SARASOTA DOLPHIN RESEARCH PROGRAM

NICKS 'N' NOTCHES

Annual Summary of the Collaborative Dolphin Research and Conservation Efforts of the Chicago Zoological Society and Mote Marine Laboratory

January 2007 **Visit our web site at: www.sarasotadolphin.org**

Demonstrating a long-term commitment to conservation, research, education, training, and animal care *By Randall Wells, PhD, Program Manager*

The "world's longest-running dolphin research program" is now in its 37th year. It continues as a full-time, year-round operation involving 8 full-time staff members, 4 part-time staff, 3 off-site contract staff, 18 graduate students, and 26 volunteers and student interns, joined during each of six months by up to five Earthwatch Institute volunteers. The scientific staff spans three academic generations of researchers. Some field projects involve more than 100 participants, including visiting scientists, animal care professionals, and trained volunteers. Since its inception in 1970, the program has gained an international reputation for providing high quality information of importance to dolphin conservation.

Having beaten the odds for first-born calves and survived its first year of life, this third generation resident (at least) of Sarasota Bay observes its Sarasota Dolphin Research Program observers.

In recent years, our scope of international work has expanded from simply providing training opportunities for foreign colleagues at our base of operations in Sarasota, Florida, to working with these colleagues in their countries and providing what assistance we can as they develop their research and conservation programs. During 2006, we provided training opportunities in support of Chinese efforts to conserve the baiji, the most endangered cetacean in the world, as well as for colleagues from Argentina and Bangladesh. We participated in the second year of a study of the ranging patterns of Franciscana dolphins in Argentina, probably the most endangered cetaceans in South American waters.

Our desire with each research or conservation project in Florida or elsewhere is to contribute to a better understanding of the structure and dynamics of populations of small cetaceans (dolphins, whales, and porpoises), as well as the natural and anthropogenic factors (factors of human origin) that impact them. We use an interdisciplinary and collaborative approach in conducting studies of bottlenose dolphins within a unique long-term natural laboratory. The primary goals of this program include (1) collecting biological, behavioral, ecological, and health data of importance to the conservation of small cetaceans, especially bottlenose dolphins, (2) providing requisite information for bottlenose dolphin conservation to wildlife management agencies, (3) disseminating the information generated by our program to scientific and general audiences in order to aid dolphin conservation efforts, (4) using our model program to develop and refine hypotheses regarding bottlenose dolphins in other parts of the species' range as well as other species of small cetaceans, (5) using the established natural laboratory to develop and test new research tools and methodologies of potential benefit to conservation efforts, (6) training cetacean conservation workers and students from around the world in the use of these techniques, (7) applying our unique program expertise to dolphin rescue operations and post-release follow-up monitoring, and (8) applying the information we gather from free-ranging dolphins to improve the quality of care for dolphins in zoological park settings.

The work toward achieving these goals is conducted under the umbrella of the "Sarasota Dolphin Research Program" (SDRP). This name links the efforts of several organizations that work together to insure the continuity of the long-term dolphin research in Sarasota. The Conservation, Education, and Training Group of the Chicago Zoological Society (CZS) has provided core staff salaries and administrative and operational support for the program since 1989. Dolphin Biology Research Institute, a Sarasota-based 501{c}3 non-profit corporation established in 1982, provides logistical support with its fleet of five small research vessels, two towing vehicles, computers, cameras, field equipment, etc. Since 1992, Mote Marine Laboratory has provided a convenient base on City Island in Sarasota Bay, with office, storage, and dock space, and easy access to good boat launching ramps. During 2006 we moved into more spacious office and lab space in the new expansion of Mote's Ann and Alfred Goldstein Marine Mammal Center.

The SDRP maintains academic connections including graduate student sponsorships primarily through the University of California at Santa Cruz, the University of North Carolina at Wilmington, the University of South Florida, Western Illinois University, and the University of Guelph. We are very pleased to be able to announce that two master's and four doctoral students associated with our program successfully defended their theses or dissertations during 2006.

Support for our program derives from a variety of sources, including grants, contracts, and donations. Major funding sources include the Batchelor Foundation, the Estate of Sybil Byrnes, Earthwatch Institute, Dolphin Quest, Disney Wildlife Conservation Fund, Florida Fish and Wildlife Conservation Commission, Harbor Branch Oceanographic Institution's Protect Wild Dolphins Program, Sea World – Busch Gardens Conservation Fund, and the National Marine Fisheries Service.

In this issue

In the articles that follow, the staff, students, collaborating scientists, and volunteers of the SDRP provide updates on the many activities of our program during 2006. The topic areas include (1) "Human Interactions and Impacts," describing our research on how human activities directly affect wild dolphins, (2) "Social Structure, Behavior, and Communication," exploring the details of the behavioral lives of the animals, (3) "Health and Physiology," where we describe the wide-range of studies examining how the animals respond to environmental challenges of human and natural origin, especially the impacts of environmental contaminants, (4) "Ecology, Population Structure, and Dynamics," which explores how to identify and define dolphin population units and measure their vital rates, (5) "Dolphin Rescues, Releases, and Follow-up Monitoring," describing efforts, in conjunction with Mote Marine Lab, to aid sick or injured individual dolphins and monitor them when they are returned to the wild, (6) "Involvement in other Marine Mammal Conservation and Research Activities" describes our involvement with other dolphin conservation and research efforts around the world through partnerships, sponsorships, or training, and (7) "Education" section describes our involvement in education and training programs that reach audiences ranging from elementary school students through research professionals from around the world. Once you've had a chance to read the material, we hope that you will agree that the interest and dedication demonstrated by these folks are making a positive difference for the dolphins of Sarasota Bay and elsewhere.

Over the past few years, it has become increasingly clear to us that the landmark legislation that provides the basis for conservation of marine mammals in the United States, the federal Marine Mammal Protection Act of 1972 (MMPA), could benefit from management agency recognition and consideration of additional existing, new, and emerging threats. As you will see in this issue of *Nicks 'n' Notches*, dolphins in coastal waters are facing an increasingly large and varied array of threats to their survival and quality of life. While many threats, such as commercial fishing operations, are largely regulated relative to marine mammal deaths under the MMPA, other human activities of significance do not receive specific consideration. For example, deaths from recreational fishing gear, impacts from environmental contaminants, health issues, and Unusual Mortality Events are not factored into determinations of allowable "takes" of marine mammals from stocks in U.S. waters. We have testified before congressional subcommittees and provided input during participation in government panels in an effort to develop a more effective management approach. The MMPA is up for re-authorization by Congress — it might be helpful for you to share with your elected representatives your views on protection of these animals.

HUMAN INTERACTIONS AND IMPACTS

Hearing abilities of bottlenose dolphins in Sarasota Bay

By Mandy Cook, PhD and David Mann, PhD, University of South Florida, St. Petersburg, FL

Bottlenose dolphins are exposed to a wide variety of noise in their environment, both naturally-occurring and anthropogenic, and there is concern that these noises may have negative effects on their hearing. Because dolphins rely primarily on acoustics to navigate, forage, and communicate with each other, hearing losses in these animals can be especially damaging. Dolphins can hear from about 75 Hertz to over 150 kiloHertz, which is a much larger hearing range than most other mammals (most humans can hear from 20 Hertz to 20 kiloHertz when they are young, but this deteriorates with age).

We measured the hearing thresholds of bottlenose dolphins in Sarasota Bay using an auditory evoked potential (AEP) protocol based on techniques used to measure hearing in human infants. Short duration tones of varying frequencies

and sound levels were played to the dolphins using a jawphone (a speaker embedded in a suction cup and attached to the lower jaw of the animal), and sensors on the surface of the dolphin's head measured microvolt potentials produced by the brain in response to the tones. The brain's responses to the sounds were then analyzed to determine each dolphin's hearing abilities.

Data were collected from 62 bottlenose dolphins (30 females and 32 males, ages 2-36 years) during capture-release sessions from June 2003 through June 2006. Our findings suggest that bottlenose dolphins exhibit a large degree of variability in their hearing abilities. Overall, the bottlenose dolphins in Sarasota Bay do not exhibit increasing hearing losses with increasing age nor are male dolphins more likely than female dolphins to have a hearing deficit. Also, these dolphins do not exhibit substantial hearing losses due to daily exposure to environmental noise, including anthropogenic sources of noise. There is still unexplained variability in hearing thresholds that is being investigated using the extensive data available on the lives of these dolphins.

Support for this research was provided by: Harbor Branch Oceanographic Institution's Protect Wild Dolphins Program, Dolphin Quest, NOAA Fisheries, the P.E.O. Scholar Award, the Jack Lake Endowed Fellowship, the Paul L. Getting Memorial Endowed Fellowship, the Von Rosenstiel Endowed Fellowship, and USF College of Marine Science Graduate Assistantships.

Measuring hearing abilities of a wild bottlenose dolphin. Soft rubber suction cups send acoustic signals and record brain responses and vocalizations.

A pilot project to study bottlenose dolphin depredation of fishing gear off Tampa Bay's Sunshine Skyway Fishing Pier

By Robin Perrtree and Kim Bassos-Hull, MSc

In late summer 2005, the Sarasota Dolphin Research Program (SDRP) was informed of complaints about dolphins stealing bait and catch from fishermen at the South Sunshine Skyway Fishing Pier. A quick search on an internet chat room used by these fishermen found many complaints, rants, and even threats aimed at the animals. We notified National Marine Fisheries Service (NMFS) staff based in St. Petersburg and in Silver Spring, MD of the problem and met with Florida-based staff at the South Pier in November to determine the scope of dolphin depredation. Based on this scoping trip and subsequent discussions, SDRP worked together with NMFS to design and implement a pilot study at the pier. On February 16th staff from SDRP and NMFS began patrolling the pier on foot, talking to the fishermen, and watching for dolphins. We collected data on the number of anglers, the number of lines in the water, the number of boats fishing near the pier, and the number of fisherman that had a dolphin depredate their line or engaged in feeding dolphins off the pier. In addition, we attempted to get photographs of the dolphins seen by the researchers. When an angler reported a depredation event or a researcher observed an interaction, we asked additional questions about what kind of bait or catch was on the line, if gear was lost to the dolphin, and how the angler responded to the situation.

PEEP swims amongst fishing lines near the Sunshine Skyway Fishing Pier on March 6th, 2006.

In ten days of walking the pier between February 16th and April 24th we collected reports of 141 current interactions between the fishermen and dolphins and many more historical accounts. Of those, there were 99 incidents of bait stealing, 37 incidents of catch stealing, and five interactions of unknown type. Anglers reported losing gear in 21 cases, four of which the line was cut by the angler, showing that the dolphins seem to be quite adept at taking both bait and fish off the line without getting hooked. Some of the fishermen reported that when they

saw dolphins or had a dolphin steal from them they would move to a different location or remove their line from the water for a while (often around 20 minutes or until they no longer saw the dolphin in the area). However, other anglers (especially visitors to the area) continued re-baiting their hooks and fishing in the same place, often inadvertently and sometimes intentionally feeding the dolphin repeatedly. Two hundred and sixteen dolphins were seen from the pier by the observers (with many of those repeat sightings of a few individuals) over the course of the ten days of effort. Photo-identification of those dolphins that were close enough to the pier to get pictures showed at least 20 different animals, including several that seemed to frequent the pier area. One individual, PEEP, who was new to SDRP but has been identified previously by the Eckerd College Dolphin Project was seen on nine of the ten days we were at the pier. Two other known SDRP animals, MLHS and FB68, were seen six days each. A total of 12 previously cataloged animals were seen at least once from the pier, including one named WILL who was subsequently found dead with fishing gear in his mouth.

This pilot study clearly showed that there were frequent interactions between dolphins and fishermen at this site. Currently there is much frustration from the fishermen who have their bait and catch stolen and dolphins are getting injured and killed because they are ingesting or getting entangled in fishing gear. As a result of this study and recent mortalities of dolphins from fishing gear in Sarasota Bay (see next article), NMFS and the SDRP have recently produced and released an official "Best Fishing Practices for Avoiding Interactions with Wild Dolphins" (see page 5). These guidelines will be distributed to and hopefully adopted by fishermen to help alleviate this problem for both the fishermen and dolphins.

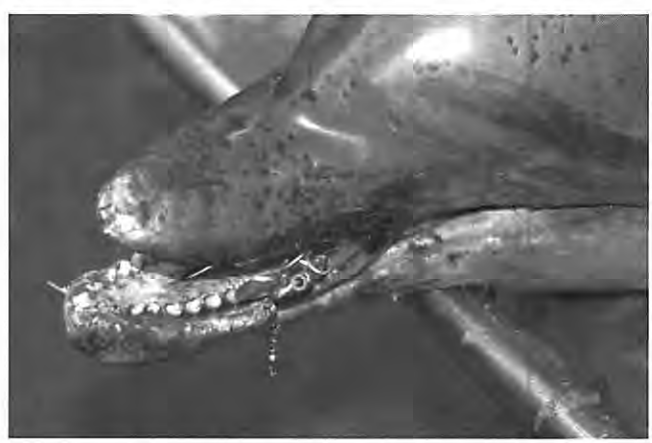
MLHS with hooked spanish mackrel near the Sunshine Skyway Fishing Pier on April 20th, 2006.

TPSP mouthing depredated grouper with lure still attached near the Sunshine Skyway Fishing Pier on March 3rd, 2006.

At least 2% of long-term resident bottlenose dolphins in Sarasota Bay died from recreational fishing gear in 2006

By Randall Wells, PhD

The past year has been the worst on record for losses of long-term Sarasota Bay resident bottlenose dolphins from ingestion of recreational fishing gear, including hooks, monofilament line, and lures. Of four carcasses of residents recovered with fishing gear caught in their mouths, throats, and/or stomachs, three were determined to have died from the gear. Another with a large fishing lure caught firmly in her mouth was determined to have likely died primarily from complications from a stingray barb penetration; the relative contribution of the lure to her death could not be determined. This does not take into account carcasses that were not reported and recovered. Previously, we have documented no more than one case of death from recreational fishing gear during any given year. These documented interactions with recreational fishing gear involved four well-known adults, FB 6, FB 75, FB 100, and JOSE, two of whom have been known to



Long-time Sarasota Bay resident adult female JOSE with fishing lure caught in her mouth.

us since their births 17 and 22 years ago, and none of whom had any previous history of interacting with anglers. These deaths occur at a time when we are seeing increasing "shadowing" of recreational fishing boats and piers in Sarasota Bay and elsewhere by dolphins. This may have come about as a learned behavior reinforced by release of catch or direct feeding by anglers, or perhaps from presentation of preferred prey fish as live bait at a time when the wild populations of these fish, such as pinfish, have collapsed from red tide-related deaths (see page 15). Population viability modeling by Dr. Robert Lacy of the Brookfield Zoo has demonstrated that the 2006 rate of mortality from fishing gear is unsustainable and will lead to a serious decline of the Sarasota Bay dolphin community should it continue. As a start toward mitigating this problem, we worked with the National Marine Fisheries Service to develop a set of "best practices" for fishing, and these are being disseminated through press releases, newspaper articles, and other outlets (see next article).

Riptorn approaching a recreational fisherman during a depredation event near Midnight Pass, February 2006.

Best fishing practices for avoiding interactions with wild dolphins

National Marine Fisheries Service

These "Best Fishing Practices" were developed in cooperation with NMFS scientists and fishery managers, and other research groups, including the Chicago Zoological Society, Mote Marine Laboratory and Hubbs-Sea World Research Institute. They were developed by reviewing information gathered from research observations at fishing piers and elsewhere, interviewing recreational anglers, and reemphasizing current conservation efforts and existing regulations.

Best Fishing Practices for Avoiding Interactions with Wild Dolphins:

1. Never feed wild dolphins – it is against federal law and is harmful to the dolphins.
2. Avoid tossing leftover bait to dolphins if they are nearby. Make use of leftover bait by taking it home to freeze for later or by giving it to your fishing neighbor.
3. Check your gear and terminal tackle to make sure they are in good shape and will not break too easily, resulting in a lost fish with a hook that could be eaten by a dolphin.
4. Avoid fishing in an area where dolphins are actively feeding – dolphins may mistake your bait or catch for food.
5. Do not release caught fish in the presence of dolphins – this reinforces the association of recreational fishing activities with a food source. Anglers should try to release the fish as far from the dolphin and as quietly as possible.
6. Change fishing locations if dolphins are showing interest in your bait or catch. Some fishing guides and anglers have reported that fishing success may decline at a site where dolphins are actively feeding. If the dolphin does not leave, or if it follows your vessel, we recommend ceasing fishing activity for a short time to discourage the dolphin's behavior.
7. Do not cast your line toward a dolphin.
8. Use corrodible hooks – any hook other than stainless steel. It may take anywhere from a couple of days, to weeks, or more for a corrodible hook to dissolve. Hooks are made from different alloys, with different coatings, that all affect how long they last. Using corrodible hooks in combination with other preventative measures may help reduce the chance of these interactions, as well as the degree of serious injury caused to the dolphins.
9. Use circle hooks – it is believed that they reduce injuries to fish and dolphins.
10. Never try to reel in a dolphin that may be hooked – if a dolphin is hooked and the hook is set, cut the line as close to the dolphin as safely possible. If the hook is not set, put slack on the line and give the dolphin time to release itself.
11. Stay at least 50 yards away from wild dolphins while boating or using personal watercraft.
12. Stow used fishing line. Make sure to collect any broken or used fishing lines to discard in recycling bins (Please visit the Monofilament Recovery and Recycling Program Website for a list of bin locations: http://floridaconservation.org/mrrp/bin_information.asp). If a recycling bin is not available, please discard in a secure bin. It's against Florida law to intentionally discard monofilament into area waters because such line can kill or injure marine mammals, birds, and sea turtles.

