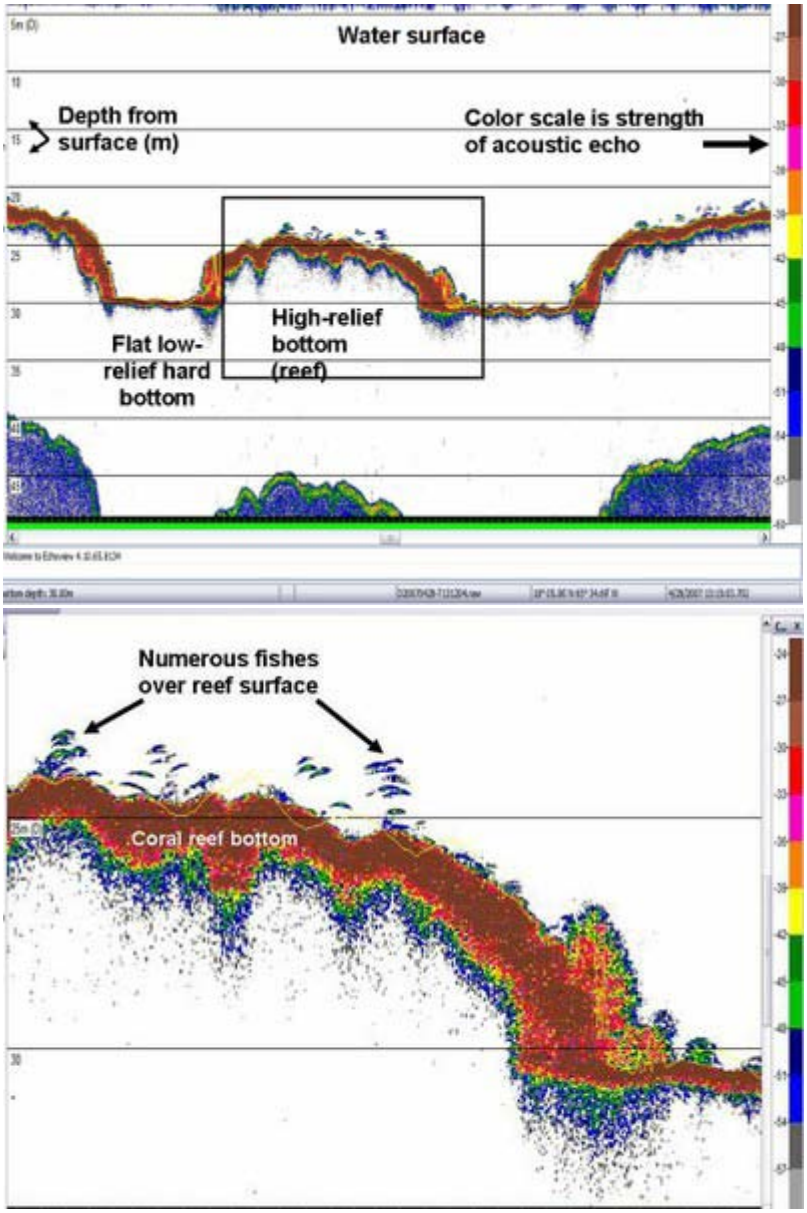
Hydroacoustic Fish Surveys

Previous research has shown that key members of reef-fish communities, most notably grunts and snappers, migrate from reef to surrounding soft-bottom habitats at night to feed. At dusk these fishes concentrate in schools at the edge of reefs, providing an opportunity to estimate the biomass of these communities. Observing these behaviors at night using divers is very difficult due to low light conditions. To overcome this issue, researchers often utilize hydroacoustic (sonar) technology to assess nocturnal fish communities. A new component of our Isla Vieques project involves using this technology for nocturnal surveys of fish distribution.

Dr. Chris Taylor, a Research Associate with North Carolina State University, is heading up these surveys with the help of Research Technician Warren Mitchell. During nighttime operations, fisheries sonar, which is a scientific fish finder, is used to estimate reef fish biomass in specific areas around Isla Vieques. The unit specifically consists of a Simrad EK60 split-beam echo sounder coupled with a Simrad EM1002 multibeam sonar. The transducer for the sonar, located on the underside of the NANCY FOSTER, sends out 15 pings per second. The pings reflect off the bottom as well as fish in the water column. These reflected “echoes” are monitored on a laptop computer and recorded onto the hard drive for later analysis and biomass estimations.

