# THE CHICAGO ZOOLOGICAL SOCIETY'S SARASOTA DOLPHIN RESEARCH PROGRAM

# NICKS 'N' NOTCHES

January 2004

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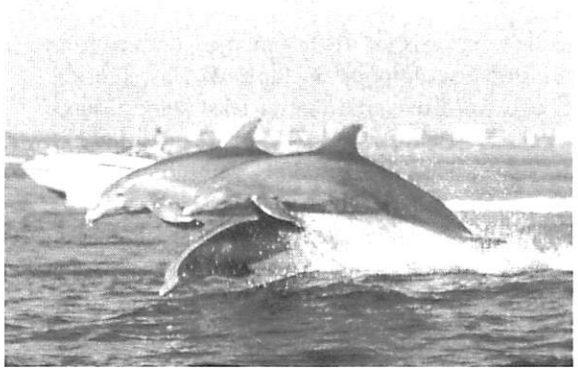
## Sarasota Dolphin Research Program: A Continuing Commitment to Conservation, Research, and Education

*By Randall Wells, PhD*

The "world's longest-running dolphin research program" is now in its 34th year. It continues as a full-time, year-round operation involving 8 full-time staff members, 7 part-time staff, 14 graduate students, and a dozen or more volunteer student interns, joined each month by up to five Earthwatch Institute volunteers. 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.



Our desire with each research project 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) applying unique program expertise to dolphin rescue operations and post-release follow-up monitoring, and (7) training cetacean conservation workers and students from around the world in the use of these techniques.

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 Biology Department 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. The SDRP maintains academic connections including graduate student sponsorships primarily through the University of California at Santa Cruz, Woods Hole Oceanographic Institution, the University of North Carolina at Wilmington, the University of South Florida, and the University of Guelph.

In the articles that follow, the staff, students, and volunteers of the SDRP provide updates on the many activities of our program during 2003. 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.

I would like to take this opportunity to thank Dr. George B. Rabb for his tremendous support of our program since 1989, when he took a chance on hiring me. Dr. Rabb recently retired from the directorship of Brookfield Zoo. His clear acknowledgement of the value of long-term studies to conservation has provided strong motivation to our staff to continue our efforts with the dolphins of Sarasota Bay. His encouragement has been one of the primary forces behind the significant growth and development of our program in recent years. Dr. Rabb's dedication to conservation will continue to be an inspiration to all of us.

## Federal Support for Dolphin Research and Education Continues

As a result of initial collaborative efforts by Congressmen Henry Hyde (R-IL), William Lipinski (D-IL), and Porter Goss (R-FL), the Chicago Zoological Society and Mote Marine Laboratory have been the recipients of congressionally-directed funds for dolphin research and education. Over the last three years, CZS and MML have shared dolphin research grants through NOAA Fisheries totaling $2,100,000 as well as a dolphin education grant of $691,000 through the U.S. Department of Education. For the past two years, continuing support for specific aspects of our research program has been a line item in President Bush's budget.

The education grant is being used to develop formal and informal programs at both institutions. Formal programs involve the design of curricula and materials that can be used via distance learning to educate school children in Florida, Illinois, and in other areas about the biology, health, and conservation of dolphins. Informal programs include interactive exhibits for visitors at both Mote Aquarium and Brookfield Zoo's Seven Seas underwater viewing area to "experience" dolphin field research and/or conservation policy decision making.

The research grant provides basic infrastructure support for our program, including expenses associated with some of our staff and graduate students, and new or replacement field and analytical equipment. The grant also supports 20 different research projects in four major areas of inquiry, including (1) population structure, dynamics, and stock identification, (2) health assessment and biomarkers of environmental contaminants and their effects, (3) feeding ecology, and (4) human interactions. Many of these projects have been selected and designed through consultations with NOAA Fisheries staff in order to complement the agency's efforts to obtain the information needed for dolphin management and protection. An explicit component of this research program is the dissemination of the information resulting from the research. Funding was first received during summer 2001, and work with existing funds is designed to continue through June 2006. Most of the projects are underway, and reports on preliminary findings are provided for some of the projects on the following pages.

*Dolphin near Sanibel Island dragging monofiliment line wrapped around it's dorsal fin. Educating the public not to discard fishing line can help to reduce entanglement problems.*

## Wells Provides Invited Testimony to Congress

On 24 July, Randall Wells provided invited testimony to the Subcommittee on Fisheries Conservation, Wildlife and Oceans of the U.S. House of Representatives Committee on Resources, regarding reauthorization of the Marine Mammal Protection Act. The following is the oral testimony, addressing topics suggested by congressional staff, and edited to fit to the time allotted before the committee from more detailed testimony submitted in writing. Responses to follow-up questions were also provided to the committee.

"Mr. Chairman and distinguished members of the Committee, my name is Randall Wells. I am a Conservation Biologist with the Chicago Zoological Society, based at Mote Marine Laboratory, in Sarasota, Florida, where I serve as Director of Mote's Center for Marine Mammal and Sea Turtle Research. I began studying dolphins two years before the implementation of the Marine Mammal Protection Act, and have seen the many accomplishments of this Act. Our understanding of the scope of threats to which marine mammals are exposed has changed over the years. We need to be able to adjust protection measures in response to a changing world. Proposed changes to the Act make some of these adjustments, expanding the scope of protection beyond that related to directed takes and commercial fisheries. I am honored to have been invited to provide testimony in support of reauthorization of this important Act.

### Introduction

Much of the basis for my testimony is derived from research on bottlenose dolphins in Sarasota Bay, Florida. Thirty years ago we discovered that at least some inshore dolphins live in resident communities. We are now studying four generations of residents, including many known since 1970, and their calves, grand-calves, and great-grand-calves. Knowledge of multi-generational residency provides important perspective for understanding exposure to threats, and can be key to providing appropriate protection. Inshore dolphins arguably face a larger variety and greater intensity of human impacts than many marine mammals because of their proximity to where we live, work, and recreate.

### Marine Mammal Bycatch Reduction Initiatives

I am pleased that recreational fisheries with incidental mortality and serious injury of marine mammals will now be held accountable for their takes. When recreational fishers are using the same gear as commercial fishers in the same waters, comparable mortalities and serious injuries are to be expected. Including recreational fisheries in the list, leading to observer coverage, will yield a more complete basis for managing stocks, and should be more equitable for commercial fishers.

### Captive Release Prohibition

The prohibition on releasing captive marine mammals is needed. We can't necessarily assume that releasing animals into the wild is in the individual's or host population's best

interests. My experiences from my own dolphin release experiment and from serving as an expert witness for NOAA in a case involving a failed dolphin release, point to the need for requiring scientific research permits.

**Marine Mammal Health and Stranding Response**

Increased support for the Marine Mammal Health and Stranding Response Program is needed. This program provides a window to serious threats that are less obvious than fishing gear. The first indications of marine mammal health problems come from stranded animals. The Program brings much-needed coordination to stranding response and health research.

Strandings and health research have demonstrated the accumulation of pervasive pollutants in marine mammals. PCB concentrations greater than those of concern for human health have been documented. In bottlenose dolphins, high PCB concentrations apparently correlate with increased first-born mortality, reduced immune system function, and reduced male reproductive hormones.

Congress should consider funding a research program to quantify the impacts from pervasive environmental threats, looking at chemical concentrations in the environment in order to establish their effects on marine mammals. Other pervasive threats, such as noise, could also be included. Cumulative risks could then be considered along with more direct takes, leading to improved stock assessments.

The Marine Mammal Health and Stranding Response Program is on the front line for detecting emerging toxic chemicals, diseases, and pathogen pollution. The authorization for annual funding from MMPA funds into the Marine Mammal Unusual Mortality Event Fund is essential for emergency responses. I hope you will consider reauthorizing complementary funding for the John Prescott Marine Mammal Rescue Assistance Grant Program, which supports non-emergency stranding response operations and research. Together, these funds allow consideration of marine mammals as sentinels of ocean and human health.

**Definitions of Harassment**

Proposed harassment definition changes should reduce human interactions such as touching, feeding, or swimming with wild marine mammals. For example, since 1990 we have observed "Beggar" and his associates, wild dolphins fed by boaters. Law enforcement has been limited because the harassment and feeding prohibitions already in the regulations were considered unenforceable. With NOAA Fisheries' "Protect Wild Dolphins" program, we evaluated the effectiveness of education in reducing this problem and determined that law enforcement was also needed. The new definitions should provide sufficient clarity to support prosecutions.

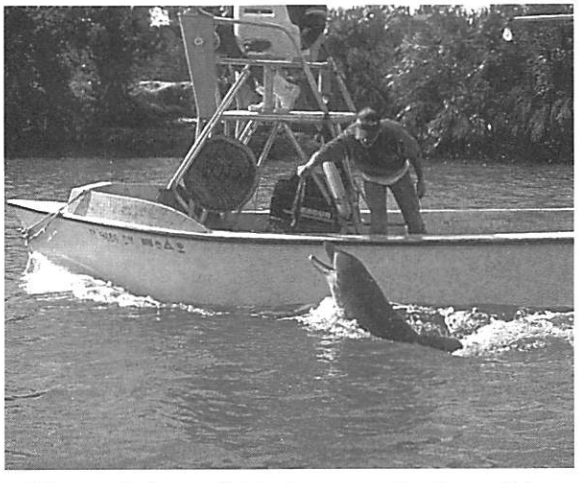
The new harassment definitions still require scientists to apply for research permits. This is a burdensome, but necessary process. My own research activities, ranging from observations to hands-on sampling, are considered "harassment." While developing ten permit applications since 1984, my research has never been delayed by the permitting process.

Some other harassment issues are particularly vexing with regards to practical regulatory solutions. Boats cause disturbance and injuries. About 4% of Sarasota Bay dolphins bear propeller scars acquired during periods of heavy boat traffic and boat races which attract thousands of spectator boats. During a typical dolphin's day, powerboats pass within 100 yards every six minutes, leading to significant changes in dive patterns and acoustic communication. The cumulative effects of repeated disturbance are unknown.

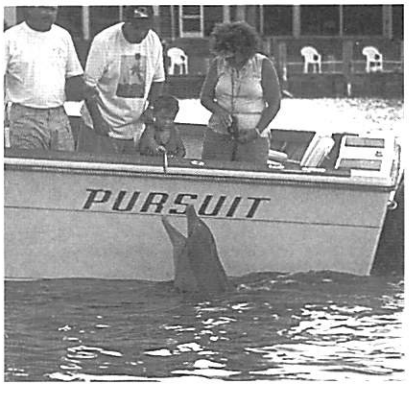
**Conclusion**

The proposed changes to the MMPA include significant advances. I hope that this momentum continues for further adjusting our management approaches to respond to emerging threats to marine mammals. Fishery impacts have not been eliminated, but many mitigation measures have been developed during the first 30 years of the MMPA. Similarly, we should begin to look for solutions to some of the emerging, and potentially equally dangerous, pervasive threats to marine mammals and consider a more complete set of threats in stock assessments.

This concludes my testimony. I would be pleased to respond to your questions."



*"Beggar" being fed by boaters. Feeding wild dolphins is illegal under the Marine Mammal Protection Act.*



## Responses of Bottlenose Dolphins and Manatees to Construction and Demolition of Underwater Structures

*By Kara Buckstaff, MSc and Randall Wells, PhD*

Coastal development involves the construction of bridges, causeways, piers, and other structures at the water's edge. Further development leads to the replacement of existing structures and removal of these older structures. In Florida coastal waters, bottlenose dolphins and manatees are the marine mammals facing the highest levels of exposure to construction and demolition noise, but little work has been done to evaluate the impacts on these animals. Both species use the waters of the southern portion of Sarasota Bay, where the Ringling drawbridge is being replaced with a larger fixed-span bridge.

We are engaged in a project supported by the Disney Wildlife Conservation Fund to relate behavior and distribution patterns of dolphins and manatees to the sound field generated by the construction and demolition activities. The construction of the fixed-span bridge was completed in July, followed by two in-air explosions in October to demolish the counterweights and bascule sections of the preexisting bridge. A final underwater explosion occurred in November to eliminate the bascule piers below water level. Before, during, and after these events occurred, boat-based dolphin surveys and aerial manatee surveys were conducted to compare distribution of sightings during bridge construction/demolition to historical sighting records. Additionally, underwater sound levels were recorded at 7 listening stations within a small study area designated to the north and south of the Ringling drawbridge. Field work for this project has just recently been completed and analyses have not yet begun.

*Second of two in-air explosions to demolish the bascule sections of the old Ringling bridge. A portion of the new Ringling fixed-span bridge can be seen in the background.*

There are currently no provisions under the federal Marine Mammal Protection Act of 1972 requiring review and permitting of coastal construction or demolition projects. Through the Endangered Species Act, requirements exist for ensuring that manatees are beyond specified distances from underwater blast sites, but few empirical data exist for evaluating the effectiveness of current criteria. It is our hope that the results of this project will provide useful information to regulatory agencies on 1) whether or not dolphins and/or manatees respond to specific forms of marine construction and demolition, 2) if they respond, how the response is manifested, 3) intensity of response, and 4) sound levels at which responses occur. Such information can be useful in determining whether construction/demolition activities should be considered for permitting under the Marine Mammal Protection Act and whether mitigation measures will need to be identified for future projects.

## Measuring the Hearing Abilities of Dolphins – Effects of Anthropogenic Noise

*By Mandy Hill, MSc, PhD student, University of South Florida*

Bottlenose dolphins are exposed to a great deal of noise from human activities, and there is much concern that this noise may be adversely impacting dolphins' hearing abilities. As a second year Ph.D. student of David Mann's at the University of South Florida in St. Petersburg, I am initiating research on bottlenose dolphin hearing abilities. Bottlenose dolphins have an impressive ability to both produce and perceive a variety of sounds. Their hearing ranges from about 75 Hz to over 150 kHz, with peak sensitivities between 8 and 32 kHz (for comparison, young humans can hear at frequencies of up to about 20 kHz, and this ability declines with age). Variations in hearing ability do occur between individual animals, and a few studies on captive dolphins have shown that hearing abilities decrease as a function of increasing age. No study to date has examined the hearing abilities of free-ranging bottlenose dolphins; therefore, variations in hearing thresholds among individuals and variations with respect to age have not been examined. Additionally, the effects of environmental noise, including anthropogenic sources, on hearing abilities of free-ranging bottlenose dolphins have not been investigated. Therefore, I will be measuring hearing thresholds in Sarasota Bay bottlenose dolphins as part of my research. This research will be conducted during the temporary capture-release sessions. Short duration tones (acoustic stimuli) will be played while the dolphins are being examined on a boat. Using a non-invasive technique known as Auditory Brainstem Response (ABR), electrodes on the surface of the dolphin's head measure microvolt potentials produced by the brain stem in response to the acoustic stimuli. This technique will be a modified version

of the techniques currently used to measuring the hearing abilities of human newborns. Acoustic stimuli of varying frequencies and loudnesses will be played to the dolphins using a jawphone in order to determine their hearing thresholds. These data will then be analyzed to determine if bottlenose dolphins in Sarasota Bay exhibit hearing losses with increasing age or if they exhibit hearing losses due to daily exposure to high levels of environmental noise, including anthropogenic sources of noise.