PEEP shadowing fishermen in southern Tampa Bay on March 6th, 2006.

Whistle playback studies

By Vincent Janik, PhD, Sea Mammal Research Unit and Laela Sayigh, PhD, Woods Hole Oceanographic Institution and University of North Carolina, Wilmington

Our playback studies are designed to test specific questions that arise from the observational studies on dolphin communication that we conduct. All of our playback studies are carried out during brief capture-release events, allowing us to carefully observe the dolphins' reactions, such as whether they turn their head towards the speaker when they hear a sound. We are particularly interested in the design and function of the signature whistle system that dolphins use to maintain contact with each other. Dolphins make up their own distinctive frequency modulation pattern (like a melody of a whistled tune) that they use to identify themselves. In May 2006 we published results from our Sarasota study that tested whether other dolphins learn to recognize this particular feature of the dolphin whistle (Janik, Sayigh and Wells 2006, PNAS 103: 8293-8297). We showed that dolphins recognized individual whistles even if we removed all voice features and only played a computer tone that mimicked the distinctive frequency modulation belonging to a close relative. This makes signature whistles similar to human names. Our study received a lot of media interest and was reported about by, amongst others, ABC, NBC, BBC, the *New York Times* and *National Geographic*.

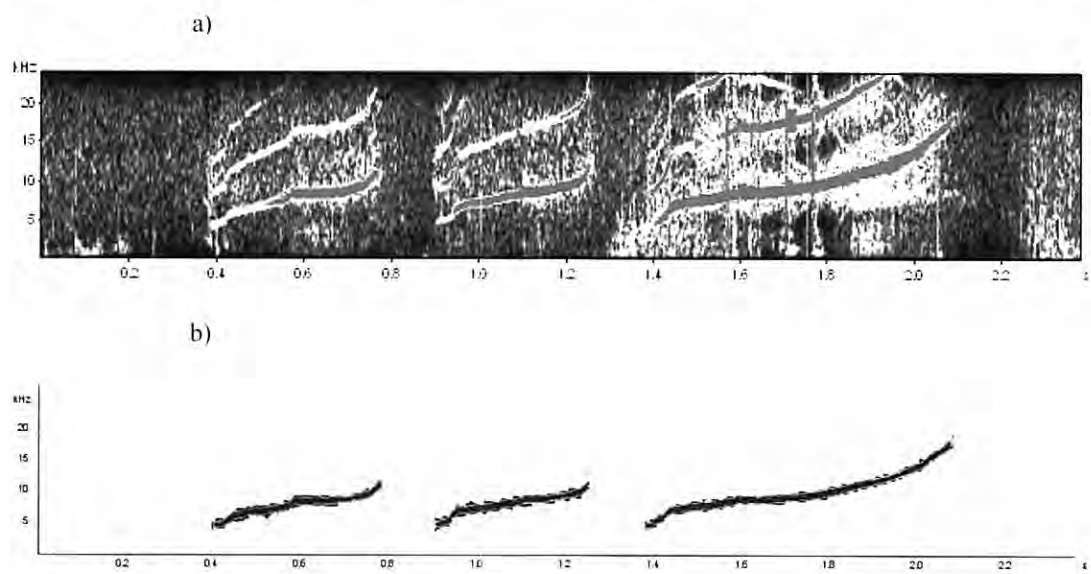
Using the same techniques we are continuing our experiments to find out whether dolphins can recognize each other by voice as well. As described above, we now know that they can recognize the frequency modulation patterns of other individuals. But can they recognize animals just by the tone of their voice? Humans are good at this and do not need to hear a person's name to recognize them on the phone. To find out, we are now playing non-signature whistles to dolphins to see whether they recognize who produced them.

A third study that is underway looks at how dolphins react when their own signature whistle is copied by someone else. Wild dolphins sometimes mimic the signatures of others, presumably to address or find a specific animal they are looking for. In this study we want to test whether dolphins react more to a copy of their own whistle than they do to other whistles. This would clarify whether dolphin signature whistles really are used like human names to address individuals.

We continue to build the unique Sarasota Dolphin Whistle Database, by making baseline recordings during capture-release projects. This database is almost fully digitized now, making it more accessible to other researchers. The Sarasota community is the only dolphin population that we can use to ask these questions, since we have long-term data from each individual on signature whistles and social partners. Through our work we can raise public awareness of the uniqueness of these animals and help to inform conservation efforts by providing data on how dolphins use sounds. This information can then be used to assess the effects of anthropogenic noise on dolphins.

This work is currently being funded by a Harbor Branch Oceanographic Institution Protect Wild Dolphins grant to L. Sayigh and R. Wells, and a Royal Society University Research Fellowship from the UK to V. M. Janik.

Spectrograms of the original (a) and the synthetic (b) version of a signature whistle used in playback experiments.



Whistles as potential indicators of stress in bottlenose dolphins

By H. Carter Esch, MSc, Laela S. Sayigh, PhD, Randall S. Wells, PhD, and Jim Blum, PhD

Stress has been defined as an environmental effect on an individual that overtaxes its functional abilities. The diversity of stress responses among marine mammals makes it difficult to develop a comprehensive diagnostic protocol to evaluate stress. The development of a relatively non-invasive tool with which to evaluate stress in bottlenose dolphins (*Tursiops truncatus*) could allow for assessments of animals that may be at risk and assessment of free-ranging animals without capture-release. The goal of this study was to evaluate whether vocalizations, specifically signature whistles, could serve as possible indicators of acute (or short-term) stress in bottlenose dolphins. Recordings made during brief capture-release events and during focal follows of undisturbed dolphins in Sarasota Bay, Florida, were used to address this question. Although there is no evidence that capture-release events have any long or short-term adverse impacts on members of the Sarasota dolphin community, it is likely that they are a source of short-term stress to the dolphins. We asked the following questions:

Will whistle rates and number of loops (repetitive elements in whistles) be greater: (1) during capture-release than during undisturbed focal follows? (2) at the beginning of a capture-release session than at the end of a session? (3) during an individual's first capture-release session than during later sessions? (4) when a mother is caught and released with a dependent calf than without a dependent calf? We also examined whether the duration of loops and/or inter-loop intervals, and maximum and minimum frequency of whistles change in any of the above contexts. Loop number was significantly higher during capture-release than during focal follows and decreased significantly from the beginning to the end of an individual's capture-release session. Loop duration was significantly shorter at the beginning than at the end of an individual session. Whistle rate was also significantly higher during capture-release than during focal follows and during a dolphin's first capture-release than during subsequent sessions. Females caught with a dependent calf produced whistles with significantly higher maximum frequencies and shorter inter-loop intervals than when caught and released without a dependent calf.

Whistle rate and loop number emerged from this study as the most promising potential vocal indicators of short-term stress in bottlenose dolphins. The findings of this project indicate that while significant patterns in whistle parameters relative to a dolphin's involvement in capture-release operations can be detected, there is no indication of any long-term adverse impact. In fact, findings suggest that habituation occurs within a capture-release session and from one session to the next. Based on the results of this study, further research would be warranted on assessing the utility of signature whistle rate and loop number as behavioral indicators of short-term stress in bottlenose dolphins. If the patterns in whistle parameters detected in this study persist once effects such as age and prior capture-release experience have been quantified, these measures could be utilized in conjunction with physiological indicators to ground-truth their reliability as indicators of various types of stressors in bottlenose dolphins.

Group fission-fusion dynamics and communication in the bottlenose dolphin

By Ester Quintana-Rizzo, PhD

The bottlenose dolphin exhibits a fission-fusion social structure characterized by temporary associations lasting from minutes to hours. Such flexible grouping patterns in which dolphins are constantly changing associates are intriguing and raise the question as to what factors are influencing a dolphin's decision to leave and join a temporary group. As groups change in composition, dolphins must be able to find each other when they are separated over long distances, and those distances must be within communication range. The purpose of my dissertation project was to (1) examine fission-fusion grouping patterns, (2) examine the communication signals produced during temporary separations, and (3) estimate the distances over which dolphins could remain in acoustic contact while separated.

It was found that a dolphin's decision to join or leave a group was related to social considerations such as the class of individual encountered (e.g., mothers with calves, adult single females, adult males, and juveniles) as dolphins move in different environments. The decision was also influenced by ecological characteristics such as the habitat where a dolphin was found. Mothers with calves regularly using deep waters frequently encountered other females in the same reproductive condition and associated with them. In contrast, mothers with calves using shallow waters often encountered juvenile dolphins but they did not associate with them frequently. When dolphins were temporarily separated, they did not always produce the sounds typically used for long-distance communication. When both whistles and echolocation were produced, they were apparently involved in maintaining contact between mothers and their calves and other associates. Estimates of active spaces defined by whistle transmission indicated that communication range varied between habitats. Shallow seagrass areas had the smallest active space while channels had the greatest active space. Findings indicated that the distances over which dolphins remain in acoustic contact and can be considered members of groups are much greater than has been described from observations of dolphin spacing and activity alone.

This project was successfully defended and accepted by the Graduate School Office of the University of South Florida. My studies at USF were supported by several graduate student fellowships from the College of Marine Science and the USF Library Fellowship Program. Fieldwork was supported by a grant from the National Marine Fisheries Service.

Juvenile dolphin behavioral development and survival strategies

By Katherine McHugh, PhD Candidate, University of California, Davis

The juvenile life stage is an extremely vulnerable and formative time for developing marine mammals, who must learn to find food and avoid predators in a complex underwater environment while forging social relationships and practicing skills critical for survival. While bottlenose dolphins are among the best studied cetaceans, virtually no work has focused on understanding behavioral development between weaning and sexual maturity or determining the selection pressures acting on the juvenile life stage. Many factors remain poorly understood - for example, what are the major differences between the behavior of juvenile and adult animals? How do skills and relationships critical for adult survival and reproductive success develop through the juvenile period? What social, ecological, and behavioral factors influence survivorship of juvenile dolphins? Because of SDRP's long-term work on the bottlenose dolphin communities in the area, the "natural laboratory" of Sarasota Bay provides a unique opportunity to address such questions.

To this end, the main objectives of my dissertation project are: 1) to develop a better understanding of the range of variability in social and behavioral development of bottlenose dolphins and 2) to determine the major ecological and behavioral influences on survival of free-ranging juvenile dolphins. I am investigating these questions by combining long-term sighting and mortality data from the resident dolphin community in Sarasota Bay with new information collected via boat-based surveys and focal animal observations on individually-identifiable juveniles. Preliminary fieldwork on this project began in 2005 and continued in Summer 2006. So far, I have collected over 160 hours of focal follow behavioral data on 26 individuals (13 females and 13 males) in the Sarasota community ranging in age from 2 to 11 years old. I plan to continue observing these juveniles over the next two years, which will allow for both a longitudinal and cross-sectional perspective on the social and behavioral development of juvenile dolphins in Sarasota Bay and provide a more detailed understanding of the maturational challenges facing newly independent juveniles on their 'path to adulthood.'

I am currently finishing data entry from our 2006 season and working on preliminary analysis of both long-term and focal follow data. I will be examining how dolphin association patterns, habitat use, ranging patterns, and activity budgets change from weaning to sexual maturity, investigating both between and within-sex differences in developmental trajectories as well as ways in which behavior patterns differ from adults. In addition, I will explore how juvenile dolphin behavior influences survival to adulthood by using long-term data to compare the ranging and association patterns of individuals who died before reproducing with those known to produce at least one offspring successfully. Finally, I hope to use this information to explore the potential social and ecological functions of mixed-sex juvenile groups by testing how group size and composition are influenced by factors such as activity state and habitat type, which may serve as proxies for predation risk and food availability. This portion of the project will benefit greatly from insights gained through SDRP's ongoing prey abundance and distribution research and may also incorporate some analysis of red tide effects on juvenile grouping behavior (since we have already noticed that there may be changes in juvenile behavior and group size during red tide events). This research will reveal the range of variability in developmental trajectories of bottlenose dolphins and provide missing data on how juvenile dolphin behavior patterns vary by sex, age, season, and time since weaning. Such information will provide a more comprehensive understanding of dolphin life history and survival strategies, which may have implications for conservation and management of long-lived coastal cetaceans.

F179 engaged in social play with other juveniles, August 2006.

Support for this project has come from NOAA Fisheries, the UC Davis Graduate Scholars Fellowship in Animal Behavior, the Animal Behavior Society's Cetacean Behavior and Conservation Award, and a NSF Graduate Research Fellowship.

Health assessment research in Sarasota Bay

By Randall S. Wells, PhD

Starting in 1987, the SDRP pioneered a program of health assessment of free-ranging bottlenose dolphins in an effort to be proactive in understanding health threats to dolphins, providing an alternative to the previous approach of recovery and examination of beach-cast carcasses. This approach continues to evolve, and subsequent programs in Texas, along the mid-Atlantic coast, and in the Indian and Banana River system of Florida have built upon the model we developed. Our capture-release health assessment program during June 2006 in Sarasota Bay, supported primarily by Dolphin Quest, involved more than 25 different concurrent projects (many of them summarized in this issue). The work was conducted by 110 staff members, collaborating scientists, graduate students, dolphin handlers, and veterinarians from around the world, including Argentina, Australia, Canada, China, Denmark, England, Germany, Guatemala, Scotland, and Tasmania. Colleagues from Argentina and China participated in order to learn how we safely capture and handle dolphins, for application to their own conservation programs with Franciscana dolphins and the most endangered cetacean, the baiji, in the Yangtze River. Continuing education opportunities were provided to staff from nine different zoos and aquaria, with the expectation that their experiences with Sarasota's dolphins would help them to better educate the public about bottlenose dolphins through their institutions' education programs.

Over the course of five days in the field (a foreshortened session due to Tropical Storm Alberto), we handled 20 dolphins, four of these for the first time. We completed sampling for our 10-year project to attempt to understand the seasonal variations in distribution and effects of environmental contaminants in dolphins (related to seasonal blubber dynamics). Of particular interest this year was the possibility of effects on health or body condition from the prolonged and severe red tide of 2005. None of the long-term resident dolphins were known to have died from red tide toxicosis (brevetoxicosis) during 2005. No specific indications of health impacts were noted during the session, but the below-average body condition of some of the sampled dolphins was consistent with declines in available resources resulting from the red tide. The three 2-year-old calves measured in 2006 were significantly smaller than same-age calves measured in previous years, and their mothers and the adult males measured during this session weighed less than expected.

The 2006 Sarasota Bay Health Assessment team.

Investigating bottlenose dolphin health along the Florida panhandle, at the site of a series of Unusual Mortality Events

By Lori Schwacke, PhD, NOAA's Center for Marine Animal Health

In July 2006, NOAA's Marine Mammal Health and Stranding Response Program conducted the second year of our dolphin health assessment research project in St. Joseph Bay, Florida with support from partners including the Chicago Zoological Society's Sarasota Dolphin Research Program, Mote Marine Laboratory, NOAA's Ocean Service, Ocean Embassy, University of North Carolina at Wilmington, Florida State University, Florida Fish and Wildlife Conservation Commission, and several public display facilities such as Gulfworld Marine Park, Dolphin Quest, Disney's Living Seas, the Mirage Dolphin Habitat, and Mystic Aquarium. The research is part of an extensive investigation into several bottlenose dolphin Unusual Mortality Events (UMEs) that have occurred in and around St. Joseph Bay along the Florida panhandle since 1999. Many of the mortalities have been linked to brevetoxin exposure, which is caused by red tide blooms.