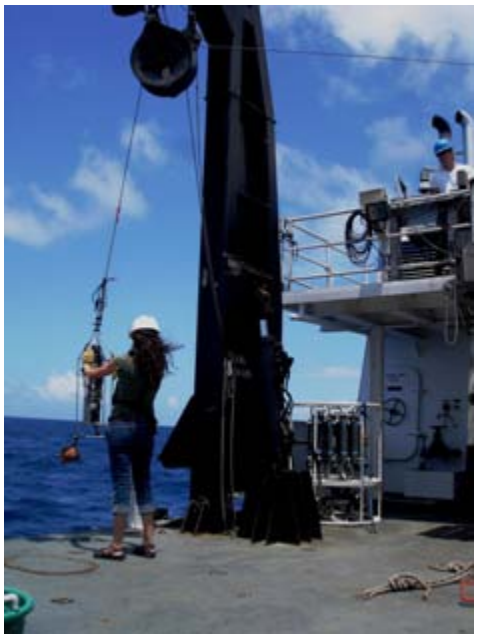


Here we see Chris (foreground) and Warren monitoring the progress of the sonar. The images below are actual echo recordings from Isla Vieques.. The use of fisheries sonar will permit observations during all hours and under all ocean conditions.



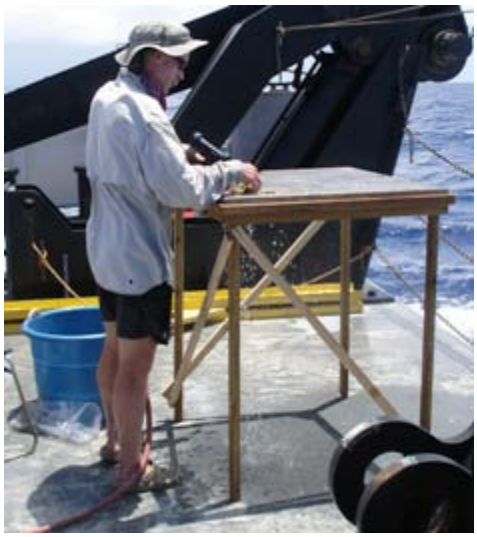
The fish sonar surveys will be paired with habitat surveys conducted by the NANCY FOSTER using the ship's multi-beam sonar tracking over the exact same locations. These fish biomass estimates, linked to specific locations and habitat types, will be useful for prioritizing conservation efforts for Isla Vieques and site selection for Marine Protected Areas.

The sonar transducer is mounted on a long pole that is lowered into the “moon pool” of the ship. The moon pool is a room, with an airtight door, that has an open floor that extends right through the bottom of the hull of the ship. A moon pool allows researchers to lower their instruments down into the water column. The actual opening that the transducer is mounted through is 10 inches in diameter. Here we see Chris and Warren, with the help of *Nancy Foster* Chief Bosun Greg Walker, lowering the transducer pole into the moon pool. Occasionally, it is necessary to check on the transducer to make sure that the unit is not fouled with line or other debris. In order to do this, the ship must turn off all of its engines and power down so that divers can enter the water and swim under the ship. Here we see *Nancy Foster* Ensign Marc Weekley examining the transducer.



A CTD (Conductivity Temperature and Depth) is a standard oceanographic tool used for profiling changes in conductivity and temperature, associated with depth, in the water column. The CTD is used to calculate the speed of sound underwater. Information gathered by the CTD is necessary to calibrate the ship’s multibeam sonar.

Day 3 – Sunday, April 29



The majority of our sampling during this cruise includes repeat visits to sites that have been monitored for a number of years. It is important to collect data over a number of consecutive time periods in order to examine response trends over time. For our seagrass research, we are observing how seagrass responds to a number of disturbances

- **hurricanes**
- **vessel groundings**
- **manatee grazing**

and how it recovers from each of these disturbance types. For our fish research, we are examining how fish communities inhabiting particular habitats fluctuate over time. All of this information is important from a resource management perspective (see the Data Applications section from the Main Page).

Erika Hansen, photo left, is sorting today's seagrass samples.

Today the seagrass team sampled an area known as Community Beach. A number of plugs of seagrass were collected from within a heavily disturbed meadow of seagrass where manatees are known to feed in large numbers. Plugs were also taken from outside the disturbed area.

- A plug of seagrass is extracted using a 15cm diameter coring tube which is manually pushed into the sediment, capped, and then pulled out.

- The plugs of seagrass are removed from the core, bagged, and returned to the ship for processing.

- On the ship, each plug is thoroughly rinsed to remove all sediment. The first photograph shows Chief Scientist Jud Kenworthy rinsing seagrass samples on the fantail of the ship.

- The numberof individual seagrass shoots per plug are then counted and the shoots are separated into blade material and root material.

- At this stage the seagrass is frozen for future processing upon return to the lab.

