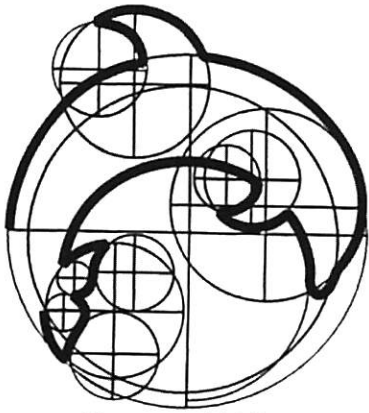


# THE CHICAGO ZOOLOGICAL SOCIETY'S SARASOTA DOLPHIN RESEARCH PROGRAM



January 2003

## NICKS 'N' NOTCHES

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### Sarasota Dolphin Research Program: Continuing Our Commitment to Conservation, Research, and Education *By Randall Wells*

The "world's longest-running dolphin research program" is now in its 33<sup>rd</sup> year. It continues as a full-time, year-round operation involving 7 full-time staff members, 6 or more graduate students, up to a dozen volunteer student interns and 5 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 six 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, and (6) 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 six small research vessels, two towing vehicles, computers, cameras, and field equipment. 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 since 2000. 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.

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**Sarasota Dolphin Research Program**



Randall Wells

*"Genie" and calf - the first dolphins to demonstrate the occurrence of at least 3 generations in Sarasota Bay.*

## Federal Support for Dolphin Research and Education

As a result of 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 two years CZS and MML have shared dolphin research grants through NOAA Fisheries totaling \$1,500,000, and a dolphin education grant of \$691,000 through the U.S. Department of Education.

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 will 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 2005. Most of the projects are underway, and reports on preliminary findings are provided for some of the projects on the following pages.



Sue Hofmann

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(December 16, 2002 issue)*

*the on-line newsletter of the National Oceanic and  
Atmospheric Administration*

*www.accessnoaa.noaa.gov*

## NOAA Fisheries Studying Dolphins for Contaminants

*By Trevor Spradlin*

*NOAA Fisheries/Office of Protected Resources*

Because of growing concern about marine mammals washing ashore in U.S. waters, NOAA Fisheries' Office of Protected Resources' Marine Mammal Health and Stranding Response Program was created in the late 1980s. It has since collaborated with scientists worldwide to investigate, monitor, assess and respond to marine mammal health issues.

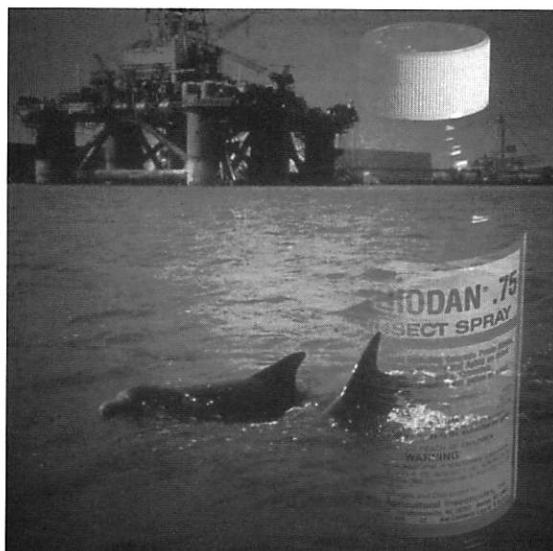
Under the provisions of the Marine Mammal Protection Act, the office develops, implements, and administers programs for the protection, conservation and recovery of whales, dolphins and porpoises and most seals and sea lions. It helps collect and disseminate health data, assesses health trends in marine mammals, correlates health with available data on physical, chemical, environmental and biological parameters, and coordinates effective responses to unusual mortality events.

In recent years, high concentrations of potentially toxic substances and an increase in new diseases have been documented, causing scientists to begin exploring a possible link between these substances and marine mammal mortality events. Their studies are contributing to a growing, worldwide effort of marine mammal biomonitoring, not only to help assess health and contaminant loads, but also to assist in determining the impact of human activity on marine mammals, marine food chains and marine ecosystem health.