The first year of the research project began in April of 2005 to evaluate the health of live dolphins in this area, and 12 animals were handled over a two-week period. The primary objective of the research is to determine if there are differences in health parameters between this population and other dolphin populations along the Florida central west coast which could indicate an increased vulnerability to brevetoxicosis for the panhandle dolphins. Nearly half of the dolphins sampled in the St. Joseph Bay area in 2005 showed blood parameters that were significantly elevated as compared to dolphins sampled from other coastal populations, such as Sarasota Bay. During the July 2006 field season, which also lasted two weeks, 18 additional dolphins were sampled, and preliminary results again indicate nearly half of the animals sampled have out-of-range blood parameters. Whether or not the abnormal health parameters are linked to an increased susceptibility to brevetoxicosis is still under investigation. The long-term research conducted by the Sarasota Dolphin Research Program has significantly contributed to our overall understanding of dolphin health and has provided an important baseline to evaluate and assess dolphins in other areas.

Brominated flame retardants in bottlenose dolphins in Sarasota Bay

By Jenn Yordy, PhD student, National Institute of Standards and Technology, Charleston, SC

Brominated flame retardants (BFRs) are chemicals that are added to many industrial and consumer products to decrease their flammability and reduce the risk of fire. Fire incidence has dropped over the past 25 years partly as a result of government regulations and fire prevention policies which mandate the use of flame retardants in many automotive and household products in use today. Flame retardants save lives and also reduce the economic impact of fires. However, many BFRs are simply additives to products and are not chemically bound, enabling them to separate and leach from the product into the environment. Some BFRs are very persistent in the environment and are found in many types of samples, including house dust, human blood, and arctic wildlife. Recent studies also suggest BFRs may disrupt endocrine system function and nervous system development and that levels, especially in the US population, are increasing.

In an effort to assess the degree of BFR exposure and potential health effects in the Sarasota Bay bottlenose dolphin population, approximately 195 blubber, blood and milk samples were collected for contaminant analysis during live capture and release health assessments since June 2000. Dolphin tissue samples were analyzed for two different types of BFRs: polybrominated diphenyl ethers (PBDEs) and hexabromocyclododecanes (HBCDs). Both contaminant types were detected in bottlenose dolphin blubber, with PBDE concentrations ranging between 40 and 1500 parts per billion (ppb). HBCDs were detected at much lower concentrations and were often below 10 ppb.

Previous research has demonstrated that the lipid-rich blubber layer of dolphins is an excellent storage site for lipophilic contaminants such as BFRs. Blubber can hold >90% of an animal's entire body burden of fat soluble contaminants making it a useful tissue in which to assess the long-term exposure of bottlenose dolphins to BFRs and other contaminants. However, it is not known whether the contaminant concentrations and mixtures stored in the blubber are representative of those found in more sensitive tissues, such as blood and other internal organs that may be targets for contaminant toxicity. To determine the availability of BFRs in blood, PBDE concentrations are being measured in paired blubber and plasma samples collected during live capture and release health assessments. Also, a collaborative project between the Sarasota Dolphin Research Program and the University of North Carolina Wilmington has allowed for the collection of tissues from bottlenose dolphins that will be used to determine BFR distribution throughout the body and help to identify target organ exposure. Preliminary data suggest that BFRs such as PBDEs are well distributed throughout the body. PBDE distribution appears to be dependent on tissue lipid content; therefore, the highest concentrations were detected in the blubber. However, PBDEs were detected within the blood of all animals analyzed to date and significant burdens of PBDEs were detected in internal tissues such as the brain, liver, spleen, thymus and thyroid gland. As these internal tissues may be targets for PBDE toxicity, these data may be used to further assess the risk of Sarasota Bay dolphins resulting from BFR exposure.

The collection of biological samples from the Sarasota Bay bottlenose dolphins will allow for an assessment of current BFR exposure in this population. In addition, to understand how diet may influence BFR exposure in Sarasota dolphins, the analysis of common prey species, including pinfish, pigfish, spot and mullet is currently underway. By determining BFR concentrations in prey species and distribution of these contaminants throughout the bottlenose dolphin body we can reliably assess whether Sarasota Bay dolphins are at risk for the adverse health effects and endocrine disruption associated with PBDE exposure.

Funding for this project is provided by the Sarasota Dolphin Research Program, National Marine Fisheries Service and the National Institute of Standards and Technology.

Brian Balmer and Rhonda Swor measure pH levels in a fecal sample.

Elizabeth Berens reads blubber thickness ultrasonically as part of the dolphin health assessment project.

Trace element homogeneity in bottlenose dolphin skin

By Colleen Bryan, MSc, PhD student, Medical University of South Carolina, Lori Schwacke, PhD, NOAA National Ocean Services, and Steven Christopher, PhD, National Institute of Standards and Technology

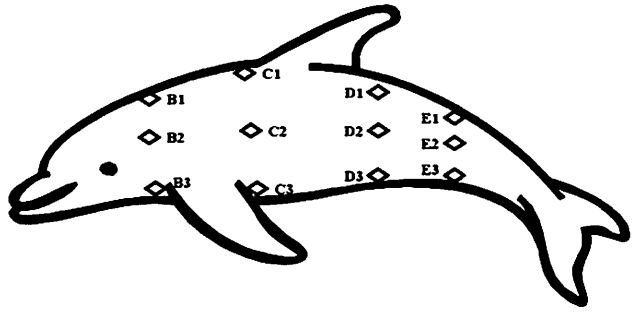
Little is known about the distributions, concentrations, or types of trace elements in cetacean skin. Cetacean skin has physiology that is unique from other marine mammals, allowing for distinct trace element accumulation patterns. Trace elements mainly accumulate in the multilayered epidermis and dermis. The high lipid content in blubber prevents the deposition of trace elements since many elements are not lipophilic. Previous studies have shown that some elements, such as mercury, are not homogeneous in skin on a micro-scale. We are referring to micro-homogeneity as homogeneity between dermal layers. No studies have examined trace element homogeneity on a macro scale, where trace element homogeneity in skin is assessed across an animal's entire body and this is the focus of the present work. Skin may be useful for assessing anthropogenic trace element contamination and population stocks. High variability in the trace element concentrations among different geographic areas and regional patterns may be used to delineate stocks.

Skin is a non-lethal sampling tissue being considered for monitoring of trace elements in wild free-ranging bottlenose dolphin populations. Currently published data are deficient for a broad suite of trace elements in bottlenose dolphin skin. Skin is always collected when wedge and dart biopsies are taken and has the potential to allow for the assessment of various trace elements. Many published studies do not indicate a standardized location when skin is obtained from a live or stranded animal and dart biopsies have a greater potential for location variation. This study addresses whether or not trace element levels in bottlenose dolphin skin are homogenously distributed across an animal's entire body, or if there is severe heterogeneity that would preclude the use of skin as a reliable non-lethal monitoring compartment.

Bottlenose dolphin skin samples were collected from twelve standardized locations from the body from two freshly dead animals to assess skin for trace element distribution and across body homogeneity (see figure to right). The sample sites on the animals were divided into two types of transects: lateral and longitudinal. The lateral transects, depicted by letter codes B, C, D, and E in the figure, were oriented vertically dividing the animal into planes around the girth anterior to posterior. The longitudinal transects, depicted by number codes 1, 2, and 3 run lengthwise, dividing the animal into planes dorsal to ventral.

Skin samples were analyzed for Al, V, Mn, Cu, Zn, As, Se, Rb, Sr, Mo, Cd, and Pb by inductively coupled plasma mass spectrometry (ICPMS) and Hg by atomic fluorescence spectrometry (AFS). Zinc had the highest (>100,000ng/g wet mass) concentration in dolphin skin; indicating skin could be a target organ for zinc deposition. Vandium, Mo, Cd, and Pb had the lowest (<10ng/g wet mass) concentrations in dolphin skin. Relative standard deviations of less than 20% between sample sites on each animal for Cu, As, Se, and Hg demonstrate that deposition of these elements may be tightly regulated in skin tissue. Multifactor mixed-effect analysis of variance analyses (ANOVA) showed significant ($p<0.05$) effects laterally (anterior-posterior) for As and longitudinally (dorsal-ventral) for Mo, Ru, Se, V, and Zn, indicating that standardized sample location collection is needed for accurate evaluation of these elements between animals due to non-homogeneous deposition in skin. Use of a standardized skin collection region will assist with comparing trace element data between cetacean studies.

Researchers should consider whether cetacean skin samples are coming from live or dead animals. If samples are collected from a dead animal, skin should be collected from a freshly dead animal to ensure that the skin has not begun to decompose, and comments on the skin condition should be put forward when reporting concentration data. Decomposing skin may not be representative of true trace element concentrations since layers would begin to slough off from the full thickness of the skin. Future studies will include correlation analyses between blood and skin to determine the degree of correlation between these tissue types for certain elements. A separate study will examine dart biopsy samples. Dart biopsies provide limited skin sample mass that may not be representative of bulk skin and the sample size may restrict determination of trace elements present at ultra low concentrations due to analytical instrumentation detection limits. Support for this project has been provided by NOAA Fisheries and the National Institute of Standards and Technology.



Skin sampling sites

Earthwatch Dolphin Monitoring Program 2005-2006

By Jason Allen, BS, Field Coordinator and Lab Manager, SDRP

We have been able to continue our year-round monthly monitoring of the Sarasota dolphin community thanks to support from Earthwatch Institute volunteers and NOAA Fisheries. The Sarasota bottlenose dolphin community is the most thoroughly studied free-ranging dolphin population in the world. We continue to address increasingly refined questions about the lives of these animals with the benefit of information gained through our intensive year-round studies of their distribution, social and reproductive patterns.

Photo-identification surveys were conducted on 102 days from November 2005 through October 2006 with the assistance of Earthwatch volunteers and undergraduate interns. We had a total of 15 volunteers from ten states and two countries. These volunteers contributed over 2,000 hours to our project. We had 593 group sightings that totaled 1,900 dolphins (including resighted animals). Monthly values were variable (Figure 1), but overall we averaged about five sightings and almost 18 dolphins per day. These values have remained fairly consistent over the past several years. We had a high of 14 sightings in one day during a September 2006 survey and a high of 92 dolphins on that same day.

We documented the births of seven new calves during the spring/summer of 2006. FB 25 had her sixth calf and Claire had her fifth while, at the age of eleven, Scooter had her first. Other mothers included Saida Beth, Murphy Brown, FB 93, and FB 183. Sadly, Saida Beth's calf was never seen alive. She was observed on the 27th of June carrying the dead calf on her rostrum. The calf was recovered the next day; upon necropsy no cause of death could be determined. Of her eight calves, only two have survived more than three years (Noah and FB 173). Four of the ten calves from summer 2005 have also died, or are missing and presumed dead.

Since November 2005 we have lost four adult long-term Sarasota Bay community members: FB 06, FB 75(Pup), Jose, and FB 100 (Scythe Fin). Sadly, each of these deaths involved human interactions, specifically ingestion of recreational fishing gear. Scrappy, the calf of Scooby Doo, was involved in yet another, though very unusual, case of human interaction. He was observed this past July with an unknown type of cloth wrapped around him just in front of his pectoral fins. When we briefly handled the animal a month later to remove the material, we discovered that it was an extra large men's Speedo! Scrappy was released the same day, has been observed many times since, and is doing well.

Through our Earthwatch-sponsored surveys, we have accounted for over 90% of the Sarasota Bay community members during the 2005-2006 field season. As of October 2006, the number of dolphins regularly using the waters surrounding Sarasota Bay stands at approximately 155 animals. We would like to thank all of our Earthwatch volunteers for their interest in, and support of, the Sarasota Dolphin Research Program.

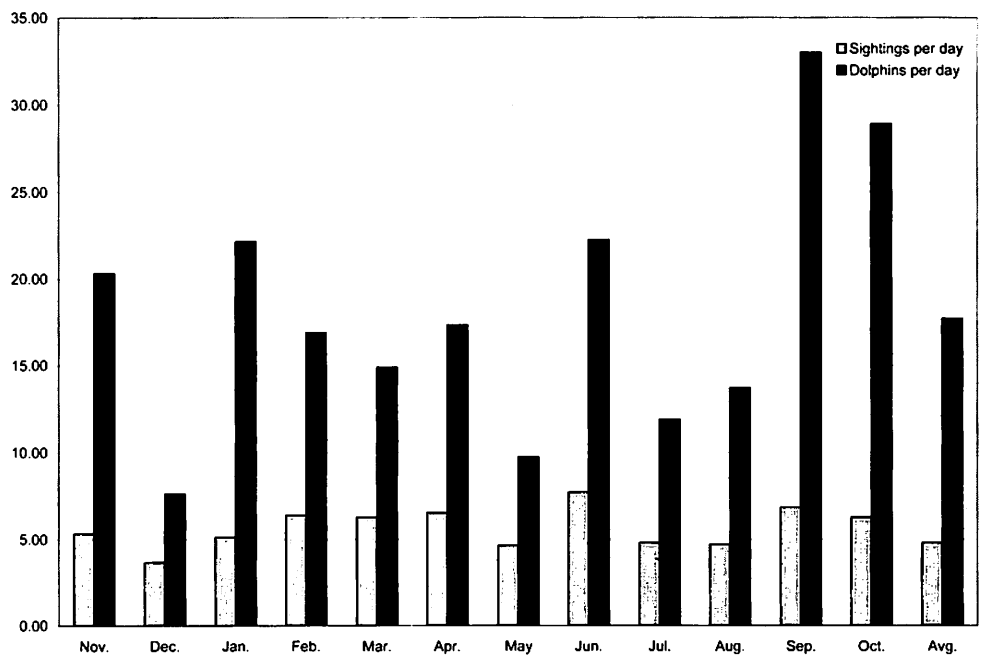


Figure 1. Average number of dolphin sightings and total dolphins per day from November 2005 through October 2006. The weather in December 2005 was unusually poor, hence the reduction in dolphin sightings.

Table 1. Births, additions, deaths, and losses to the Sarasota Bay population over the past year. Seven new calves were born and four well-known animals were confirmed dead.

Sarasota Community's Gains and Losses in 2006

Births

ID	Name	EVENT
FB25	FB 25	Sixth known calf
FB33	Saida Beth	Eighth known calf
FB93	FB 93	Fourth known calf
F109	Scooter	First known calf
F131	Claire	Fifth known calf
F155	Murphy Brown	Third known calf
F183	FB 183	Fourth known calf

Additions

ID	Name	EVENT
F242	Bent high nicks	Sampled June 2006

Missing

ID	Name	EVENT
FB83	Jagged Mama	Not IDed in 2005, 2006
F105	43LA	Not IDed in 2005, 2006

Deaths

ID	Name	EVENT
C076	Sixth calf of FB 07	Missing, presumed dead
C338	Eighth calf of FB 33	Died 26 June 2006
C872	Second calf of FB 87	Died 3 July 2006
FB06	FB 06	Died 12 June 2006
FB75	Pup	Died 01 May 2006
F100	Scythe Fin	Died 13 July 2006
JOSE	Jose	Died 12 April 2006

F155 with her third calf, 1553, born in June 2006.

Merrily, her yearling, F228 and others in a large group off Key Royale Bar, January 2006

C992 gets a push during a socializing bout, August 2006.

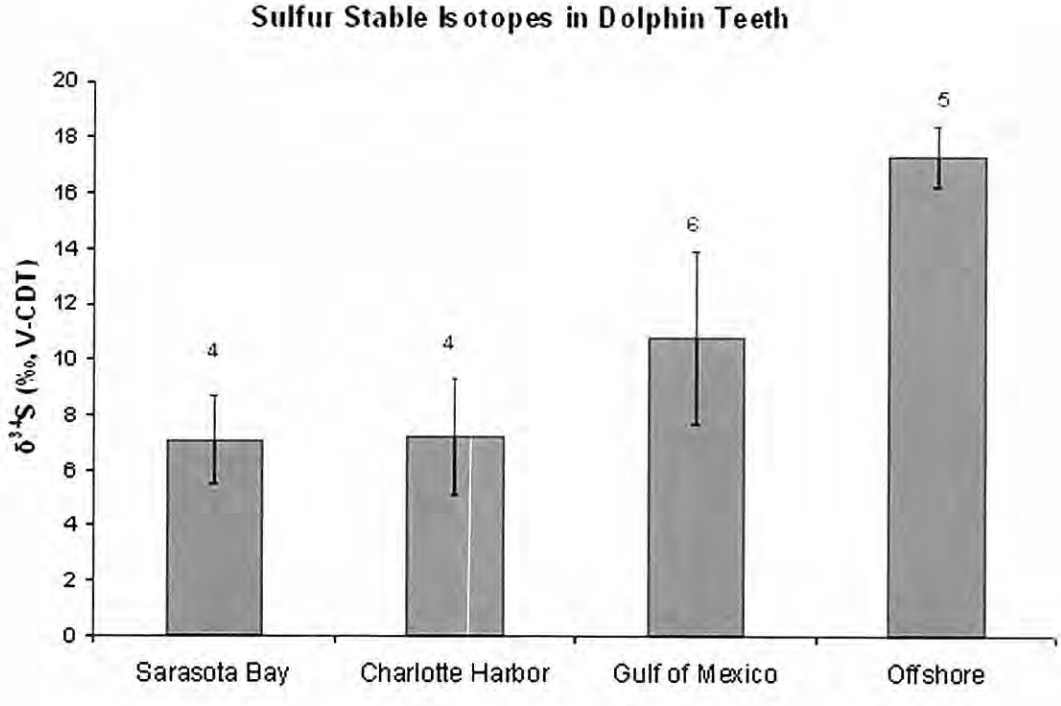
Murphy Brown surfacing under Longboat Pass Bridge. Neither the local boys on the beach nor our field team could tell that she was pregnant with her third calf.