This year, the fish team is sampling at randomly selected sites encompassing three different habitat types:

- reef,
- seagrass/algae,
- mangrove

and three depth strata:

- outer,
- mid,
- inner.

Green Algae on sea floor.

Scientist Kevin Kirsch ready to conduct habitat surveys.

Some sites are new, and some are revisits from 2006. At each site, a diver conducts fish visual census surveys along a 30m transect line identifying and recording all fish sighted within 1m on either side of the line. A second diver follows behind the first and estimates the percent cover, at 5m intervals, of various habitats falling within a 0.5 x 0.5m square.

Day 4 – Monday, April 30

SCUBA is an acronym that stands for Self-Contained Underwater Breathing Apparatus. In 1942-43, Jacques Costeau and Emile Gagnan developed the Aqua Lung, the precursor to modern day SCUBA, from a redesigned car regulator. Designs have evolved over the years, but the principles remain the same. To this day, SCUBA remains an essential component to most marine science research as it enables scientists to interact hands-on with the underwater environment as opposed to using cameras or other remotely operated devices.

Modern SCUBA gear consists of the following items:

Scuba tank or Cylinder

Attaching two stage reguator to scuba tank

Cylinder – Commonly referred to as a tank, cylinders are made of aluminum or steel, and contain compressed air, air that is enriched with oxygen, or air mixed with other gases (i.e., helium). The maximum amount of compressed air that a tank can be filled with depends upon the size of the tank, but most tanks are filled to 3000 PSI (pounds per square inch).

Two-Stage Regulator – The *first stage* regulator reduces the cylinder pressure from 3000 PSI to an intermediate level of about 145 PSI. The *second stage* demand valve regulator, connected via a low pressure hose to the *first stage*, delivers the breathing gas at the correct ambient pressure to the diver's mouth and lungs. The diver's exhaled gases are exhausted directly to the environment as waste. The first stage typically has at least one "high pressure" outlet, which delivers breathing gas at unreduced tank pressure. This is connected to the diver's pressure gauge to show how much breathing gas remains.

Amy with bouyancy vested tank, regulator, inflator hose and button, and high pressure outlet to pressure/depth guage.

With an inflatable vest, the diver is able to control buoyancy by filling or bleeding air from it while under water

Buoyancy Compensator – Often shortened to BC, this piece of equipment is an inflatable vest that the diver is able to fill with air in order to control his/her buoyancy while under water. The BC attaches to the tank via a velcro strap and buckle. Divers need to adjust their buoyancy underwater in order to safely control ascent and descent rates. The inflator hose from the regulator inserts into a hose on the BC, and air is delivered to the BC by depressing a button.

the weight belt is worn by divers with varying amounts of weights attached to help with buoyancy.

Weight Belt – Like the name implies, the weight belt is a belt that a diver wears to which varying amounts of weight may be attached. The weight belt, like the BC, aids in buoyancy control.

Wet suit – A body suit made of neoprene rubber foam. Water absorbed by the wetsuit is heated by the skin and provides an insulating layer. Wetsuits come in varying thicknesses. Thicker wetsuits provide more insulation than thinner ones.

This computer constantly measures depth and time, based on a pre-programmed algorithm

Dive Computer – Typically worn on the diver's wrist like a watch, the computer constantly measures depth and time, based on a pre-programmed algorithm. The computer also calculates tissue nitrogen uptake and elimination and provides a continuous readout of the dive profile, including: depth, elapsed time of the dive, duration at current depth before decompression becomes mandatory, and a warning if the rate of ascent is too fast.

Pressure and depth Guages a vital piece of equipment

Here we see scientist Sean Meehan fully equipped and monitoring his depth, pressure, and dive time during his ascent.

Pressure/Depth Gauge - These gauges show how much breathing gas remains in the tank and also display the diver's depth throughout the dive.

Day 5 – Tuesday, May 1

ABOUT THE *Nancy Foster*

NOAA Ship Nancy Foster was originally built for the U. S. Navy as a yard torpedo test craft. The vessel is 187 ft long, with a 40 ft beam, and 10 ft draft. In 2001, the ship was transferred to NOAA and converted to conduct marine research along the Atlantic and Gulf coasts of the United States and the Caribbean. The ship was commissioned in 2003 and is named for Dr. Nancy Foster in tribute to her outstanding contributions in advancing NOAA's mission. The vessel is capable of remaining at sea for 14 days before returning to port to refuel. *Nancy Foster* homeports in Charleston, South Carolina.

Check out *RV Nancy Foster*.