In collaborating with scientists around the world, Dr. Teri Rowles, DVM, Ph.D. and Dr. Janet Whaley, DVM, coordinate efforts for NOAA. A key partner is the Sarasota Dolphin Research Program, based at the Mote Marine Laboratory in Sarasota, Florida. The program was founded by Drs. Randall Wells, Michael Scott and Blair Irvine, who have been conducting research on the resident population of bottlenose dolphins from the west coast of Florida for over 30 years. It represents the combined efforts of the Dolphin Biology Research Institute, the Conservation Biology Department of the Chicago Zoological Society, Earthwatch and Mote Marine Laboratory.

The unique research links researchers from several academic institutions and government agencies, including NOAA Fisheries scientists – and is the longest ongoing field study of dolphins in the world.

Individual dolphins have been studied throughout the course of their lives. To date, over 2500 different individual dolphins have been identified from the west coast of Florida based on the unique markings on, and shapes of, their dorsal fins. Over 100 of the dolphins have been studied for contaminants. A cornerstone of the International Whaling Commission's Pollution 2000 effort, the program was launched to foster cooperative efforts by Europe and the U.S. to better understand the impacts of contaminants on marine mammals.



Flip Nicklin/Bob Myers

One or two weeks are devoted each summer, fall or winter to a temporary capture and release program in order to conduct health assessment examinations of the dolphins and research their physiology, bio-acoustics and genetics. The dolphins are safely encircled by a net and carefully placed on a medical boat for 30 to 45 minutes to allow the research team to examine the animals closely. Once examinations are completed, the dolphins are safely released. Health assessments include physical exams, blood sampling, body condition, ultrasound, cultures, fecal analysis and urinalysis.

For the June 2002 field season, the NOAA Fisheries' Office of Protected Resources invited Scott Gudes, the Deputy Under Secretary for Oceans and Atmosphere, to learn about this unique and valuable research program which has significantly contributed to NOAA's marine mammal conservation efforts. Scott was able to see first-hand how NOAA scientists, such as Dr. Rowles, are working in successful partnership with outside academic researchers and institutions to meet common goals.

Scott met Dr. Rowles, Dr. Wells and the rest of the research team on June 4, 2002 and was able to actively participate in the research, including capturing, holding, assessing and releasing the dolphins. Scott was accompanied to Florida by Mara Brown from his office and Trevor Spradlin from the NOAA Fisheries Office of Protected Resources. Jeff Brown from the NOAA Fisheries Southeast Regional Office and Dr. John Reynolds from the U.S. Marine Mammal Commission were also on site participating in the research.

Dr. Wells and his colleagues have also been extremely supportive of the NOAA Fisheries "Protect Dolphins" campaign which was established to educate the public that feeding and harassing wild dolphins is harmful to the animals, dangerous to people, and illegal under the Marine Mammal Protection Act. Dr. Wells and his colleagues have conducted research on the effects of people feeding or harassing wild dolphins, provided the scientific information and photographic images used in the "Protect Dolphins" materials, and have conducted a community-oriented outreach program to promote safe and responsible viewing of wild dolphins in partnership with NOAA Fisheries.

## Effects of Environmental Contaminants

*By Randall Wells*

Dolphin health continues to be a primary focus of our research program, especially in relation to effects of environmental contaminants. Previous work with the Sarasota dolphins suggests that these animals are exposed to moderate levels of some chemical contaminants (including organochlorines such as DDT metabolites and PCBs), facilitating the investigation of sub-lethal effects of these chemicals on dolphin health and reproduction. Such research requires the examination and collection of samples from individuals of known age, sex, and reproductive history for measurement of contaminant residues, health assessment and reproductive activity. This kind of research has been identified by the International Whaling Commission and NOAA Fisheries as requisite to understanding the effects of contaminants, and identifying biomarkers of the contaminants. To address these issues, and to begin to understand the dynamics of these fat-soluble chemicals in dolphins seasonally and inter-annually, we have been conducting dolphin capture, sample, and release programs in Sarasota Bay, through the support of Dolphin Quest, NOAA Fisheries, and Disney. Each of the 5-25 dolphins examined and sampled during a given session is involved in about 20 different projects. Typically 40 to 100 or more scientists, veterinarians, students, and dolphin handlers participate in the work over a three to five day sampling period at three times during the year.