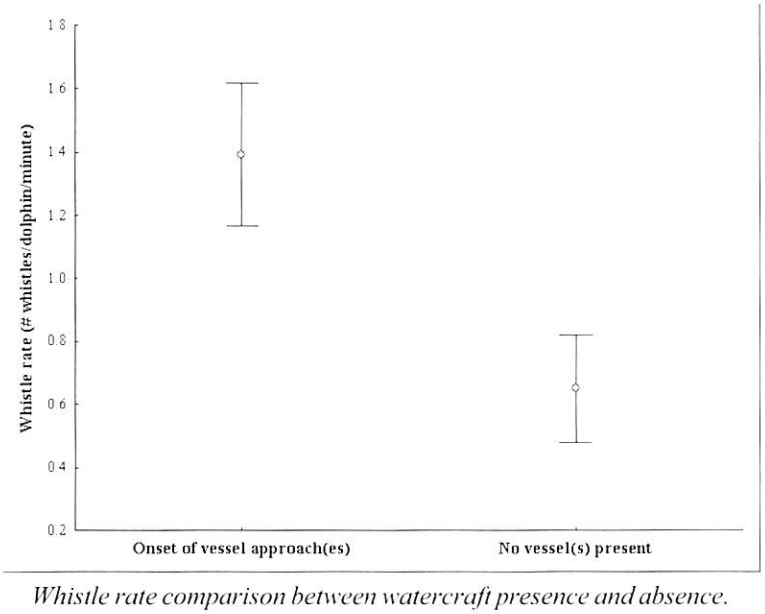
We collected our first dataset from 12 bottlenose dolphins (5 females and 7 males) ages 3-24, during the June 2003 temporary capture-release sessions. These data are in the process of being analyzed and the results will be presented at the 15th Biennial Conference on the Biology of Marine Mammals in December. Future datasets will be collected during capture-release sessions in February and June of 2004, and June of 2005. Funding for this research has been provided by: Harbor Branch Oceanographic Institution, Inc. Protect Wild Dolphin Program, the Paul L. Getting Memorial Endowed Fellowship, the Von Rosenstiel Endowed Fellowship, USF College of Marine Science Graduate Assistantship, Frances Peter Fensel Memorial Fellowship, and UNCW Faculty Summer Research Initiative.

*Measuring hearing capablilities with non-invasive ABR technique.*

## Assessing the Impacts of Watercraft Noise on the Acoustic Behavior of Bottlenose Dolphins

*By Kara Buckstaff, MSc*

Watercraft may provide the greatest source of anthropogenic noise for bottlenose dolphins living in coastal waters. In 2002, 41,558 recreational watercraft were registered in Sarasota and Manatee counties combined, accounting for 95% of total registered vessels (the other 5% being commercial vessels). Previous studies have shown that due to the high level of watercraft traffic in the study area these dolphins are exposed to a vessel passing within 100 meters approximately every six minutes during daylight hours. Energy of boat noise ranges between 0.1-10 kHz. This frequency range overlaps that of dolphin whistles (4-20 kHz), an important mode of communication among individuals. Recent studies indicate that the direction and type of acoustic behavioral responses are variable among species, but typical responses may enhance signal detectability and group cohesion in a noisy environment.

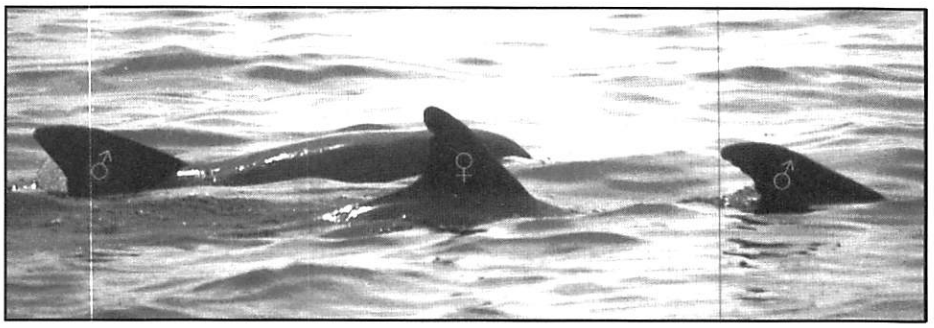



*Whistle rate comparison between watercraft presence and absence. There was a significant difference in whistle rate between the onset of vessel approaches and when no vessels were present (P = 0.000). Error bars represent standard error.*

For my Master's research (completed in June 2003), I investigated the circumstances under which watercraft may impact the acoustic behavior of this community, specifically looking for short-term changes in whistle frequency range, duration, and rate of production. Signature whistle duration and frequency range did not change significantly when boats approached, however, dolphins whistled significantly more often before the presence of a vessel compared to during and after approaches. Whistling rate was also significantly greater at the onset of a vessel approach than when no vessels were present (see figure). Increased whistle repetition as watercraft approach may simply reflect heightened arousal, an increased motivation for animals to come closer together, with whistles functioning to promote reunions. It may also be an effective way to reduce signal masking and enhance communication in a noisy environment. Funding for this research was provided by the Disney Wildlife Conservation Fund, the NOAA Fisheries, the Earl and Ethyl B. Myers Oceanographic Trust, the American Cetacean Society, and the University of California-Santa Cruz Ocean Sciences Department.

## Why Do Adult Male Dolphins Form Pair Bonds?

*By Edward Owen, PhD*




*Adult males, Blackstripe Leadcrease and Pair O' Nicks, flanking adult female Merrily. This photo illustrates the ability of pair-bonded males to control female movements by traveling in this formation, one male located in close proximity and on either side of the female.*

In December 2003, I completed my dissertation through the Ocean Sciences Department at the University of California, Santa Cruz under the guidance of Dr. Randall Wells. The focus of my research was to understand why adult male dolphins form pair-bonds. These pair-bonds are extremely strong, second only among the Sarasota dolphins to mothers and calves in the amount of time individuals spend together, and they are the longest lasting relationships in the Sarasota dolphin community. One pair of males, Norman (FB26) and Jimmy Durante (FB48) were pair-bonded for at least 22 years! During the course of their lifetime, the majority of males form pair-bonds, typically with a similar-aged male (within 4 years).

With geneticist Dr. Debbie Duffield at Portland State University, I investigated how related these pair-bonded males are to one another by comparing their DNA, extracted from blood samples taken during the health assessment program. We wanted to know whether kinship could be used as an evolutionary explanation for pair-bond formation. We found that while some pairs form between close kin (half-brothers), on average, pair-bonded males are no more likely to be related to their partners than to males which are not their partners. Factors other than kinship, such as having a previously established social relationship with a prospective partner and being close in age, seem to be more important when selecting a partner.

Another component of my research was to use both data that I collected and long-term data-sets maintained by SDRP to test hypotheses regarding the function of the pair-bond. It has been hypothesized that males may form these bonds: 1) to increase access to females for mating or 2) to provide other ecological benefits such as enhanced foraging success through cooperative foraging or increased predator detection and protection. I found evidence that one of the advantages of having a partner is being able to stay close to a female for a longer period of time, which in all likelihood provides more mating opportunities. Males in pairs may be able to do this because they can act in a coordinated fashion to better control female movements and guard her against other males (see photo). I also found some evidence for enhanced predation detection and protection and for enhanced foraging ability (although more data are needed to explore these benefits further). Thus the data strongly suggest that males form pair-bonds to gain greater access to females for mating, and they may also gain additional ecological benefits from these relationships.

This work has important conservation implications because it enhances our understanding of the mating system of bottlenose dolphins. Though captive breeding success has improved dramatically in recent years, success has not been universal. Information on male breeding patterns leading to their reproductive success is crucial for developing optimal breeding situations in captive colonies, thereby reducing pressure for collecting from wild populations, and for evaluating probabilities for replenishment of depleted stocks. This work has been supported by NOAA Fisheries and the Disney Wildlife Conservation Fund.

## Whistle Use by Pair-bonded Male Bottlenose Dolphins

*By Stephanie Watwood, PhD*
*Woods Hole Oceanographic Institution*

This past summer I defended my Ph.D. thesis from the Woods Hole Oceanographic Institution (WHOI) in Biological Oceanography. I spent four summers on Sarasota Bay collecting data on the behavior of male dolphins in the Sarasota community. Male dolphins form stable, long-term alliances comparable to long-term relationships formed by terrestrial species. The goal of this thesis was to determine the effect of the formation of these alliances on vocal development. Bottlenose dolphins develop individually distinctive whistles called signature whistles. I found that alliance partners have similar signature whistles, while non-partners do not. Whistle similarity seen in alliance partners mirrors group-specific vocal convergence in stable groups of birds and bats.

I also explored whether signature whistles function as contact calls by looking at the whistles that are produced by different social groups. An allied male produced signature whistles most often when separated from his partner and least often when with his partner. Signature whistles were also

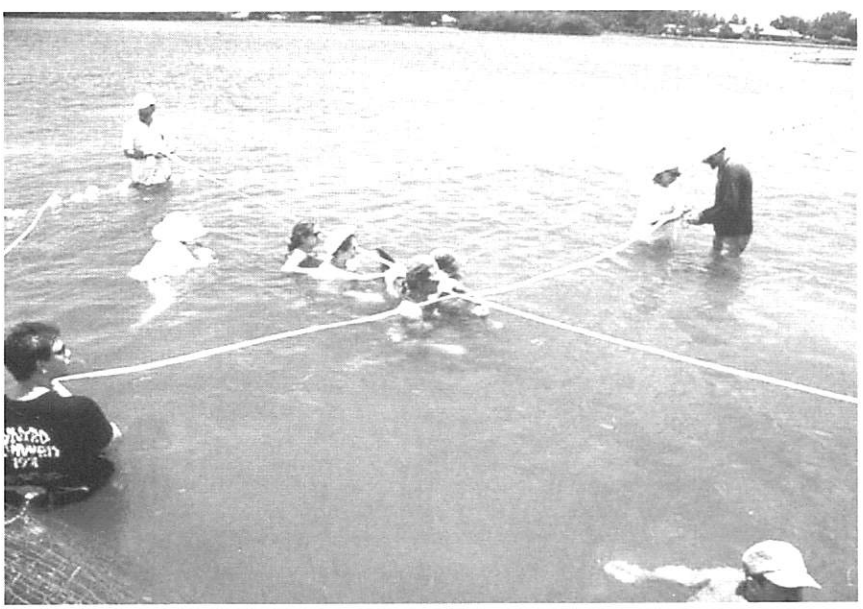
highly individually distinctive, and therefore well suited as contact calls, while other whistle types were not. Separations and reunions between alliance partners were examined to determine if whistles are used to maintain contact between partners. Most whistles recorded from separated males were signature whistles. The timing of whistle production was correlated with the timing of the maximum partner separation and the initiation of a reunion. Few whistles were produced as the partners separated. Therefore, whistles may initiate reunions between partners. This thesis demonstrates several general mechanisms that bottlenose dolphins use to locate and maintain contact with close associates. I hope to continue this work in the future, looking more specifically at how whistles change over time as social relationships change. This work was funded by the National Geographic Society, the National Science Foundation, WHOI Ocean Ventures Fund, National Institutes of Health, SERDP, Dolphin Quest, Chicago Zoological Society, WHOI Academic Programs Department, and ONR.

*Stephanie Watwood and Edward Owen observing and recording male pairs.*

## What's in a Voice?

*By Vincent M. Janik, PhD, University of St Andrews and Laela S. Sayigh, PhD, University of North Carolina at Wilmington*

Bottlenose dolphins have fascinating vocal repertoires. They produce a huge variety of whistles and click sounds, many of which are used for communication. One particularly interesting aspect of their repertoire is the signature whistle. Each individual has its own distinctive whistle, and other dolphins can apparently recognize it over long distances. In a previous study, Laela Sayigh and colleagues showed that dolphins recognize their kin by listening to their signature whistles. This was tested by playing whistles to dolphins that were held by several people in the water and observing whether or not they turned towards the playback speaker (see photo). In our current playbacks we are using the same method to see what this reaction is based on. A dolphin could either be recognized by its distinctive voice or by the shape (contour) of the whistle itself. This is equivalent to testing whether a human reacts to the name of someone only if it is spoken by that person, or if they would react similarly if the name was produced by a computer generated voice. The reason we are interested in this question has to do with the evolution of communication. Signature whistles are very recognizable, an attribute that may be an important adaptation to underwater noise. If we can show that subtle voice features are not necessary to make the whistle recognizable it would support our ideas about the origins of these calls and bring us a step closer to understanding dolphin communication. Knowing what parts of the whistle carry what information can also help to address how anthropogenic noise may affect dolphin communication. In June of 2003 we started to look at reactions of dolphins to playbacks of computer generated whistles that mimic those of relatives, and we will be continuing this work next year. Playback experiments are a very promising tool to investigate dolphin communication, and the brief capture-release events that are possible in Sarasota provide a unique opportunity to carry them out. We plan to continue this line of research with experiments pertaining to dolphin whistle perception in the future. This study was supported by the Sarasota Dolphin Research Program, the University of North Carolina at Wilmington, and the Royal Society of London.



*Experimental setup for acoustic playbacks. Dolphins are held while observers note whether or not they turn towards the playback speaker.*

## Dynamics of Group Fission-fusion: Acoustic Mechanisms Used by Individual Bottlenose Dolphins (*Tursiops truncatus*) to Leave and Join a Temporary Group

*By Ester Quintana-Rizzo, MSc, PhD Student, University of South Florida*

Bottlenose dolphins form temporary associations, the composition of which changes frequently as partners join and leave in a fluid manner. Such fluid associations are intriguing, and their nature suggests that group members remain within acoustic detection range when associates temporarily separate. The objective of my project is to examine how wild unrestrained bottlenose dolphins communicate with associates during different dynamic events of group formation and division. I will also examine the characteristics of whistles that make them a good vehicle for long-distance communication and will identify the maximum propagation range of whistles in particular marine habitats. Studying boundaries of communication between group members as well as the dynamics of group fission-fusion are important ways to understand what constitutes a group in the bottlenose dolphin. This research is part of my dissertation project through the University of South Florida.

My research project has involved three field seasons of data collection, completed this fall. This year I conducted focal follows to document behavior and acoustic communication patterns of dolphins. A total of 47 focal follows of resident female bottlenose dolphins were conducted in 109 hours of observations this year. During focal follows, I recorded the behavioral activity and positions of all dolphins associating with a focal female as well as the acoustic signals used during temporary separations and reunions. Recording of acoustic signals was done as continuously as possible while dolphins were followed. Signals from each hydrophone were digitized and stored to a computer hard drive. In the second part of my fieldwork, I conducted a series of field experiments to quantify how far sounds in the frequency range of whistles travel in two different habitats: channels and shallows. The experiments were conducted in areas where separations and reunions of dolphins occurred. Although data analysis is still underway, field observations suggest that sound propagation characteristics are habitat dependent. Such data will provide the first estimate distances overwhich dolphins may be able to maintain acoustic communication when separated from associates in Sarasota Bay, FL. The next step of my project is the analysis and writing up of the behavioral, acoustic, and sound transmission loss data. My fieldwork was possible with the help of a wonderful team of field assistants that applied to the Mote Marine Laboratory internship program: Alison Boler, Meagan Dunphy-Daly, Ida Eskesen, Lindsey Fenderson, Lu Lu, Marde McHenry, Minelia Miravete, and Kathleen Mohning. NOAA Fisheries, the Sarasota Dolphin Research Program, the USF Acoustic Laboratory, the USF Physiology Laboratory, and the USF Jack Lake Fellowship have provided support for this project.

*Research team studying the acoustic communication of wild dolphins. A hydrophone was towed on each side of the boat, separated by a 3-m PVC pipe tied across the gunwales at the bow of the boat*

## Transmission of Foraging Specializations of Bottlenose Dolphins

*By Jessica Weiss, MSc Student, Duke University*

Bottlenose dolphins have evolved complex foraging specializations to detect and pursue prey. Individual preference plays a role in the use of foraging specializations and may be shaped in response to habitat or variation in prey resources. Foraging specializations may be products of cultural transmission, and the long duration of the mother-calf bond presents an ideal opportunity for mothers to transmit specialized foraging behaviors to their calves. Transmission of foraging specializations within a community allows individuals to adapt to environmental change and to reduce indirect competition for prey.