LIFE AT SEA

In addition to withstanding the rolling of the ship, inclement weather, equipment malfunctions, and other typical incidents at sea, spending 10 days on a research cruise requires patience, flexibility, and consideration for others. Scientists have to remember and respect that *Nancy Foster* is home for the crew. Imagine being inundated with 14 crazy relatives all coming to stay at your house for a couple of weeks!

Scientists bunk in staterooms consisting of two sets of bunk beds (racks), a sink, and four lockers. A typical stateroom on *Nancy Foster* berths four scientists comfortably.

Everyone eats together in the mess hall during established meal times.

For entertainment, there is a "theater" with a library of over 600 movies, a small area with board games and books, and a small workout room with some exercise equipment and free weights.

DAY 6 – MAY 2

MEET THE SCIENTISTS

There are ten scientists aboard *Nancy Foster* from NOAA's Center for Coastal Fisheries and Habitat Research (CCFHR) in Beaufort, North Carolina. In addition, we have colleagues joining us from other branches of NOAA and from North Carolina State University.

Dr. Jud Kenworthy, an Ecologist at CCFHR, is the Chief Scientist for this cruise and the lead scientist for the hurricane and manatee disturbance portion of the seagrass effort. Jud has made a lifelong career studying the biology and ecology of seagrasses worldwide. His research also focuses on recovery dynamics and restoration of disturbed seagrass beds.

Dr. John Burke is a Research Fisheries Biologist and is the lead scientist for the fish-habitat survey project. John's research focuses on fish behavior and the relationship between habitat quality and fisheries productivity.

Amy Uhrin is an Ecologist at CCFHR and the lead scientist for the seagrass blowout project. Amy is a diver on the fish team, conducting habitat surveys. In addition, she has been responsible for preparing and submitting web page content for the cruise.

Paula Whitfield is the Chief Diver on this cruise. She is responsible for making sure that we all dive within NOAA safe diving limits and she also serves as a fish counter. You may recognize Paula's name from her work with the invasive lionfish off the coast of North Carolina.

Brian Degan is a Research Technician at CCHFR. He assists the Chief Scientist in scheduling the Plan of the Day, is responsible for selecting our random fish sampling stations, and participates in the fish census work as a fish counter.

Jenny Vander Pluym is a Research Technician with CCFHR and supports the fish sampling effort by conducting habitat cover surveys. Jenny has also devoted time to filling SCUBA tanks so that we have a constant supply of tanks to use each day.

John Hackney is a Research Fisheries Biologist at CCFHR. John is a habitat surveyor on the fish team and has also helped tremendously with filling tanks.

Brooke Landry is a Research Technician at CCFHR. During the cruise, Brooke is responsible for maintaining our GIS database and participates in the seagrass sampling effort.

Erika Hansen is a Research Technician at CCFHR. During the cruise, Erika is responsible for maintaining a log of all sampling activities that occur throughout the duration of the cruise. In addition, Erika takes part in the seagrass sampling effort.

Giuseppe Di Carlo is a post-doctoral researcher at CCFHR. A major component of Giuseppe's research at CCFHR revolves around the seagrass project here at Isla Vieques, particularly how seagrass below-ground material responds to disturbance.

Sean Meehan and Kevin Kirsch are from NOAA's Office of Response and Restoration (ORR), Assessment and Restoration Division, in St. Petersburg, Florida. Sean focuses on community outreach while Kevin deals with oil spill injury assessment and also plays a role in ORR's Vieques project. Check out the following link for more information on ORR's Vieques Project. http://www.response.restoration.noaa.gov On the cruise, both Sean and Kevin support the fish sampling effort by conducting fish and habitat surveys, respectively.

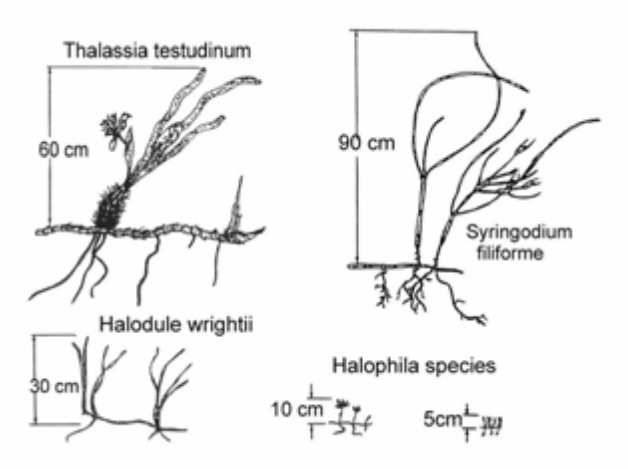
Dr. Todd Kellison is a Research Fisheries Biologist at NOAA's Southeast Fisheries Science Center in Miami. Todd's research focuses on many aspects of coral reef fish ecology.