Dolphins are encircled with a net, and are brought aboard a specially designed veterinary examination vessel. Body condition is evaluated (weight, length, girth, ultrasonic measurement of blubber thickness). The animals are given a physical exam, and blood, milk, blubber, urine, fecal, and microbiological samples are collected. Diagnostic ultrasound provides information on health and reproductive condition. Well-known mothers know ages of most dolphins from documentation of their birth; unknown ages are determined from growth layer groups in a tooth. Organochlorine concentrations in blubber, milk, and blood are examined relative to age, sex, body condition, birth order, and health parameters, including immune system function. Possible effects on reproductive success are examined through measurement of reproductive hormone concentrations, tracking of paternity patterns as determined from genetic samples, and by tracking individual female calving success through their reproductive lifespan.

Identifying the most appropriate analytical laboratories and securing funding for these analyses has taken a number of years, but tremendous progress is being made now that these issues have been largely resolved. Samples are being analyzed by several different laboratories, through the support of NOAA Fisheries, International Whaling Commission, and the Conservation Medicine Center of Chicago. Analyses by the University of Utah (W. Jarman), University of Barcelona (A. Borrell), and NOS (G. Mitchum) have yielded preliminary results that were presented in an invited talk in November 2002 at the Annual Conference of the Society for Environmental Toxicology and Chemistry, in Salt Lake City. Initial findings indicate the accumulation of organochlorine contaminant residues in dolphin tissues at levels that exceed those of concern for human health.



High concentrations in first-time mothers correlate with high first-born calf mortality. Concentrations in females decline with lactation, a process known as "depuration." Apparent relationships for males between increases in concentrations of contaminants with age, and declining testosterone concentrations and shorter lifespan are being examined, but conclusive cause-effect relationships have not yet been demonstrated. Continuing analyses of new samples and analyses of archived samples will be conducted by the National Institute of Standards and Technology (J. Kucklick), and the University of Guelph (D. Muir/M. Houde). We will be able to begin to look at the relationships between specific congeners of the contaminants relative to health and reproduction. Studies are also underway to look at the effects of inorganic chemicals such as mercury and selenium on dolphin health (T. O'Hara/V. Woshner). In combination, long-term observational monitoring and periodic biological sampling provide a powerful, non-lethal approach to understanding the correlations of contaminant concentrations and health or reproductive parameters in coastal dolphins, thereby providing critical information for hazard and risk assessment in marine mammals.



*Dolphins accumulate contaminants from the fish they eat.*

## **Assessment of Emerging Environmental Contaminants in Bottlenose Dolphins**

*Magali Houde, Doctoral Student, University of Guelph, Canada*

Exposure assessment of marine mammals to man-made contaminants is an essential part of work on the conservation and management of wild populations. Over the last ten years, efforts to assess the biological effects of persistent organic pollutants (POPs) contamination, rather than merely measuring concentrations, have been increased. Mechanisms of action and impacts of these pollutants on marine mammals' physiological systems have been the subject of numerous studies. Evidence of adverse effects on the immune, reproductive and endocrine systems have all been linked with concentrations of POPs in several pinniped and cetacean populations. Is the Sarasota Bay dolphin community, which lives in a fairly closed environment surrounded by human activity, affected by pollution? Evidence of reduction of immune responses, in association with increasing levels of POPs, has been observed in a small number of individuals from this community leading us to an affirmative answer.

Organic contaminants in mammals can be chemically transformed by biotransformation processes sometimes to more persistent and biologically active chemicals, such as the conversion of p,p'-DDT to p,p'-DDE. Other by-products of biotransformation are more readily eliminated. This project will focus on the assessment of polychlorinated biphenyl (PCB) and brominated diphenyl ether (PBDE) metabolites as well as fully fluorinated compounds. Concentrations will be determined from the analysis of dolphin blood plasma collected in the 2002 and 2003 sampling efforts. PCBs are persistent chemicals of known toxicity that are widely distributed in the global marine environment. There is growing evidence that PBDEs are also equally widely distributed. Hydroxylated PCB

and PBDE metabolites have had less scientific attention than their parent molecules but may be as toxic in their actions. There is particular concern about the effects of hydroxy-PCBs and PBDEs on thyroid and estrogenic hormone activity. Fluorinated chemicals are, for their part, of increasing concern because of their global distribution in the environment, their impact on cellular biology and their ongoing industrial use. High concentrations of fluorinated chemicals have already been reported in the blood and liver of stranded bottlenose dolphins from Sarasota. Possible use of biological indicators (biomarkers) and *in vitro* tests may also indicate mechanisms of action and impacts of such contaminants on the endocrine system of dolphins.

