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Bulletin
OCTOBER 2009

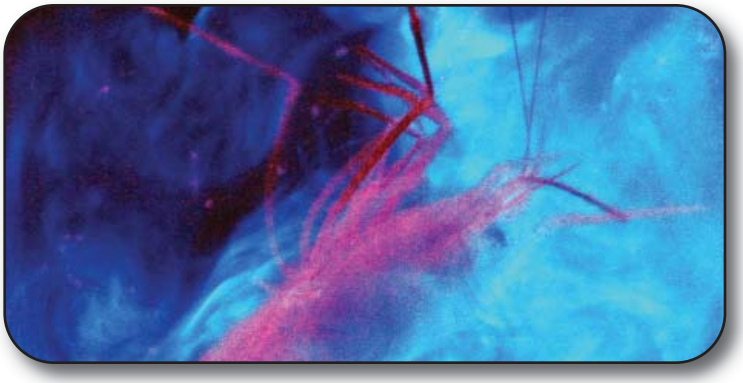
SCIENTISTS TO EXPLORE "LIVING LIGHTS" ON THE DEEP SEA FLOOR

By Jeff Dudas
UnderwaterTimes.com

Scientists from Harbor Branch Oceanographic Institute at Florida Atlantic University, Duke University, the Ocean Research & Conservation Association (ORCA), the Monterey Bay Aquarium Research Institute (MBARI), and Nova Southeastern University Oceanographic Center are using their combined expertise in bioluminescence, taxonomy, visual ecology, imaging and molecular biology to explore the environment of the deep-sea bottom to search for undiscovered "living lights" off the Bahamas.

This research expedition took place from July 20-31, 2009, and was funded by the National Oceanic and Atmospheric Administration (NOAA) Office of Ocean Exploration and Research. These scientists used sensitive low-light cameras and Harbor Branch's Johnson-Sea-Link submersible to photograph bioluminescence of animals in their natural environment.

"Bioluminescence is a fascinating phenomenon that is found only in a few species on land, but is common in all the world's oceans," said Dr. Tamara Frank, research scientist at Harbor Branch's Center for Ocean Exploration and Deep-Sea Research and principal investigator and lead scientist on the expedition. "If you have ever seen a firefly, then you have witnessed the same process in action."



***Parapandalous sp* spews blue bioluminescence. Dr. Frank will determine the range of wavelengths that the shrimp can see.**

***Dr. Tammy Frank* and submersible pilot *Frank Lombardo* finish a successful research dive.**

Animals have evolved to deal with the darkness of the deep sea through the process of bioluminescence and have developed the ability to use chemicals within their bodies to produce light. Bioluminescence occurs when certain chemicals are mixed together; the effect is similar to the soft green glow produced by green light sticks when the seal in the stick is broken.

Scientists estimate that about 90 percent of the animals living in the open waters above the sea floor are bioluminescent. However, information on living light among deep-dwelling creatures is very sparse because they are so inaccessible. Furthermore, most bioluminescent animals do not glow constantly, but rather, only light up in response to mechanical or visual stimuli. They may use bioluminescence for a number of possible reasons including camouflage, attracting prey, mating and communication. Based on the few but varied deep-sea attached animals, such as corals or sea anemones, that are known to produce light, and the adaptations in the large eyes of the some of the mobile predators discovered on previous NOAA-OER funded Harbor Branch explorations, it is likely that bioluminescence is abundant and plays a significant role in animal interactions on the deep-sea floor.

"Living Lights" continued

**The incredible eyes of the benthic *Gastroptychus spinifer*.
They can detect light in the bioluminescence and ultra-violet wavelengths.**

"An intriguing, and as of yet unverified idea, is that when marine animals die and accumulate on the ocean floor they are covered with luminous bacteria, which unlike other bioluminescent organisms, glow continuously," said Frank. "Bioluminescent bacteria occur throughout the marine environment, and these bacteria are known to colonize shrimp and fish carcasses, suggesting that the resulting background glow may be used as a cue by deep-sea scavengers to find carcasses."

Previous expeditions by Frank and her colleagues have explored the vision of some of these scavengers, which are crustaceans called isopods. They have demonstrated that the isopod's eyes work like a camera with a very slow shutter speed which makes them extremely sensitive to light. Frank and her colleagues have also discovered several species of deep-sea crabs that have an ultraviolet (UV)-sensitive visual pigment in addition to blue-sensitive ones. This suggests that UV sensitivity plays an important role in their ecology, and this sensitivity may also permit them to see as-yet undiscovered short wavelength bioluminescence from other bottom-dwelling organisms. UV bioluminescence on the deep ocean floor may be a novel, private channel of communication, allowing these animals to find their preferred habitat.

"Without damaging or endangering these fascinating creatures, we photographed them from the Johnson-Sea-Link with all of the lights off using a special camera with a very wide aperture, as well as with ORCA's Eye-in-the-Sea camera system that uses a very low light sensitive video camera. This should allow us to record bioluminescence which we are unable to see with the naked eye," said Frank.

Frank was joined by her colleagues Drs. Sönke Johnsen, Duke University; Edith Widder, ORCA; Charles Messing, Nova Southeastern University Oceanographic Center; and Steve Haddock, MBARI, on this research expedition.

The two selected locations for this expedition included the western margin of the Little Bahama Bank and a location in the Northwest Providence Channel that was last studied in 1978.

Underwater Laser Imaging and Communications

Novel underwater laser networking and imaging technologies being developed by scientists at the Ocean Visibility and Optics Laboratory at Harbor Branch Oceanographic Institute at Florida Atlantic University may provide significant advantages over existing technologies in rapidly identifying and communicating potential threats in murky coastal waters.

Harbor Branch has received $2 million from the U.S. Department of Defense, Office of Naval Research, to continue its cutting-edge research and development in the area of underwater laser sensing and robotics in an effort to develop next generation underwater sensing networks to enhance the security of coastal waters and ports, and to expand ecosystem monitoring capabilities.

This project will build on current technologies and capabilities in laser imaging developed at Harbor Branch. When the technology is fully developed, it will be used onboard a group of small, co-operating underwater robots and will have extensive utility for future U.S. military operations including U.S. war fighters (intelligence, surveillance and reconnaissance, and mine countermeasures operations). Domestically, it will be used for maritime security and environmental assessment to address some of the most critical areas in need of ocean research and technology development over the next ten years.

The project is being developed in three phases, with the overall goal of investigating concepts in concurrent laser imaging and communications where dual-purpose imaging and communications system components are distributed within the co-operating group of underwater robots. Scientists at Harbor Branch will use advanced computer simulation software to predict the underwater laser light field in variable environmental conditions.

Combined with measurements from their state-of-the-art underwater laser test facility which will be used as a proving ground for the techniques, the objective is to gain a thorough understanding of how such techniques can contribute to underwater imaging missions of the future.

According to Dr. Fraser Dalgleish, principal investigator and assistant research professor at Harbor Branch, images of suspicious underwater objects need to be rapidly transmitted to a command center or to those who may be in danger. "Underwater mines could pose a major threat to U.S. Navy, Coast Guard and merchant fleets," said Dalgleish. "Using intelligent, adaptive laser imaging and communication techniques with swarms of co-operating underwater robots could provide identification-quality underwater imagery in real-time across much greater regions of seabed than current technology allows, and will therefore be vital for effectively classifying both military and environmental threats to our coastal regions in the future."

Robots scan the ocean floor with lasers and send information about what they find to modem robots higher in the water. The information is then relayed to a ship.

Architect's concept of the new courtyard, looking towards the channel.

New Campus Center will Celebrate Harbor Branch Traditions

With the construction of a new 40,000-square-foot Marine Science Lab Building, a major renovation of the Link Building and the creation of a new park-like plaza, the western end of our central channel will become the new center of our campus. Each core element will be designed to celebrate traditional Harbor Branch Oceanographic Institute science values and take advantage of the most impressive views available on campus.

Harbor Branch is first and foremost an ocean science research site and our new Marine Science Building will enable us to continue in that direction. Locating this signature building adjacent to the revitalized Link Building on the west end of the channel allows for the creation of a special pedestrian space between the buildings and the water's edge. The full channel view from this location will enable all to appreciate the truly unique qualities of Harbor Branch Oceanographic Institute at Florida Atlantic University.

Look for a big change when you enter the eastern end of the campus at the end of 2010. Our live oaks will still dominate, but there will be a very different building behind them. The Link Building will be totally transformed. Among the new or rebuilt functions within the upgraded facades will be an enlarged library, improved offices, better meeting facilities, new corridors, restrooms and a cafeteria that will now open on to a waterfront plaza. Mechanical systems will be replaced and upgraded to meet the latest energy efficiency standards (LEED Silver) for new buildings.

Construction will begin in the spring of 2010. We will keep you posted as our campus evolves and these exciting changes take place.

Harbor Branch Attracts Students from Around the World for:

"Envirovet"

Veterinary scientists and students from around the United States and the world recently gathered at Harbor Branch Oceanographic Institute at FAU for the aquatic wildlife segment of Envirovet, a seven week graduate-level course originating from the University of Illinois. The program aims at helping scientists to identify animal diseases and their causes in the wild, so veterinary skills used for domesticated animals can be applied. Envirovet provides intensive lecture, laboratory and field experiences for veterinarians, veterinary students and wildlife biologists in the area of terrestrial and aquatic ecosystem health in developed and developing country contexts. The 2009 program highlighted the trans-disciplinary, cooperative nature of work required for effective wildlife and ecosystem research, management, and long-term problem solving.

Of this year's 28 Envirovet participants, 10 were veterinary students from throughout the United States and 18 were veterinarians representing 14 other countries. Participants came from the African nations of Cameroon, Democratic Republic of the Congo, Nigeria, Rwanda, South Africa, Tanzania, and Uganda. Rounding out the group were veterinarians from Canada, Chile, Madagascar, Myanmar (Burma), India, Indonesia, and Switzerland.

Students seining for the abundant sea life in the Indian River Lagoon.

Clean Up!

Harbor Branch volunteers, associates and scientists worked together on the 2nd Annual Treasure Coast Waterway Cleanup on Saturday, July 25. The Harbor Branch team collected over 35 large bags of bottles, cans, styrofoam, etc. along the Indian River Lagoon coastline. Also included in the group's findings were empty buckets, construction debris, parts of boats, shoes and various canisters.

L-R Back row: Marge Aylor, Jack Aylor, Alex Kreisman, Marilyn Mazzoil, Bill Churchill, Ned Smith, Elaine Jones
Middle Row: Jean Catchpole, Cecilia Chandler, Esther Guzman, Elizabeth Howells, Lauren Nys
Front Row: Sydney Lyons, Lia Tull

Late Afternoon Cruise on the Indian River Lagoon

get out on the beautiful Indian River Lagoon and learn about it directly from Harbor Branch Researchers. You may even catch a sunset!

2009 Dates:

October 19 from 3-5 PM -
Cost (includes boat trip, lecture and BBQ supper) - Members: $50; Nonmembers: $60

November 16 from 2-4 PM - Cost (includes boat trip, lecture and a surprise treat!) - Members: $40; Nonmembers: $50

December 14 from 2-4 PM - Cost (includes boat trip, lecture and holiday cheer!) Members: $40; Nonmembers: $50

- Meet Harbor Branch Scientists/Guides
- Enjoy the Water and the Wildlife
- Hear About Harbor Branch Research
- Learn about the Indian River Lagoon
- Make New Friends

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www.hboi.fau.edu

Friends of Harbor Branch Launches Fall Membership Drive!

The Friends of Harbor Branch recognizes all of our supporters and ensures Harbor Branch continues as an innovative leader in ocean science.

The "Friends of Harbor Branch" kicks off its fall membership campaign with plans to grow programs and outreach according, to membership program coordinator Patti Gibbons. The Friends of Harbor Branch is an expansion of the Associates program which has been a major part of Harbor Branch outreach for many years.

"We are looking to build upon the many annual contributors to Harbor Branch and open our programs to a much wider audience. The name 'Friends of Harbor Branch' is more reflective of what the program is and what we want to promote," said Gibbons.

One of the most recognized programs that members attend is the Ocean Science Lecture Series, featuring FAU researchers. This outstanding program is offered weekly from January through March and once a month the rest of the year. Members also receive regular announcements regarding educational programs, the film series, social events and special trips. Eco tours based from Harbor Branch offer unique water and land based experiences including boat tours, trips to other environmental areas and special opportunities to join with researchers and specialists.

"The Friends of Harbor Branch recognizes all friends, supporters and associates through annual membership gifts and designated gifts in support of Harbor Branch research programs," said Director of Development Jack Aylor. "The Friends of Harbor Branch is encompassing of all donations. Designated gifts to research programs are considered a part of the Friends of Harbor Branch and provide a more comprehensive way for recognition and communication," he said.

Annual membership gifts have a declared value of $30. Membership gifts above that level are tax deductible and support HBOI. Designated gifts with no membership benefit are fully tax deductible. All members are recognized by HBOI for stewardship purposes. Contributions in support of Harbor Branch are administered through the Florida Atlantic University Foundation, Inc.

Annual Membership Benefits

- Invitations to HBOI Events and Lectures
- Invitations to Educational Trips and Tours
- Special HBOI Member-Only Events
- Receive HBOI E-mailings / Newsletters
- Invitation to HBOI Film Series
- VIP Tour and One Guest Pass
- FAU Lifelong Learning Society Discount
- Ocean Discovery Center Programs
- HBOI Logo Gift (New)

Friends Annual Membership

- Individual Membership - $75
- Partner Membership - $100
- Family Plus - $250
- Sustaining Sponsor - $500

HBOI Friends Plus Recognition Levels

The Friends Plus recognizes gifts of $1,000 or more supporting the scientific research of Harbor Branch Oceanographic Institute. All donors at these levels are honorary annual members with added recognition.

Levels

- $1,000-$2,499
- $2,500-$4,999
- $5,000-$9,999
- $10,000 and above

"Slow down for Dolphins!"

Martin County is the home of one of the busiest boating intersections along the Indian River Lagoon (IRL). This area is home to resident dolphins that have to share the waters with recreational boaters. Unfortunately, there are times when there just isn't enough room for both to coexist harmlessly. Recently boaters reported sightings of a dolphin that appeared to have been struck by a vessel near the St. Lucie Inlet. This dolphin, named TOOT, is a part of a local group of dolphins that have been observed by FAU Harbor Branch photo identification research scientists for over 10 years. Although the trauma appears to be healing, TOOT may have health complications for the remainder of his life due to this boating interaction.

Harbor Branch biologists also encountered a second boat-hit dolphin that was so badly injured that they could not identify the dorsal fin. This dolphin appears to be healing, but now has a sliced dorsal fin and possible associated internal injuries.

Within the lagoon, six percent of the dolphins bear scars from boating impacts. The majority of boat-hit dolphins, including three that died as a result of their injuries, inhabit the southern portion of the IRL. A recent paper (in press) by Harbor Branch's Sarah Bechdel suggests that slower speed zones should be implemented within Martin County to prevent additional injuries to the dolphin population. The boating community can help by limiting high-speed driving in shallow waters, staying within the Intracoastal waterway, being alert and observant for wildlife, and obeying all posted speed signs. Because the lagoon is very shallow, dolphins are often unable to dive deeper to avoid boats. Please take these simple precautions and ask your boater friends to do the same. Maintaining a cautious speed in shallow waters affords the opportunity to enjoy the beauty of the dolphin lagoon population without endangering them.

Intern Presentations and 35th Anniversary of Link Foundation Intern Program at Harbor Branch

The summer intern program drew to a close on July 29, 2009 with presentations made by the program's 18 summer 2009 participants. Over the past 35 years, this education program—Harbor Branch's oldest—has continued and prospered and has become a special one to our scientists and engineers, who are invigorated by the talent of the young interns each year. From 1974 to 2009, there have been 465 summer interns at Harbor Branch.

Summer interns, from left to right: (standing) Link Foundation Representative Jimmie Anne Haisley, Alexis Temkin, Nichole Walker, Natalie Harrison, Jennifer Giard, Irene Foley, Lindsey Harris, Joanna Ames, Maggie McQuillan, Serena Parton, Karen Ladd, Lauren Nys, Marilyn Link. (kneeling) Laura Millerick, Stephen Szymanski, Corey DiBenedetto, Robert Decarreau, Daniel Rowan.

These interns have come from over 150 universities and colleges from 35 states and 11 foreign countries. They have benefited from over 100 mentors, all Harbor Branch staff members.

The Link Foundation has supported about 63% of the interns. Another 11% have been funded by the Gertrude E. Skelly Charitable Foundation, which has been providing major support for interns in marine biomedical research since 1996. Most Harbor Branch interns go on to professional careers, with nearly half receiving an M.S. degree and about one of six earning a Ph.D.

This year had the added significance of being the 35th anniversary of the founding of the program by the Link Foundation.

Articulated by the late Edwin Link as an "opportunity for students to find their genius," the program is recognized as an exceptional opportunity for students to get real experience in the field towards which they are directing their undergraduate or graduate education. The summer interns gave presentations during the day-long program at Harbor Branch. The summer intern reports are available through our library.

Visit *www.binghamton.edu/home/link/link.html.*

Harbor Branch at Florida Atlantic University
Ocean Science Lecture Series

"A Fish in Every Creel: Florida's Marine Fisheries Enhancement Initiative"
Speaker: Jeff Beal, Florida Fish & Wildlife Conservation Commission
October 21 at 7:00 pm

At the Johnson Education Center, Harbor Branch, 5600 US 1 North, Ft. Pierce, FL.
Free Admission

Go to our website at **www.hboi.fau.edu** to see the most
up-to-date information on dates and times of our lecture series and events!

Marine and Oceanographic Academy

MOA, located on FAU's Harbor Branch campus provides high school students the opportunity to interact with marine scientists and engineers, as well as to see first-hand the equipment and tools used to study the oceans.

The new school year has begun! Another grade has been added, so this year we have classes for freshmen, sophomores, and juniors, totaling about 230 high school students on the Harbor Branch campus. HBOI staff teach 20% of the science classes, with each student taking two science classes each year.

The finishing touches are still being made on the new MOA facility, which is located on Old Dixie Highway, just north of the Marine Science Building, but things are pretty much ready for the first day of school. The facility is located on land that has been leased by HBOI/FAU to the St. Lucie County School Board for five years per an agreement approved this past spring. The facility that was built over the summer will also handle the additional enrollment expected over that time (maximum will be 400 students).

A full ribbon-cutting/open house will be occurring later in the school year.

Friends of Harbor Branch/FAU

Fall Schedule

Oct. 13 Film Series – "River Into the New World: The St. Johns"
4:00 pm & 7:00 pm – Johnson Education Center

Film takes viewers on a journey through time and place as we explore the St. Johns River, from its source near the Everglades, following it 310 miles north through Jacksonville and into the Atlantic Ocean. Film Series is open to members and their guests.

Oct. 19 Eco-Boat Cruise & BBQ, 3:00 pm

Join Capt. Chop Lege and a Harbor Branch scientist on a late afternoon cruise on the Indian River Lagoon. Boat will depart from the Johnson Education Center at 3:00 pm for a two-hour educational scenic cruise followed by a delicious mesquite chicken and BBQ dinner served with all the fixins' by Dale's BBQ. Cost: Members-$50; Nonmembers - $60

Oct. 21 Ocean Science Lecture Series – "A Fish in Every Creel: Florida's Marine Fisheries Enhancement Initiative."
7:00 pm - Johnson Education Center

Speaker: Jeff Beal, Florida Fish & Wildlife Conservation Commission. Free Admission.

Oct. 27 VIP Tour – for Members & Guests – 9:30 through 11:30 am

Tour begins at the Ocean Discovery Center (ODC). Friends may use guest passes for nonmember guests. Call (772) 465-2400 ext. 559 for reservations.

Nov. 10 Film Series – "Private Lives of Dolphins"
4:00 & 7:00 pm - Johnson Education Center

Nov. 16 Eco-Boat Cruise – HBOI – Dr. Brian Lapointe

Nov. 20 Long Shadows Ranch Tour – Vero Beach

Nov. 24 Members VIP Tour

For more information, call 772/465-2400 ext. 559.

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Florida Atlantic University, a member of Florida's State University System, was established by legislative act in 1961. In addition to its original 850-acre campus in Boca Raton, FAU has campuses in Fort Lauderdale, Davie, Dania Beach, Jupiter, Port St. Lucie and Fort Pierce. Fully accredited by the Southern Association of Colleges and Schools, FAU is currently serving 27,000 regularly enrolled, degree-seeking students through its 10 colleges.

FAU's Harbor Branch Oceanographic Institute is dedicated to exploring the world's oceans—integrating the science and technology of the sea with the needs of humankind. Harbor Branch is involved in research and education in the marine sciences; biological, chemical, and environmental sciences; marine biomedical sciences; marine mammal conservation; aquaculture; and ocean engineering.

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Visit the

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10 am - 5 pm, Monday through Friday; 10 am - 2 pm, Saturday
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