Dr. Chris Taylor is a post-doctoral researcher at North Carolina State University's Center for Marine Sciences and Technologies. Chris is in charge of the fish hydroacoustic surveys during the cruise.

Warren Mitchell is the 2006 North Carolina Sea Grant Marine Fisheries Fellow, based at North Carolina State University's Center for Marine Sciences and Technologies. During the cruise, Warren has assisted Chris with the fish hydroacoustic surveys.

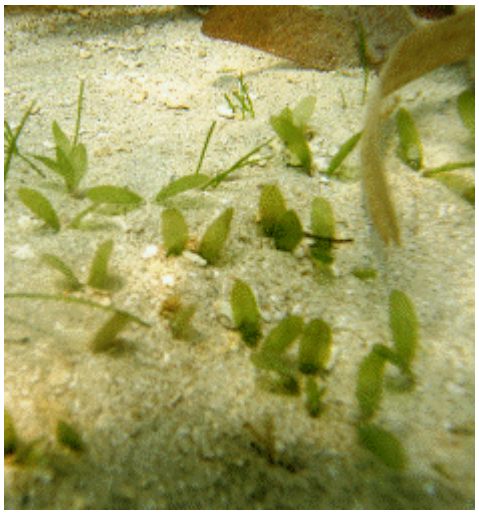
DAY 7 – MAY 3

SEAGRASS RECOVERY FROM VESSEL GROUNDINGS

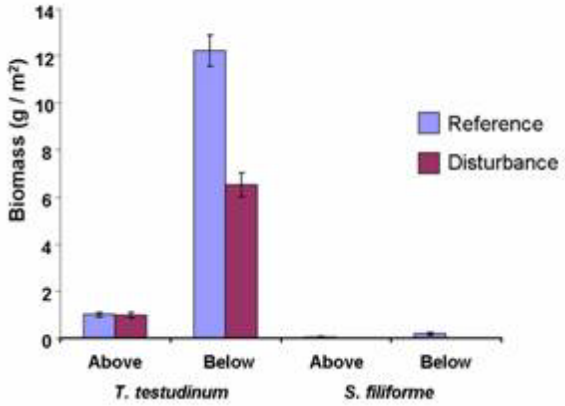


Four species of seagrass occur in southeastern Puerto Rico and Vieques Island: *Thalassia testudinum (turtle grass), Halodule wrightii (shoal grass), Syringodium filiforme (manatee grass)* and *Halophila decipiens (paddle grass).*

Thalassia is the dominant seagrass throughout this region, followed by *Syringodium* and lesser amounts of *Halodule and Halophila.* Sometimes locally high abundances of *Syringodium* and *Halodule* are found in physically disturbed environments such as high energy areas, deeper water, manatee grazing areas, and halos in the proximity of reefs subjected to herbivory and other bioturbation. One of the major objectives of our studies of disturbance and recovery dynamics is to calibrate our seagrass injury recovery model for conditions in the deeper tropical environment. The original model was formulated for conditions in the sub-tropical Florida Keys National Marine Sanctuary where there is much more seasonality in environmental conditions than in southeastern Puerto Rico.



One of our study sites is located where a Navy fuel barge grounded during Hurricane Georges in 1998. In about a 1000 m 2 impacted area, sediments were excavated and nearly all of the seagrass bed was removed. The dominant seagrass species in the area before the impact was *Thalassia*. An initial assessment was performed after the hurricane, and we have revisited this site numerous times between 1999 and 2006 to assess seagrass recovery by examining seagrass species composition, shoot density, and above and belowground biomass. We have compared the recovery process in the disturbed site to an adjacent undisturbed seagrass bed, in order to assess recovery.



Our data show how *Thalassia* above-ground biomass (leaves) has fully recovered, while belowground biomass (roots) has recovered about 60%. *Syringodium*, which originally represented a small component of the total seagrass biomass present in the site, but has showed no recovery. *Thalassia* biomass recovery has occurred nearly twice as fast in Puerto Rico as predicted by our recovery model developed for the Florida Keys, illustrating an adaptive response of this plant to overcome disturbance as well as the critical need to locally calibrate the model for fully tropical environments. In addition to the relatively rapid rate of *Thalassia* recovery at all of our "single event" disturbance sites, we have also noted that there is no succession of species. If a *Thalassia* dominated seagrass meadow is severely disturbed it recovers directly back to *Thalassia* instead of one of the faster growing opportunistic species, either *Syringodium* or *Halodule.* This is substantially different from succession models previously described in the scientific literature where the opportunistic species temporarily substituted for *Thalassia* during the earlier stages of recovery. The implications are that for tropical seagrass systems where disturbance occurs in a single event, the recovery models require some modification.