I am interested in the mechanisms by which foraging specializations are transmitted within the Sarasota dolphin community. Two examples of such specializations include barrier feeding and kerplunking. Dolphins may use several types of structures as barriers to herd fish. These structures may include seawalls, markers, or the water surface. Kerplunking is a behavior in which the dolphin raises its tail stock and drives its flukes through the water column, creating a splash, bubble cloud, and low frequency sound. It is believed that the purpose of this action is to elicit a startle response in fish so that the dolphin may find its prey. Such foraging specializations are correlated with particular habitat types, and I am also interested in how the use of specialized foraging behaviors affects choice of foraging habitat. During the summer of 2003, I followed five females and their dependent calves for a total of 40 hours to document which foraging specializations they used, in what types of habitats they were used, and whether calves showed indications of learning the specializations from their mothers. Data analysis is currently in progress, however, preliminary results suggest that females within Sarasota Bay exhibit preferences for foraging specializations. Further analysis will determine if females target foraging habitats to use these specializations and whether calves learn specialized foraging behaviors from their mothers. The results of this study will define future research questions concerning the stability of foraging specializations within a community and provide insight into the mechanisms of transmission of complex behaviors. Support for this project was provided by Mote Marine Laboratory, Duke Marine Laboratory, and Dolphin Biology Research Institute.

## Integrating Life History, Health, and Reproductive Success Data to Examine Potential Relationships with Organochlorine Contaminants for Bottlenose Dolphins in Sarasota Bay

*By Randall S. Wells, PhD*

Environmental contaminants pose a serious threat to marine mammal populations around the world. More than 10,000 chemicals have been produced. Some of these have been documented to have adverse impacts on animal health and/or reproduction, but little direct evidence for these effects in marine mammals is available, due in large part to the difficulties of defining cause-effect relationships outside of laboratory experiments. The resident community of bottlenose dolphins in Sarasota Bay, Florida, provides unparalleled opportunities to investigate relationships between organochlorine contaminant residues and dolphin life history, health and reproductive parameters, by examining correlations between contaminant concentrations and sublethal effects. Most dolphins are identifiable, and many are of known age, sex, and maternal lineage (up to 4 generations). Observational monitoring provides data on dolphin occurrence, births and fates of calves, and birth order. Capture-release operations conducted for veterinary examinations provide biological samples for life history and genetic analyses, health assessment, and contaminant residue measurement. Organochlorine concentrations in blubber, milk, and blood are examined relative to age, sex, body condition, birth order, and health parameters. Reproductive success is evaluated through hormone measurement, tracking of paternity patterns via genetics, and tracking of individual female lifetime calving success.

We have worked with a variety of analytical labs to develop a preliminary picture of the role of environmental contaminants relative to dolphin health and reproduction, developing a weight of evidence approach. Initial analyses of PCBs, DDT and other organochlorine compounds have been performed by Wally Jarman (U. of Utah), Greg Mitchum (NOAA), and Assuncion Borrell (U. of Barcelona). Apparent seasonal variations in blood plasma contaminant concentrations suggest a pattern of deposition in lipid-filled tissues during winter, when blubber thickens, and mobilization in spring as blubber thins. Males accumulate some contaminants throughout their lives, whereas females begin to depurate with their first calf. Contaminants are transferred from mother to calf through lipid-rich milk, ultimately bringing the mother into an apparent equilibrium between contaminant intake through food and lactational loss. High rates of first-born calf mortality are correlated with higher concentrations of contaminants in blood and blubber of first-time mothers; subsequent calves have a higher survivorship. Males, unable to depurate, have a shorter life span than females, living only into their early 40s as compared to maximum female ages of 53 years. Preliminary findings demonstrated decreased male immune system function with increasing organochlorine concentrations. Though some 40-year-old males sire calves, testosterone concentrations decline after 25 years of age. Similar declines in other cetaceans have been hypothesized to be related to organochlorines.

Long-term observational monitoring and periodic biological sampling provide a powerful, non-lethal approach to understanding the correlations of organochlorine concentrations and health or reproductive parameters for coastal dolphins. Analyses of new and several hundred archived samples will be performed over the next 2-3 years by John Kucklick (National Institute of Standards and Technologies), and Derek Muir and PhD student Magali Houde (University of Guelph) will be investigating emerging contaminants of concern. Seasonal sample collection is being supported by Dolphin Quest, NOAA Fisheries, and Disney Wildlife Conservation Fund, and analytical work is being funded primarily through NOAA Fisheries.

## Emerging Environmental Contaminants – New Threats to Dolphins

*By Magali Houde, PhD student, University of Guelph*

Assessment of emerging environmental contaminants is an important aspect of the conservation and management of wild populations such as marine mammals. Organic contaminants in mammals can be chemically transformed by metabolism to more persistent and biologically active chemicals, such as the conversion of PCBs to hydroxylated-PCBs (OHPCBs). Some OH-PCB congeners are known as endocrine disrupters, with the potential to interfere with reproduction. Persistent perfluorinated acids (PFAs) are of increasing concern because of their present industrial use, their global distribution and their carcinogenicity. Very few studies have been conducted on OH-PCBs and PFAs in cetaceans. The long-term

monitoring and seasonal capture-release procedures of Sarasota Bay bottlenose dolphins creates a unique opportunity to study the toxicokinetics (e.g. pattern of bioaccumulation, elimination) of these emerging contaminants in marine mammals. PCBs have been found at high concentrations in the blubber of wild Sarasota Bay dolphins and levels of PFAs in the liver of stranded dolphins from this population are also elevated. In this study, OH-PCBs and PFAs were assessed in free-ranging cetaceans for the first time. Concentrations of OHPCBs and PFAs were determined in plasma and urine of live-captured dolphins. The PFAs and OH-PCBs are relatively polar and, unlike PCBs, they were found in plasma. We found no sex or age-related differences in the dolphin population for these contaminants as previously observed for PFAs in minks and seals. Low lactational transfer from mother to offspring and excretion may explain these results. OHPCBs and PFAs were found in urine of dolphins suggesting that the urinary system is a mean of excretion for these compounds. Results clearly show that these persistent organic pollutants have a different pattern of accumulation than known lipophilic (i.e. high affinity with fat) contaminants.

## Investigating the Thermal Response of Sarasota Bay Dolphins to Changing Environmental Temperatures

*By "Team Thermal" – Ann Pabst, PhD, Bill McLellan, MSc student, Andrew Westgate, MSc, PhD student, Erin Meagher, MSc, PhD student, Michelle Barbieri, MSc student, and Ari Friedlaender, MSc, PhD student*

The goal of our work with the Sarasota Dolphin Research Program is to better understand reproductive and whole-body thermoregulatory function in bottlenose dolphins. The long-term, health-monitoring program for Sarasota Bay dolphins offers us a unique opportunity to study thermoregulation in wild cetaceans. Our current project is aimed at understanding how Sarasota Bay dolphins thermally adapt to seasonal changes in environmental temperatures. Their year-round residency exposes these dolphins to water temperatures that can drop below 12°C (55°F) in the winter and exceed 32°C (90°F) in the summer.

Bottlenose dolphins in Sarasota Bay may invoke a suite of physiological modifications to cope with their changing thermal environment, including well-documented seasonal changes in blubber thickness. The goal of our current study is to describe seasonal variation in the thermal responses of bottlenose dolphins in Sarasota Bay. We investigate thermal function in dolphins using multiple measurement techniques, which include skin surface temperatures and heat flux values, measured at multiple positions on the dolphin's body. Heat flux is the rate of energy transfer per unit area and measured in Watts/$m^2$. Deep core temperatures, measured with a specialized colonic probe, and blubber thicknesses, measured using ultrasound, will also be recorded. A dorsal fin Trac Pac will be deployed on a subset of dolphins, which will record skin surface temperatures and heat flux values, as well as velocity and time-depth records. These Trac Pacs are attached to the fin's surface, using suction cups, and deployed for periods lasting up to 8 hours. Infrared thermal imaging will be used to measure skin surface temperatures of wild dolphins, both during temporary restraint, and while they are free-swimming.

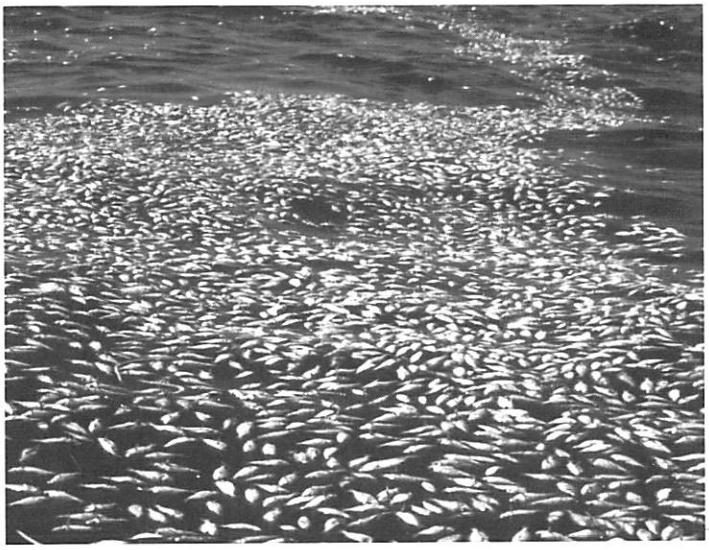
Our research team has collected this suite of physiological data on Sarasota dolphins during summer health-monitoring studies over the past two years. These data suggest that dolphins must actively dissipate body heat during the summer to maintain constant body temperatures. Our current study has permitted us the first opportunity to investigate the mechanisms used by wild dolphins to maintain homeothermy over the course of a year, as they experience a wider range of environmental conditions. Our results have been somewhat surprising! Infrared thermal imaging and heat flux data suggest that dolphins may be dissipating more heat to the environment during fall and winter than summer. We had hypothesized that Sarasota dolphins would decrease their rate of heat loss to the environment during the colder seasons. These combined data suggest that the responses of wild bottlenose dolphins to changing environmental temperatures are complex and that a larger sample size is needed, especially in the colder seasons, to gain a more complete understanding of their thermal biology. Data will be collected during winter and summer 2004 to gain a better understanding of the physiological responses of wild Florida dolphins to changing environmental temperatures. This study has also offered two of our current graduate students, Ms. Erin Meagher (PhD) and Ms. Michelle Barbieri (MSc), the opportunity to gather data critical to their thesis research on dolphin thermoregulation. Support for this project has been provided by an HBOI Protect Wild Dolphins grant.

*Ann Pabst (perched on bow of boat) and Team Thermal measuring skin temperatures and heat flux for a dolphin in Sarasota Bay, February, 2003. The dolphins were much more effective at thermoregulation than were the members of Team Thermal.*

## Red Tide and Dolphins

*By Spencer Fire, MSc, PhD student*

For decades "red tide" has been considered a nuisance along Florida's gulf coast and has had a significant impact on the economy, wildlife, and human health of many coastal regions of the U.S. It has been responsible for shellfish poisoning, fishery closures, loss of tourism and marine animal die-offs, including marine mammals. In recent years, several large mortality events of bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico and on the Atlantic coast have been suggested to be caused by red tide. Brevetoxin, the neurotoxin produced by the red tide algae *Karenia brevis*, has been shown to have harmful effects on a wide variety of organisms, but its effects on bottlenose dolphins are unclear. The aim of my research is to gain an understanding of the impact of red tide on the diet, health, and behavior of bottlenose dolphins in Florida's Sarasota Bay area.



*Fish kill during red tide event in Sarasota Bay. How do red tides impact resident dolphins?*

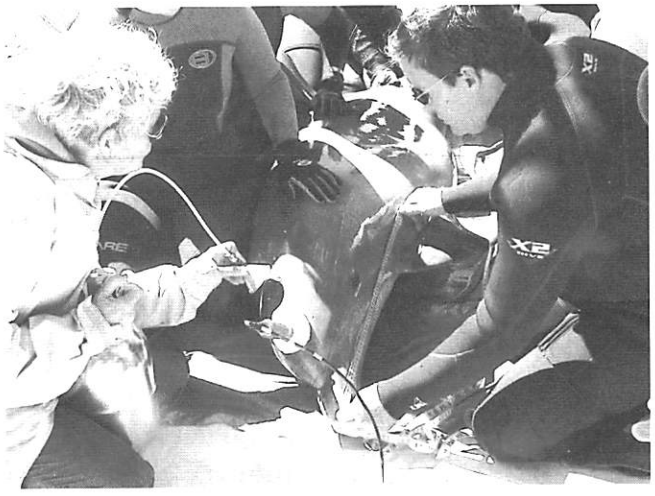
My study will involve quantifying brevetoxin levels in the tissues of fish eaten by dolphins, as well as in dolphin tissues recovered from carcasses stranded during red tide events. This may give insight to what levels of brevetoxin are present in the dolphins' diet and how the toxin is distributed throughout the animal once ingested. The behavioral response of dolphins to the presence of red tide will also be investigated. It is unknown whether dolphins are aware of (or react to) the presence of high concentrations of *Karenia brevis* during red tide events. By observing their behavioral states and recording their movements relative to concentrations of *Karenia brevis*, we may be able to determine if there is a response to the toxic event. The purpose of these efforts is to estimate the levels of harmful toxin to which dolphins are exposed and through which pathways the exposure presents itself. It is hoped that an increased understanding of how dolphins are affected by red tide will help conservation efforts in the future. Support for the coming year's lab analyses and field observations has been generously provided by NOAA Fisheries, AIGC, AISES, and the Chicago Zoological Society.

## Evaluating Dolphin Health and Reproduction by Examining their Breath

*By Bets Rasmussen, PhD, OGI School of Science & Engineering, OHSU*

Volatile organic compounds in exhalant breath are a reflection of biochemical constituents circulating in the blood. Non-invasive monitoring of such compounds may give health, reproductive, physiological, and seasonal information about wild dolphins. From a conservation aspect, information from breath of wild dolphins may reveal 1) areas of localized, specific pollution if particular dolphins are known to frequent such regions, 2) incidence of respiratory diseases, 3) basic metabolic requirements, especially seasonal, and 4) possible reproductive status information.

Breath samples are collected during exhalation into a small funnel connected to an evacuated tank. Breath samples were collected from 24 dolphins at sufficient compound concentrations to identify and semi-quantify more than 50 compounds. Immediately successive breath samples demonstrated, in the first breath sample, higher levels of several discrete compounds, namely pentane, indicative of strenuous exercise, and three sulfur compounds, presumably of bacterial origin. In future health assessments we will be monitoring concentration changes that may 1) be indicative of a disease origin, 2) reveal seasonal changes related to fat metabolism, and 3) demonstrate chemical clues about reproductive condition.



*Bets Rasmussen collecting breath samples while Randy Wells obtains measurements and acoustic recordings are made via a suction cup hydrophone.*

## Integration of Genetic and Behavioral Data for Bottlenose Dolphin Population Unit Definition

*By Karen Martien, PhD, Anna Sellas, MSc, Patricia Rosel, PhD, and Randall Wells, PhD*

Defining population units of bottlenose dolphins in such a way as to be biologically-meaningful as well as useful to wildlife managers has long been a problem. We used a new approach of parameter estimation to define genetic population units for bottlenose dolphins from the west coast of Florida. The study area centered on Sarasota Bay, Florida, an area from which extensive behavioral and photo-identification data are available. The genetic samples were first stratified into hypothesized units using Boundary Rank (BR), a geographically constrained clustering method. The resulting units were then evaluated by estimating dispersal rates between them using the software program Migrate. The BR analysis requires that the genetic samples first be grouped into small initial units, a step that can be difficult when samples are continuously distributed. In order to determine the impact that the definition of initial units had on our results, we ran two analyses using two different sets of initial units. For the 'naïve' analysis, initial units were defined strictly on the basis of the geographic proximity of samples. For the 'expert' analysis, extensive behavioral data, including the sighting histories of the animals sampled in the study, as well as information on the fine-scale habitat variation across the study area were integrated into the definition of initial units. Analyses using the two sets of initial units produced very similar results, suggesting that BR could be successfully applied for the definition of management units in areas from which extensive behavioral data are not available. Dispersal rate estimates between the population units suggested by BR were on the order of a few genetic dispersers per generation between Tampa Bay, Sarasota Bay and Charlotte Harbor. These low estimates of dispersal suggest that bottlenose dolphins in the Gulf of Mexico are structured on a very fine geographic scale, and should therefore be managed on a fine scale if they are to be adequately protected. Support for this project was provided by NOAA Fisheries and the Harbor Branch Oceanographic Institution's Protect Wild Dolphins program.