Accumulation of contaminants may vary depending on the gender, age and reproductive status of the animals. Females are usually less contaminated with POPs than males because of the transfer of contaminants to the offspring through gestation and lactation. The long-term monitoring of the Sarasota bottlenose dolphin population gives us the unique opportunity to identify the biological parameters prior to adequate interpretation of toxicological data. Does sex and age of dolphins or reproductive history of females affect the concentration of fluorinated compounds in the same manner as it affects chlorinated ones? Are these contaminants associated with effects on the thyroid or estrogen systems in the dolphins? Such questions about these newly studied pollutants that may soon be answered.



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

By “Team Thermal” — Ann Pabst, Bill McLellan, Andrew Westgate, Erin Meagher, Michelle Barbieri, and Ari Friedlaender

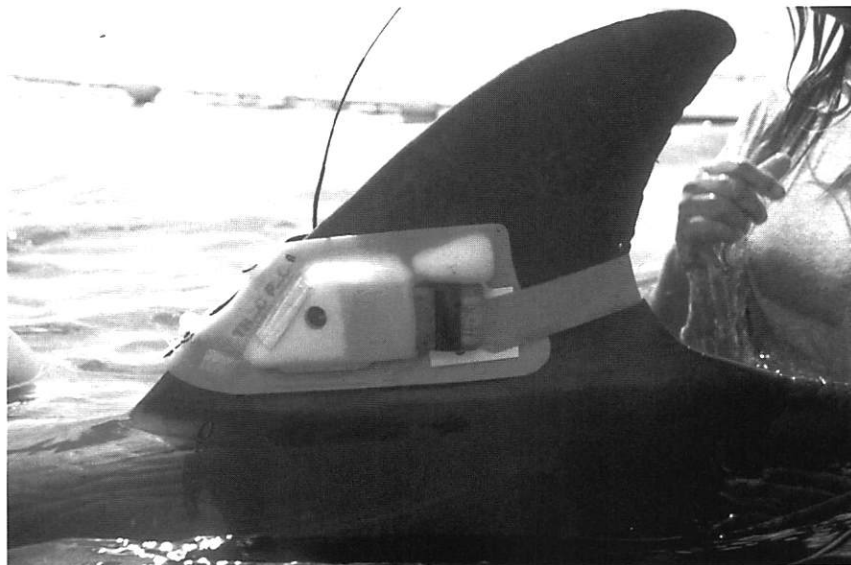
The goal of our work with the Sarasota Dolphin Research Project is to better understand reproductive and whole-body thermoregulatory function (temperature regulation) in bottlenose dolphins. The long-term, health-monitoring program for Sarasota Bay dolphins offers us a unique opportunity to study thermoregulation 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 10°C in the winter and exceed 31°C in the summer.

Bottlenose dolphins in Sarasota Bay may invoke a suite of physiological modifications to cope with their changing thermal environment. 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<sup>2</sup>. Deep core temperatures, measured with a specialized

colonic probe, and blubber thicknesses, measured using ultrasound, will also be recorded. A non-invasive 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. The proposed study would offer 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. These data would add to our understanding of the biology and health of Florida bottlenose dolphins.

This study also offers two of our current graduate students, Erin Meagher (PhD) and Michelle Barbieri (MSc), the opportunity to gather data critical to their thesis research on dolphin thermoregulation, through the University of North Carolina, Wilmington. Support for this project has been provided by the Harbor Branch OI Protect Wild Dolphins program.



*Suction-cup mounted Thermal Trac-Pac for measuring dorsal fin temperatures.*

## Earthwatch Dolphin Monitoring Program 2000-2001 and 2001-2002

By Sue Hofmann, Field Coordinator

We have been able to continue our year-round monthly monitoring of the Sarasota dolphin community thanks to support from Earthwatch Institute 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 studies of the distribution, social and reproductive patterns of these animals.