DAY 8 – MAY 4

The nature of our research allows us to explore amazing habitats and encounter unique marine life. However, it also exposes us to a number of hazards both in and out of the water.

Prior to diving operations, the small boats are loaded with SCUBA gear and sampling equipment. Much of this equipment is heavy and awkward and often necessitates a group effort to load. The small boats are then launched from the *Nancy Foster* by using a crane. It requires no less than five crew members to man the lines and operate the crane. It also requires a high level of communication among crew members via radios, hand signals, and verbal commands.

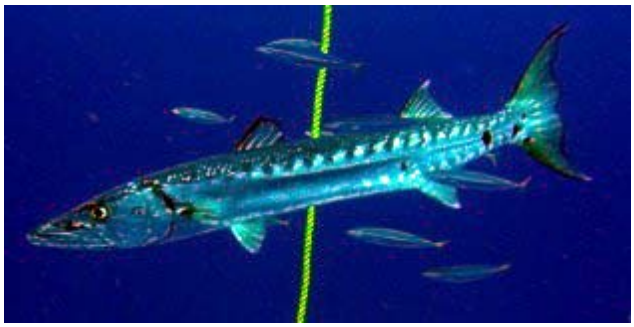
In order to board the small boat once it is deployed, scientists must climb down a small ladder that is attached to the ship. When seas are choppy, this can be tricky.

Sometimes divers are deployed directly from the ship. Divers make a “giant stride” entry directly from the ship’s deck, dropping to the water nearly six feet below.

After a day of diving, it is necessary to re-fill the SCUBA cylinders with compressed gas for the next day. A special diving compressor is used for this. The greatest risk of cylinder explosion occurs at filling time. While filling cylinders, care must be taken to monitor the pressure of the gas in addition to its oxygen content at all times.

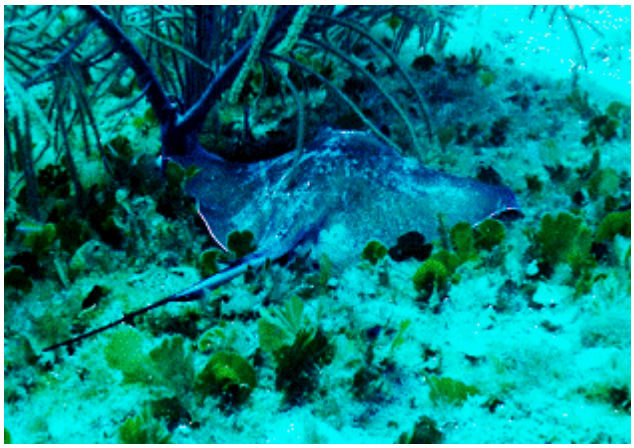
UNDERWATER HAZARDS

A number of creatures encountered while diving can pose a threat if caution is not exercised. The following photos were taken by our divers during sampling efforts. The animals were in no way molested or provoked. Some are just naturally curious and approach of their own accord.



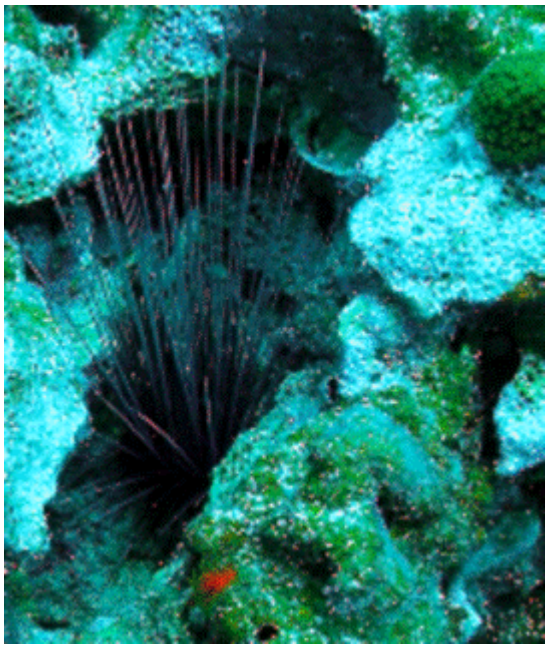
Great Barracuda

The barracuda has a bad reputation due to its menacing countenance and its habit of approaching and following divers. There are very few reports of unprovoked attacks and these fish normally move away if they are approached closely.



Southern Stingray

Hazards associated with stingrays have recently come to light as a result of the death of celebrity Steve Irwin. Most rays lie motionless on the seafloor and appear unconcerned unless closely approached or molested. Many species have one or more venomous spines at the base of the tail which can penetrate wetsuits and flesh. The venom is a powerful nerve toxin that can affect the heart in a number of ways, some dangerous.



Long-spined Sea Urchin

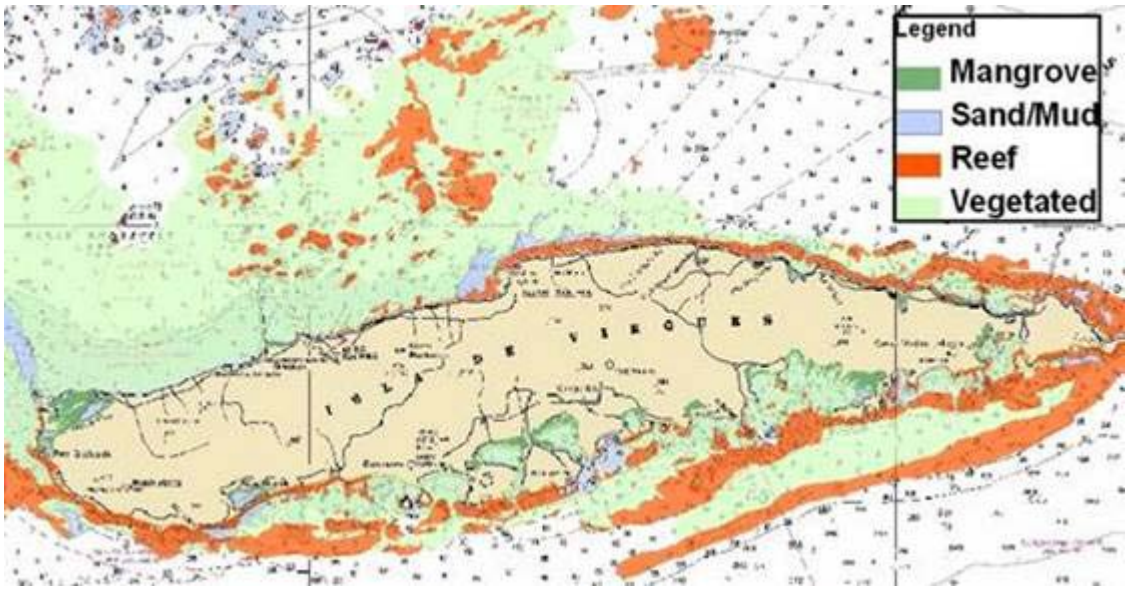
The spines of this urchin can easily puncture the skin and break off in the flesh causing a painful wound. Fortunately, embedded spines dissolve within a few days.

Fire Coral

Contact with bare skin produces an intense stinging sensation in addition to welts, redness or rash. Typically the sting is short-lived.

DAY 9 – MAY 5

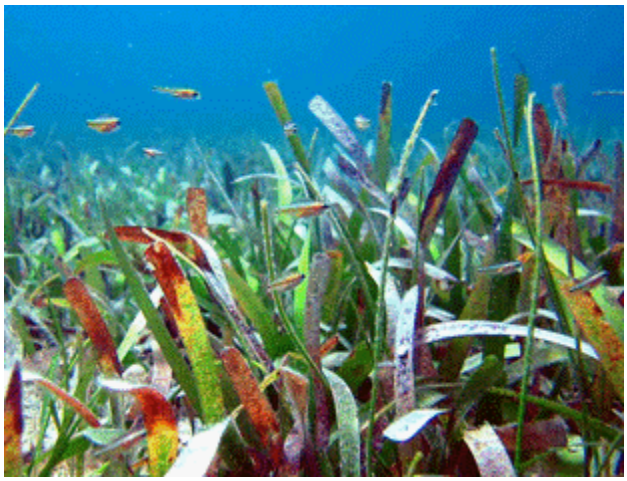
VIEQUES' MILITARY PAST

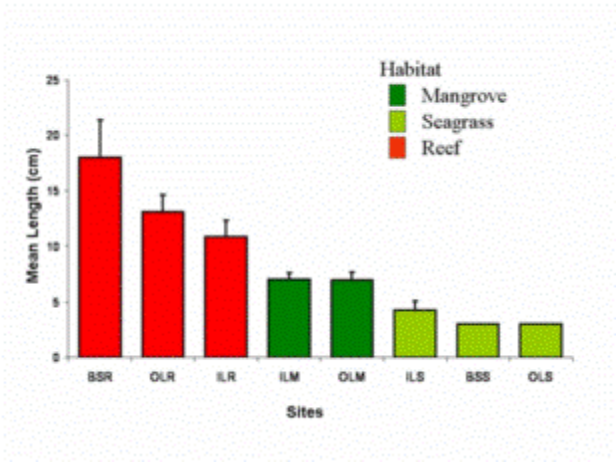


Isla Vieques (seven miles southeast of mainland Puerto Rico) was formerly used by the United States Navy for naval gunfire support and air-to-ground ordnance training since the early 1940's. Beginning in 2001, the Navy turned over land on the western end of Isla Vieques to the Municipality of Vieques, the United States Department of the Interior (DOI), and the Puerto Rico Conservation Trust. On May 1, 2003, the Navy ceased all military operations on the island and transferred its property on the eastern side of the island to the US Fish and Wildlife Service and the land was designated as a wildlife refuge.

The Navy is currently investigating areas it previously occupied to determine the extent of any potential contamination. NOAA's Office of Response and Restoration (ORR) is assisting the Navy with the assessment of contamination, identification of risks to the environment, and development of cost-effective strategies for assessment, cleanup, and restoration of natural resources. For more information about ORR's work in Vieques check out http://www.response.restoration.noaa.gov.

FISHERIES AROUND VIEQUES





Fisheries around Puerto Rico have been overexploited. Due to the past presence of the United States Navy, the extent of overexploitation is not as severe around Isla Vieques making it a promising location for establishment of a Marine Protected Area (MPA) designed to sustain fisheries in the area. One of the aims of our cruise is to compare fish communities at different locations around Isla Vieques to allow us to identify the best locations for establishment of an MPA. The study will help understand the connection between different fish species and habitat, and identify what habitats are of most value for fisheries around Vieques. In addition to helping to prioritize conservation efforts these data will also assist in the cleanup and restoration efforts.

Many of the commercially important reef fish species of the region have a life cycle that involves a cross shelf migration. Adults are found offshore on deep reefs where they form aggregations and spawn. Their floating eggs hatch to a larval stage over the shelf and after a month or so of growth and development in the water column these larvae settle to the bottom. These early juveniles tend to move inshore to shallow water where they find shelter in a variety of habitats. As these juveniles grow they tend to move back offshore where they join the adult stock spawn and the cycle turns. This graph displays mean grunt lengths from a variety of habitats across the island shelf. These data indicate that the largest grunts occupy reefs and that adult grunts are found on offshore reefs.
Smaller juvenile grunts are found in seagrass and an intermediate size in mangrove habitat.

The size of fish populations and their production may be greater in some areas than others due to differences in the amount and types of habitat available and how these habitats are arranged relative to one another across the shelf. One of the factors that will influence the productivity of

an area is the amount of nursery habitat available for juvenile fishes as this will influence their abundance, survival and growth rates. Probably the most important types of nursery habitats are seagrass and macroalgae beds.

Because of their small size and timid nature, juvenile fishes are poorly sampled in vegetated habitats by visual and sonar surveys. As a result we estimate juvenile fish densities in seagrass and macroalgae beds with a push-net. Two divers push the net over the bottom for a distance of around 100 ft (30 meters). The net is two meters wide so that the catch provides a density estimate for the 60 square meters over which it sweeps. Target species are juvenile tropical fishes, including snappers, grunts, parrot fishes, goat fishes, some wrasse species, and groupers that hide and feed in seagrass and macro-algae meadows that have developed in the shallow areas of the island's shelf. These Essential Fish Habitats should be included within a Marine Protected Area designed to sustain fisheries.

DAY 10 – MAY 6, 2007

Bright and early, two teams headed off to retrieve the seagrass shoots that had been hole-punched on Day 1. Then we bid a fond farewell to all of our fish friends below, and it was anchor's aweigh and full steam ahead for port. The smooth steam back allowed everyone to catch up on some much needed rest to prepare for a grand celebration upon our return to Old San Juan.

It was a successful cruise, to say the least. We at CCFHR would like to thank all of our visiting scientists for their hard work, patience, and persistence and to acknowledge the crew of *NancyFoster* for their dedication to making the cruise as safe and productive as possible.

We leave you with some of our favorite parting shots.

Until next year, adios from the Science Party!

Scientist Amy Uhrin captured this sea rod in silhouette during one of her shallow-water habitat dives.

Scientist Brooke Landry documented this flying gurnard trying to make a quick getaway.

This eagle ray was "spotted" by Scientist John Burke during a dive safety stop.

A verdant pasture of green algae as seen by Scientist Erika Hansen.

A fish "frenzy" witnessed by Scientist John Burke.

The *Nancy Foster* is welcomed back to port by El Morro, the antiquated guardian of Puerto San Juan. The national flags of Puerto Rico, the United States, and the Spanish military waving majestically seven levels above the rolling surf, bidding us *bienvenidos*. (Photo by Amy Uhrin)