## Genetic Analyses of Stock Structure in Tampa Bay: Examining Community Structure of Bottlenose Dolphins in Tampa Bay using a Genetic Approach

*By Kim Urian, MSc*

In my Master's thesis work I described five separate communities of dolphins in Tampa Bay, defined by their patterns of association and home ranges. We are now interested in determining how much gene flow occurs among these five communities and how well they fit the model described above by Karen Martien and associates. In August 2003, we conducted field work in Tampa Bay to examine the genetic structure of these communities.

We conducted biopsy sampling and photo-identification surveys of dolphins throughout northern and western Tampa Bay from our field base in St. Petersburg. We focused on dolphins identified in previous surveys and, in particular, we targeted known members of specific communities. Genetic samples have already been collected from two communities in southern and eastern Tampa Bay as part of other SDRP projects, so we focused our efforts on the other three communities - including the waters of Old Tampa Bay and Hillsborough Bay. We saw many familiar fins from the surveys we conducted during 1988-1993, and collected 28 genetic samples from dolphins over the course of 9 field days. We obtained 13 samples from community 2, 4 from community 3 and 11 from community 5. Our success was due in large part to the skill of Brian Balmer, who conducted the biopsy sampling. And, as an added bonus, on August 20th, we saw FB58 and his partner, TNLV, east of McDill Air Force Base; FB58 is one of the first animals tagged by Randall Wells and Blair Irvine in 1970. This was the farthest point FB58 has been documented outside Sarasota.

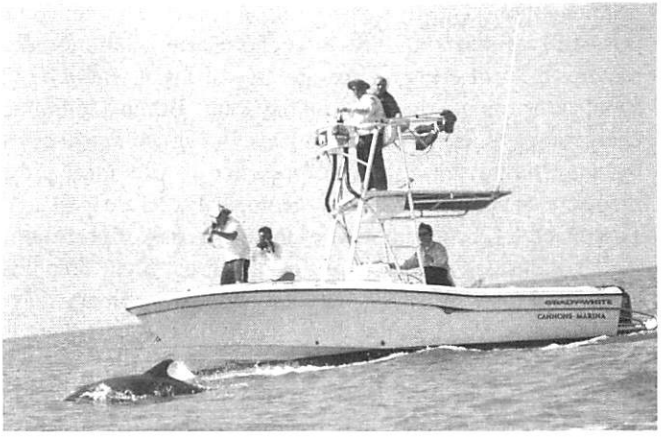
The analysis of the digital images we obtained during the August surveys will be conducted this winter to determine the identities of the dolphins we sampled, and the biopsy samples have been provided to NOAA Fisheries for genetic analyses. Once the genetic analysis is conducted, we will be able to determine how much gene flow occurs among the five communities in Tampa Bay. This will help us to better understand the fine-scale population structure of bottlenose dolphins in this region. In addition, the samples collected during these surveys will supplement the growing genetic catalog of dolphins along the west coast of Florida and provide information on population structure over a broad geographic area. This research was supported by the NOAA Fisheries.

## Genetic and Contaminant Sampling of Bottlenose Dolphins in Charlotte Harbor, Tampa Bay, and Sarasota Bay

*By Brian Balmer, Laboratory Research Assistant*

Over the past year, biopsy darting efforts have resulted in sampling 48 animals from the Tampa Bay and Charlotte Harbor estuaries. Of the 48 samples collected, all provided a small sample of skin for genetic research and 39 provided blubber for contaminant research. The Tampa Bay field season in August provided 28 samples in 9 field days, from 4 of the 5 Tampa Bay dolphin communities described by Kim Urian. The two Charlotte Harbor field seasons in February and September were successful as well. The February field season concentrated on sampling animals in the Lemon Bay and Gasparilla Sound areas of Charlotte Harbor. In 9 field days, 12 samples were collected, with 7 of the animals sampled having been seen in past survey efforts. The September field season focused on the southern end of Sanibel Island, the waters off St. James City, and Tarpon Bay. Eight samples were collected in 4 field days, with 4 of the sampled animals seen in previous surveys. Genetic samples are being analyzed by Dr. Patty Rosel and Anna Sellas of NOAA Fisheries

Over the next year, biopsy efforts will be directed towards three areas. The first is sampling animals that are seen in the middle of Sarasota Bay. These animals spend the majority of their time in deep water, making capture, sampling, and release difficult if not impossible. Genetic sampling from this group will provide valuable insight into how these animals fit in the Sarasota dolphin community. The second focus is in Tampa Bay and the collection of additional samples from each of the resident communities there. The final sampling effort will be in northern Charlotte Harbor. This area is the last section of the harbor that has not been sampled. Once samples are collected, a better understanding of Charlotte Harbor bottlenose dolphin community structure will be known.



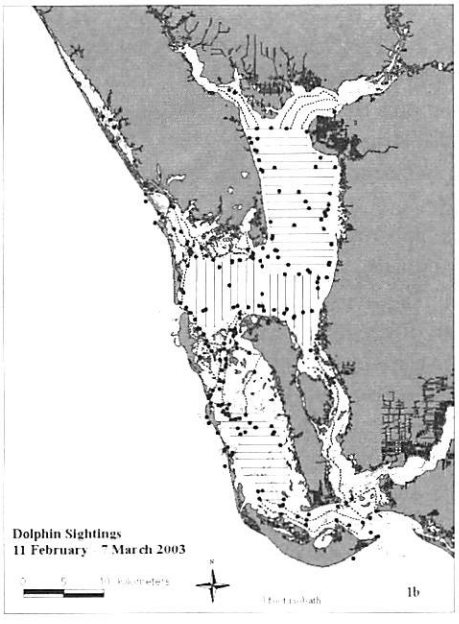
*Biopsy sampling for genetic and contiminant samples.*

## Bottlenose Dolphin Abundance, Distribution, Population Structure, and Health in the Charlotte Harbor Ecosystem: Update and Findings

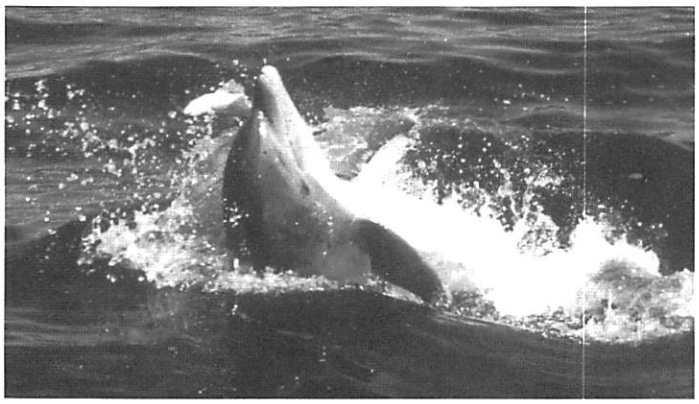
*By Kim Bassos-Hull, MSc, Research Associate*

Bottlenose dolphins are top-level predators in the Charlotte Harbor ecosystem and their numbers, reproductive rates, health, and body condition can be indicative of ecosystem health. Their distribution can be indicative of environmental features and prey distribution. We have been continuing semiannual photographic identification surveys since September 2001 to examine dolphin abundance and distribution from Lemon Bay and the mouths of the Peace and Myakka Rivers down to the Sanibel Island Causeway. We have completed five multi-week surveys during September/October 2001, February 2002, September 2002, February/March 2003, and September 2003 along with four opportunistic mini-surveys (May 2002, July 2002, May 2003, and June 2003). Two types of search effort were used to collect sighting information; (1) a 1 km grid transect design which included cross-harbor, edge, and contour transects and (2) opportunistic transects both within the defined study area and in the Gulf coastal waters and inshore areas to the north and south of the study area. We attempted to collect identification photographs of all dolphins in each sighting and information on location, group size, numbers of calves, and activities, along with data on tidal state, salinity, temperature, Beaufort state, cloud cover, and glare. Photo-analysis is underway to identify individuals and to perform mark-recapture analyses to estimate abundance. These data will be compared to those from similar surveys conducted during 1990-96. Distribution of sightings and feeding locations will be examined relative to habitat features, prey distribution, and environmental features to see if feeding observations are indicative of related ecological parameters. Preliminary findings show relatively low numbers of dolphins in the upper harbor from Burnt Store Marina to the mouths of the Peace and Myakka Rivers during September surveys and during hypoxic events, and larger numbers of dolphins during winter when the waters were well mixed. We have also had repeated sightings of marked individuals across the five multi-week and opportunistic surveys giving preliminary indications of year round use of the estuary. Some re-identifications occur over decades. A few individuals also have been resighted at multiple study sites outside of Charlotte Harbor.

Seventy one blubber/skin biopsy samples have been collected from within the estuary and nearshore gulf waters outside the passes. Eleven of these have been examined for organochlorine contaminant concentrations, providing suggestions of lower levels than in Sarasota Bay dolphins. The remaining samples have been delivered to the National Institute of Standards and Technology for contaminant analyses, and funding has been obtained for these analyses. Biopsy samples are also being used in a genetic model analysis examining stock structure of dolphins from Tampa Bay, Sarasota Bay, Charlotte Harbor, and the Gulf of Mexico. Preliminary results indicate significant fine-scale structuring of the population units, supporting previous work and reinforcing the concept of species management at the level of bay systems.




*Dolphin sightings during February/March 2003. Locations of cross-harbor transect lines are shown as bold lines, contour transects as dashed lines. Edge transects occur between the endpoints of cross-harbor transect lines off of the three foot isobath line. Both transect sightings and opportunistic sightings are shown here.*



## Habitat Quality and Prey Availability for Bottlenose Dolphins

*By Damon Gannon, PhD*

To conserve any species, scientists and government managers need to understand that species' specific habitat requirements. The bottlenose dolphins of Florida inhabit one of the most urbanized coastlines in North America. Despite intense study in recent decades, habitat requirements of bottlenose dolphins are poorly known. What qualities do dolphins look for when selecting habitat? To what degree do the distributions of prey, predators, and competitors influence the dolphins' habitat preferences? And how does the presence of humans affect their use of coastal waters? These are just a few of the questions we hope to answer with our new investigation of dolphin prey.

As a new postdoctoral scientist with the Sarasota Dolphin Research Program, I will be coordinating an ambitious fisheries sampling program to determine how prey are distributed among the various habitats within Sarasota Bay and how the distribution of prey changes over the seasons. The sampling program will use both traditional tools of fisheries science (net sampling) as well as new techniques (passive acoustic monitoring of sounds produced by fish). By coupling the fish data with our long-term database on how dolphins and people use the Bay, we will be able to quantify habitat quality for bottlenose dolphins. With this knowledge, we can create a simple index of habitat quality that will allow scientists and government managers to quickly determine the quality of any habitat for bottlenose dolphins. Such a tool for assessing habitat could be of great benefit to the conservation of bottlenose dolphins all over the world by helping resource managers predict the consequences of altering habitats. The data on fish abundance in Sarasota Bay will also be used to make a model of Sarasota Bay's food web, which could allow managers to predict how changes to one part of the Sarasota Bay food web will affect all other parts of the food web. For example, the model will be able to predict how an increase in fishing activity will affect each fish species, as well as dolphins, manatees, seagrass, mangroves, and everything else that lives in the Bay. This research is funded by NOAA Fisheries.

## Acoustic Playback Experiment Yields Clues on How Dolphins Find Food

*By Damon Gannon, PhD*

Biologists have known for decades that bottlenose dolphins possess a sophisticated echolocation, or sonar, system. For example, trained dolphins can detect a three-inch metal sphere from a distance of almost 400 feet and can distinguish subtle differences in size, shape, and material. Despite their remarkable sensitivity, dolphins appear to use their echolocation sparingly in the wild.

Why don't dolphins use their echolocation more often? One potential explanation for this incongruity is that echolocation is a costly behavior for dolphins. Producing the powerful sounds required for echolocation undoubtedly requires a lot of energy. Imagine how tiring it would be to shout at the top of your lungs all day long. But in addition to energetic costs, echolocation may also incur ecological costs by advertising the dolphin's presence to potential prey, predators, or competitors. These ecological costs are measured as reduced food consumption or increased risk of predation.

Besides echolocation, what senses might dolphins use to find food? Vision is not likely to be the primary sense for detecting prey because the visibility in coastal waters is often very low. Even in clear water, fish often conceal themselves within seagrass or other types of shelter. Mote Marine Lab's Nélio Barros hypothesized that bottlenose dolphins find prey by listening for them. Several studies (including one by Barros and Randall Wells) have noted that most of the fish eaten by bottlenose dolphins are soniferous, or noise-making. Many species of fish communicate with sound to attract mates and to maintain group cohesion. Croakers, drums and grunts are all types of fish named for the sounds they make and they are all important food for bottlenose dolphins.

As part of my Ph.D. research at Duke University, I teamed up with Nélio Barros, Doug Nowacek (Mote Marine Lab), Andy Read (Duke University), Danielle Waples (Duke University), and Randall Wells to test whether the dolphins of Sarasota Bay respond to the calls of the prey species that they eat. We conducted experiments in which we measured their responses to recorded sounds played through an underwater speaker. There were two types of sounds that we played: fish sounds (the *experimental* treatment) and sounds of snapping shrimp (a common species in Sarasota Bay but one that is not eaten by dolphins; the *control* treatment). The fish sounds were recorded from 11 different species known to be eaten by the dolphins. Using an overhead digital video camera and a hydrophone, we measured the dolphins' change in direction and rate of echolocation in response to the sound playbacks. Dolphins responded to fish sounds by turning toward the sound source and increasing their rate of echolocation. The sounds of snapping shrimp elicited neither a directional nor an echolocation response. From our results, we concluded that bottlenose dolphins use passive listening extensively while searching for food. Dolphins produced echolocation signals infrequently, except immediately after we

played our fish sounds. Therefore, it appears that one strategy dolphins use to find prey is to use passive listening to make the initial detection, at which point they commence echolocating to track the fish's precise movements during the pursuit and capture phases of the feeding process. Combining the findings of this project with that of another that I conducted in North Carolina's Neuse River, it seems that dolphins use passive listening at two distinct scales. First, they appear to choose habitats based on the occurrence of fish calls. Second, once they have positioned themselves in an area where fish are abundant, they locate individual fish by listening for their calls.

Eavesdropping on fish communications can provide a foraging dolphin with much useful information, including the species of the fish, the number of individuals present, their sizes, and their locations. Such judicious use of echolocation suggests that this sensory modality does incur significant energetic or ecological costs. The fact that bottlenose dolphins use passive listening to detect prey indicates that there are risks associated with sound production for fish. Bottlenose dolphins and their prey may be engaged in an evolutionary arms race, similar to that described between bats and some insects, in which improvements in the predator's ability to detect prey drive improvements in countermeasures employed by the prey, and vice versa.

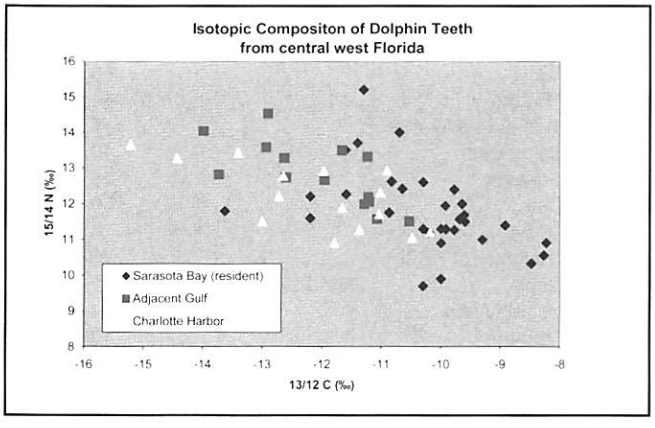
This work raises further concerns regarding the effects of human-caused noise on the dolphins' well being. Injuries and deaths of marine mammals caused by intense sounds, such as Navy sonar, have been getting a lot of press lately. But the common sounds that we associate with normal life in a modern world, such as boat traffic, automobile traffic, and construction noise, may have a greater effect on coastal marine mammals in the long run by interfering with their ability to hear and locate their prey. The sounds produced by fish tend to be low in frequency, generally between 200 and 2,000 Hz. This is also the frequency range in which many human-generated sounds occur. When a loud sound overlaps the frequency range of a quieter one, the quiet sound becomes masked, or indistinguishable. Florida's dolphins inhabit one of the most urbanized coastlines in the world and noise pollution is particularly common here.

Field experiments of this sort are not often attempted with marine mammals because they are extremely difficult. But experimental studies provide much clearer information than do observational ones. This project was made possible by the skill of the SDRP research staff and by the high-quality tools with which they can work. And thanks to SDRP's long-term research program with the dolphins of Sarasota Bay, we were able to gain much greater insight than would have been possible had we worked in another location. There is no other population of dolphins in the world where the sexes, ages, pedigrees, health statuses, reproductive histories, and association patterns of so many individuals are known. This research received funding support from the Taylor Foundation, the Oak Fund, the U.S. Environmental Protection Agency, and DBRI. My co-authors and I presented the results of this research at the 15th Biennial Conference on the Biology of Marine Mammals in Greensboro, NC in December. We are also preparing a manuscript for publication in a peer-reviewed scientific journal.

## Assessing the Trophic Ecology of Sarasota Bay Dolphins using Conventional Analyses and Stable Isotopes

*By Nélio Barros, PhD, Peggy Ostrom, PhD, and Randall Wells, PhD*

The movements and distribution of a predator are generally thought to reflect those of its prey, both in space and time. To better understand the trophic ecology of bottlenose dolphins in the Sarasota Bay area we used conventional (stomach content analyses) and novel technology (stable isotopic analyses), in addition to long-term behavioral observations of feeding. Analyses of stomach contents of stranded dolphins of known feeding history revealed a diet composed primarily of fish, most of which were associated with seagrass beds. We found a close agreement between the species represented in the diet and the observed feeding behaviors of resident dolphins. Dolphins in this area usually feed alone or in small groups in shallow, vegetated habitats. We applied stable isotopic techniques to reconstruct the dietary history of dolphins in Sarasota Bay and adjacent areas. Thus, isotopic signatures of carbon and nitrogen were obtained from available tissues of predators (dolphin teeth from the Mote Marine Lab specimen collection) and their main prey fish (pinfish, pigfish, spot, mullet). Comparisons of carbon isotopic ratios in tissues of dolphins and fish prey indicate that seagrasses and associated vegetation provide important feeding habitats for dolphins in Sarasota Bay. Trophic comparisons using nitrogen isotopic ratios in dolphins and fish also confirm the importance of particular species in the diet of dolphins. In addition, we found that dolphins of older ages had enriched carbon isotopic values and depleted nitrogen values, possibly an indication of ontogenetic shifts in diet or an exploration of different sites during foraging.



## Earthwatch Dolphin Monitoring Program 2002-2003

*By Sue Hofmann*

We have just completed our 22nd year of monitoring of the Sarasota dolphin community with the support from Earthwatch volunteers. The Sarasota bottlenose dolphin community is the most thoroughly known free-ranging dolphin population under study 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 the distribution, social and reproductive patterns of these animals.

Photo-identification surveys were conducted on 103 days during monthly survey sessions from October 2002 through September 2003 with the assistance of 40 Earthwatch volunteers from 20 states and 4 countries. These volunteers contributed over 3,200 hours to our project.

We had 683 group sightings that totaled 2,484 dolphins (including resighted animals). Our average numbers of sightings per day and dolphins per sighting have remained fairly constant throughout the past several years. We averaged nearly 7 sightings per day with just under 4 dolphins per sighting during the most recent year. During 2002-2003, we had a high of 17 sightings in one day during an October 2002 survey and a high of 58 dolphins during that same October day. During this same time period, our annual average of the number of dolphins sighted per day was slightly higher, at 24.2, than in the previous four years (which averaged 22.1 dolphins/day).

We were able to document the births of three new calves during the spring/summer of 2003 while monitoring the Sarasota dolphin community. One of these calves belonged to "Palm", an animal that we know from southern Tampa Bay. She was first sighted in early June in the northern region of our study area and stayed in the area for several months while associating with members of the Sarasota community. The other two calves belonged to Murphy Brown and Rose. These calves were the second-born for each mom. In addition, Sandy delivered a stillborn fetus, but this was the result of a ruptured uterus from an apparent stingray barb puncture. Her first calf, Remo, now three, is still in the area. Rose's first calf, Bud, now five years old, continues to be seen often. All ten of the 2002 calves that survived into 2003 are thriving as of this writing.

Since June 2002, six new animals have been freeze-branded. We have freeze-branded three young females and one young male who might be grown calves of known Sarasota females. These animals would have become independent before they were distinctively marked, and we are awaiting genetics testing to determine their parentage. We also freeze-branded a female and her calf that were first sighted in the study area in August 2002.

During the past year, we lost three members of the community, including Sandy's fetus. Sandy, a 12-year-old female, died in June 2003, probably from complications resulting from a stingray barb that punctured her body cavity. Genie, a 29-year-old female known since 1976 died in February 2003. Through our Earthwatch-sponsored surveys, we have accounted for 90% of the dolphins that use Sarasota Bay on a regular basis (see Table). As of October 2003, the number of dolphins regularly using the Bay and surrounding waters stands at approximately 150 animals.

Once again, we would like to thank all of our Earthwatch volunteers for your interest in and support of the Sarasota Dolphin Research Program.

## Sarasota Dolphin Status in 2003

| FEMALES | | EVENT | MALES | | EVENT |
|---|---|---|---|---|---|
| 1 | Sandy | Died 11Jun03 | 2 | Son of FB 59 | |
| 3 | Daughter of FB 19 | | 6 | Son of FB 71 | |
| 5 | FB 5 | | 10 | Petey | |
| 7 | Lightning | | 14 | Jack | |
| 9 | Pumpkin | | 20 | Perry | |
| 11 | Merrily | | 26 | Norman | Not IDed in 2002, 2003 |
| 13 | 47LA | | 28 | FB 28 | |
| 15 | Nicklo | | 32 | Son of FB 5 | Not IDed in 2003 |
| 17 | FB 17 | | 36 | B-8 | |
| 25 | FB 25 | | 44 | R | |
| 27 | Moonfin Look-alike | | 46 | FB 46 | |
| 33 | Saida Beth | | 48 | Jimmy Durante | |
| 35 | Squiggy | | 58 | Ken | |
| 43 | Cathy | | 66 | Otter | |
| 54 | FB 54 | | 76 | Racing Stripe | |
| 55 | Daughter of FB 5 | | 78 | Riptorn | |
| 59 | Genie | Died 20Feb03 | 92 | Lasagna | |
| 63 | Ms. Mayhem | | 94 | Sparks | |
| 65 | Tramp | | 100 | Scythe Fin | |
| 73 | Tag 51 | Not IDed in 2003 | 102 | Scoopnick | Not IDed in 2003 |
| 75 | Pup | | 106 | 3NIK3 | |
| 79 | FB 79 | | 108 | 3NIK | |

| FEMALES | | EVENT |
|---|---|---|
| 83 | Jagged Mama | |
| 84 | Mama Mia | Not IDed in 2003 |
| 87 | Squarenotch | |
| 90 | Killer | |
| 93 | Daughter of FB 35 | |
| 99 | FB 99 | |
| 101 | Rose | Had a YOY in 2003 |
| 105 | 43LA | Not IDed in 2002, 2003 |
| 109 | Scooter | |
| 113 | Lizzie | |
| 117 | FB 117 | Not IDed in 2003 |
| 119 | Bobby Jo | |
| 123 | Daughter of FB 15 | |
| 125 | Daughter of RP 27 | |
| 127 | Daughter of FB 13 | |
| 131 | Claire | |
| 133 | Bobbitt; daughter of Killer | |
| 135 | Daughter of FB 54 | |
| 137 | Daughter of Pecan Sandie | |
| 139 | Remo | |
| 141 | Big Shout | |
| 149 | FB 149 | |
| 151 | Daughter of Big Shout | |
| 153 | Blacktip Doubledip | |
| 155 | Murphy Brown | Had a YOY in 2003 |
| 157 | Pecan Sandie | |
| 159 | FB 159 | |
| 163 | LA94 | |
| 165 | FB 165 | First IDed Feb 2003 |
| 167 | Mom of FB 171 | First IDed Aug 2002 |
| 169 | FB 169 | First IDed Feb 2003 |
| 171 | Calf of FB167 | First IDed Aug 2002 |
| 175 | Daughter of FB 75 | |
| 183 | Tri A | |
| 210 | FB 210 | |
| BRDO | Bardot | |
| DRSN | Dr. Strangenotch | |
| FTTP | Fattop | |
| 49LA | 49LA | |
| JOSE | Jose | |
| SBDO | Scooby Doo | Not IDed in 2003 |
| SHTC | Shortcut | |
| WAND | Wanda | |
| ZRBA | Zorba | |
| **UNKNOWN GENDER** | | |
| CWM3 | 1991 calf of WTMA | new mom in '03? |
| C354 | 1992 calf of FB 35 | |
| C991 | 1994 calf of FB 99 | |
| 49C4 | 1995 calf of 49LA | |
| C871 | 1996 calf of FB 87 | |
| IKN2 | 1997 calf of IKNO | |
| JOSC | 1997 calf of JOSE | |
| SBDC | <1998 calf of SBDO | Not IDed in 2003 |
| C596 | 1998 calf of FB59 | Independent/ indistinct |
| C835 | 1998 calf of FB 83 | |
| 1833 | 1998 calf of FB 183 | |
| C273 | 1999 calf of FB27 | Independent/ indistinct |
| C653 | 1999 calf of FB 65 | |
| C756 | 1999 calf of FB75 | Independent/ indistinct |
| 1312 | 1999 calf of FB131 | Independent/ indistinct |
| 1536 | 1999 calf of FB153 | Probably died Apr 2003 |
| CCL6 | 1999 calf of FB111 | Independent/ indistinct |
| ZRBC | 1999 calf of ZRBA | |

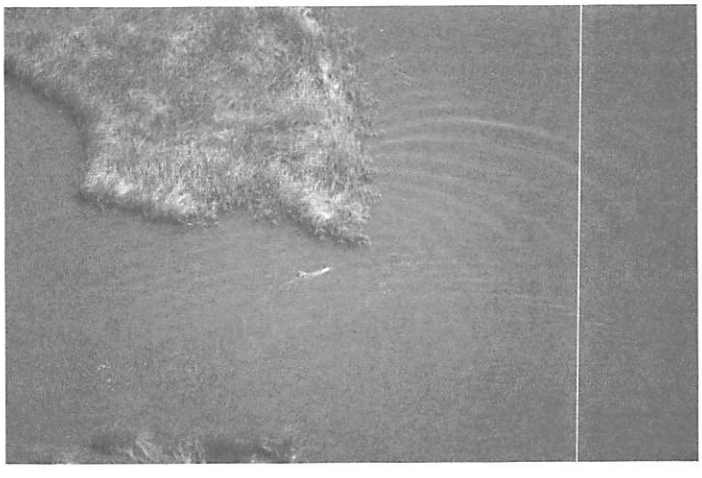
| MALES | | EVENT |
|---|---|---|
| 110 | FB 110 | |
| 114 | FB 114 | |
| 118 | Casper, Son of FB 54 | |
| 126 | FB 126 | |
| 128 | Son of FB 153 | |
| 130 | FB 130 | Not IDed in 2002, 2003 |
| 132 | FB 132 | Not IDed in 2002, 2003 |
| 134 | Mr. Natural | |
| 136 | Sawblade | |
| 138 | Son of FB 63 | |
| 142 | FB 142 | |
| 146 | Son of FB 11 | |
| 148 | Son of FB 54 | |
| 154 | RT-3 | |
| 160 | FB 160 | |
| 162 | FB 162 | |
| 164 | FB 164 | |
| 174 | TNLV | |
| 176 | FB 176 | |
| 178 | pi; son of FB 9 | |
| 180 | HSM2 | |
| 182 | Son of FB 183 | |
| 184 | Son of FB 149 | |
| 186 | Famous Amos | Not IDed in 2002, 2003 |
| 188 | Noah | |
| 190 | Son of Fattop | |
| 194 | Pair 'O Nicks | |
| 196 | Bud | |
| 198 | Son of FB 25 | |
| 200 | FB 200 | |
| 214 | Squash; son of Pumpkin | |
| 218 | Son of FB 55 | |
| 220 | Son of Lightning | |
| 222 | FB 222 | First IDed Aug 2002 |
| C834 | Pokey | |
| RY 34 | RY 34 | |
| **UNKNOWN GENDER** | | |
| C932 | 2000 calf of FB 93 | |
| C992 | 2000 calf of FB 99 | |
| 1493 | 2000 calf of FB 149 | |
| CSH3 | 2000 calf of SHTC | |
| BRD3 | 2001 calf of BRDO | |
| CRP2 | 2002 calf of RP 27 | |
| FTT2 | 2002 calf of FTTP | |
| WAN2 | 2002 calf of WAND | |
| C094 | 2002 calf of FB 9 | |
| C112 | 2002 calf of FB 11 | |
| C255 | 2002 calf of FB 25 | |
| C274 | 2002 calf of FB 27 | |
| C337 | 2002 calf of FB 33 | |
| C757 | 2002 calf of FB 75 | |
| 1751 | 2002 calf of FB 175 | |
| C012 | 2003 calf of FB 1 | Stillborn fetus June 2003 |
| 1012 | 2003 calf of FB 101 | |
| 1552 | 2003 calf of FB 155 | |
| IBMP | Indent Bumps | |
| MPTB | Mid Pointy Bucks | |
| "ped notches" | | First IDed 1999 |
| PILA | pi Look-alike | First IDed 2001 |
| PITA | Pain in the "butt" | First IDed 2000 |
| RIFF | Riff | First IDed 2001 |
| SOLB | Scoops Over Low Buck | |
| YORI | Yorick | |

# DOLPHIN RESCUES, RELEASE, AND FOLLOW-UP MONITORING

Over the last 33 years, the staff and associates of the Sarasota Dolphin Research Program have acquired specialized expertise and resources for the safe capture, handling, and tracking of dolphins. We are frequently called upon to provide advice or assistance with dolphins that are in need of help, often as a result of human interactions. In the Sarasota Bay area, we work closely with the Mote Marine Laboratory Stranding Investigations Program of Mote's Center for Marine Mammal and Sea Turtle Research and with the dolphin hospital that I and my colleagues established at Mote in the early 1990's (now supported and operated by Mote Aquarium). During 2003, we consulted with NOAA Fisheries on a number of stranding, rehabilitation, and release cases, and we participated in three rescue/release cases along the west coast of Florida, all of which have apparently been successful. Though there is little or no financial support specifically for these often-expensive rescue operations, we consider such efforts to be a priority application of our abilities and resources, especially when they are made necessary by human interactions.

**"CR"**

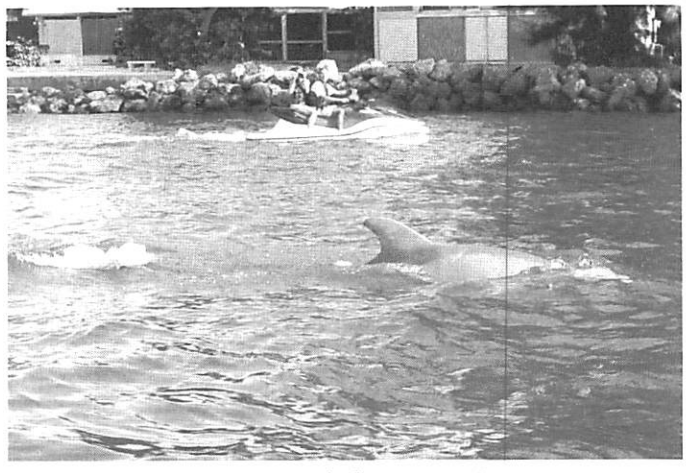
This young male dolphin was brought from Crystal River to Mote's Dolphin and Whale Hospital by staff of the FWC's Florida Marine Research Institute. The animal had spent several weeks in the fresh water of the river and had developed severe skin lesions as a result. Once these and associated problems were resolved, we tagged him with a small VHF radio transmitter and worked with hospital staff to release him offshore of the mouth of Crystal River. We tracked him over the next 2 days as he returned to the marshy areas as well as using Gulf waters, and interacted with other dolphins. Over the next month, SDRP research assistant Brian Balmer continued to track CR from an aircraft, and he remained in the same general area. When we observed him from a boat one month after release, he appeared to be in good condition.



*Dolphin "CR" (center) following a mother and calf in the marshes near Crystal River, photographed from the tracking plane.*

**"Casper"**

On October 26th, Mote's Stranding Investigations Program received a series of reports of a dolphin trailing a crab float and line. Upon investigation, Nélio Barros and Jim Grimes confirmed that the animal was FB118, Casper, an 11-year-old Sarasota Bay resident. Using the program's personal watercraft, they attempted to approach the animal, but he was swimming strongly, diving well, and avoided approaches. SDRP teams were mobilized the next day to search for Casper, but we were unable to locate him before increasing winds sent us back to the lab. Because the gear had been observed on the animal for an entire day, the SDRP decided to deploy a capture-release team to remove the gear and evaluate the animal. On October 28th, the team of 4 vessels and 26 people was unable to locate the animal during 1 ½ hours of searching before an approaching squall drove us back to the lab. The next morning the capture-release team located Casper and determined that he had successfully shed the gear. He was with other animals in his normal home range, within about ½ mile of where he had become entangled in the gear.



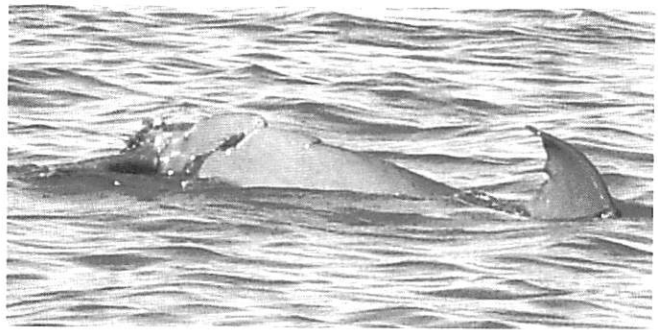
*Casper towing crab float in Big Pass.*

**Placida Harbor Dolphin Calf**

Mote's Stranding Investigations Program responded to reports from local ferry operators of a small dolphin in Placida Harbor suffering from deep wounds on its tail apparently made by a boat propeller, with monofilament fishing line trailing from these wounds. Photographs showed that the fishing line was embedded in the boat propeller wounds, aggravating them and causing bleeding and interfering with healing. Subsequent observations two days later led staff to conclude that the animal was not going to shed the fishing line on its own.

Two days later, on November 14th, a rescue team coordinated by the Sarasota Dolphin Research Program, including 20 biologists, Mote veterinary staff, and trained dolphin handlers was deployed to the harbor on four vessels, to try to briefly capture the dolphin to remove the gear. The dolphin was found in Placida Harbor by about 10:00 in the morning, but the calf and her mother swam out Gasparilla Pass

and did not return to the harbor until late afternoon. At 4:30, the yearling female finally swam into shallow water, where local commercial fisherman and long-time dolphin program collaborator Larry Fulford deployed a small circle of net around the animal. The team worked quickly to clear the fishing line from the animal, remove necrotic tissue, administer an antibiotic, and release it so it could return to its mother. The approximately 10 lb test fishing line was deeply embedded in the flukes and wounds on the tail stock, with tissue growing around it, and there was serious concern about infection. Fortunately, blood values indicated that the animal was not suffering from a major infection. The dolphin was observed on several occasions over the next week, with its mother, engaged in normal behaviors and swimming well.



*Female dolphin calf in Placida Harbor with propeller wounds, fishing line embedded in the wounds, and algae caught in the fishing line.*

## SARASOTA DOLPHIN RESEARCH PROGRAM INVOLVEMENT IN OTHER DOLPHIN STUDIES

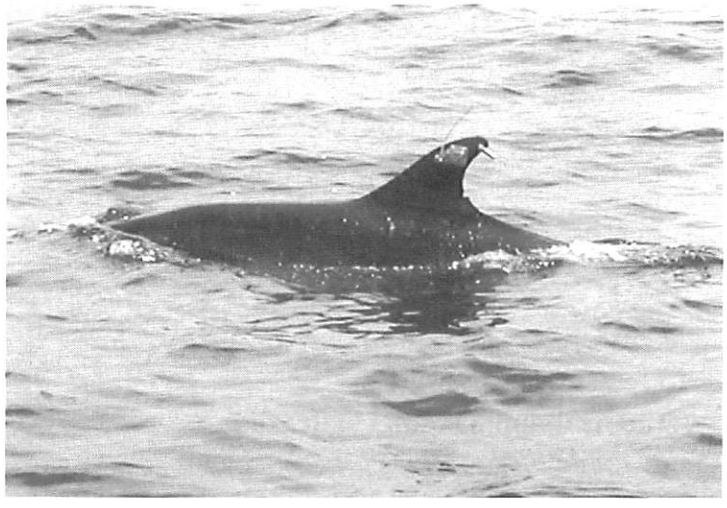
### Bermuda Dolphin Tracking Project

*By Leigh Klatsky, MSc student, Dolphin Quest*

Recent sightings of bottlenose dolphins around the island of Bermuda, and the first recorded stranding in February 2003, made it possible to initiate the first-ever study of offshore bottlenose dolphins in this area. This study incorporated satellite-linked radio telemetry to observe the movements and dive behavior of bottlenose dolphins in a deep-water oceanic environment. In June 2003, SDRP staff members Randall Wells and Brian Balmer joined me in Bermuda to participate in the capture, sampling, tagging, and release of three bottlenose dolphins.

Location information was received for a total of 45 days from one female, seven days from one male, and five days from another male. For the majority of the tracking period, all three dolphins stayed within close proximity to the 100 and 1000 fathom contour lines around the island of Bermuda and the two submerged seamounts located 19 and 32 kilometers to the southwest of the island. Time-depth recorders located on the satellite tags recorded dives to depths greater than 500 meters, mostly at night – these are the deepest dives ever reported for wild bottlenose dolphins, and they are consistent with the long dive durations (> 5 minutes) and high hematocrit values recorded during the study.

This study has provided baseline information about the habitat use and dive behavior of bottlenose dolphins residing in the deep waters around Bermuda during the summer months. We also obtained samples for genetic and contaminant analyses for comparison with those from the Sarasota Bay dolphins. Future research plans include continuation of this study to investigate seasonal variations in behavior and possible alternative tagging deployment strategies. Funding and support for this project was provided by Dolphin Quest, with additional support from the Bermuda Zoological Society and the Chicago Zoological Society.



*Bottlenose dolphin off Bermuda, with satellite-linked dive recording transmitter and VHF transmitter.*

## Radiotracking Study of Franciscana Dolphins in Argentina Planned in Collaboration with Wildlife Trust Project

*By Randall Wells, PhD*

Franciscana dolphins are among the smallest and least-known dolphins in the world. They inhabit the coastal waters of Brazil and Argentina, where they are subject to high levels of mortality in fishing nets. Wildlife Trust project leader Pablo Bordino, a biologist, has been studying franciscana dolphins for many years off the coast of Argentina. He has made great strides working with fishermen to reduce bycatch of these dolphins in their nets, but much work remains to be done. Little is known about population structure or movement patterns – information that is critical for evaluating impacts and protection measures for these animals. These dolphins lack the distinctive natural markings that would allow photographic identification. Radiotracking offers one potential means of addressing these questions. Wildlife Trust sent Randall Wells to work with Bordino in September to identify possible sites and methods for capture, tagging and release. Fieldwork for deploying tags and tracking is scheduled for March 2004 and will include a highly experienced capture, tagging, and tracking team from the Sarasota Dolphin Research Program.

*Franciscana dolphin off Argentina, photographed by Wildlife Trust Project Leader, Pablo Bordino.*

## Tucuxi Dolphin Studies in Brazil

*By Paulo Flores, PhD*

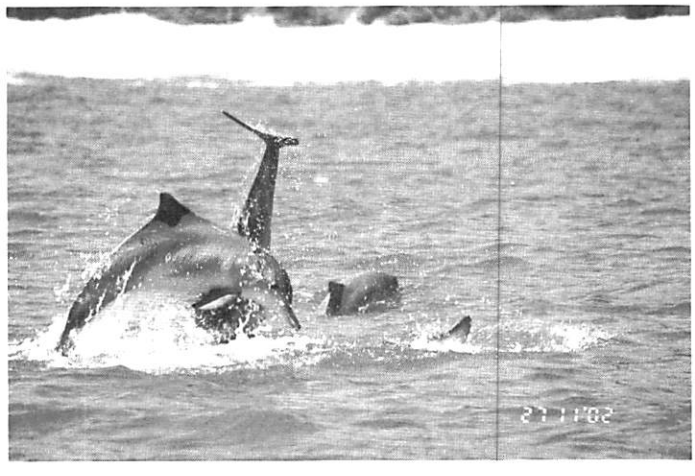
With assistance from Randall Wells, we continue the long term monitoring of the tucuxi dolphin (*Sotalia fluviatilis*) population in and around the Environmental Protection Area of Anhatomirim (EPAA), Baia Norte, southern Brazil. Started in 1991, this is one of the longest ongoing research projects on this species in its marine habitat. The research focuses on the species' southernmost population located within a national protected area established in 1992 to protect these dolphins. Specific objectives include: to follow site fidelity, residency and home ranges; estimate population abundance and trends; evaluate habitat through water, sea bottom, and coastline characteristics; analyze dolphin behavior patterns and habitat use; characterize social structure; evaluate man made direct impacts. Through this scientific information, we help to keep improving conservation policy for the species in the area. For example, one of my undergraduate students (Mariana Pereira) is looking at dolphins' behavioral reactions to tourism boats. Tucuxis have shifted their distribution over the years and we are proposing a buffer zone in response to this apparent trend.

We receive Earthwatch volunteers in eight teams a year. Volunteers work as a team to locate dolphins and take data on their group composition, behavior, and the local habitat. Back on shore, they help process ID photos, enter data, and maintain equipment. Please see more at http://www.earthwatch.org/expeditions/flores.html

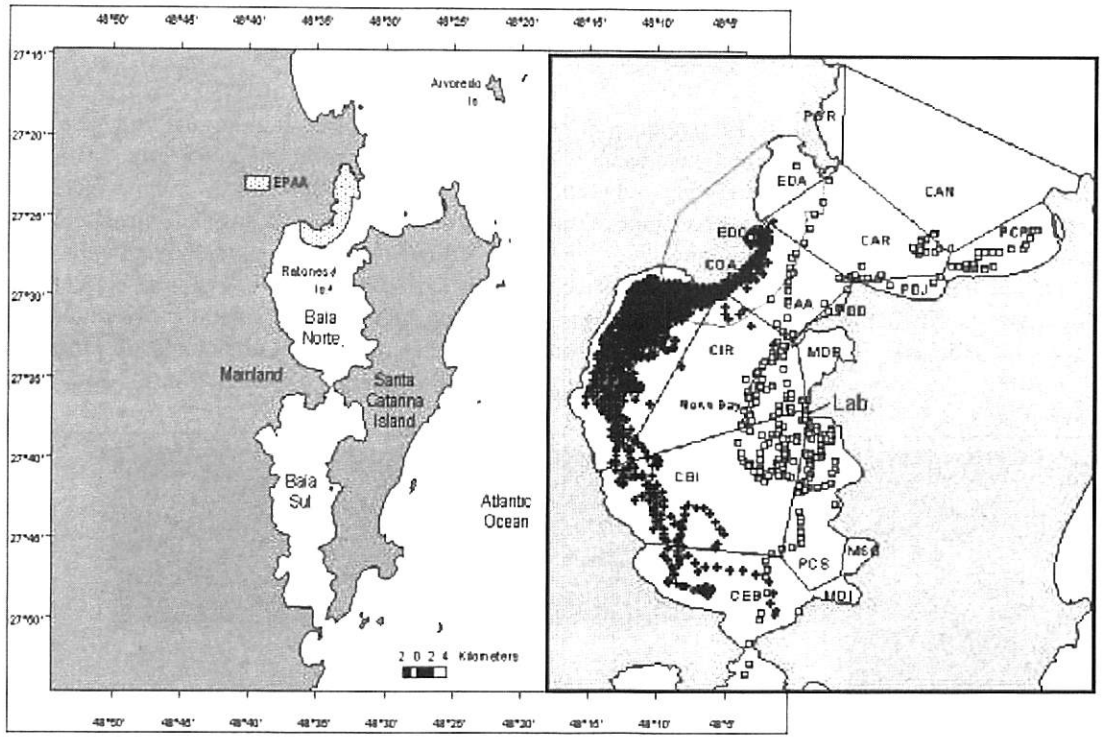
Additionally we are collecting similar data on the bottlenose dolphins in the area and finding intriguing results which lead to more questions and research. The bottlenose dolphins and tucuxi dolphins use very different parts of the bay (see map). Part of the results of the 10 years of research was presented as my Ph.D. dissertation last August, with Dr. Wells on the committee.

In addition to our ongoing efforts, plans for the marine tucuxi study for next year include genetic evaluation of this population based on existing samples from stranded tucuxi recovered from the study area to assess population structure and distinctiveness. To help this we also will be starting a biopsy sampling program, which will allow a better look at social structure. We are expanding our study area to the North and South for assessing distribution and occurrence as well as individual movements to help refine our population distinctiveness model. Additionally, we will have a Ph.D. candidate on dolphin behavior patterns and habitat use (Mariel Bazzalo, associate researcher).

Funding for this work has been provided by Earthwatch Institute, Cetacean Society International and the Humane Society of the United States. Logistical support is from the Aquaculture Laboratory of Universidade Federal de Santa Catarina and Chicago Zoological Society.



*Socializing tucuxi dolphins in Brazil.*




*Field site for tucuxi studies in Brazil, showing details of sightings of tucuxis (+) and bottlenose dolphins (▫) in Baia Norte.*

## Distribution, Habitat Use and Abundance of Tucuxi Dolphins along the Caribbean Coast of Colombia

*By Salomé Dussán, MSc*

Marine tucuxi (*Sotalia fluviatilis*) have been catalogued in Colombia as an endangered species. Some of the threats to the Colombian marine populations are: isolation and displacement caused by loss of habitat, regional changes in prey abundance due to overfishing, incidental catches in fishing gear and possible water contamination. The main goal of this long-term research is to evaluate the distribution, habitat use and relative abundance of tucuxi in the Gulf of Morrosquillo, Colombia, in search for guidelines for the future management and conservation of this species and its habitat.

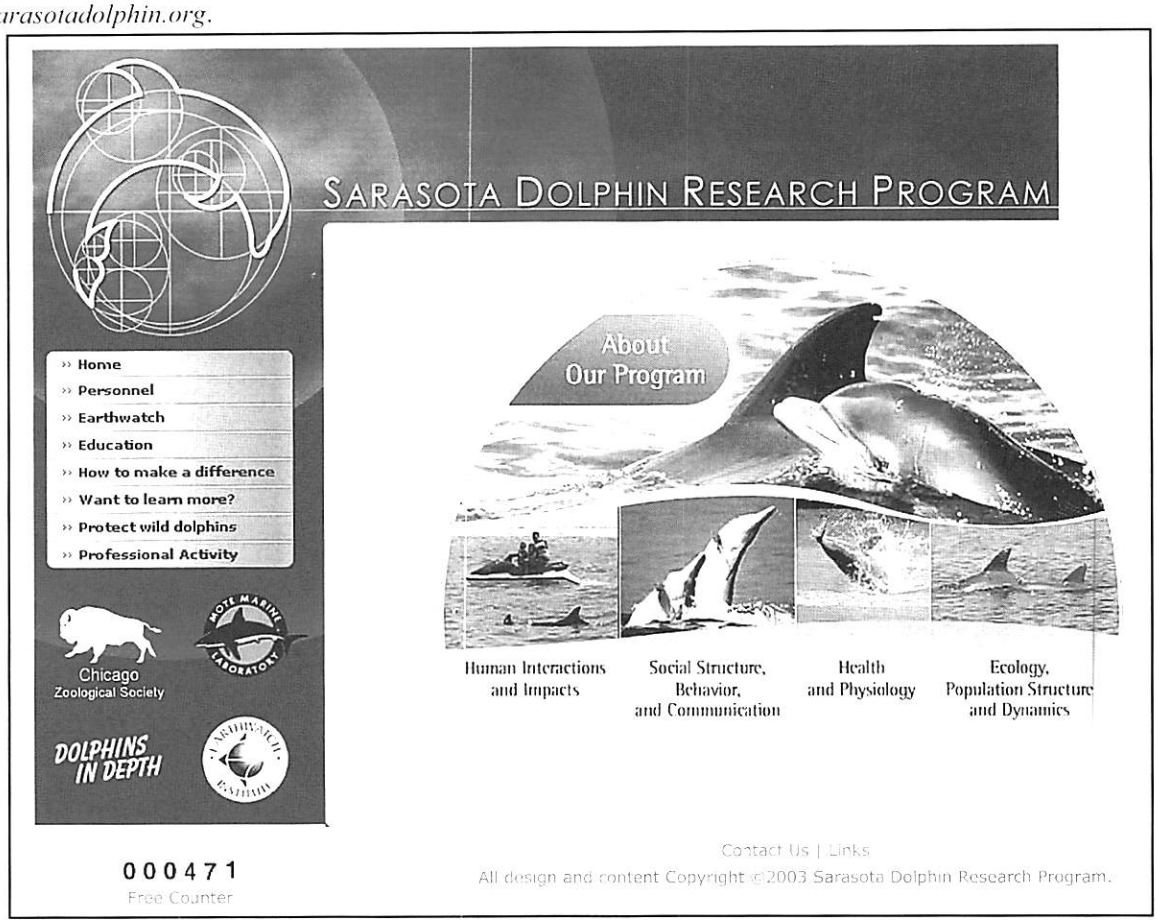
In November 2002 and March through August 2003, field data on this species were collected in the Morrosquillo area. The data included environmental conditions, group size, structure and behavior, geographic information (GIS) and photographic data of the dolphins' dorsal fins. The results of this study are being compared with the results of the previous studies conducted in the area by Avila in 1995. The preliminary analysis results of this study showed: a diminution in the rate of dolphins sightings per day from 3 sightings/day to 0.96 sightings/day, a change in the depth of the sightings from 5 m average to 11.7 m average, a different distribution of the tucuxi with a clear reduction in the use of the area adjacent to the Sinú's River mouth and a conglomeration of the dolphins sightings in specific sub-areas of the Gulf showing some habitat and use selection. These results suggest a change in the dolphins' habitat and habitat use, but the reasons behind these changes still are unclear. The photo-identification procedure has been challenging due to the evasiveness of the dolphins to the proximity of the research boat.

As part of the future plans of this study, field data will be collected from January to May 2004. In addition to the methodology that has been conducted, two new tasks will be added: linear transects will be made to determine the relative abundance of this species and aerial surveys will be performed to have a better idea of the general distribution of the tucuxi dolphins in the Gulf of Morrosquillo. At the end of 2004, after the analysis of the results, a management plan of this population will be presented to the Colombian government. This research is supported by CVS (Corporacion Regional de los Valles del Río Sinú y San Jorge, Colombia), Conservation International (Endangered Species Award), Chicago Board of Trade, Mote Marine Laboratory and Fundación Omacha, Colombia.

# SARASOTA DOLPHIN RESEARCH PROGRAM OPERATIONS

## New SDRP Website!

The Sarasota Dolphin Research Program is proud to announce the launch of our new website at *www.sarasotadolphin.org*. The redesigned site will help us to better disseminate the information generated by our program to scientific and general audiences in order to aid dolphin conservation efforts. The new website is easier to navigate and contains a comprehensive overview of current SDRP research projects ranging from human interactions and impacts to ecology and population dynamics. From the homepage, visitors can link to many of our affiliated organizations including Earthwatch Institute, Brookfield Zoo, and Mote Marine Laboratory. Special features include a link to Brookfield Zoo's "Dolphins in Depth" interactive game and a Professional Activity Summary page that includes our recent publications and presentations. We would like to thank web developer, Lincoln Anderson, of 352 Media Group for assisting us in the creation of our site and for providing us with discounted web hosting. We welcome any feedback or suggestions concerning our site. Please send comments to *info@sarasotadolphin.org*.




## Equipment Update

SDRP has finally taken the plunge! This past year we purchased five Nikon digital camera systems for the lab, thanks to the Disney Wildlife Conservation Fund and NOAA Fisheries. We tested the cameras early in the year with side-by-side shooting of digital and slide film and we were pleasantly surprised with the quality of the digital images. The new digital cameras traveled to Charlotte Harbor this past fall for their first large-scale field project. Kim Hull and her crew amassed over 7,000 digital images, demonstrating the value and utility of the systems. While we have just started with the cameras, our hope is that they will enable the lab to be more efficient both with matching fins and archiving data.

Boats and trucks are the essential components of our field research. We have been fortunate in being able to upgrade our research fleet in recent years, thanks to donations and support from NOAA Fisheries. This allowed us to retire two of our older vessels this year, *Makila* (30 years old) and *Hobo* (19 years old). These boats were originally donated to Dolphin Biology Research Institute, and they provided many years of exceptional service, facilitating a number of funded research projects as well as thesis and dissertation projects. The five boats that remain in the fleet are used regularly. During the past year we obtained a new Chevrolet pickup truck thanks to the generosity of Don and Lee Hamilton. This truck gives us the much-needed capability of launching and retrieving our largest vessels.

## Education

Education is 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 public presentations at Brookfield Zoo, Mote Marine Laboratory and elsewhere, articles and interviews, and through volunteering opportunities through Earthwatch Institute. In addition, John Reynolds and Randall Wells have recently published a book entitled, "Dolphins, Whales, and Manatees of Florida: A Guide to Sharing Their Waters." This inexpensive book, published in December 2003, is designed to fill a niche for teaching people about how to better appreciate and treat marine mammals in their environment.

In May 2003, Brookfield Zoo opened a new exhibit in the Underwater Viewing area of the Seven Seas Panorama. This exhibit, developed with federal support, allow visitors to participate in a virtual dolphin survey in Sarasota Bay, learning along the way about some of our research techniques and some of the conservation issues surrounding these animals. In 2004, Mote Marine Lab plans to open an Immersion Studios interactive experience that is based on our long-term dolphin research and conservation program.

Students at all levels are crucial elements of conservation. Through the encouragement of long-time program supporters and participants John and Ronnie Enander and Bill Scott, we are working with 5th grade teachers in Sarasota County on a program to educate students about dolphins and manatees, their needs, and how to treat them in the wild, through classroom visits by Randy Wells. In preparation for these classroom visits, each class is provided with free copies of Wells' book "Dolphin Man: Exploring the World of Dolphins."

For older students, education staff at Brookfield Zoo and Mote Marine Lab are working with us to develop curricula for distance learning programs on dolphins, taking advantage of our long-term datasets to develop student activities that mirror some of the ways the scientists address current research topics (see next article).

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, contact Andrea Davis at 941-388-4441). As described throughout the newsletter, graduate students come to our program through the University of California at Santa Cruz, Woods Hole Oceanographic Institution, the University of South Florida, and the University of North Carolina, Wilmington to conduct their thesis or dissertation research (10 doctoral dissertations and 16 master's thesis projects have been conducted in association with our program). We participate in college-level marine mammal courses, and provide supporting materials for these courses. We continue to host the annual summer MARVET marine mammal veterinary student course, now in its 6th year.

Our efforts to provide information to our colleagues and wildlife management agencies continue, through publication of numerous scientific articles, through invited presentations at scientific conferences such as the Biennial Conference on the Biology of Marine Mammals (at least 17 presentations at the December 2003 conference in Greensboro, NC resulted from our team's efforts), and through participation in national/international panels such as the Atlantic Scientific Review Group, the Working Group on Unusual Marine Mammal Mortality Events, the IUCN Cetacean Specialist Group, and the IUCN Reintroduction Specialist Group.

## The Secret Life of Dolphins Curriculum Is On Its Way!

*By Robin Dombeck, Brookfield Zoo*

As the year comes to a close, we are nearing completion of the much-anticipated Secret Life of Dolphins curriculum, based on the Sarasota Dolphin Research Program's research and findings. The SLD is a joint project of Brookfield Zoo and Mote Marine Lab, funded by the U.S. Department of Education. Developed for middle and high school classroom use, these materials will help students understand more about how scientists study dolphins and how that knowledge is applied, both in the wild and in zoos and aquariums.

The SLD curriculum package utilizes diverse media to encourage student learning. These include classroom teacher guided explorations, interactive data analysis software with mapping and graphing capability, videoconference sessions, and field trips. Classroom teachers have helped us develop the SLD content topics, which include dolphin physiology, dolphin social structure, study of the Sarasota Bay ecosystem, dolphin communication and dolphin diets. The teachers are also first testing the materials in which students will manipulate and analyze authentic data to answer questions, such as those being asked by marine mammal scientists.

The pilot materials for this unit will be completed in February 2004, with a teacher workshop slated for May 21 and 22. In the fall of 2004, workshop teachers will pilot the materials in their classrooms.

## Intern Perspective

*By Jane Bauer and Marissa Kakoyiannis, SDRP Interns*

During the first three weeks of our internship at the Sarasota Dolphin Research Project we participated in dolphin surveys in Charlotte Harbor, FL, where we were introduced to the techniques and methodologies employed in cetacean field research. The second month of our internship brought us up to Sarasota, FL, to the SDRP lab. We have since then been involved in entering and processing the data collected from Charlotte Harbor and Sarasota field surveys. Additionally, we have been learning the nuances of photo identification and have devoted much time to labeling and digitizing images to better facilitate the process of identifying dolphins. Our internship has also afforded us the opportunity to participate in a project examining the effects of bridge demolition on the marine environment, specifically on dolphins and manatees in Sarasota Bay.

The intern experience at SDRP has been a unique learning experience and opportunity to contribute to ongoing research efforts aimed at understanding the community structure and dynamics of bottlenose dolphins. If you're interested in volunteering or interning for the Sarasota Dolphin Research Program, please contact Andrea Davis, adavis@mote.org, the Volunteer/ Intern coordinator at Mote Marine Laboratory.

## 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.

## Manuscripts In Press, In Revision, or In Review

Wells, R.S., H.L. Rhinehart, L.J. Hansen, J.C. Sweeney, F.I. Townsend, R. Stone, D. Casper, M.D. Scott, A.A. Hohn, and T.K. Rowles. In press. Bottlenose dolphins as marine ecosystem sentinels: Developing a health monitoring system. Ecology and Health 1 (suppl. 1).

Wells, R.S. In press. Dolphins (Delphinidae). Pp. xxx-xxx *In:* Grzimek's Animal Life Encyclopedia. The Gale Group, Farmington Hills, MI.

Nowacek, S.M., R.S. Wells, D.P. Nowacek, E.C.G. Owen. T.R. Speakman, and R.O. Flamm. In press. Manatee behavioral responses to vessel approaches. Biological Conservation.

Schwacke, L., R.S. Wells, et al. In press. Geographic variation in polychlorinated biphenyl and organochlorine pesticide concentrations in the blubber of bottlenose dolphin from the U.S. Atlantic coast. Science of the Total Environment.

Watwood, S.L., P.L. Tyack, and R.S. Wells. In press. Whistle sharing in paired male bottlenose dolphins, *Tursiops truncatus*. Behavioral Ecology and Sociobiology.

Hill, M.L., L.S. Sayigh, J. Blum, and R.S. Wells. In press. Signature whistle production in undisturbed free-ranging bottlenose dolphins (*Tursiops truncatus*). Proceedings B: Biological Sciences.

Watwood S.L., E.C.G. Owen, R.S. Wells, and P.L. Tyack. In revision. Signature whistle use by free-swimming and temporarily restrained bottlenose dolphins. Animal Behaviour.

Fripp, D., C. Owen, E. Quintana-Rizzo, A. Shapiro, K. Buckstaff, R.S. Wells, and P. Tyack. In revision. Bottlenose dolphin calves model their signature whistles on the whistles of community members they rarely hear.

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.

Fazioli, K.L., S. Hofmann, and R.S. Wells. In review. Use of coastal Gulf of Mexico waters by distinct assemblages of bottlenose dolphins, *Tursiops truncatus*. Marine Mammal Science.

Sayigh, L.S., L.E. Williams, R.S. Wells, and A.A. Hohn. In review. Modifications of signature whistles in adult female bottlenose dolphins. Submitted to Animal Behavior.

Buckstaff, K.C. In review. Effects of watercraft noise on the acoustic behavior of bottlenose dolphins, *Tursiops truncatus*, in Sarasota Bay, Florida. Submitted to Marine Mammal Science.

Gannon, D.P. and D. M. Waples. Submitted. Food Habits of Coastal bottlenose dolphins from the Mid-Atlantic Coast of the U.S. Submitted to Marine Mammal Science.

Gannon, D.P., N.B. Barros, D.P. Nowacek, A.J. Read, D.M. Waples, and R.S. Wells. Prey detection by bottlenose dolphins (*Tursiops truncatus*): an Experimental test of the passive listening hypothesis. Submitted to Animal Behavior.

## Peer-reviewed Journal Articles and Book Chapters

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. Pp. 32-56 *In:* F.B.M. de Waal and P.L. Tyack, eds., Animal Social Complexity: Intelligence, Culture, and Individualized Societies. Harvard University Press, Cambridge, MA.

Wells, R.S., T.K. Rowles, A. Borrell, A. Aguilar, H.L. Rhinehart, W.M. Jarman, S. Hofmann, A.A. Hohn, D.A. Duffield, G. Mitchum, J. Stott, A. Hall, and J.C. Sweeney. 2003. Integrating data on life history, health, and reproductive success to examine potential effects of POPs on bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Organohalogen Compounds 62:208-211.

Harper, C.G., M.T. Whary, Y. Fang, H.L. Rhinehart, R.S. Wells, S. Xu, N.S. Taylor, and J.G. Fox. 2003. Comparison of diagnostic techniques for detecting *Helicobacter cetorum* infection in wild Atlantic bottlenose dolphins (*Tursiops truncatus*). Journal of Clinical Microbiology 41:2842-2848.

Nowacek, D.P., B.M. Casper, R.S. Wells, S.M. Nowacek, and D.A. Mann. 2003. Intraspecific and geographic variability of West Indian manatee (*Trichechus manatus* spp.) vocalizations (L). J. Acoust. Soc. Am. 114(1):66-69.

## Theses and Dissertations

Owen, E.C.G. 2003. The reproductive and ecological functions of the pair-bond between allied, adult male bottlenose dolphins, *Tursiops truncatus*, in Sarasota Bay, Florida. Ph.D. dissertation, Ocean Sciences Department, University of California, Santa Cruz

Watwood, S.L. 2003. Whistle use and whistle sharing by allied male bottlenose dolphins (*Tursiops truncatus*). Ph. D. dissertation, Massachusetts Institute of Technology and Woods Hole Oceanographic Institution, Woods Hole, MA. 227 pp.

Flores, P.A.C. 2003. Ecology of the marine dolphin (*Sotalia fluviatilis*) in southern Brazil. Ph.D. dissertation. Pontificia Universidade Católica do Rio Grande do Sul.

Buckstaff, K.C. 2003. Effects of watercraft noise on the acoustic behavior of bottlenose dolphins, *Tursiops truncatus*, in Sarasota Bay, Florida. M.Sc. thesis, University of California, Santa Cruz. 37 pp.

Gannon, D.P. 2003. Behavioral Ecology of an acoustically mediated predator-prey system: bottlenose dolphins and sciaenid fishes. Ph.D. Dissertation, Duke University, Durham, N.C. 244 pp.

## Popular Articles, Books

Reynolds, J.E., III, and R.S. Wells. 2003. Dolphins, Whales, and Manatees of Florida: A Guide to Sharing Their World. University Press of Florida.

## Presentations at Professional Meetings

Wells, R.S. 2003. Biology and conservation of bottlenose dolphins – perspectives from long-term research. Keynote Address, MARCUBA, 5 December 2003, Havana, Cuba.

Wells, R.S. 2003. Caring for and caring about bottlenose dolphins – perspectives from 33 years of collaborative dolphin research. Keynote address, 31st Annual Conference of the International Marine Animal Trainer's Association, 19 November 2003, Long Beach, CA.

Wells, R.S., T.K. Rowles, A. Borrell, A. Aguilar, H.L. Rhinehart, W.M. Jarman, S. Hofmann, A.A. Hohn, D.A. Duffield, G. Mitchum, J. Stott, A. Hall, and J.C. Sweeney. 2003. Integrating data on life history, health, and reproductive success to examine potential effects of POPs on bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Dioxin 2003: 23rd International Symposium on Halogenated Environmental Organic Pollutants and POPs, 24-29 August, 2003, Boston, MA

Wells, R.S. 2003. The role of long-term study in bottlenose dolphin research and conservation. Symposium of Aquatic Mammals: Conservation and Research. 5 August 2003, Porto Alegre, Brazil.

Buckstaff, K.C. and R.S. Wells. 2003. Effects of watercraft noise on the acoustic behavior of bottlenose dolphins, *Tursiops truncatus*, in Sarasota Bay, FL. 1st International Conference on Acoustic Communication by Animals, Univ. of Maryland, 27-30 July, 2003. (poster).

Wells, R, T. Rowles, H. Rhinehart, S. Hofmann, G. Mitchum, W. Jarman, A. Borrell, A. Aguilar, A. Hohn, J. Sweeney, D. Duffield, and A. Hall. 2003. Integrating life history, health, and reproductive success data to examine potential relationships with organochlorine contaminants for bottlenose dolphins in Sarasota Bay, Florida. 15th Biennial Conference on the Biology of Marine Mammals. December 14-19, 2003, Greensboro, NC.

Barbieri, M.M., W.A. McLellan, R.S. Wells, S. Hofmann, and D.A. Pabst. 2003. An assessment of seasonal changes in the dorsal fin surface temperatures of free-ranging bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, FL, USA. 15th Biennial Conference on the Biology of Marine Mammals. December 14-19, 2003, Greensboro, NC.

Gannon, D., N. Barros, D. Nowacek, A.Read, D. Waples, and R. Wells. 2003. Prey detection by coastal bottlenose dolphins: Testing the passive listening hypothesis. 15th Biennial Conference on the Biology of Marine Mammals. December 14-19, 2003, Greensboro, NC.

Hurst, G.E., D.A. Fauquier, N.B. Barros, J.F. Gorzelany, T.P. Lipscomb, M.J. Kinsel, and R.S. Wells. 2003. Bottlenose dolphin, *Tursiops truncatus*, strandings and mortality on the West Coast of Florida, 1985-2002. 15th Biennial Conference on the Biology of Marine Mammals. December 14-19, 2003, Greensboro, NC.

Barros, N. B., P.H. Ostrom, and R.S. Wells. 2003. Dietary reconstruction of bottlenose dolphins from central West Florida using stable isotope analyses. 15th Biennial Conference on the Biology of Marine Mammals. December 14-19, 2003, Greensboro, NC.

Buckstaff, K.C. and R.S. Wells. 2003. Effects of watercraft noise on the acoustic behavior of bottlenose dolphins, *Tursiops truncatus*, in Sarasota Bay, FL. 15th Biennial Conference on the Biology of Marine Mammals. December 14-19, 2003, Greensboro, NC.

Hill, M.L., R.S. Wells, and D.A. Mann. 2003. ABR hearing measurements in free-ranging bottlenose dolphins (*Tursiops truncatus*). 15th Biennial Conference on the Biology of Marine Mammals. December 14-19, 2003, Greensboro, NC.

Houde, M., R.S. Wells, K.R. Solomon, and D.C.G. Muir. 2003. Hydroxy-PCBs and perfluorinated acids in free-ranging bottlenose dolphins (*Tursiops truncatus*) from the Sarasota Bay, Florida. 15th Biennial Conference on the Biology of Marine Mammals. December 14-19, 2003, Greensboro, NC.

Klatsky, L., B. Hurley, M. Campbell, J. Sweeney, and R. Wells. 2003. New depths in research: Dolphin Quest's role in field research and conservation in Bermuda. 31st Annual Conference of the International Marine Animal Trainer's Association, 19 November 2003, Long Beach, CA.

Martien, K., A. Sellas, P. Rosel, B. Taylor, and R. Wells. 2003. Integration of genetic and behavioral data for bottlenose dolphin population unit definition. 15th Biennial Conference on the Biology of Marine Mammals. December 14-19, 2003, Greensboro, NC.

Meagher, E.M., W.A. McLellan, A.J. Westgate, R.S. Wells, and D.A. Pabst. 2003. Seasonal differences in heat flux across multiple body surfaces in wild bottlenose dolphins (*Tursiops truncatus*). 15th Biennial Conference on the Biology of Marine Mammals. December 14-19, 2003, Greensboro, NC.

Morrissette, C., L. Sayigh, and R.S. Wells. 2003. Quantifying stereotypy of bottlenose dolphin signature whistles. 15th Biennial Conference on the Biology of Marine Mammals. December 14-19, 2003, Greensboro, NC.

Owen, E., S. Watwood, R.S. Wells, and D. Duffield. 2003. Reproductive and ecological functions of adult male alliances in bottlenose dolphins, *Tursiops truncatus*, in Sarasota Bay, Florida. 15th Biennial Conference on the Biology of Marine Mammals. December 14-19, 2003, Greensboro, NC.

Rosel, P., A. Hohn, L. Hansen, A. Sellas, and R.S. Wells. 2003. Genetic analysis reveals complicated population structure for coastal bottlenose dolphins in the Western North Atlantic and Gulf of Mexico. 15th Biennial Conference on the Biology of Marine Mammals. December 14-19, 2003, Greensboro, NC.

Rowles, T.K., A.A. Hohn, R.S. Wells, L.J. Hansen, F.I. Townsend, H.L. Rhinehart, and J.T. Saliki. 2003. Evidence of susceptibility to morbillivirus in free-ranging populations of bottlenose dolphins from the United States Atlantic and Gulf of Mexico coasts. 15th Biennial Conference on the Biology of Marine Mammals. December 14-19, 2003, Greensboro, NC.

Sayigh, L., C. Morrissette, V. Janik, and R.S. Wells. 2003. Signature whistles of bottlenose dolphins: fact, not "fallacy". 15th Biennial Conference on the Biology of Marine Mammals. December 14-19, 2003, Greensboro, NC.

Watwood, S. E. Owen, R. Wells, and P. Tyack. 2003. Signature whistle use by free-swimming and temporarily Restrained Bottlenose Dolphins, *Tursiops truncatus*. 15th Biennial Conference on the Biology of Marine Mammals. December 14-19, 2003, Greensboro, NC.

Stott, J., M. Blanchard, C. Funke, T. Rowles, and R. Wells. 2003. Immunologic profile of free-ranging dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida, U.S.A. 15th Biennial Conference on the Biology of Marine Mammals. December 14-19, 2003, Greensboro, NC.

## Invited Public and University Lectures

| | |
|---|---|
| 15 Jul 2003 | Bottlenose dolphins and human interactions. NMFS Headquarters, Silver Spring, MD. |
| 8 May 2003 | Bottlenose dolphin conservation based on long-term behavior, ecology, life history, and health research. Biology of Marine Mammals course, University of California, Santa Cruz, CA. |
| 13 Jan 2003 | Dolphin family values. Monday Night at Mote, Mote Marine Laboratory, Sarasota, FL. |
| 9 Jan 2003 | Bottlenose dolphin conservation and long-term research along Florida's west coast. College of Veterinary Medicine, University of Florida, Gainesville, FL. |
| 9 Jan 2003 | The lives of Sarasota Bay's bottlenose dolphins. College of Veterinary Medicine, University of Florida, Gainesville, FL |

## How You Can Make a Difference

**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 Rescue Fund** — Because of our expertise and specialized gear, we are increasingly involved in rescuing dolphins suffering from human interactions. These rescues typically involve up to 4 vessels and 20 people, with direct field costs of about $1,000 per day, not including staff salaries. Tags for follow-up monitoring cost $250 for a VHF tag, and about $2,000 for satellite-linked location monitoring tags. These efforts currently have no source of support. We would like to establish a rescue fund of at least **$5,000** to make sure that we are able to provide the level of immediate response that can optimize our chances for success.

Contributions can be directed to our program through any of three not-for-profit organizations, Dolphin Biology Research Institute, Chicago Zoological Society, or Mote Marine Laboratory. Dolphin Biology Research Institute (IRS-EI#59:2288387) is a 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). Donations go almost entirely to offset research and education program expenses. During the most recent fiscal year, only 2% of funds received by DBRI were spent on fund-raising activities. No salaries were paid by DBRI to any of its Officers or Directors. The Chicago Zoological Society and Mote Marine Laboratory also have mechanisms for accepting funds specified for use by the "Sarasota Dolphin Research Program."

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

**Edward McCormick Blair, Jr.**
**William and Sandra Scott**
**William Spence**
**Tom and Anita Moxley**
**Disney Wildlife Conservation Fund**
**Disney's EPCOT - The Living Seas**
**Don and Lee Hamilton**
**Randy Puckett**
**Marletta Darnall**
**Indianapolis Zoo**
**Disney's Animal Kingdom**
**Dolphin Quest, Jay Sweeney and Rae Stone**
**Ronnie and John Enander**
**Stephen Bartram**
**Rosemary Laur**
**NOAA Fisheries**
**Mote Scientific Foundation**
**Harbor Branch Oceanographic Institute's Protect Wild Dolphins Program**
**Earthwatch Institute/Center for Field Research**
**Cannons Marina, David and Lucille Miller**

### Staff During 2003

Randall S. Wells, Ph.D., Program Manager
Sue Hofmann, B.Sc., Field Coordinator
Stephanie Nowacek, M.Sc., Lab Manager
Kim Bassos-Hull, M.Sc., Research Associate
Howard Rhinehart, A.H.T., Veterinary Technician
Jason Allen, B.Sc., Field Research Assistant
Brian Balmer, B.Sc., Lab Research Assistant
Christine Craven, B.Sc., Technician
Aaron Barleycorn, B.Sc., Technician
Damon Gannon, Ph.D., Post-Doctoral Investigator
Douglas Nowacek, Ph.D., Post-Doctoral Investigator
Edward Owen, Ph.D, Post-Doctoral Investigator
Michael Scott, Ph.D., Secretary-Treasurer, DBRI
Blair Irvine, Ph.D., President, DBRI

### Contract Staff During 2003

Kim Urian, M.Sc., Research Associate
Kristi Fazioli, M.Sc., Research Associate
Kara Buckstaff, M.Sc., Research Associate

### Master's Students During 2003

Michelle Barbieri, University of North Carolina, Wilmington
Meghan Bolen-Pitchford, University of California, Santa Cruz
Kara Buckstaff, University of California, Santa Cruz
Virginia Fuhs, Western Illinois University
Leigh Klatsky, San Diego State University
Jessica Weiss, Duke University

### Doctoral Students During 2003

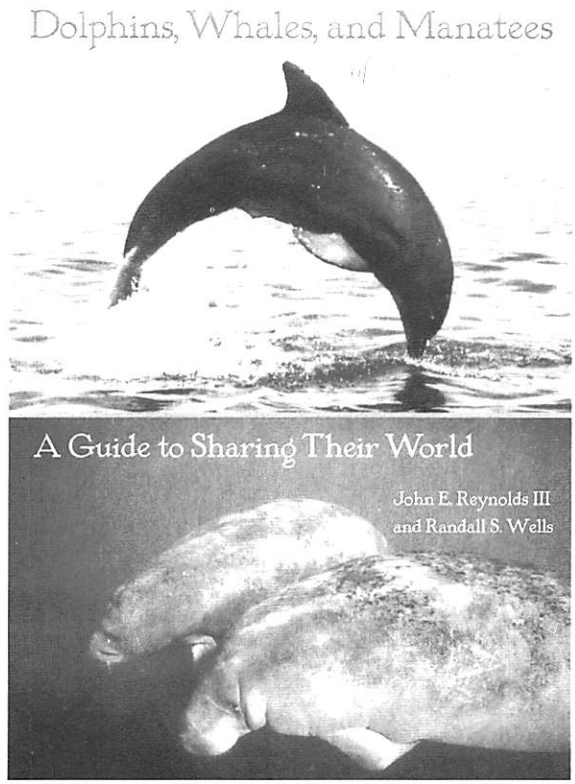
Spencer Fire, University of California, Santa Cruz
Paulo Flores, Pontificia Universidade Católica do Rio Grande do Sul.
Mandy Hill, University of South Florida
Magali Houde, University of Guelph
Erin Meagher, University of North Carolina, Wilmington
Edward Owen, University of California, Santa Cruz
Ester Quintana, University of South Florida
Stephanie Watwood, MIT/WHOI

### Interns During 2003

Sarah Layton
Minelia Miravete
Sandy Wiggins
Sam Arden
Meagan Dunphy-Daly
Alison Boler
Eleanor Stone
Ida Eskesen
Teresa Gisburne
Lindsey Fenderson
Jane Bauer
Lu Lu
Susan Newsom
Sandra Beksic
Marissa Kakoyiannis
Marde McHenry
Kathleen Mohning

## Want to Learn More?

The following books on dolphins and manatees, produced by our staff or by colleagues working closely with our program, are either currently available or will be published soon. To purchase copies, please contact your local bookseller, or look for them on-line.

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Glaser, Karen and John E. Reynolds, III. 2003. Mysterious Manatees. University Press of Florida, Gainesville, FL. 188 pp. ISBN 0-8130-2637-7

Powell, James. 2002. Manatees: Natural History & Conservation. Worldlife Library. Voyageur Press, Stillwater, MN. 72 pp. ISBN 0-89658-583-2

Reeves, Randall R., Brent S. Stewart, Phillip J. Clapham, and James A. Powell. 2002. Guide to Marine Mammals of the World. Chanticleer Press, Inc., New York, NY. 527 pp. ISBN 0-375-41141-0

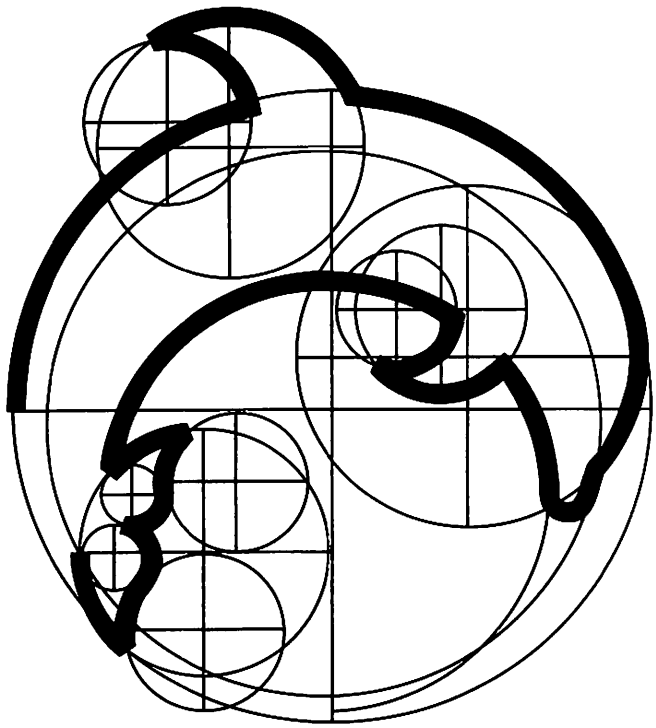
Pringle, Laurence and Randall S. Wells. 2002. Dolphin Man: Exploring the World of Dolphins. Boyds Mills Press, Honesdale, PA. 42 pp. ISBN 1-59078-004-3

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



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