Bottlenose dolphin population differentiation and trophic studies using Carbon, Nitrogen, and Sulfur stable isotopes and stomach content analyses

By Nélio Barros, PhD, Mote Marine Laboratory, Peggy Ostrom, PhD, Michigan State University, Craig Stricker, PhD, U.S. Geological Survey, and Randall S. Wells, PhD

We used a combined approach of stable isotope and conventional stomach content analyses in dietary and population differentiation studies of bottlenose dolphins from central west Florida. Teeth obtained from dolphins stranded in Sarasota Bay (resident animals of known feeding history), the adjacent Gulf of Mexico, Charlotte Harbor and offshore waters were analyzed for their carbon (ä^{13}C), nitrogen (ä^{15}N) and sulfur (ä^{34}S) isotopic signatures. Selected fish prey species collected in Sarasota Bay were also analyzed for C and N isotopes (ranges of ä^{13}C: -16.2 to -10.2‰ and ä^{15}N: 2.9 to 8.6‰). Sarasota Bay dolphins (n= 48) had significantly higher ä^{13}C values (-10.7‰ ± 1.2 SD) than animals from other populations (adjacent Gulf: -11.9‰ ± 0.9 SD, n= 30; Charlotte Harbor: -12.0‰ ± 1.5 SD, n= 27; offshore: -11.6‰ ± 1.0 SD, n= 10), whereas ä^{15}N values did not differ (Sarasota Bay: 12.4‰ ± 1.5 SD, Adjacent Gulf: 12.7‰ ± 0.8 SD, Charlotte Harbor: 12.3‰ ± 0.9 SD, offshore: 12.9‰ ± 0.9 SD). Isotope data for Sarasota Bay are consistent with preference for seagrass-associated fish prey, particularly pinfish, as determined from stomach content analyses and behavioral observations. Preliminary analysis of sulfur isotope data suggests nearly non-overlapping ranges in the few specimens analyzed, where estuarine (Sarasota Bay and Charlotte Harbor) were less than Gulf of Mexico which were less than offshore dolphins (Fig.1). Thus, animals inhabiting the Charlotte Harbor estuary, an area influenced by runoff from three major rivers, had lower Sulfur values (ä^{34}S: 7.2 ‰ ± 2.1 SD, n= 4) compared to other populations (inshore animals stranded in Gulf beaches: 10.8 ‰ ± 3.1 SD, n= 6; animals from the offshore ecotype: 17.3 ‰ ± 1.1 SD, n= 4), likely reflecting the freshwater signature acquired in these brackish waters. Sarasota Bay dolphins had Sulfur values similar to those from Charlotte Harbor (Fig. 1). With additional samples being analyzed, further isotopic discrimination among parapatric populations is expected. Stable isotopes hold great promise in tracing energy flow in pelagic, neritic and estuarine bottlenose dolphin populations and, together with stomach content analyses, can be used as tools in understanding trophic ecology, assessing ontogenetic variability at the individual and population levels, and assigning population identification of stranded animals of unknown history.

Figure 1. Sulfur values of dolphin tooth samples collected from different populations off central west Florida; results are expressed in delta notation relative to the V-CDT scale. Sample sizes are shown above the histograms; error bars represent ± 1 standard deviation.



Red Tide Returns in 2006

By Deborah Fauquier, DVM, Mote Marine Laboratory

Beginning in August 2006 and continuing to the present, a persistent bloom of the red-tide alga, *Karenia brevis*, has been present in Sarasota Bay and surrounding waters. Cell concentrations have reached levels of several million cells per liter of seawater, indicating a severe red tide event. As point of reference, cell concentrations of 1,000 cells per liter or less are considered background levels, and 100,000 cells per liter or more typically cause respiratory irritation in humans and fish kills. The previous red tide event that occurred in Sarasota Bay waters persisted from February 2005 to January 2006, and cell concentrations reached a maximum of 300 million cells per liter. During the 2006 red tide bloom there have been significant increases in sea turtles stranding. Since 1 August 2006, Mote has responded to 84 sick or dead sea turtles in the Sarasota Bay region. On average, Mote responds to 50-60 sea turtle strandings per year. This increase in sea turtle strandings was also seen last summer during the prolonged red tide event in which over 92 sea turtles stranded between August and November 2005. Lastly, dolphin strandings do not appear to have increased during the current red tide event, with only 3 dolphins stranding since August 2006. This is in contrast to last year's event when over 20 dolphins stranded between August and November 2005, and Sarasota Bay was included in the region identified as part of a Florida West Coast Unusual Mortality Event. Blood samples tested from the live sea turtles stranding during this year's event have been positive for the red tide toxin. The scope of this year's red tide event is currently smaller in magnitude and severity than last year's year-long red tide bloom, but the cumulative effects of these continued red tide events on the Sarasota Bay ecosystem are unknown and currently under investigation.

Effects of red tide on dolphins

By Spencer Fire, PhD-ABD, University of California, Santa Cruz

For decades "red tides" have been considered to be a nuisance along Florida's Gulf coast and have had a significant impact on the economy, wildlife, and human health of many coastal regions of the U.S. This type of harmful algal bloom (HAB) has been responsible for shellfish poisoning, fishery closures, loss of tourism and marine animal die-offs, including marine mammals. In recent years, several Unusual Mortality Events involving bottlenose dolphins in the Gulf of Mexico and on the Atlantic coast have been suggested to be caused by red tide. Brevetoxins, the neurotoxins produced by the red tide alga *Karenia brevis*, have been shown to have harmful effects on a wide variety of organisms, but their effects on bottlenose dolphins are unclear. The aim of my research has been to gain an understanding of the impact of red tide on the diet, biology, and behavior of bottlenose dolphins in Florida's Sarasota Bay area.

My study involves quantifying brevetoxin levels in dolphin carcasses, in dolphin prey items and in live dolphins sampled during red tide events. This gives insight into what level of brevetoxin exposure is associated with dolphin mortalities in areas frequently affected by red tides. It is unknown whether dolphin behavior is affected by red tide, and this study has sought to observe their behavioral states and record their movements relative to *Karenia brevis* concentrations. It is hoped that an increased understanding of how dolphins are affected by red tide will help conservation efforts in the future.

Laboratory analysis of samples collected from dolphin carcasses show that the majority of animal carcasses recovered during active red tide events have detectable levels of brevetoxins. Samples of liver, kidney, lung, muscle and blubber tissue, as well as stomach contents, urine and fecal samples have concentrations of brevetoxin ranging from 7 to 2,900 nanograms per gram (ng/g) of tissue (as point of reference, the current regulatory limit for brevetoxin in shellfish is 800 ng/g). Samples of dolphin prey fish (pinfish, spot, pigfish, mullet) taken during a red tide event also had detectable levels of brevetoxin in their tissues, with concentrations ranging from 3 to 261 ng/g. Brevetoxins have also been detected in samples from dolphin carcasses and fish recovered more than 6 months after the last red tide occurrence in the same area, which raises further questions about the residence time of the toxin in these animals. Additionally, live dolphins sampled during red tide events had detectable levels of brevetoxins. Behavioral data from dolphins observed during red tide indicate that these animals have a higher incidence of chuffing (a type of explosive exhalation) compared with non-exposed animals. Also data suggest that dolphins utilize waters with lower *K. brevis* levels compared with levels found in nearby locations. Support for lab analyses and field observations has been generously provided by Long Marine Laboratory, Disney Wildlife Conservation Fund, National Marine Fisheries Service, Harbor Branch Oceanographic Institution's Protect Wild Dolphins program, and the Chicago Zoological Society.

Effects of Red Tide on Prey Availability

By Damon Gannon,PhD, Elizabeth Berens, MSc, and Sandra Camilleri, BSc

Red tide can affect fish in several ways: by exposure to brevetoxin (the neurotoxin produced by the red tide organism, *Karenia brevis*) in the water; by consuming food that is tainted by brevetoxin; or by exposure to hypoxic water (water with unusually low concentrations of dissolved oxygen), which often accompanies severe red tides. Red tide causes an increase in the biomass of dead organisms in the water, and the process of decomposition uses up oxygen. Both brevetoxin and hypoxia can kill fish and may, therefore, decrease the amount of food available to dolphins.

Sarasota Bay experienced a severe red tide event (>100,000 cells per liter) from February to October 2005, which appears to have had a significant effect on the Bay's fish community. SDRP's quantitative survey of fish resources in Sarasota Bay documented dramatic decreases in fish abundance coinciding with the red tide. Compared to the same period in 2004 (in which there was no red tide), overall catch rates of fish in the summer of 2005 dropped by 50%. Declines in abundance of the species typically eaten by dolphins were even greater than the average rate for all species. For example, combined catches of pinfish (-75.4%), pigfish (-99.7%), silver perch (-99.5%), spotted seatrout (-93.2%), mojarra (-68.9%), and hardhead catfish (-96.2%) decreased by 76.1%. Despite these massive declines in fish abundance in 2005, some species returned to their pre-red tide levels by the early summer of 2006. Some of the longer-lived, slower-growing species, such as spotted seatrout, have not yet fully recovered. The abundance of one species, thread herring, actually appears to be positively correlated with the presence of red tide. It is possible that thread herring, which is normally not an important prey species for dolphins, provide a food source for dolphins during severe red tides.

Our investigation of the effects of red tide on dolphin prey is in its early stages, and so far the work has generated more questions than answers. We plan to continue our survey to monitor how the fish community responds to ecological perturbations caused by red tide, including the red tide that started in August 2006.

Table 1. Factors to be investigated for inclusion in predictive habitat use models.

Abiotic Factors

- Bathymetry
- Habitat
    1. Seagrass
    2. Pass
    3. Sand/Mud flat (unvegetated bottom, <2.5 m)
    4. Open Bay (>2.5 m)
    5. Gulf
    6. Channel
    7. Mangrove
- Distance to Each Habitat Type
- Distance to Shoreline Features
    1. Mangroves
    2. Bulkhead/seawall
    3. Beach
    4. Soft bank
- Navigation Channels
- Distance to Navigation Channels
- Distance to Artificial Structures
    1. Artificial reefs
    2. Piers/bridges
    3. Marina docks
    4. Mooring fields
- Substrate
    1. Sand
    2. Mud
- Tidal State
- Water Quality
    1. Salinity
    2. Temperature
    3. Dissolved oxygen
    4. Turbidity

Biotic Factors

- Occurrence of Ambient Sounds:
    1. All fish
    2. Fish by species
    3. Boats
- *Karenia brevis* cell concentration
- Prey Density ("prey" defined in a variety of ways)
- Predator Density
- Dolphin Density
    1. Overall
    2. By demographic group
- Boat Density

Computer Modeling of Dolphin Habitat Use

By Damon Gannon, PhD

Elizabeth Berens, Janet Gannon, Randy Wells, Ari Friedlander (Duke University), and Damon Gannon are working to create predictive habitat use models for the bottlenose dolphins of Sarasota Bay. The goals of the project are to (1) identify patterns of habitat selection, (2) determine which environmental factors (e.g., prey abundance) drive these patterns of habitat selection, and (3) create computer models that can identify areas of high use by dolphins. A tremendous amount of data will be incorporated into the models. These data have been collected in the field by SDRP biologists and by remote sensing (see table 1). This project relies heavily on Geographic Information System (GIS) and statistical modeling software. These models can then be used to predict how human-induced changes to the habitat will affect the health of the Sarasota Bay dolphin community and to identify potentially important habitats in other geographic regions where little is known about the local dolphins. The amount and quality of data that we can bring to bear on these models is unprecedented in marine mammal habitat modeling and will hopefully result in the models having superior predictive powers.

Population structure of bottlenose dolphins in and around St. Joseph Bay, Florida

By Brian Balmer, MSc Candidate

Bottlenose dolphins along the Florida panhandle experienced three unusual mortality events in 1999, 2004, and 2006, in which over 320 dolphins died. A large number of these strandings were located near St. Joseph Bay, FL. However, it is not known which stock(s) were impacted. This project represents the first effort to identify dolphin ranging patterns in this region. We used three methods to determine these patterns: photo-identification/biopsy darting surveys, mark-recapture abundance estimates using photo-identification, and radio tracking of individuals.

Photo-identification/biopsy darting surveys were undertaken during April – May 2004, February – July 2005, and February 2006. Over 250 individuals have been identified, and half of these have been identified in multiple seasons. One hundred and one biopsy samples have also been collected from individuals along the Florida Panhandle. These samples are currently being analyzed by Sue Carney (Mote Marine Laboratory) and Patty Rosel (National Marine Fisheries Service).

Mark-recapture photo-identification surveys were conducted February-March, April, May, and July 2005, as well as February and September 2006. Preliminary data from these mark-

Radio-tagged calf (FB X27) from the July 2006 health assessment.

recapture abundance estimates suggests a two- to three-fold increase in dolphin numbers during the spring and fall seasons. Summer and winter seasons appear to have a smaller, yet more stable number of animals within the St. Joseph Bay region.

In April 2005 and July 2006, NOAA sponsored capture-release health assessments of dolphins in the region; twenty four individuals were tagged with VHF radio transmitters. These dolphins were monitored daily through boat, aerial, and/or vehicle tracking for over 109 days. Dolphin utilization areas were estimated for each radio tagged animal by measuring the distance of shoreline between the farthest east and west sighting location and multiplying that distance by the maximum distance the dolphin was located offshore. In comparing the tagging results from the April 2005 and July 2006 St. Joseph Bay health assessments, there are some interesting trends observed. The average utilization areas for animals tagged in April 2005 and July 2006 are very similar, suggesting similar range size between the animals tagged in both health assessments. However, the distribution of animals during these two time periods is notably different. The ranges of all animals from July 2006 covered approximately 65 km of coastline, predominantly within the St. Joseph Bay region. However, four of the tagged animals from April 2005 had ranges extending well past the St. Joseph Bay region, covering approximately 165 km of coastline. These data, along with ongoing photographic identification and genetic analyses, are beginning to suggest the presence of animals with differing utilization area patterns within the same geographic region, possibly with a seasonal component to the variation.

These results, although preliminary, suggest that the 1999, 2004, and 2006 unusual mortality events may have impacted multiple stocks of dolphins along the Florida panhandle, and/or that dolphins originating in regions to the east and west may now be utilizing habitat vacated by dolphins that died during the UMEs.

This research would not be possible without funding from NOAA Fisheries and the Disney Wildlife Conservation Fund.

Investigating potential hurricane and red tide related impacts on bottlenose dolphin abundance, reproductive rates, distribution, and site fidelity in Charlotte Harbor and Pine Island Sound.

By Kim Bassos-Hull, MSc

On August 13, 2004, Hurricane Charley, a major Category Four storm, swept a path through Charlotte Harbor and Pine Island Sound on the west coast of Florida causing widespread ecological damage. Subsequently, Charlotte Harbor and Pine Island Sound were affected by prolonged red tide episodes at fish kill levels throughout 2004 and 2005. These combined events may have affected habitat health, including prey availability, in ways that could have short or long-term implications for the bottlenose dolphins that use this estuary. Our program was in a unique position to evaluate potential impacts from these natural events because of existing baseline data. Dolphin abundance, reproductive rates, distribution, and site fidelity was collected in this region during intensive seasonal surveys immediately prior to the 2004 hurricane. Longer-term data on residency was collected over the last 24 years. Knowledge of the status of the dolphin population units inhabiting Charlotte Harbor and Pine Island Sound is important for management, and follow-up surveys would provide a unique opportunity to investigate the adaptability of these animals to large scale disturbances.