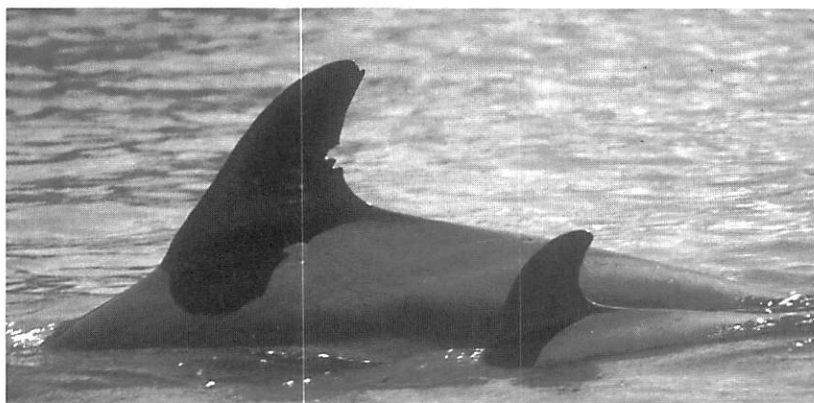
Photo-identification surveys were conducted on 91 days from October 2000 through September 2001 with the assistance of 81 Earthwatch volunteers from 23 states and 8 countries. Surveys from October 2001 through September 2002 were conducted on 108 days with the assistance of 42 volunteers from 17 states and 3 countries. These volunteers contributed over 6,100 hours to our project. An increase in survey days and decrease in volunteer numbers were a result of the restructuring of our project. We added extra field days and only accepted two-week volunteers.

During the '00-'01 year, we had 587 group sightings that totaled 1,952 dolphins (including resighted animals) while 671 group sightings resulted in 2,130 dolphins (including resights) during the '01-'02 year. 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 over 3 dolphins per sighting during the two most recent years. During 2000-2002, we had a high of 18 sightings in one day during a May 2001 survey and a high of 61 dolphins in a day during a September 2001 survey. During this same time period, our annual average of the number of dolphins sighted per day was lower, at 20.5, than in the previous year ('99-'00) but comparable to values from the years prior to 1999-2000.

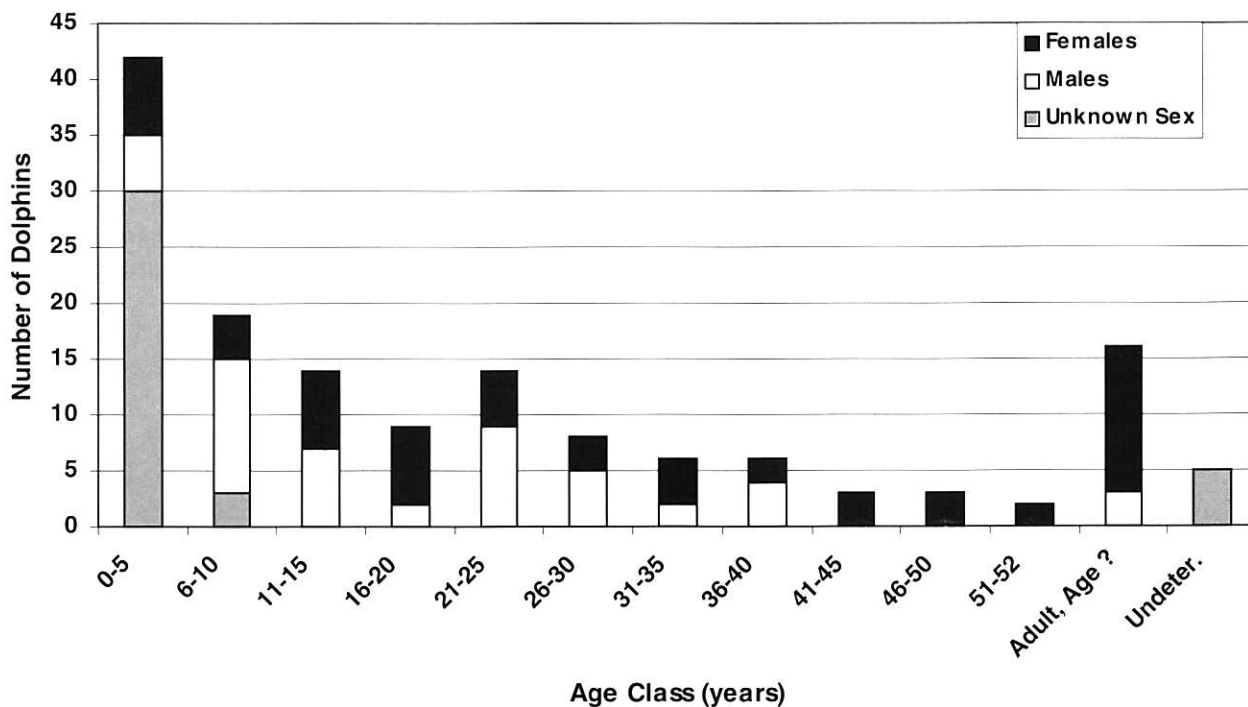
We were able to document the births of three new calves during the spring/summer of 2001 while monitoring the Sarasota dolphin community. The fourth calf of FB 79 was first seen shortly after birth in April, but disappeared in mid-August. Saida Beth (FB 33) gave birth to her sixth calf in early July. Unfortunately, this calf only survived for two weeks. Bardot's third known calf wasn't sighted until October, at which time it was at least several months old. During the spring/summer of 2002, we documented the births of thirteen new calves. FB 175 gave birth to her first calf in August 2002 while FB 59, FB 75 and Saida Beth all gave birth to their seventh calves. Additional mothers include RP 27, FB 131, FB 25, Moonfin Look-alike, Pumpkin, Merrily, Lightning, Fattop and Wanda. Unfortunately, both Lightning's and FB 131's calves disappeared in July while FB 59 lost her calf in August.

During the past two years, we lost six other community members in addition to the five YOYs that died. FB 96 ("H"), a 35-year-old male, died in June 2001. He had lost his partner FB 98 ("G") in 1995. FB 216 (son of FB 163) also died in June 2001. "I Know" died in September 2001. During 2002, FB 212 (son of FB 3) died in February, Clown Look-alike died in August, and Blackstripe Leadcrease died in November. A number of other individuals have not been identified during the last year or two, but photo analyses are not yet complete, and some may still be identified. Through our Earthwatch-sponsored surveys, we have accounted for 87% of the Sarasota community members. As of November 2002, the number of dolphins regularly using the surrounding waters stands at 144 animals. This number has steadily increased since the mid-1990's.

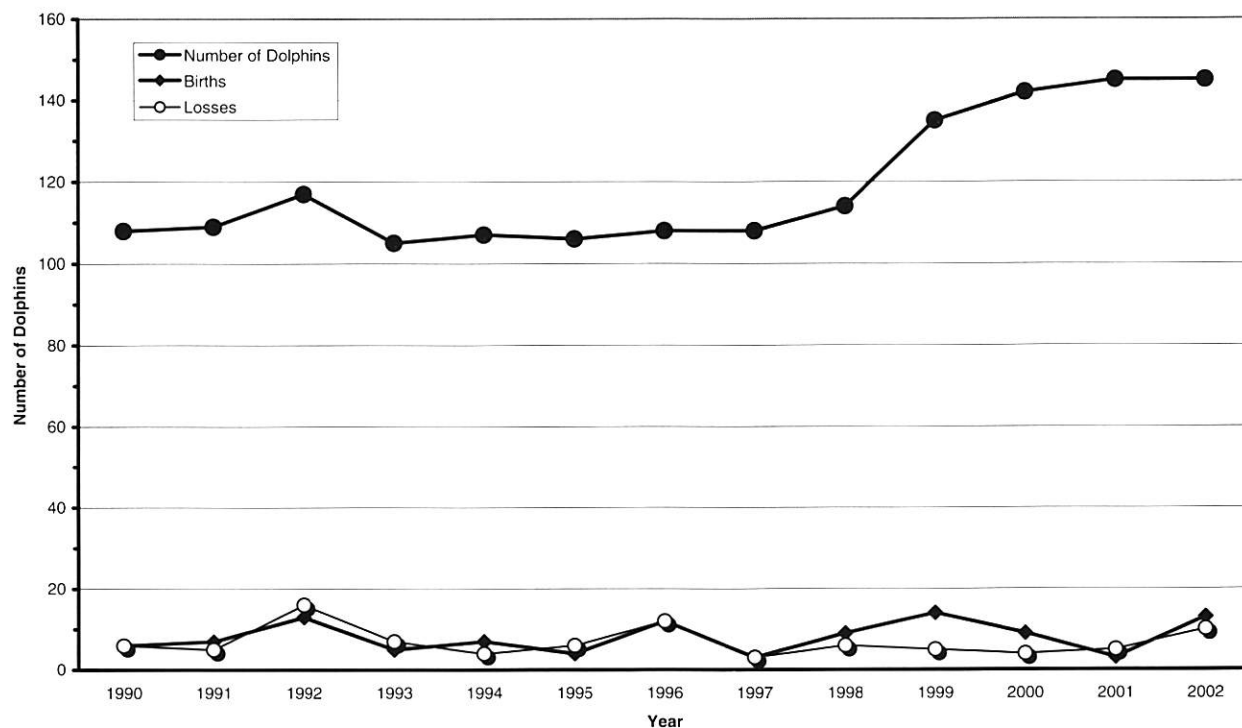
Once again, we would like to thank all of our Earthwatch volunteers for your interest in and support of the Sarasota Dolphin Research Program.



*Bobby Jo (RP27) and her new calf May 2002. Though orphaned at 16 months of age, this dolphin has been able to raise 2 calves to date.*



Age/sex distribution of Sarasota Bay dolphins in 2002, indicating the numbers of dolphins of each gender in each 5-year age class. The oldest known dolphins in 2002 were 52 years old.



Trends in numbers of dolphins frequenting Sarasota Bay during 1990-2002, along with numbers of births and losses. Increases since the late 1990's correlate with presumed fish stock increases since the net ban, but cause-effect relationships have not been conclusively established.



## Echo and Misha Update: Twelve Years Back in the Wild

By Kim Bassos-Hull, M.Sc., Research Associate

It has been 12 years since Echo and Misha were returned to the wild in their native Tampa Bay waters after spending two years at a research laboratory in California. Both dolphins were the subjects of a unique two-part scientific experiment. Echo and Misha were initially collected in Tampa Bay in July 1988 and spent two years at the University of California at Santa Cruz's Long Marine Laboratory where researchers studied their echolocation processing abilities and behavior patterns. Then, as planned prior to collection, on October 6<sup>th</sup> 1990 they were released back into Tampa Bay after a transition process in a seapen at Mote Marine Laboratory. During intensive monitoring during the first year following their release, both Echo and Misha were observed feeding, interacting with other local dolphins, and in general displaying typical behavioral, ranging, and social association patterns as well as excellent body condition.

Echo and Misha split up after the first few months back in the wild but researchers have continued to observe both dolphins through opportunistic sightings. Misha has been sighted on 69 days since release along the southeast coastline of Tampa Bay. During Misha's most recent sighting on 30 May 2002 in Terra Ceia Bay, he was observed with another longtime associate, KATT, flanking a female dolphin with an older calf. Flanking behavior is commonly seen by adult males during this time of year which is peak breeding and calving time. Perhaps there is a little Misha in the works! Also present in this sighting was RP61 (also known as "Bumpy Fin") with a brand new calf (see more news about RP61 in the article on Charlotte Harbor). Echo has been sighted 54 times since release, the last several sightings by the Eckerd College Dolphin Research Program in the Boca Ciega region (western part) of Tampa Bay. Echo's most recent sighting was on 4 June 2002 near Pinellas Point. With plans to conduct more survey effort in Tampa Bay over the next few years we hope to keep tabs on these two special dolphins.



Kim Bassos-Hull

Misha (left) and Knob Above Triangle Tabb (KATT) in Terra Ceia Bay on 30 May 2002.

## Hearing Abilities of Free-Ranging Dolphins

By Mandy Hill, Doctoral Student, University of South Florida

As a first year Ph.D. student of David Mann's at the University of South Florida in St. Petersburg, I am initiating a study of 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. However, variations in hearing ability occur between individual animals, and a few studies have shown that hearing abilities decrease in bottlenose dolphins as a function of increasing age. All studies to date, however, have been conducted on captive dolphins, where environmental noise can be controlled or eliminated. No study to date has examined the hearing abilities of free-ranging bottlenose dolphins; 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 the bottlenose dolphins in Sarasota Bay 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 loosely restrained in the water. Using a non-invasive technique known as Auditory Brainstem Response (ABR), electrodes on the surface of the dolphin's head will measure microvolt potentials produced by the brainstem 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 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. