HARBOR BRANCH
FLORIDA ATLANTIC UNIVERSITY
Ocean Science for a Better World™
Bulletin
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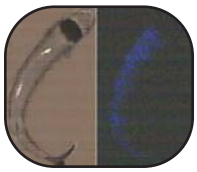
DR. TAMMY FRANK'S INTERNATIONAL RESEARCH EXPEDITION

DR. TAMARA FRANK, Associate Scientist, participated in an international research expedition from July 1 – July 21 on the German research vessel *SONNE*. Tammy, the only American, joined scientists from Germany, England, Scotland, Japan, and Belgium, trawling for animals from the deep waters between Apia, Samoa to Auckland, New Zealand, for physiological studies. Included in the expedition was a shipment of 1500 lbs of scientific and trawl gear, including Tammy's midwater trawl net for collecting animals.

South Pacific waters are extremely clear, meaning that the abundance of animals is low, yet the number of different species present is very high. Dr. Frank and her team managed to collect some very rare specimens, alive and in the best condition that they've ever been observed.

One of the species collected was the cookie cutter shark (*Isistius sp*). They are so named because they have circular jaws that scientists think are used to bite into fish like tuna. They then rotate themselves with a flick of their tail, removing a cookie shaped piece of flesh.

This cookie cutter shark was 24 cm long (about 10").



Interestingly, this species of shark is bioluminescent. While the bioluminescence has been described before, this was the first time that the bioluminescence had been captured on film. Almost the entire underside of the shark glows with a dim blue bioluminescence matching the dim downwelling sunlight and essentially hiding their silhouette when viewed from below. The only portion that doesn't glow corresponds to the dark brown collar around the neck. It has been suggested (in a publication by former Harbor Branch Senior Scientist **EDIE WIDDER**) that cookie cutters swim in schools, so when seen from below by a predator such as tuna, the tuna would mistake these small dark patches for small fish and approach the cookie cutters thinking they're going after a school of prey. As soon as the tuna is close enough, the sharks bite into the tuna and remove small cookie-shaped pieces. This hypothesis provides a reasonable explanation for how a relatively slow-swimming cookie cutter can catch one of the fastest fish in the ocean.

Another truly remarkable specimen is the four-eyed fish, *Dolichopteryx sp*. This fish has two tubular eyes pointing upward with large lenses, and two smaller eyes without lenses, pointing downwards.

Dr. Frank's Expedition, Continued:

While there were a number of deep-sea squid that the team had seen before, they did get several squid species that could not be identified and were sent out to experts. The squid in the photograph to the left has eyes on the end of stalks, which is often seen in paralarval glass squid (*Family Cranchiidae*).

The squid in the photograph to the right, about an inch long, has an iridescent white mantle that has not been seen before. The brown-orange edges of the mantle are chromatophores, which most squid enlarge and contract. In this squid, photographed under ambient light, they are completely contracted, so it's possible that under dimmer light, the chromatophores expand to enable the squid to blend in better with dim background light.

The midwater trawl net used to collect these animals was constructed by the engineering department at Harbor Branch. The engineering team included **Chris Tietze,** who was instrumental in designing and building parts of the net and net timer. **Mike Young** was involved in designing and building the closing cod-end. **Dan Boggess** designed the net timer, and **Jack Yager** fabricated and welded the net bar assembly. This net is one of only a handful of such nets in the world that can collect live deep-sea organisms in excellent condition for physiological studies. The net can be sent down closed, opened after a pre-determined amount of time has passed, fished for 1 to 9 hours, and then closed at depth with the aid of net timer. The dimensions and construction of the net are designed for a large initial capture area with sufficient flow through the knotless nylon which has a ¼ inch mesh size.

The canvas sleeve of the secondary net attaches to a temperature-insulated, light-tight cod-end, or collecting vessel, all of which were constructed by Harbor Branch engineering. The cod-end has an inner net bag that traps animals funneled in from the net. The cod-end is designed to close when the net closes, which insulates animals against temperature changes as they are brought to the surface. It also protects the animals' extremely sensitive eyes from blinding by the surface and ship's lights.

Check out Tammy's expedition in the Gulf of Mexico at www.at-sea.org

Dr. Esther Guzmán's Report on Pancreatic Cancer

The tragic loss of the great tenor **Luciano Pavarotti** to pancreatic cancer, despite having access to the best medical treatment available, highlights the pressing need for a breakthrough in battling this disease. Pancreatic cancer is the fourth leading cause of death from cancer in the United States. Fewer than five percent of those afflicted survive because detection tends to occur after the cancer has already spread to other parts of the body. Cancers that spread to other sites tend to be very aggressive and no effective drugs exist to fight them.

With initial funding of $20,000 over two years, from a philanthropist who had been widowed by pancreatic cancer, the **Marine Natural Products Drug Discovery Group** at Harbor Branch Oceanographic Institution began studying the diseases and potential treatments. Leveraging the results from that initial investment in fighting this disease, the group pursued and received a $1 million grant from the **National Institutes of Health**.

This grant funds research to find new drugs to fight pancreatic cancer. The research is focused on testing compounds found in deep sea sponges and corals to find those that have the ability to either kill pancreatic cancer cells or to make the cancer less aggressive. Sponges and corals are targeted because these primitive marine organisms often produce chemical compounds (called natural products) to help them survive. For instance, these natural products can range from unpalatable to uncompromisingly toxic, thereby staving off being eaten or overgrown. Work by Harbor Branch has resulted in one of the largest collections of sponges, corals and micro-organisms specifically for biomedical research.

Dr. Guzmán, on right, discussing results with intern Megan Carrier

Dr. Guzmán's Report, Continued:

Several interesting compounds have been found, such as *Manzamine A*. Isolated from a marine sponge, this compound has the ability to lower the ability of pancreatic cancer cells to spread to other organs, and makes pancreatic cancer cells easier to kill. The batzellines, a family of compounds from a marine sponge, are excellent killers of pancreatic cancer cells. Two other compounds from sponges show strong potential to fight pancreatic cancer and are being evaluated by a pharmaceutical company.

"Although these compounds are years away from getting to the clinic, we are very excited about the potential these compounds show" said **Dr. Esther Guzmán**, the leader of the Cell Biology program in the drug discovery group. "We hope to be able to continue this research to take it to a stage where we can interest a pharmaceutical company to move the potential new medicines forward, and be able to save lives." Renewal is pending for the group's current grant for pancreatic cancer research. Even so, government funding is tight for this type of research. This means that the group is looking for other sources of support.

The **Marine Natural Products Drug Discovery Group** at Harbor Branch consists of a small team of scientists, including chemists and biologists, whose aim is to use organisms from the deep ocean, collected with Harbor Branch's unique submersibles, to find cures for dreaded diseases. The group is led by **Dr. Amy Wright**, one of the top marine natural products chemists in the world, who has worked in this field for more than two decades.

Harbor Branch has a unique collection of compounds derived from marine sponges, gorgonians, bacteria, and fungi that have strong potential to help not only treat pancreatic cancer, but other forms of cancers such as liver, breast, and prostate as well as Alzheimer's and drug-resistant bacterial infections. One of their compounds, discodermolide, isolated from a sponge, was licensed to **Novartis** and shows promise as a treatment for breast cancer.

We mourn the loss of one of opera's greatest talents, and at the same time we apply the considerable talents of Harbor Branch biomedical researchers who are dedicated to unlocking Nature's even greater talent for making medicines that can be used to help cure and eradicate man's principal killers.

Do You Want to support Drug Discovery Research?

Please Contact
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Tell Your Friends!

You know a lot of people: Help us get the word out about Harbor Branch! Send us your contact names and we'll put them on the e-bulletin list. Send your contact e-mail addresses to: jmcduffie@hboi.edu. Please include their name in your email to Janice.

Kites Counting on Harbor Branch to end Apple Snail Drought

Florida apple snails lay eggs in the evening hours during the breeding season, which is from March to October. Each female lays about 20 - 30 eggs in a clutch.

The loss of just one species can deeply impact those that rely on it for food. **The Snail Kite** – a bird whose primary home is South Florida – specifically the Everglades and Lake Okeechobee – is in danger of extinction. Why? The **apple snail** (*Pomacea paludosa*), the Kite's primary food source, is dwindling in numbers due to the draining of marshes for farming and development and due to drought conditions. The Aquaculture team at Harbor Branch, in collaboration with the **South Florida Water Management District (SFWMD)**, is leading the research to find ways to grow and restock the apple snail.

Lake Okeechobee is the primary area of interest for this study. The lake is a 1730 square kilometers located at the center of the largely interconnected aquatic ecosystem of South Florida. The lake provides regional flood protection, water supply for agricultural, urban and natural areas and critical habitat for fish and wildlife. However, unnaturally high and low water levels driven by rainfall and water management practices have impacted the environmental health of this water body over the past 50 years and have affected ecosystem species all the way up the food chain to the lake's top predators.

The survival of the Florida apple snail is particulary affected by the lake's water level. The apple snail is the largest freshwater snail in North America and it is a critical component of the food web in freshwater wetlands of southern Florida. This snail comprises a significant portion of the diets of many birds such as limpkins, white ibis, and boat tailed grackles. Alligators, sunfish, and soft-shelled turtles have also been reported to feed on these snails. More importantly, this snail is the predominant food source of the endangered snail kite. In the photo to the left, this adult apple snail is about 3 - 4 months old and is 30 mm (a little over 1 inch) in size.

The Florida apple snail is well adapted to the fluctuating water conditions that exist in South Florida wetlands. These snails can survive for limited time during the dry season by closing their operculum, lowering their metabolism, and burying themselves into the substrate. The drought conditions within the lake boundaries have the potential to greatly affect apple snail population dynamics. In fact, previous apple snail surveys that have been conducted following drought conditions suggest that snail populations may decrease to undetectable levels. The cumulative effects on species higher up the food web from the decline of apple snails during times of prolonged drought could potentially be alleviated through the enhancement of apple snail stocks with the use of aquaculture techniques. The South Florida Water Management District is interested in investigating the feasibility of this potential management strategy and has tapped Harbor Branch to do it.

Apple snail juveniles grow relatively fast and like to eat available vegetation in the field and romaine lettuce in the laboratory.

Kites Counting on Harbor Branch, Continued:

Phil Darby, Associate Professor, University of West Florida, is a lead researcher in apple snail biology and behavior. He visited Harbor Branch on Sept. 21 to meet with HBOI and SFWMD scientists to discuss research plans. Shown l-r: Phil Darby (UWF), Chuck Hanlon, Amber Shawl (HBOI), Megan Davis (HBOI), Rachael Harris (SFWMD), Ellen Grefsrud (HBOI) and Hector Acosta-Salmon (HBOI).

The objectives of this project are to determine whether or not apple snails can be artificially propagated on a scale large enough to stock the freshwater wetlands of Lake Okeechobee, to determine the survival and reproductive rates of snails stocked in the field, and evaluate the appropriate density needed to maintain a sustainable apple snail population in a marsh ecosystem. If large scale production of apple snails is possible, it will be determined whether this is a practical management technique, in terms of time and cost, to be used during times of low water conditions or following a drought.

Harbor Branch, in partnership with SFWMD Environmental Scientists **Rachael Harris** and **Chuck Hanlon,** will be responsible for the design, development, and implementation of an apple snail culture program which will determine the feasibility of large scale production of this species for stock enhancement purposes. The culture trials will be conducted at Harbor Branch Aquaculture Development Park and will be performed by **Amber Shawl,** Research Associate, with assistance from **Hector Acosta-Salmon**, Assistant Research Scientist, and **Ellen Grefsrud,** Post Doc.

Egg clutches on marsh sticks were collected in August and September and hatched in the Harbor Branch labs. There are now about 500 juvenile apple snails available to conduct feeding trials (they love Romain lettuce), density trials, substrate and system type studies, and captive breeding experiments. Once the apple snails have reached maturity, which occurs at about 3 months, they will be released for field experiments. Releasing adult apple snails in sites near Lake Okeechobee will allow the Harbor Branch and SFWMD scientists to study reproductive output as a method to increase apple snail juvenile populations. The laboratory and field studies will take 12 months to complete.

"We're excited to have the opportunity to find ways to grow and reproduce the apple snail for restocking efforts in Lake Okeechobee.," said **Amber Shawl.** "The future of the snail kite and others who feed on the apple snail is at stake here. Our goal is to find the right combination of food, water quality and density to allow us to grow replacement apple snails before they are permanently gone from Lake Okeechobee."

Amber Shawl, Research Associate and lead Principal Investigator on the apple snail project. She is looking over the freshwater systems that will be used to conduct density, feed and temperature studies with the Florida apple snail.

An Evening with Wyland: October 30, 2007

An Evening with Wyland

Join Harbor Branch and *renowned marine life artist* **Wyland** for an evening of ocean discovery. **An Evening with Wyland** features:

- *Meet the Artist*
- *Premier of Wyland's newly re-edited film narrated by the late* ***Lloyd Bridges***
- *An exciting live painting auction*
- *Cocktails and hor d'oeuvres*

Preview Patron Party
5pm - 6pm
$500 per person
Limited Availability

The Preview Patron Party is Sold Out

Tuesday, October 30
6pm - 9pm

Harbor Branch Education Center
5600 North US 1, Fort Pierce

Tickets are $100 per person
Call 772-465-2400, ext. 500
E-mail oceandiscovery@hboi.edu

Proceeds from the evening benefit The Wyland Foundation and Harbor Branch Marine Mammal Stranding and Critical Care Center

WYLAND FOUNDATION.
2171-B Laguna Canyon Road
Laguna Beach, CA 92651

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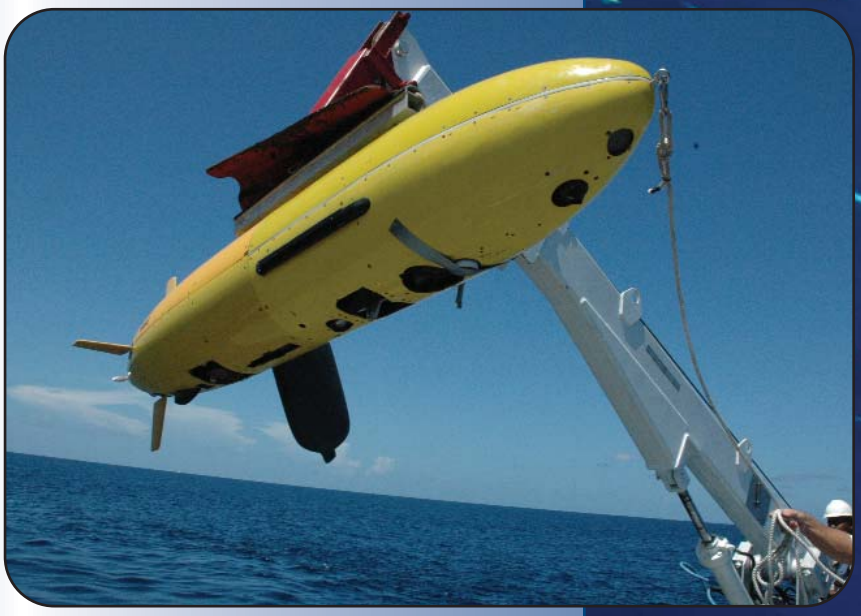
Next Month...

Join **Dr. Brian Lapointe**, Harbor Branch Senior Scientist, for an update on the coral reef crisis gripping coastal waters of the wider Caribbean region. Brian has documented how nutrient pollution exacerbated by expanding human populations is causing a proliferation of harmful algal blooms and coral diseases. Does this affect you?

Plus:

Were **James Bond** to request an underwater laser imaging device that could capture high-resolution pictures in turbid sea water, Q would have to call Harbor Branch's Scottish underwater imaging wiz, **Dr. Fraser Dalgleish.** In next month's issue, you will find out what his team does and why the **US Navy** got to him before Q could....



Have Story Ideas? Need Extra Copies?

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