With funding from Harbor Branch Oceanographic Institution's Protect Wild Dolphins program, we conducted a comprehensive, multi-week photographic identification survey in Charlotte Harbor and Pine Island Sound in September 2006 at the same scale as our 2001-2003 September surveys. Using 3 boats we surveyed two complete sets of transects between September 5-22nd, for a total of 46 boat-days. Overall, we had 246 sightings with 1,222 dolphins, 225 calves, and 71 young-of-the-year. We took 10,318 photographs and are currently in the grading and photo-identification stage of analysis. As of November 30th, we have matched over 200 individuals to our catalog. Prior to these September 2006 surveys we completed two smaller scale (3-4 day) surveys after Hurricane Charley in August and September 2004 with emergency funding provided by Mote Marine Laboratory. From the August and September 2004 surveys we identified 32 dolphins that had at least 10 sightings. These dolphins had been observed both before and after Hurricane Charley with no obvious change in their sighting distributions. With the completion of these larger scale September 2006, surveys we will be able to look at abundance trends and reproductive rates while amassing a larger set of animals to compare pre- and post-Hurricane Charley sighting distributions. Preliminary reproductive rates from these September 2006 surveys were within the range of the September 2001-2003 values (mean young-of-the-year proportion in 2006 = 0.042 ± 0.103 SD) compared to 2001 (0.020 ± 0.069 SD), 2002 (0.037 ± 0.097 SD), and 2003 (0.047 ± 0.110 SD). We are also interested in looking at the health of these animals to see if there are any effects from red tide or other habitat changes. We have worked with Mote's Stranding Investigations Program to identify carcasses and measure brevetoxin levels when possible. In addition we have observed lesions on several individuals and will compare current sightings to those from the last few years. Over the next six months we hope to complete analyses and determine whether these dolphin communities in Charlotte Harbor and Pine Island Sound were affected by these large scale ecological disturbances. I would like to take this opportunity to thank Don and Dorothy Gulnac for letting us base our field surveys out of their beautiful Demere Key paradise.

Some of the Charlotte Harbor survey team at Demere Key. From left to right: Rubai and Elisabeth Fahrni Mansur, Laura Markley, Aaron Barleycorn, Robin Perrtree, Goldie Phillips, Katie McHugh, Vanessa Greenwood, and Kim Bassos-Hull.

Echo and Misha Update: Misha's death 16 years post-release

By Kim Bassos-Hull, MSc

It is with sad news that I report that Misha's carcass was recovered on July 6, 2006, near Port Manatee in Tampa Bay. Misha was one member of a pair of dolphins that participated in a unique two-part scientific experiment. Echo and Misha were initially collected in Tampa Bay in July 1988 and spent two years at the University of California at Santa Cruz's Long Marine Laboratory where researchers studied their echolocation processing abilities and behavior patterns. Then, as planned prior to collection, on October 6, 1990, they were released back into Tampa Bay after a transition process in a seapen at Mote Marine Laboratory. During intensive monitoring during the first year following their release, both Echo and Misha were observed feeding, interacting with other local dolphins, and in general displaying typical behavioral, ranging, and social association patterns as well as excellent body condition.

Echo (top) and Misha (bottom) underwater view at Long Marine Lab, 1989.

Misha during an echolocation trial at Long Marine Lab, 1990.

Photo by Flip Nicklin

Release day! Misha takes a peek seconds before release.

Echo and Misha split up after the first few months back in the wild, but researchers continued to observe both dolphins through opportunistic sightings. Misha had been sighted on 70 different days since release along the southeast coastline of Tampa Bay. The last sighting of Misha by our program before his death was on August 16, 2005, in the Manatee River (southeastern Tampa Bay) where he was observed with longtime associate, KATT. Echo has been sighted 55 times since release, the last several sightings by the Eckerd College Dolphin Research Program in the Boca Ciega region (western part) of Tampa Bay. Echo's most recent sighting was on June 26, 2003, in upper Boca Ciega Bay.

Misha was freshly dead when his carcass was recovered by the Florida Fish and Wildlife Conservation Commission's Marine Mammal Pathobiology Lab, but cause of death was not immediately obvious upon necropsy. It is suspected that he was suffering from an infection but histopath samples provided no clear insights into cause of death. He was in good physical condition and reproductively active at time of death. At 25 years of age, he had reached a length of 257 cm and weight of 223 kg, typical for males his age. Misha was found along the same section of coast where: 1) he was first tagged in 1984, 2) he was caught in 1988 and taken to UC Santa Cruz, 3) he was released in 1990, and 4) he was resighted most often following release. We hope to re-sight Echo in the next year with increased effort in the Tampa Bay area and additional collaboration with the Eckerd College Dolphin Research Program surveys.

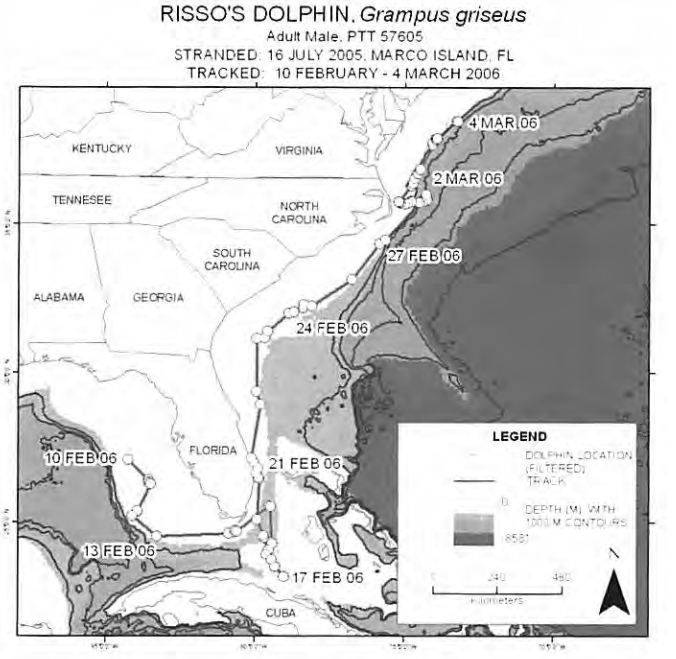
Misha and Echo together two months after release in December 1990.

Release and follow-up monitoring of Risso's dolphin "Clyde": Record movements and dives

By Randall S. Wells, PhD

During 2006, the Sarasota Dolphin Research Program, in collaboration with Mote Marine Laboratory's Dolphin and Whale Hospital, had the opportunity to learn about the movement and dive patterns of a species of deep-water dolphin for which little information was previously available. On July 16th, 2005, five Risso's dolphins, *Grampus griseus*, stranded near Marco Island, Florida. Two of these, an adult male "Clyde" and an adult female "Bonnie," were transported to Mote's Dolphin and Whale Hospital. They were treated for severe pneumonia, as well as a variety of other conditions, including elevated white cell counts and elevated liver enzyme levels. Unfortunately, Bonnie, who was determined to be pregnant several months after arriving at the hospital, did not survive. Clyde was tagged with a satellite-linked radio transmitter and was released about 115 miles offshore of Sarasota on February 10th, 2006. The release was planned to return Clyde to the appropriate deep water habitat nearest to Sarasota, in order to reduce transport time. Clyde was tracked for 23 days, as he moved from the Gulf of Mexico to a deep trench just north of Cuba, then continuing northward in the Atlantic Ocean to the waters offshore of Delaware (see map below). Most of Clyde's dives were to depths of less than 100 meters, but some were to 400-500 meters, and were of up to 10 minutes in duration. To the best of our knowledge, these are the deepest dives ever recorded for this species. Clyde's last transmissions showed him to be in typical habitat for the species, and in the same general area where a rehabilitated Risso's dolphin released by Riverhead Foundation in New York had been tracked during 2005.

Clyde's release resulted from the dedicated efforts of many volunteers through Mote's Dolphin and Whale Hospital. Tagging and tracking were supported by the J.H. Prescott Marine Mammal Rescue Assistance Grant Program.



Risso's dolphin "Clyde" at Mote's Dolphin and Whale Hospital.

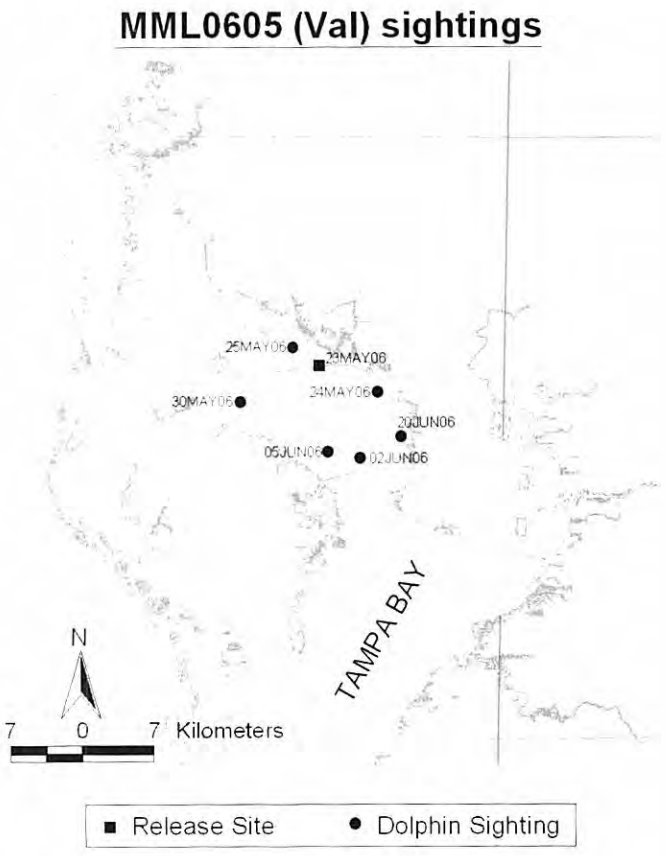
Release and follow-up monitoring of bottlenose dolphin "Val" in Old Tampa Bay

By Brian Balmer, MSc candidate

On February 12th, 2006, an adult female bottlenose dolphin stranded on a mud flat near Oldsmar, Florida in the northwest corner of Old Tampa Bay. The animal was covered in abscesses, dehydrated, and emaciated. It was rescued by Clearwater Marine Aquarium staff and brought to Mote Marine Laboratory's Dolphin and Whale Hospital. For the next three months, MML0605, or "Val", was rehabilitated by the Dolphin and Whale Hospital.

On May 23rd, 2006, Val was successfully released back into Tampa Bay, on the north side of the Courtney Campbell Causeway. She was fixed with a VHF radio transmitter to track her progress for the following month. Within two hours of her release, Val was observed socializing with 6-8 other animals in the area. Over the next month, Val was visually located by boat five times and triangulated by land once. During her sightings, Val was routinely seen with other animals, traveling and socializing as well as foraging. Over the month of follow-up monitoring, she spent the majority of her time in the NW corner of Tampa Bay primarily between the Gandy Bridge and Courtney Campbell Causeway.

The post-monitoring success of Val would not have been possible without the help of numerous Mote Marine Laboratory staff, volunteers, and interns as well as Galati Marina for logistical support. Tracking was supported by the J.H. Prescott Marine Mammal Rescue Assistance Grant Program.



Val with another dolphin in Old Tampa Bay.

Rescue of bottlenose dolphin "Scrappy" from possible death (or at least an embarrassing apparel choice)

By Randall S. Wells, PhD

It is amazing what a difference a poor fashion choice can make for your life. For one Sarasota Bay bottlenose dolphin, "Scrappy", the wearing of a large men's Speedo bathing suit nearly cost him his life, but his successful rescue made him a media darling, starring in an article by Pulitzer Prize-winning *Chicago Tribune* reporter Bill Mullen, earning him a spot on National Public Radio's "*Wait, Wait, Don't Tell Me*" program, and getting acknowledged by best-selling Florida author Carl Hiaasen during a newspaper interview. Scrappy was first observed as the apparent calf of resident Sarasota Bay dolphin "Scooby Doo" in 1998, but he became independent in recent years, moving through the deeper waters of Sarasota Bay. He had been seen more than 100 times, all in Sarasota Bay, and mostly in deep water, prior to this episode. Scrappy was observed by Jason Allen and SDRP staff on July 6th, 2006, with a large piece of cloth or synthetic fabric stretched across its back, and presumably around its body. As of 31 July, the material remained in the same place on its body. Concerns regarding potential injuries to the soft skin of the dolphin from prolonged entanglement and tight wrapping in the material led to development of plans for a rescue operation, and a request for permission for such an operation from the National Marine Fisheries Service.

On August 3rd, a team of 31 experienced people, including two veterinarians, on five boats located Scrappy within 15 minutes of leaving the Mote Lab dock. Over the next seven hours, our capture-release net, designed for shallow water use, was set around him three times in some of the deepest waters of Sarasota Bay. He went under the net the first time, over the next, but he was finally secured and brought aboard the veterinary examination boat. The material was removed and determined to be a bathing suit, and his wounds were evaluated and treated. The bathing suit had come off very easily – it seemed clear that it was only the force of water flowing over his body that was keeping it on him and up against his flippers. He had gone through the waist and one leg hole. The bathing suit was showing little wear, and it seemed clear that it would not have rotted off the animal anytime soon. A few barnacles had begun to grow in the suit. It had caused deep (1-1.5 cm) but relatively clean cuts at the anterior insertion of each flipper – it also seemed clear that these would have become progressively deeper if the suit had not been removed. The dolphin had a relatively fresh but small shark bite on his peduncle – punctures only, no tissue removal, and a slice through the trailing edge of his left fluke that might also have been from a shark. Blood samples and blowhole swabs were taken, he was given an injection of antibiotic, his wounds were cleaned, length, girth, and blubber thickness measurements were taken, he was freeze-branded for future identification, he was given a small VHF radio tag, photos were taken, and he was released. The vets had determined that little benefit would have been derived from admitting him to Mote's Dolphin and Whale Hospital, given his condition. Once the transmitter was jettisoned subsequent tracking and observations indicate that he has recovered well and is continuing his normal activities in Sarasota Bay.

Bottlenose dolphin "Scrappy" wearing his Speedo bathing suit.

INVOLVEMENT IN OTHER MARINE MAMMAL CONSERVATION AND RESEARCH ACTIVITIES

Tagging and tracking of Franciscana dolphins in Argentina: Year 2

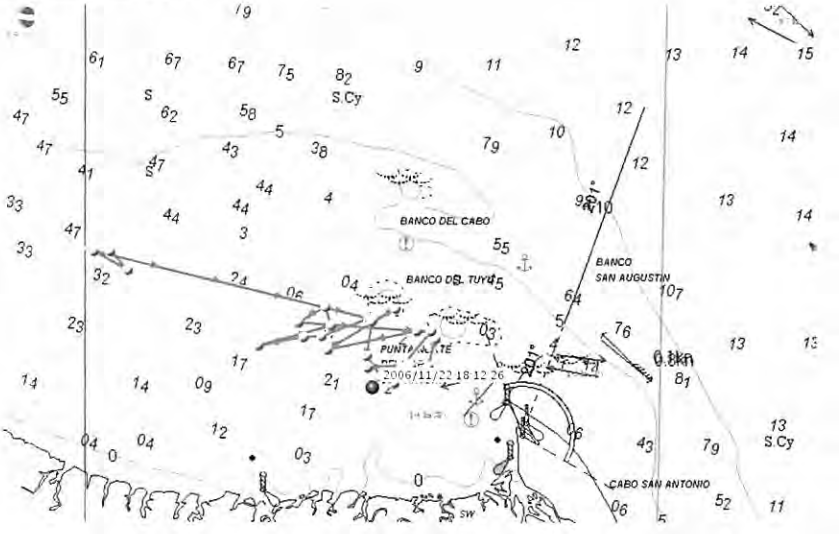
By Randall Wells and Pablo Bordino

Franciscana dolphins, a species of small dolphin found only in the coastal waters of Argentina, Uruguay, and Brazil, continue to be killed in large numbers in artisanal fishing nets. Little is known about their biology and behavior, beyond what has been gleaned from fishing bycatch. In 2005, following several training sessions for Argentine researchers in Sarasota Bay, Pablo Bordino of AquaMarina and Wildlife Trust initiated a collaborative field project with the Sarasota Dolphin Research Program and Disney's Animal Programs to begin to study the ranging patterns of these tiny dolphins in the waters of Bahia Samborombon, in Buenos Aires Province, Argentina. The research team, composed primarily of Argentine researchers, students, and veterinarians, attached small VHF transmitters to the dorsal fins of three adult female dolphins – the first time this species had ever been tagged. Tracking from a lighthouse and other shore vantage points suggested that the dolphins were much more localized in their movements than had been thought previously, but the location data from 42 days of primarily shore-based tracking were very imprecise.

In 2006, we built upon this pilot study by using small satellite-linked tags to provide more precise location information, over a longer period of time. Four dolphins (two adult females, two juvenile males) were tagged, and they were tracked over periods ranging from one week to 261 days, with three of the four dolphins reaching or exceeding the desired 2-month minimum tracking duration. The four dolphins confirmed the patterns suggested from 2005.

