10-1-2001

NCRI 3-D Visualization of Coral Reef Habitat

Brian K. Walker
Nova Southeastern University, walkerb@nova.edu

Aquaculture Center Changes: More Fish, More Research, More Business

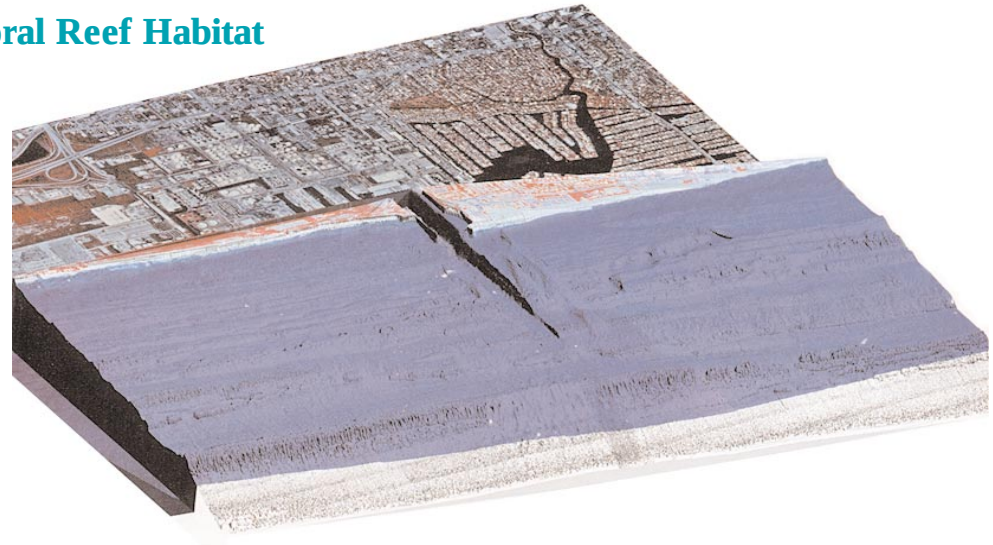
A new step in the operation of the Davie ARC (Aquaculture Research Center) is underway. Four years into a joint venture with Nova Southeastern University to grow fish in sanitized treatment tanks at the town's former sewer plant, Davie, Florida was poised to finally cut bait. Under a new, almost five-year lease, the town will no longer subsidize the Aquaculture Research Center.

The fish farm opened in 1997 at 6300 SW 36th Court and started in two of the town's old sewage tanks. The sewer plant, which closed in 1988, was a target for vandals and an eyesore. Its conversion into a fish farm was unique. We call it the ultimate in recycling," said **Bart Baca**, Ph.D., the facility's director and an NSU professor. It has grown to eight tanks and about 200,000 tilapia in various stages of growth. Currently, the fish farm has sales of about $7,000 to $10,000 a month, Baca said. The university wants to initially invest about $180,000 in the farm and double its size, adding at least six new tanks. "We are making a commitment," Baca said. "This is a five-year lease and we hope to continue it for many years so this becomes a centerpiece of our freshwater fish program." Baca said the facility wants to branch out and farm shrimp and redfish. Besides tilapia, it now has about 150,000 eels. According to Baca, tilapia is more popular than other freshwater fish like catfish and rainbow trout. "Right now, we have demand for three times what we can produce," Baca said. "The only way to meet that demand is to expand, invest, and take over the lease," he said.

The mission of the ARC remains to accomplish outstanding education and research in aquaculture. The NSU business school will partner with the NSUOC for sound business management of aquaculture operations and to develop aquaculture business courses and programs to serve needs of students. Baca will be joined by Phil Friedman, D.B.A., of the Huizenga School, who adds businessacumen and content to the curriculum, operations, and research.

NCRI 3-D Visualization of Coral Reef Habitat

The NSU Oceanographic Center dean and National Coral Reef Institute's (NCRI) executive director, **Richard Dodge**, Ph.D, and NCRI Geographical Information Specialist, **Brian Walker**, have recently published a small photo layout in the Nov–Dec 2001 edition of *UnderWater Magazine* by the Association of Diving Contractors International pictorial titled "Visions in Sonar." The photo layout (page 62) displays a bathymetric survey recently conducted in southeast Florida (Broward County) during April 2001 using the Laser Airborne Depth Sounder (LADS) system. The survey encompassed an area from North Miami-Dade County, through the entire Broward County coastline, to south Palm Beach County (approximately 43 km), and from the shore eastward to depths of 130 feet (approximately 2.5–3.5 km offshore). The data collection was funded by Broward County Department of Planning and Environmental Protection.



The Port Everglades entrance channel in Broward County, Florida. This is Laser Airborne Depth Sounder (LADS) bathymetry data overlayed by a 1:24,000 scale aerial photograph mosaic looking west. Features include the New River north of the channel; old breakwaters running east/west; and a prominent, actively accreting coral third reef in foreground. Image created by Brian Walker of the National Coral Reef Institute and Nova Southeastern University.

The survey technique is a relatively new technology where a laser is shot from an airplane. A distance is extrapolated from the time it takes for that laser to return. Then, from the altitude of the plane, a depth below mean sea level is calculated. The laser is limited to relatively shallow water (less than 150 ft.), however, it is an economically and timely means of acquiring data. The resolution of the data depends on the spacing of the laser returns. The Broward survey is four-meter resolution, which means a point was taken approximately every four meters. The data is recorded as x, y, z (latitude, longitude, depth). These several million points are then processed using a variety of computer programs to produce a triangulated irregular network (TIN). This is a data structure that represents a continuous surface through a series of irregularly spaced points with values that describe the surface at that point (elevation/depth). From these points, a network of linked triangles forms the surface. Once this surface is created, sun shading, color coding, and/or draping georeferenced airplane or satellite photography are all possible. Special mapping and imaging software enable the model to be zoomed and tipped to the desired orientation and processed into three-dimensional perspectives.

Using 3-D imaging software, two-dimensional views can be used to create three-dimensional anaglyphs (viewable with 3-D glasses). The anaglyph provides a unique view into the bathymetry that is unattainable by two-dimensional imagery. Multiple views are useful for identifying benthic features and habitats, including coral reefs. The well-known First, Second, and Third Reef terraces (5, 10, and 20 meter depth) are well depicted, as well as previous sand mining events, artificial reefs, and other seabed features like reef gaps and the old New River channel (just north of Port Everglades). This pictorial shows examples of the various stages of the data presentation. This data is extremely useful for a variety of applications in various fields such as coastal management, reef and geology science, and even telecommunications engineering.

Manatee Skeleton at Oceanographic Center

The Florida manatee *(Trichechus manatus latirostris)* is a large aquatic marine mammal native to Florida waters. It is a subspecies of the West Indian Manatee *(Trichechus manatus)*. Manatees have large, gray-brown bodies that taper to a flat, paddle-shaped tail. The average adult manatee is about 10 feet long and weighs about 1,000 pounds. They have two flippers with three to four nails on each, and their head and face are wrinkled with whiskers on the snout. The manatee's closest relatives are the elephant and hyrax, a small furry animal that resembles a rodent. Manatees are believed to have evolved from a wading, plant-eating animal. The West Indian manatee is related to the West African manatee, the Amazonian manatee, the dugong, and Steller's sea cow, which was hunted to extinction in 1768.

Florida manatees have no natural enemies, and it is believed they can live 60 years or more. Many manatee mortalities are human-related. Most human-related manatee mortalities occur from collisions with watercraft. Other causes of human-related manatee mortalities include being crushed and/or drowned in canal locks and flood control structures; ingestion of fish hooks, litter, and monofilament line; entanglement in crab trap lines; and vandalism. Ultimately, however, loss of habitat is the most serious threat facing manatees today. There are approximately 3,000 Florida manatees left in the United States.

Florida West Indian manatees in the United States are protected under federal law by the Marine Mammal Protection Act of 1972, and the Endangered Species Act of 1973, both of which make it illegal to harass, hunt, capture, or kill any marine mammal. Florida manatees are also protected by the Florida Manatee Sanctuary Act of 1978. Florida Fish and Wildlife Conservation Commission (FWC) biologists are responsible for recovering, necropsying, and documenting all recovered manatee carcasses, as well as coordinating rescues of injured manatees. The FWC also makes cleaned manatee skeletons available, on a semipermanent loan basis, for public display and education. This article describes the construction of a display case for a manatee skeleton, and the assembly of the skeleton in the case.

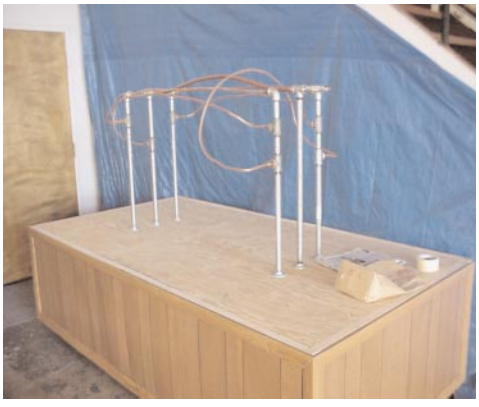
The skeleton is from a female manatee (MNW0002) that died in Crystal River, Citrus County, Florida, in January 2001. At the time of death, she was carrying a fetus, and she became trapped in the secondary cooling unit discharge pipe at the Crystal River Nuclear Power Plant. She was badly decomposed when she was collected for necropsy at the Marine Mammal Pathobiology Laboratory in St. Petersburg, Florida. She was 321 cm long, and her fetus was 112 cm long.

The skeleton was requested in 1999 from the Marine Mammal Pathobiology Laboratory in St. Petersburg, Florida. **Amy Paine**, NSU grad student, took the initiative to learn how to request the skeleton. The skeleton arrived at the NSU Oceanographic Center in the spring of 2001, and the display was constructed during the summer of 2001 by **Edward O. Keith**, Ph.D., and Jessica Davis, a high-school intern working with Keith. The first step was to determine exactly how to construct an armature to support the skeleton. Several prototypes were examined before arriving at the final design.

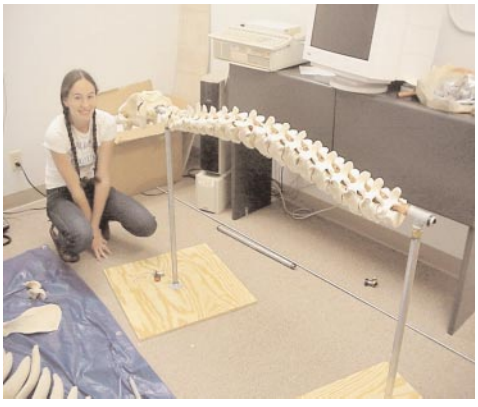
After the armature was painted a neutral color, the bones were assembled on it. The vertebrae and skull went on first, and then the first few ribs. Then the shoulder girdle was added, and finally, the last ribs. The ribs were held on to the armature with plastic ties.

After the skeleton was assembled, the unfinished top of the base was covered with cloth arranged to simulate the animal's aquatic habitat, and then the clear plexiglass cover was placed on the base to complete the display. Keith's graduate level class in marine mammalogy assisted with the final assembly and cover placement.

Completed skeleton assembly with cloth draping and graduate level class in marine mammalogy.



Once the base was completed, the armature was constructed on it.



Jessica Davis with curved-spine armature, which was the design used in the final assembly.

NSUOC Graduate Student Amy Paine with the completed display. Amy investigated the availability of the skeleton and learned how one could be obtained from the Marine Mammal Pathobiology Laboratory.