Sherwood Forest Flag Expedition

May 10\textsuperscript{th} to 20\textsuperscript{th} 2005

Flag #53

Introduction:

Since its inclusion in the nation’s largest permanent marine reserve as part of the Florida Keys National Marine Sanctuary, Sherwood Forest continues to astound divers and scientists alike with its beautifully-colored false bottom full of nooks and crannies where fish and other sea creatures can find shelter. The reef, estimated to be over 9,000 years old and the only one its kind in this hemisphere remains one of the best nursery habitats in the United States: an important spawning site for aggregating species. What role the Sherwood Forest/Tortugas North reef structure plays in the broader context of the Tortugas Ecological Reserve and the entire Florida Keys National Marine Sanctuary needs to be examined. This expedition will complement baseline data to further such an understanding.

The reef is between 60 to 130 feet deep and represents a “mid-range depth category”, distinct from the much more well-known and studied shallow reefs above 50 feet. For the last fifty years, underwater coral research using SCUBA has been limited largely by depth and time restraints, and by decompression safety limits. By introducing newer SCUBA technologies as oxygen-enriched air “Nitrox” and closed and semi-closed circuit rebreathers, these limits have now been expanded and this expedition has begun a thorough study of mid-range corals in Sherwood Forest, within the Dry Tortugas Ecological Reserve.

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Purpose and Objectives:
In a 2001 NOAA report, *Distribution and sighting frequency of reef fishes in the Florida Keys National Marine Sanctuary*, the "uniqueness of the Tortugas reefs relative to other regions of the Florida Keys" was noted:

The extensive and abundant fungiform coral colonies are found only in Sherwood Forest, where they are abundant. The extensive space beneath the closely spaced canopies provides unparalleled protected space for fish and other invertebrates. In addition because this old growth coral forest is at depths of 20-40 meters, it is removed from many of the near surface impacts like increased water temperatures and excessive ultra violet radiation. As a result, the resident corals, fish and invertebrates, some of which are the same as those on Florida’s shallow reefs, could provide larvae and juveniles to repopulate shallow reefs in serious decline.

Fish species (biodiversity) was, however, less in this region, possibly in part due to "the more limited variety and extent of habitats" for reef fishes. Do the mushroom-like capped formations provide a most-needed refuge for juvenile fish in a manner similar to mangrove/sea-grass areas of the other Keys regions? Again, as pointed out in this report, "the importance of specific characteristics of habitats in controlling fish populations indicates the need to investigate sub-regional scale phenomena..."

Members of the Expedition:
Captain Tim Taylor FN ‘04, Expedition Leader
Dr. Robert Ginsburg, Chief Scientist
Mark and Marianne Palmer, Sponsors
Dr Judith Lang, Independent Biologist, Scientific Advisor
Dr Rodrigo Garza-Perez, Post-doctoral Assistant, GIS specialist
Christopher Moses, PhD Candidate, Diving Safety Officer
Ken Marks, Fish Specialist, Cameraman
Patricia Ayers, Fish Specialist
Jacqueline Morales, RN, Chef
Zack Roehr, Crew

Expedition Team
Photos Copyright © Tim
Background: Two explorers cross paths

Dr. Robert Ginsburg is known worldwide for his research, leadership, and teaching. His work includes a lifetime study of Florida’s reefs and sediments; arresting findings on the origins of reef walls of Belize, and primary research on the evolution of the Bahamas during the glacial epochs. He has long taken a leading role in collaborative international scientific efforts, serving as the organizer and chairperson for two international conferences on reefs, as the originator of a program on global sedimentary geology, and as the head of the International Year of the Reef (1997) that focused on research and education worldwide. Presently, teaching at the Rosenstiel School of Marine Atmospheric Science, Division of Marine Geology and Geophysics, at the University of Miami. He is also the main promoter of the Atlantic Gulf Rapid Reef Assessment (AGGRA) program, with a regional database of 800 reef surveys in the Western Atlantic.

In the early 1990’s Captain Tim Taylor FN ’04 first discovered, explored and named Sherwood Forest Reef, a unique reef where coral grows at the unusual depth of 60 to 130 feet into an amazing canopy of mushroom-like formations. In late August of 1997, while Tim was hosting a group of scientists aboard his research vessel Tiburon, the site was discussed and at Tim’s suggestion, they visited the reef. Although not a part of their original reconnaissance survey of the Dry Tortugas National Park, the group made two additional trips to Sherwood Forest; a testimony to its uniqueness. As a direct result of this expedition, Sherwood Forest became the poster child for scientists to rally support from the state of Florida and numerous other national groups to establish the Tortugas Ecological Reserve.

Dr. Ginsburg first visited the Dry Tortugas in the 1950’s, when as a young scientist he lived in the lighthouse storeroom on Loggerhead Key, studying the beach rocks. His roommate at that time was John Lewis, who is currently recognized as a leading Canadian marine biologist. In 1998, Bob saw photographs of a newly discovered reef tract called Sherwood Forest and was captivated by the unusual “mushroom-capped” appearance of the coral formation. By 1999, having pulled together funding from his own resources as well as the National Geographic Society, he returned to the Tortugas with a submersible which allowed him to make a map of the reef. Based on sampling he found this formation of “old growth” coral was composed of base pedestals of Montastraea faviolata topped by mushroom caps of Montastraea franksii.

In October 2004 the two explorers finally crossed paths when Dr. Ginsburg chartered Captain Taylor and his vessel to research coral formations within the Dry Tortugas Ecological Reserve. During the course of this ten-day AGGRA survey, Bob and Tim spent many hours scanning the bottom topography with sonar, discussing Sherwood Forest as well as the opportunities that could be created by joining forces. For the last fifty years coral research has been determined largely by the equipment limitations of open water scuba tanks. By introducing newer technologies in the form of mixed gas and rebreathers to Dr. Ginsburg’s work, they could launch a first of its kind expedition that was concentrated on mid-range corals in the Sherwood Forest Reef of the Dry Tortugas Ecological Reserve.

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Methodology:

Initial methodology incorporated a modified AGRRA survey protocol on a random subsample of the stratified random sites used during an extensive series of fish surveys conducted on Tortugas Bank in (Ault et al., 2001). An AGRRA survey looks at various components of a reef – hard corals, algae, and fish— in order to arrive at an overall assessment of its health. Data are collected by transect surveys; corals along a transect are measured, identified, and their partial tissue mortality estimated, along with any observations of possible coral diseases and instances of coral bleaching. The cover of important algal groups (crustose corallines, fleshy macroalgae and calcareous macroalgae) is also quantified, along with height estimates of the macroalgae (for biomass estimates) and densities of the important, herbivorous sea urchin, Diadema antillarum. The species, size, and abundance of selected (commercially or ecologically significant) fishes are measured as well in separate transects. Twenty-three sites were surveyed in the course of eight days.

In addition, within the specifications of the NOAA (National Oceanic Atmospheric Administration) collection permit, the team gathered coral samples from three sites. According to Dr. Judith Lang, there were three purposes for the specimen collection efforts undertaken. The first consisted of collecting chips from the coral pedestals to ascertain the identity of the original coral at the base of the pillar formation. The team consistently found that the pillar samples were composed of Monastraea cavernosa. It is important to note that although their shape and size varied at the two collection sites, the pillars were all M. cavernosa. For the second collection effort, Dr. Lang collected subsamples (at the same sites) of the colonies of Montastrea forming the “caps” of the “mushroom”. Preliminary identification of the species that make up the caps will be verified by molecular analysis of the soft (live) tissues and morphometric analysis of their skeletons. The third collection was performed in order to obtain some preliminary data of possible relevance to the rather large percentage of dead corals that was observed at several sites. Subsamples were taken of corals that had recently recruited to the tops of 2 large corals exhibiting relatively recent mortality (i.e., thought to be within the last decade). These samples will be X-rayed and age-dated in an effort to approximate the date of the death of the underlying corals. Such sampling will need to be supplemented by a wider collection effort before meaningful interpretations can be made from the data.

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One night was spent on the Tortugas Banks collecting plankton by towing a plankton net in the mid-water column behind the vessel at three separate sites, varying in depth from about 80 feet over the reef to 150 feet above a sand plain. Towing was accomplished at a constant depth, essentially mid-water, despite the varying bottom compositions under the plankton tows. As Dr. Rodrigo Garza explained, “in previous studies vast amounts of what was believed to be plankton had been noted, coming up from the mid-water range, and showing up as scatter on the boat’s sonar”. Huge quantities of colonial tunicates (salps), fish larvae, ctenophores, and crustaceans were pulled up in each tow, confirming that this scatter was indeed caused by rising plankton. Collection took place starting at 11PM. Specimens will be further identified in the laboratory to obtain a general composition of possible settling larvae, and thus potential new additions to the reef population, and for clues as to the likely origins of the plankton, which could be demersal (interstices in the reef or the sand plains), or pelagic (deep water adjacent to the bank margin).

Additionally, in two areas surveyed on the Tortugas Banks, a new species (for these scientists) of paper-thin black sponge was noted to be growing directly over other sedentary organisms. Algae like Lobophora variegata and Halimeda goreauii were still completely pigmented underneath, suggesting that either it is currently growing very rapidly or that enough light passes through its tissues as to allow algal photosynthesis to occur. It did not appear to be killing the algae at present, and one specimen was even found to be growing over a live tube-dwelling worm. However, the underlying marginal tissues of several corals that were being overtopped had bleached, hence, are at risk of dying. Pictures and samples were taken for further study and identification. Captain Taylor and his crew volunteered to monitor and record the growth of the sponge over the next few months, as they will be working in the same area on other projects.

Conclusions:

With initial data collection completed, the hard work of evaluating what it all means, now faces the team. The answers must wait until specimens have been thoroughly identified and studied; data compiled, reviewed and analyzed. What is apparent is that this trip has raised even more intriguing questions about the Sherwood Forest reef tract. Including: why did the fish food web appear so unbalanced? With very few herbivores, planktivores and deposit feeders, and the most common carnivore, the red grouper, Epinephelus morio, apparently feeding on crustaceans hiding down in holes beneath the coral mushrooms. These, as well as many other questions demonstrate the need for continued research in this area.

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1. Example of Sherwood Forest reef cavern systems; 2. (Acropora cervicornis) Staghorn coral growth; 3. Dr. Judy Lang organizing coral samples; 4. Dr. Ginsburg with plankton trawl sample; 5. Dr Rodrigo Garza-Perez hauling in plankton trawl; 6. Research Vessel Tiburon

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Study Grids: The large red area at the upper Left and Corner of this chart (upper left side of the Tortugas Banks) indicates Sherwood Forest Reef. Each square is 2000 x 2000 feet square.