The movements of all four dolphins remained within an area of less than about 25 km distance from the capture-release sites, and most positions were within only a few kilometers (see sample map below). The fact that two of the dolphins tracked for 6-8 months remained in the same area hints at year-round residency to the shallow waters of the bay. Such a high degree of site fidelity should provide important guidance to Argentine wildlife managers as they determine how best to protect this species – it is a very different picture from the original management scheme of wide-ranging movements along the entire coast of the country. Future research will attempt to determine movement patterns in other parts of the species' range.

Franciscana dolphin being released with satellite-linked radio transmitter, March 2006.



Movements of adult female Franciscana dolphin "Chica" during 15-22 November 2006 in southern Bahia Samborombon, Buenos Aires, Argentina. Water depths are in meters.

Distribution, habitat use, and relative abundance of coastal dolphins in the Gulf of Morrosquillo, Colombia.

By Salomé Dussán-Duque, MSc

The Gulf of Morrosquillo is located in the Caribbean coast of Colombia, and it extends from the Sinú river to the San Bernardo Islands. The gulf represents a typical tropical coastal ecosystem with extensive areas covered by mangroves and channels. This highly productive ecosystem supports two species of coastal dolphins: *Sotalia guianensis* or sotalia, and *Tursiops truncatus* or bottlenose dolphins. Sotalia were designated in 2005 as a vulnerable species in Colombia, due to extreme habitat changes happening at a rapid pace, caused mainly by anthropogenic pressure. Very little is known about the Colombian populations of bottlenose dolphin. They have been designated as "data deficient" over the last 10 years. The main goal of this project over the last four years has been to evaluate the distribution, habitat use, and relative abundance of the coastal dolphins in the South region of the Gulf of Morrosquillo, and to develop guidelines for the management and long-term conservation of these species and their habitats.

Due to the vast expanse of the Gulf, and the physical impossibility to survey it all at once, we decided in 2002 to survey only the South region: from the Sinú river mouth to the city of Tolú (see map). We divided the study area in 8 zones defined by oceanographic features; 5 of these were defined previously by Avila in 1994. The survey routes go from the station, located in Cispatá Bay, to the river mouth, and from the station to the city of Tolú. We have been making an extra effort to survey both routes equally whenever it was possible.

From November 2002 through June 2006 we collected data on both species. Using an 11-ft fiberglass boat, we surveyed 4270 km over194 survey days, collecting environmental, behavioral, photographic identification, and carcass data. In addition, since 2005, we have been recording the vocal behavior of sotalia in collaboration with Matteo Bernasconi from the Institute of Marine Research in Norway. The month of sampling was divided into two field seasons, and we collected seven hours of acoustic data. The data for both species are still under analysis, and they will be compared with the results of previous studies of these species, especially from Colombia and Brazil. In addition, we are integrating the data with the results of fisheries and mangrove studies conducted by colleagues in our study area.

The preliminary main results for sotalia are: (1) The total number of dolphins/km over all survey transects was 0.2, (2) 56.4% of the sightings (n = 75) were in Zone 3 or Cispatá Bay, (3) the Zone with the highest density of dolphins/km was Zone 3, as well, with 62.6% (n = 526), (4) Zone 3 presented the highest level, 0.1 calves/adult dolphin, (5) the average depth of the sightings was 9.9 m, the average salinity was 28.6 ppm , and the average sea surface water temperature was 30° C, (6) there is a strong tendency for site fidelity, and some individuals seem to be permanent residents of the study area over the last 11 years, (7) the whistles recorded presented higher frequencies than the ones reported in Brazil. These results show us very important findings about sotalia and its habitats in the Gulf. Findings will probably show a decline in the numbers of dolphins in the area in the last 11 years or a shift in their distribution and habitat use, as well as the need for the declaration of Zone 3, or Cispatá Bay, as a protected area for this species. The bottlenose dolphin data are still under analysis as well, but the preliminary differences in habitat use with sotalia are highly significant.

Presumed pregnant sotalia.

Our project was approved for funding for 2007, so we are going back to the field in March with Dr. Paulo Flores from Brazil to increase our photo-identification efforts and continue with our research. We would like to thank especially for support for all these years the Sarasota Dolphin Research Program, Corporación Autónoma Regional de los Valles del Sinú y del San Jorge (CVS), Colombia, and Conservación Internacional, Colombia. Other very supportive sponsors have been: Chicago Zoological Society, Cetacean Society International, USA, Fondo de Becas para Especies Amenazadas "Jorge Ignacio Hernández Camacho", Colombia, Invemar, Colombia and ESRI, USA.

Searching for baiji dolphins in the Yangtze River: Will this be the first cetacean species to go extinct in our lifetime?

By Randall Wells, PhD

The Yangtze River dolphin, or baiji, is found only in the Yangtze River and its tributaries in China. It is likely the most endangered species of cetacean in the world, with only dozens of individuals estimated to remain along the 1,600 km stretch of the Yangtze River, the area considered to be its current habitat. This habitat, which serves nearly 15% of the people on the face of the earth, continues to decline in its suitability for sustaining baiji, and the finless porpoises that share the river. This deteriorating situation has brought Chinese conservationists and a number of cetacean specialists from around the world to the point of deciding that the few remaining baiji should be removed from the river and placed into a breeding colony in a protected, pinched-off oxbow of the river, the Shishou Semi-natural Reserve (see photo below). This decision and initial plans have come about during a number of meetings including several in which we have participated in Wuhan, China, Washington, DC, and San Diego over the past few years. The Sarasota Dolphin Research Program has been called upon to provide input on safe and effective dolphin capture techniques. During June 2006, Mr. Wei Zhou of the Institute of Hydrobiology in Wuhan participated in our health assessment program in Sarasota Bay to learn more about our capture-release and handling techniques.

Are these plans too little, too late? As of this writing (late November 2006), a survey of the Yangtze River was being conducted to search for baiji and to identify potential capture sites. With more than half of the survey already completed, no baiji have been found, and numbers of finless porpoises were lower than expected.

Shishou Semi-natural Reserve for baiji and finless porpoises (surfacing above), a protected, 21-km long oxbow of the Yangtze River.

Dolphins in Bangladesh

By Elisabeth and Rubaiyat Fahrni Mansur

In 2002, Brian Smith, Associate Conservation Zoologist for Wildlife Conservation Society and Asia Coordinator for IUCN SSC Cetacean Specialist Group, opened our eyes to the world of cetaceans. Having spent considerable time in the Sundarban, the world's largest contiguous mangrove forest, as nature guides and wildlife photographers, we were unaware of the amazing diversity of marine mammals in Bangladesh waters.

After the initial Sundarban dolphin survey, we continued to collect data on the distribution and abundance of the "endangered" Ganges River dolphin or shushuk (*Platanista gangetica*), Irrawaddy dolphin (*Orcaella brevirostris*), Indo-Pacific humpback dolphin (*Sousa chinensis*) and finless porpoise (*Neophocaena phocaenoides*) present in the estuarine waters, with the help of the captains of our tourist vessels.

During a dedicated cetacean survey of the Bangladesh coastal waters in 2004, we recorded large groups of Indo-Pacific bottlenose dolphins (*Tursiops aduncus*), pantropical spotted dolphins (*Stenella attenuata*) and spinner dolphins (*S. longirostris*), as well as a possible resident population of Bryde's whales (*Balaenoptera edeni*) and fin whales (*B. physalus*). The high number of different cetacean species observed at a 900 plus-meter undersea canyon known as the Swatch-of-No-Ground, was especially exciting. It was

The endangered Ganges River dolphins, locally known as shushuk, occur throughout the river system of Bangladesh. They are most commonly seen near confluences.

The crew of The Guide Tours Ltd. found and rescued this emaciated Ganges River dolphin, whose rostrum had been entangled in monofilament net.

during this survey that Brian encouraged Rubai to initiate a study of the bottlenose dolphin population using photo-identification at the Swatch. With funding from WDCS, only limited reference literature at hand, and no prior experience in photo-identification, Rubai started his first field session in the winter of 2005/2006.

It soon became clear that we needed to gain further experience in this field to maximize the success of our study. While planning a visit to our grandparents in the United States this summer we started looking for possible photo-id projects to join. After contacting numerous individuals and organizations without success, we finally received an e-mail from Randall Wells of the Sarasota Dolphin Research Program. We could not believe our luck - an invitation to join and train with the longest-standing bottlenose dolphin research project in the world!

And so our summer turned into a truly memorable study tour. From the moment we arrived in Sarasota, we were completely overwhelmed by the hospitality, generosity, and professional cooperation at by the staff of the Sarasota Dolphin Research Program and Mote Marine Laboratory. Everybody was interested in our work and willing to share their experience and knowledge. We had opportunities to join Elizabeth Berens and her team on their fishing vessel, discuss opportunities regarding turtle by-catch studies with Dr. Tony Tucker, exchange ideas for an educational outreach program with Dr. David Niebuhr, learn about the long-standing Mote stranding network, proper preservation of bones as well as the basics of ACCESS database software. We spent time with Jessica Powell and the dolphin care team, and Dr. Colin Simpfendorfer helped us by analyzing shark bites on our study animals. We were also invited to join Kim Bassos-Hull and her team for the survey of Charlotte Harbor – definitely a highlight of our summer. What better way to learn about photo-id techniques than being in the field with this professional and dedicated team? The time spent with Kim, Aaron Barleycorn, Robin Perrtree, Katie McHugh, Anna Sellas, Sue Hofmann as well as several interns and volunteers, talking about dolphins and research, was truly exhilarating. We shared our lovely accommodation with Gene and Lorry Stover, which on its own was a unique experience - a life-lesson in humor and humanity.

The collaboration between professional and dedicated researchers with the Sarasota Dolphin Research Program was a totally new experience for us, an example of how passionate people can work together to make a real difference. Although the techniques and means need to be adapted to our circumstances, we returned to Bangladesh with valuable experiences, new friendships, and most importantly a supporting network of professionals, for which we are very grateful. The upcoming field season in the Sundarban and at the Swatch-of-No-Ground will profit from our experiences and we are greatly indebted to Randall Wells and his team.

The Irrawaddy dolphin population in Bangladesh is probably the world's largest. The long-term survivability of cetaceans in these waters is however tempered by increasing depletion of prey due to massive non-selective catch of fish fingerlings and crustacean larvae in small mesh "mosquito" nets.

Farther offshore in habitat influenced by freshwater inputs the Indo-Pacific humpback dolphin is found.

A relatively short distance from the Sundarban mangrove forest is the Swatch-of-No-Ground, where a burst of biological productivity created by upwelling currents supports large groups of Indo-Pacific bottlenose dolphins. The 900 plus-meter deep offshore undersea canyon supports extraordinary cetacean diversity. The canyon sides drop off abruptly, causing a distinct color-change.

Scientific Representative on Take Reduction Teams

Damon Gannon, PhD

Damon Gannon was asked by the National Marine Fisheries Service to serve as a scientific representative to two marine mammal take reduction teams, the Pelagic Longline Take Reduction Team and the Atlantic Trawl Gear Take Reduction Team. Under the Marine Mammal Protection Act, the government is required to form Take Reduction Teams (TRTs) for commercial fisheries that accidentally kill or injure marine mammals. Take reduction teams are composed of experts and stakeholders—representatives from the fishing industry, environmental organizations, government agencies, and the scientific community—who work collaboratively to develop strategies for reducing bycatch of marine mammals. Both teams have been convened to develop plans for reducing the unintended catch of long-finned (*Globicephala melas*) and short-finned (*G. macrorhynchus*) pilot whales. The Pelagic Longline TRT released a Take Reduction Plan in May 2006, which is currently being reviewed by the National Marine Fisheries Service. The Atlantic Trawl Gear TRT held its first meeting in September 2006 and must approve a draft Take Reduction Plan by August 2007. Once each Take Reduction Plan goes into effect, the affected fisheries have five years in which to reduce pilot whale mortality and serious injury to "insignificant levels approaching zero." The TRTs will meet periodically during this five-year period to assess whether the plan is working satisfactorily and to make any changes that may become necessary.

Entanglement Working Group

Kim Bassos-Hull, MSc

The Entanglement Working Group (EWG) for the State of Florida was initiated in the late 1990's to address increasing problems with manatee entanglement in various types of fisheries gear such as crab trap lines and monofilament fishing lines. The EWG was officially incorporated into the state's Manatee Recovery Team in 2003. A few years later the focus of the group expanded to include marine wildlife in general (especially focusing on manatees, turtles, and dolphins). One of the key programs the EWG initiated is the Monofilament Recovery and Recycling Program (MRRP). This program was started in the Florida Keys and Brevard County and has since expanded statewide and is even expanding to other states. The MRRP encourages anglers to responsibly recycle their fishing line in designated recycling bins and boxes at fishing locations, boat ramps, and tackle shops within their communities. This decreases the potential for this line to make its way into the environment with the potential to entangle wildlife.

The Sarasota Dolphin Research Program (primarily through Kim Bassos-Hull) joined this group in 2005 out of concern for the increasing number of entangled dolphins we were observing and sometimes having to rescue. In addition, we have seen an increase in dolphins depredating fishing lines and mortalities associated with fishing gear. The EWG has increased efforts to educate the public through their website and signage as well as coastal cleanup efforts involving local communities. To learn more go to www.fishinglinerecycling.org.

Educational signage

Monofilament recycling boxes are being placed at local tackle shops and marinas.

Monofilament recycling bins are being placed at many fishing piers and active fishing locations.

EDUCATION

Education continues to be a major component of SDRP activities, directed toward the general public, students, colleagues, and wildlife management agencies. We work to educate the general public regarding bottlenose dolphins and conservation issues through 1) public presentations at Brookfield Zoo, Mote Marine Laboratory, and other venues, 2) articles, 3) interviews, and 4) volunteering opportunities through Earthwatch Institute. We also produce books for the general public and students. One of these, "*Dolphins, Whales, and Manatees of Florida: A Guide to Sharing Their Waters*," by John Reynolds and Randall Wells, was published in 2003 to teach people how to better appreciate and treat marine mammals in their environment. Another, "*Dolphin Man: Exploring the World of Dolphins*," by Laurence Pringle and Randall Wells, was published in 2002 to provide middle school students with an opportunity to learn about Sarasota Bay's dolphins and about one pathway for becoming a marine biologist engaged in dolphin biology research and conservation.

An Immersion Cinema interactive program, "*Dolphin Bay*," loosely based on our long-term dolphin research and conservation program in Sarasota Bay, is now being aired multiple times daily at Mote Marine Laboratory's 165-seat theater. Participants are able to investigate realistic threats to bottlenose dolphins in the imaginary bay and attempt to resolve those threats by applying field research techniques and performing rescues. The program is designed to entertain as well as educate young people, especially, about the threats faced by coastal dolphins and about possible means available to them for making a positive difference in the dolphins' lives. It tries to present a balanced selection of realistic alternatives. The consequences of the participants' choices on the Dolphin Bay population 50 years hence are estimated using the modeling program "*Vortex*" (developed by the Chicago Zoological Society's Dr. Robert Lacy).

At the college level, we are fortunate to have access through Mote Marine Laboratory to high quality, dedicated undergraduate student interns who volunteer with our program for at least 3 months at a time (for more information on participation, please contact Andrea Davis at adavis@mote.org). During 2006, 23 interns participated in this program. We also teach college-level marine mammal courses, provide supporting materials for these courses, and continue to host the annual summer MARVET marine mammal veterinary student course.

As described throughout this newsletter, graduate students come to our program primarily through the University of California at Santa Cruz, the University of South Florida, and the University of North Carolina, Wilmington to conduct their thesis or dissertation research. To date, 16 doctoral dissertation and 24 master's thesis projects have been conducted in association with our program. During 2006, two master's students (Carter Esch and Colleen Bryan) and four doctoral students (Magali Houde, Mandy Cook, Ester Quintana-Rizzo, and Spencer Fire) successfully defended theses or dissertations; all were based at least in part on data or samples collected through the Sarasota Dolphin Research Program.

Our efforts to provide information to our colleagues and wildlife management agencies continue through publication of numerous scientific articles, invited presentations at various scientific conferences, and participation in national/international panels such as the Atlantic Scientific Review Group (R. Wells, member and past-chair), Take Reduction Teams (D. Gannon, member), the Working Group on Marine Mammal Unusual Mortality Events (R. Wells, chair), the International Whaling Commission Pollution 2000+ Programme (R. Wells, Steering Committee member), the IUCN Cetacean Specialist Group (R. Wells, member), and the IUCN Reintroduction Specialist Group (R. Wells, member).

ntern Vanessa Greenwood learns how to photograph dolphin fins in Charlotte Harbor.

Intern Goldie Phillips records data while intern Kathrine Marter and volunteer Traci Hedgepath collect enviromental data with a YSI device.

Dr. Randy Wells shows Chinese colleague Wei Zhou how to take dolphin measurements.

Education and outreach regarding feeding wild dolphins

By Randall S. Wells, PhD

Human feeding of wild dolphins is a continuing and growing problem in the southeastern United States. It is believed that this may be contributing to the increased number of mortalities and serious injuries from entanglement in and depredation of recreational fishing gear in Florida and elsewhere. These actions are illegal under the federal Marine Mammal Protection Act, and they are bad for the animals. Dolphins such as Beggar, well-known from the Sarasota area since 1990 for his approaches to boaters for handouts (see photo below), are at increased risk from other human interactions as they approach people and boats or become reliant on these handouts. We suspect that this begging behavior may be passed from dolphin to dolphin. In 2006, our program published a peer-reviewed manuscript in the journal *Aquatic Mammals* summarizing our research on Beggar to date.

The National Marine Fisheries Service (NMFS) is stepping up efforts to curtail feeding of wild dolphins. They have recently installed billboards in dolphin feeding hotspots, near Panama City, FL, and near Beggar's hang-out (see NMFS photo below). In addition, NMFS is contacting businesses with an interest in wild dolphins, explaining the laws governing human activities around dolphins.

In collaboration with the Sarasota Dolphin Research Program and Dolphin Research Center, NMFS is developing a 30-second public service announcement (PSA) that will hopefully discourage the public from feeding wild dolphins. Distribution is planned to include broadcast networks, in-house programming for hotels and other businesses, schools, conservation groups, etc. We hope to produce and release the animated feature in 2007, but we are still seeking $90,000 of the production and distribution costs. To date, Harbor Branch Oceanographic Institution's Protect Wild Dolphins Program has pledged $100,000, Dolphin Quest has provided $5,000, and the Sea World – Busch Gardens Conservation Fund has contributed $5,000 for this project.

Beggar receiving handouts during 2006. Note the two large NMFS signs on the bridge fender on the opposite side of the boat, informing boaters of the prohibition on feeding wild dolphins.

One of the NMFS billboards to discourage feeding of wild dolphins.

Intern Perspective

Leonardo Berninsone, AquaMarina

I come from a country that is primarily known for its food and music, but not many people know that is one of the three countries in the world where you can find the most endangered cetacean of the south, the Franciscana dolphin. For the past three years I have worked as a volunteer for AquaMarina, an Argentinean NGO whose goal is to conserve the Franciscana dolphin by working in association with local fishermen to reduce their bycatch in gillnets. Recently, we have also attached radio and satellite tags to seven of these dolphins to better understand their movement and ranging patterns. This work would not have been possible without the help and support of SDRP, which provided training during the capture-release health assessment in Sarasota Bay and helped during our tagging and tracking efforts in Argentina.

Initiating a new program of international training, the Sarasota Dolphin Research Program invited Franciscana Project leader Pablo Bordino to select a member of AquaMarina to work with SDRP projects in need of research assistants. The first project to benefit from this program was the radio-tracking and photographic identification study sponsored by the National Marine Fisheries Service and conducted by Brian Balmer in the panhandle of Florida. This is how I became an intern for nearly four months working in St. Joseph Bay. The first two weeks of my internship I was part of the Sarasota Dolphin Research Program crew that took part in the NOAA capture-release health assessment project. For the next two months I lived with Brian at the St. Joseph Bay Buffer Preserve, tracking the dolphins with attached radio tags while doing photo identification on all the photographed animals. Once all of the tags stopped transmitting, we began line transect photo-identification surveys throughout the bay and nearby waters. Before leaving the Buffer Preserve we participated in the Birding and Wildflower Festival. We gave talks and took people on tours inside the bay to teach them about our work. The final three weeks I lived in Sarasota, working at the SDRP base at Mote Marine Laboratory, helping staff and volunteers with the monthly Sarasota Bay surveys.

It's been a great experience for me to share so much time with Dr. Randy Wells and his team learning about the different techniques and ways of working with marine mammals in the field. Being trained by this group of professionals is like "a living dream" for people who work in small or developing countries. It's good to know that there are organizations like the Chicago Zoological Society that care about research teams who work in other areas of the world and support internships like mine. I think that the communication between different groups of researchers and the training of young researchers is crucial for achieving the common goal: preserving the marine environment. I believe that these experiences are going to help me and others in Argentina understand and conserve the Franciscana.

The Argentine capture-release crew celebrates the release of their fourth Fransiscana dolphin in March 2006.

Volunteer Perspective

By James Thorson

I was reading an online magazine the other day and in a reader's forum they were asking people what they would choose if they could repeat any 600 seconds (10 minutes) of their life. People mentioned weddings and times with their children and I'm sure if I thought about it I could come up with some of those too. But the very first thing that sprang to mind was 10 minutes in Argentina last March with Pablo Bordino and his crew when we let go the last of the Franciscana dolphins we had tagged.

We were out for the last day of a two-week project where we had hoped to satellite tag 5-7 Franciscanas. Weather and rough water had limited our time in the field and we had only put out two tags when, on our last possible set, we managed to catch three at once, including a mom and an older calf. With three dolphins in the net we needed more people in the water than the handful of us who had worked on the Sarasota captures so Pablo put in most of his crew, a number of whom had never been in the water with a wild dolphin before. A flurry of activity followed as we got our hands on the three dolphins and in turn got the two larger individuals onto a boat for quick measurements and tagging. Everyone in the water worked together as a team and in short order we had one of Pablo's crew doing the final "three, two, one" count down as we let the last dolphin swim off.

As we watched them go our group of researchers now felt like a bunch of old friends and we cheered and hugged like a college basketball team that had just won a national championship. A photo of that last moment is sitting on a shelf in my office here in Minnesota as I type this and I look at it often. I've worked with Randy Wells and the Sarasota Dolphin Research Program off and on for 20 years now, ever since I came across them through the Earthwatch Institute back in the mid 1980s, and I don't think I have ever had a more gratifying moment. I am very grateful to Pablo for making me one of the few non-professionals invited to participate in his research.

There are many opportunities to simply donate money to a favorite cause, but what has made those last two decades so rewarding to me has been the opportunity to make a more personal investment in both wildlife conservation and the advancement of science. To be fully immersed in a field so different from what I do the rest of the year has been an adventure and an education. To find that in that time I have developed skills and knowledge that I can take to another part of the world and help others begin a similar journey makes it even more fulfilling.

James Thorson, veteran SDRP volunteer, contemplating the life aquatic.

SARASOTA DOLPHIN RESEARCH PROGRAM OPERATIONS

SDRP Database Progress

By Janet Gannon, MSNR

How do you keep 36 plus years of data safe while allowing a large number of people to access information for research? Our custom-built Microsoft Access application is designed to consider both data integrity and usability. We maintain a "front end-back end" arrangement for this database, keeping our valuable verified data on a server and accessing it through interfaces on each workstation.

While we spend many days in the field collecting data, we spend many more in the lab entering data, verifying them, and using them for analyses. Our database is more than just a collection of data – it includes built-in analyses commonly used by our program. For example, we are able to generate "coefficients of association" (COAs) directly in the database, rather than having to export to another program. Or, with the press of a button, we can see how many times each animal in the catalog was seen during each year since the 1970's, allowing us to work on life history questions. The database is constantly expanding. At the end of 2006, we have over 31,000 sightings in it, comprised of sightings of over 3,700 distinct individual animals.

Staff Members During 2006

Randall S. Wells, Ph.D., Program Manager
Jason Allen, B.Sc., Lab Manager/Field Coordinator
Kim Bassos-Hull, M.Sc., Senior Biologist
Damon Gannon, Ph.D., Staff Scientist, Deputy Program Manager
Andrew Westgate, Ph.D., Post-doctoral Scientist
Stephanie Nowacek, M.Sc., Lab Manager/Research Associate
Janet Gannon, MSNR, Senior Biologist
Elizabeth Berens, M.Sc., Staff Biologist
Aaron Barleycorn, B.Sc., Research Assistant
Robin Perrtree, B.Sc., Research Assistant
Stephanie Schilling, B.Sc., Research Assistant
Katie Brueggen, B.Sc., Research Technician
Sandra Camilleri, B.Sc., Research Technician
Gene Stover, B.Sc., Operations Manager
Michael Scott, Ph.D., Secretary, DBRI
Blair Irvine, Ph.D., Vice-President, DBRI

Contract Staff During 2006

Kim Urian, M.Sc., Research Associate
Kara Moore (Buckstaff), M.Sc., Research Associate
Sue Hofmann, B.Sc., Research Associate
Anna Sellas, M.Sc.

Master's Students During 2006

Brian Balmer, University of North Carolina, Wilmington
Colleen Bryan, College of Charleston
Carter Esch, University of North Carolina, Wilmington
Lance Miller, University of Southern Mississippi
Laura Monaco, Western Illinois University

Doctoral Students During 2006

Mandy Cook, University of South Florida
Glenn Dunshea, University of Tasmania
Deborah Fauquier, University of California, Santa Cruz
Spencer Fire, University of California, Santa Cruz
Magali Houde, University of Guelph
Katie McHugh, University of California, Davis
Erin Meagher, University of North Carolina, Wilmington
Martin Mendez, Columbia University
Ester Quintana-Rizzo, University of South Florida
Christine Shepard, University of California, Santa Cruz
Jennifer Yordy, Medical University of South Carolina

Interns During 2006

Christina Aiello
Sarah Alessi
Justine Bartow-Funk
Leo Berninsone
Sandra Camilleri
Leah Card
Elizabeth Crompton
Erika Fredericksen
Vanessa Greenwood
Nicole Kierl
Anna Marie Laura
Laura Markley
Kathrine Marter
Goldie Phillips
Kelly Preston
Jessica Raney
Abby Sapp
Erin Seghesio
Brittany Skogen
Julie Sperl
Christina Toms
Jenna Voss
Douglas Wood

Volunteer Research Assistants

Bill Kayser
Bill Scott
James Thorson
Lorry Stover

Gene Stover radiotracking released dolphin, "Val:, in Tampa Bay.

Janet Gannon in her office in all her GIS and map glory.

Elizabeth Berens with a "prize catch" (and release) spotted sea trout from the purse seine.

Net boat searches for dolphins during the June health assessment project in Sarasota Bay.

Aaron Barleycorn, Jessica Powell, and Jason Allen (left to right), pull the net back on the boat.

Pablo Bordino (front left,Argentina) and Wei Zhou (2nd from right, China) learn dolphin capture and handling techniques for application to conservation issues in their countries.

Dr. Damon Gannon overseeing prey sampling.

Jenna Voss, Damon Gannon, Douglas Wood, Elizabeth Berens, and Katie Brueggen work together to haul in the purse seine and measure their catch of fish in Sarasota Bay

Sandra Camilleri hauls in the corks on our purse seine.

The "Bling" boys in Argentina. Left to right, Brian Balmer, Jason Allen, Aaron Barleycorn, and James Thorson.

Bangladeshi colleague Rubaiyat Fahrni Mansur ready to photograph fins in Charlotte Harbor.

Rubai and Elisabeth Fahrni Mansur photograph a leaping dolphin while intern Leah Card records data.

A beautiful day in Charlotte Harbor! Left to right is Sarah Alessi, Lorry Stover, Elisabeth Fahrni Mansur, and Kim Bassos-Hull.

Professional Activity Summary

One accepted measure of the productivity of a research program is its record of achievement in providing information to the scientific community, wildlife management agencies, and the public. The following list includes our program's products since the publication of our last newsletter, including the relevant work of our collaborators from partner institutions. Copies of specific papers can be obtained upon request for the cost of copying and postage, or in some cases as pdf files.

Peer-reviewed Journal Articles and Book Chapters

Cunningham-Smith, P., D.E. Colbert, R.S. Wells, and T. Speakman. 2006. Evaluation of human interactions with a wild bottlenose dolphin (*Tursiops truncatus*) near Sarasota Bay, Florida, and efforts to curtail the interactions. Aquatic Mammals 32:346-356.

Fazioli, K.L., S. Hofmann, and R.S. Wells. 2006. Use of coastal Gulf of Mexico waters by distinct assemblages of bottlenose dolphins, *Tursiops truncatus*. Aquatic Mammals 32:212-222.

Hall, A.J., B.J. McConnell, T.K. Rowles, A. Aguilar, A. Borrell, L. Schwacke, P.J.H. Reijnders, and R.S. Wells. 2006. An individual based model framework to assess the population consequences of polychlorinated biphenyl exposure in bottlenose dolphins. Environmental Health Perspectives. 114 (suppl.1): 60-64.

Houde, M, B.C. Balmer, S. Brandsma, R.S. Wells, T.K. Rowles, K.R. Solomon, and D.C.G. Muir. 2006. Perfluorinated alkyl compounds in relation with life-history and reproductive parameters in bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, Florida, USA. Environmental Toxicology and Chemistry 25:2405-2412.

Janik, V., L.S. Sayigh, and R.S. Wells. 2006. Signature whistle shape conveys identity information to bottlenose dolphins. Proceedings of the National Academy of Sciences. 103:8293-8297.

Quintana-Rizzo, E., D.A. Mann, and R.S. Wells. 2006. Estimated communication range of social sounds used by bottlenose dolphins (*Tursiops truncatus*). Journal of the Acoustical Society of America. 120:1671-1683.

Ramcharitar, J., D.P. Gannon, and A.N. Popper. 2006. Review of the bioacoustics of the family Sciaenidae (croakers and drumfishes). *Transactions of the American Fisheries Society* 135:1409-1431.

Manuscripts in Press, In Revision, or In Review

Barbieri, M.M., W.A. McLellan, R.S. Wells, J.A. Blum, S. Hofmann, J. Gannon, and D.A. Pabst. In review. Thermoregulatory responses of a resident community of bottlenose dolphins (*Tursiops truncatus*) to seasonal changes in environmental temperature in Sarasota Bay, FL, U.S.A. J. Comparative Physiology B.

Buck, J.D., R.S. Wells, H.L. Rhinehart, and L.J. Hansen. In press. Aerobic microorganisms associated with healthy wild dolphins (*Tursiops truncatus*) in Gulf of Mexico and North Carolina waters – a twelve year perspective. Journal of Wildlife Diseases.

Buckstaff, K.C., R.S. Wells, J.G. Gannon, and D.P. Nowacek. In review. Responses of bottlenose dolphins to construction and demolition of coastal marine structures. Biological Conservation.

Gannon, D.P. In revision. Passive acoustic techniques in fisheries science: a review and prospectus. Transactions of the American Fisheries Society.

Gannon, D.P. In press. Acoustic behavior of Atlantic croaker *Micropogonias undulatus* L. (Sciaenidae). Copeia.

Gannon, D.P. and J.G. Gannon. In review. Can passive acoustic methods be used to assess trends in abundance of soniferous fishes. Canadian Journal of Fisheries and Aquatic Sciences.

Hall, A.J., R.S. Wells, J.C. Sweeney, F.I. Townsend, B.C. Balmer, A.A. Hohn, and H.L. Rhinehart. In review. Annual, seasonal and individual variation in hematology and clinical blood chemistry profiles in bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, Florida. Comparative Biochemistry and Physiology Part B: Biochemistry and Molecular Biology.

Houde, M., G. Pacepavicius, R.S. Wells, P.A. Fair, R.J. Letcher, M. Alaee, G.D. Bossart, A.A. Hohn, J.C. Sweeney, K.R. Solomon, and D.C.G. Muir. In press. Polychlorinated biphenyls (PCBs) and hydroxylated polychlorinated biphenyls (OH-PCBs) in bottlenose dolphins (*Tursiops truncatus*) from the Western Atlantic and the Gulf of Mexico. Environmental Science & Technology.

Houde, M., T.A.D Bujas, J. Small, R.S. Wells, P.A. Fair, G.D. Bossart, K.R. Solomon, and D.C.G. Muir. In press. Biomagnification of perfluoroalkyl compounds in the bottlenose dolphin *(Tursiops truncatus)* food web. Environmental Science & Technology.

Mintzer, V.J., D.P. Gannon, N.B. Barros, and A.J. Read. In review. Stomach contents of mass-stranded short-finned pilot whales (*Globicephala macrorhynchus*) from North Carolina. Marine Mammal Science.

Moore, M.M, G. Early, K. Touhey, S. Barco, F. Gulland, and R. Wells. In revision. Rehabilitation of marine mammals in the United States: Risks and benefits. Marine Mammal Science.

Owen, E.C.G., D.A. Duffield, and R.S. Wells. In revision. Cooperation between non-relatives: alliances between adult male bottlenose dolphins, *Tursiops truncatus*, in Sarasota Bay, Florida. Animal Behaviour.

Wetzel, D.L. J.E. Reynolds, III, J. Sprinkel and R.S. Wells. In review. Fatty acids in blubber of the bottlenose dolphin (*Tursiops truncatus*): diversity, inter-annual variation, and similarities between fatty acid profiles of mothers and their calves. Marine Biology.

Theses and Dissertations

Doctoral Dissertations

Cook, M.L.H. 2006. Behavior and auditory evoked potential (AEP) measurments in Odontocete cetaceans. University of South Florida.

Fire, S. 2006. Effects of *Karenia brevis* blooms on wild coastal bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Ocean Sciences Dept., University of California, Santa Cruz.

Houde, M. 2006. Emerging organohalogen contaminants in bottlenose dolphins (*Tursiops truncatus*). University of Guelph. 312 pp.

Quintana-Rizzo, E. 2006. Group fission-fusion dynamics and communication in the bottlenose dolphin (*Tursiops truncatus*). University of South Florida. 166 pp.

Master's Theses

Esch, C. 2006. Whistles as potential indicators of stress in bottlenose dolphins (*Tursiops truncatus*). University of North Carolina, Wilmington.

Bryan, C.E. 2006. Non-lethal monitoring of trace elements in bottlenose dolphin, *Tursiops truncatus*. College of Charleston. 171 pp.

Technical Reports

Balmer, B.C. and R.S. Wells. 2006. Bottlenose dolphin health assessment research: Radio-tracking summary, St. Joseph Bay, Florida, April-July 2005. Final Contract Report to National Marine Fisheries Service, Requisition/Reference No. NFFK0000-5-00147. 13 pp.

Hall, A.J., J. Stott, M. Blanchard, T.K. Rowles, and R.S. Wells. 2006. The relationship between immune measures and blubber organochlorine concentrations in bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, Florida. International Whaling Commission Report SC/58/E.

Reijnders, P., R. Wells, A. Aguilar, A. Bjørge, G. Donovan, T. O'Hara, T. Rowles and U. Siebert. 2006. Final report on Pollution 2000+: Phase I. International Whaling Commission Report SC/58/E.

Wells, R.S., G.A. Early, J.G. Gannon, R.G. Lingenfelser, and P. Sweeney. In review. Tagging and tracking of rough-toothed dolphins (*Steno bredanensis*) from the March 2005 mass stranding in the Florida Keys. NOAA Tech. Memo.

Wilson, J.Y., R. Wells, A. Aguilar, A. Borrell, V. Tornero, P. Reijnders, M. Moore, and J.T. Stegeman. 2006. Cytochrome P450 1A1 (CYP1A1) expression in integument biopsies from a coastal bottlenose dolphin population. International Whaling Commission Report SC/58/E.

Woshner, V., K. Knott, R. Wells, C. Willetto, R. Swor, and T. O'Hara. 2006. Mercury and selenium in blood of bottlenose dolphins (*Tursiops truncatus*): Interaction and reference to life history and hematologic parameters. International Whaling Commission Report SC/58/E24.

Presentations at Professional Meetings

Barros, N.B., P. Ostrom, C. Stricker and R. Wells. 2006. Bottlenose dolphin population differentiation and trophic studies using carbon, nitrogen, and sulfur stable isotopes and stomach content analyses. Defenders of Wildlife's Carnivores 2006. St. Petersburg, FL, 12-15 November 2006.

Bernasconi, M., S. Dussán-Duque, L. Di Iorio, and A. Passerini. 2006. Comportamiento vocal de *Sotalia*. Marino (*Sotalia guianensis*) en el Golfo de Morrosquillo, Colombia. Workshop on the Research and Conservation of the Genus *Sotalia*. June 19-23, 2006, Rio de Janeiro, Brazil.

Berens, E. and D.P. Gannon. 2006. Effects of Red Tide on the availability of prey for bottlenose dolphins. Oral presentation, Southeast and Mid-Atlantic Marine Mammal Symposium, Nova Southeastern University, Ft. Lauderdale, FL.

Carlson, S.L., V. Cornish, L. Engleby, K. Thoms, K. Wells, T. Spradlin and R. Wells. 2006. Feeding and harassment of wild bottlenose dolphins in the Southeastern Region: Overview of activities of concern and mitigation efforts. Defenders of Wildlife's Carnivores 2006. St. Petersburg, FL, 12-15 November 2006.

Dussán-Duque, S., R.S. Wells, and K. Bassos-Hull. 2006. Distribución, uso de hábitat y abundancia de *Sotalia guianansis* en el Golfo de Morrosquillo, Colombia. Workshop on Research and Conservation of the Genus *Sotalia*, Armacao dos Búzios, Rio de Janiero, Brazil, 19-23 June 2006.

Flores, P.A.C., D.A. Duffield, P.C. Simões-Lopes, and R.S. Wells. 2006. A technique for extracting DNA from teeth of *Sotalia*. Workshop on Research and Conservation of the Genus *Sotalia*, Armacao dos Búzios, Rio de Janiero, Brazil, 19-23 June 2006.

Flores, P.A.C., D.A. Duffield, P.C. Simões-Lopes, and R.S. Wells. 2006. Lack of genetic variability in a small, resident population of marine tucuxi. Workshop on Research and Conservation of the Genus *Sotalia*, Armacao dos Búzios, Rio de Janiero, Brazil, 19-23 June 2006.

Gannon, D.P., J. Allen, E. Berens, D. Fauquier, J. Gannon and R. Wells. 2006. Role of ecological disturbance in the foraging ecology of coastal bottlenose dolphins. Defenders of Wildlife's Carnivores 2006. St. Petersburg, FL, 12-15 November 2006.

Quintana-Rizzo, E., D.A. Mann, and R.S. Wells. 2006. Estimacion del rango de comunicacion de los sonidos sociales usados por los delfines nariz de botella (*Tursiops truncatus*). X Congreso de la Sociedad Mesoamericana para par Biologia y la Conservacion. Antigua Guatemala Oct 29 - Nov 3.

Wells, R.S. 2006. Follow-up monitoring as an integral component of cetacean rehabilitation programs. Keynote Address. Southeast Region Marine Mammal Stranding Network Biennial Conference. May 3-5, 20006. Panama City, FL.

Wells, R.S. 2006. CZS Dolphin Conservation Program: Conservation activities involving Austral and Neotropical America. Analysis of the Technical Capacity for Conservation in Latin America and the Caribbean Workshop. Brookfield Zoo, Brookfield, Illinois, 19-21 June 2006.

Wells, R.S. and N.B. Barros. 2006. The combined application of photographic identification and genetic sampling to understanding population structure and dynamics of small cetaceans. Workshop on Research and Conservation of the Genus *Sotalia*, Armacao dos Búzios, Rio de Janiero, Brazil, 19-23 June 2006.

Wells, R.S., K. Bassos-Hull, J. Allen, N. Barros, D. Fauquier, J. Gannon and R. Lacy. 2006. Impacts of human activities on a long-term resident community of bottlenose dolphins on Florida's west coast. Defenders of Wildlife's Carnivores 2006. St. Petersburg, FL, 12-15 November 2006.

Yordy J., R. Wells, B. Balmer, L. Schwacke, T. Rowles, and J. Kucklick. 2006. Contaminant partitioning between blubber and blood in wild bottlenose dolphins: Implications for biomonitoring. SETAC, Montréal Canada.

Yordy, J., W.A. McLellan, D.A. Pabst, R. Wells, T. Rowles, and J. Kucklick. 2006. Tissue specific exposure to organohalogen contaminants in the bottlenose dolphin, *Tursiops truncatus*. SETAC, Montréal Canada.

Invited Public and University Lectures

Balmer, B.C. 2006. The bottlenose dolphins of St. Joseph Bay: Background, Recent Findings, and Future Research. Florida Panhandle Birding and Wildflower Festival.

Balmer, B.C. 2006. Marine mammal diversity and the dolphins of St. Joseph Bay. Port St. Joe High School.

Gannon, D.P. 2006. Silent dolphins, noisy fishes, and the toxic tide that plagues them. Invited Lecture, California State University, Northridge, Northridge, CA

Gannon, D.P. 2006. Costs and benefits of sound production for bottlenose dolphins and their prey. Invited Lecture, Spring Seminar Series. University of North Carolina Wilmington, Wilmington, NC.

Gannon, D.P. 2006. Bottlenose dolphins and noise-making fishes: A predator-prey arms race. Invited Lecture, Monday at Mote Lecture Series. Mote Marine Laboratory, Sarasota, FL.

Wells, R.S. 2006. Mote's Center for Marine Mammal and Sea Turtle Research. Peace River Power Squadron, Port Charlotte, FL. 26 Sep 2006.

Wells, R.S. 2006. Factors influencing the health and survivorship of bottlenose dolphins in Florida. Introduction to Conservation Medicine and Ecosystem Health. Conservation Medicine Center of Chicago, Loyola University/University of Illinois College of Veterinary Medicine. 10 Oct 2006.

Wells, R.S. 2006. Bottlenose dolphin social structure and effects of red tide. Zoo University, Brookfield, IL. 29 Mar 2006.

Wells, R.S. 2006. Meeting the challenges of the life aquatic. Brookfield Zoo Spring Lecture Series, Brookfield, IL. 28 Mar 2006.

Wells, R.S. 2006. The bottlenose dolphin community of Sarasota Bay: Lessons from 36 years and 5 generations. Biology Dept. Seminar, University of South Florida, Tampa, FL. 23 Mar 2006.

Wells, R.S. 2006. Dolphins in the Wild. Mote Family Programs, Mote Marine Laboratory, Sarasota, FL. 11 Feb 2006.

Wells, R.S. 2006. Mote's Center for Marine Mammal and Sea Turtle Research. Boater's Lunch, Bird Key Yacht Club, Sarasota, FL. 8 Feb 2006.

Wells, R.S. 2006. Wild dolphin societies: Lessons from 36 years and 5 generations. Sunnyside Academy, Sarasota, FL. 7 Feb 2006.

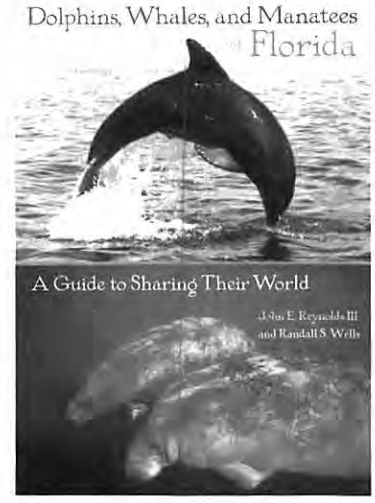
Wells, R.S. 2006. Extending the reach of Brookfield Zoo's flippers for dolphin conservation. Brookfield Zoo Women's Board Meeting, Chicago, IL. 18 Jan 2006.

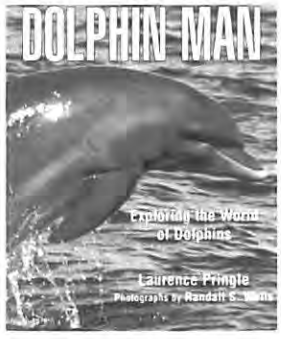
Wells, R.S. 2006. A day in the life of spinner dolphins. Mote Marine Laboratory Volunteer Class, Sarasota, FL. 12 Jan 2006.

Want to learn more?

The following books on dolphins and manatees, produced by our staff or by colleagues working closely with our program, are currently available. To purchase copies, please stop by the Brookfield Zoo or Mote Marine Laboratory gift shops, contact your local bookseller, or look for them on-line.

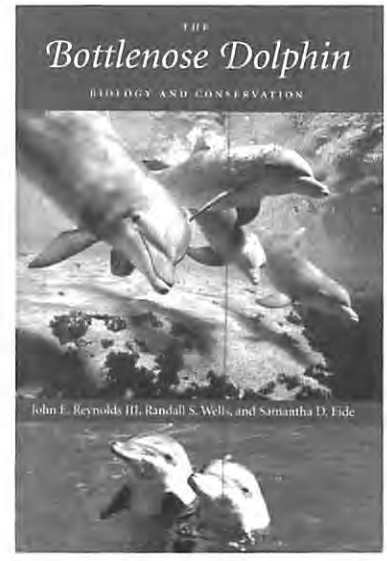
Reynolds, John E., III, and Randall S. Wells. 2003. Dolphins, Whales, and Manatees of Florida: A Guide to Sharing Their World. University Press of Florida, Gainesville, FL. 150 pp. ISBN 0-8130-2687-3



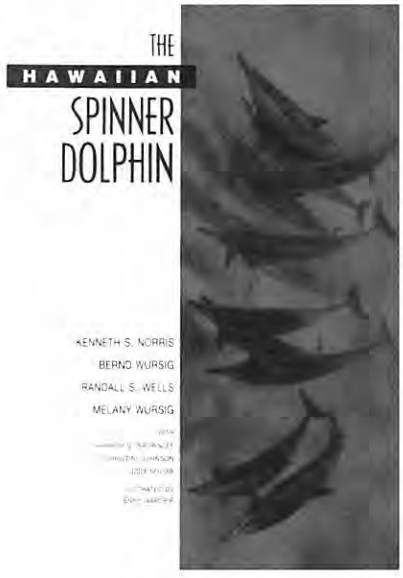


Pringle, Laurence and Randall S. Wells. 2002. Dolphin Man: Exploring the World of Dolphins. Boyds Mills Press, Honesdale, PA. 42 pp. ISBN 1-59078-004-3

Reynolds, John E., III, Randall S. Wells and Samantha D. Eide. 2000. The Bottlenose Dolphin: Biology and Conservation. University Press of Florida, Gainesville, FL. 289 pp. ISBN 0-8130-1775-0



Reynolds, John E., III and Sentiel A. Rommel, (eds.). 1999. Biology of Marine Mammals. Smithsonian Institution Press, Washington, DC. 578 pp. ISBN 1-56098-375-2



Norris, Kenneth S., Bernd Würsig, Randall S. Wells and Melany Würsig. 1994. The Hawaiian Spinner Dolphin. University of California Press, Berkeley, CA. 435 pp. ISBN 0-520-08208-7

Howard, Carol J. 1995. Dolphin Chronicles. Bantam Books, New York, NY. 304 pp. ISBN 0-553-37778-7

How You Can Make a Difference

We would like to take this opportunity to acknowledge the support and contributions to Chicago Zoological Society, Mote Marine Laboratory, and Dolphin Biology Research Institute in support of Sarasota Dolphin Research Program activities from:

The Batchelor Foundation
Edward McCormick Blair, Jr.
Ronnie and John Enander
Harbor Branch Oceanographic Institute's Protect Wild Dolphins Program
Eric Frick and Pam Salaway
Don and Lee Hamilton
The Whales of Randy Puckett
William and Sandra Scott
Trac Pac
United Way of Delaware
Cannons Marina, David and Lucille Miller
Disney Wildlife Conservation Fund
Disney's Animal Programs
Dolphin Quest, Jay Sweeney and Rae Stone
Sea World – Busch Gardens Conservation Fund
Earthwatch Institute
Harris Bank Foundation, Chicago, IL
MARVET
Laura Monaco
NOAA Fisheries
Estate of Sybil Byrnes

Endowment for Long-term Program Continuity — The staff and volunteers of the Sarasota Dolphin Research Program would like to be able to maintain our continuing ambitious level of field work, analyses, publishing, and presenting, but we need to expand our base of support in order to make this possible. We would like to establish an endowment of **$2,000,000** to ensure the continuity of the most basic monitoring activities of the world's longest-running dolphin research program.

Dolphin Feeding PSA — Having secured $110,000 of the estimated production and distribution costs, we are seeking the balance of $90,000 to produce a public service announcement to curtail human feeding of wild dolphins.

Contributions of funds should be directed to the Chicago Zoological Society or Mote Marine Laboratory, both of which have mechanisms for accepting funds specified for use by the "Sarasota Dolphin Research Program," or directly to Dolphin Biology Research Institute.

In Florida, donations of boats, vehicles, and other field equipment in good condition can be made to Dolphin Biology Research Institute (IRS-EI#59:2288387). DBRI is a Sarasota, Florida-based, 501{c}3 not-for-profit corporation; thus donations of funds and/or equipment are tax-deductible (Florida State Solicitations Registration No. SC-01172). Our current fleet of active research boats and trucks is composed largely of donated equipment. Cash realized from sales of such donations go almost entirely to offset research and education program expenses. During the most recent fiscal year, less than 1% of funds received by DBRI were spent on fund-raising activities. No salaries were paid by DBRI to any of its Officers or Directors.

Sarasota Dolphin Research Program
708 Tropical Circle
Sarasota, FL 34242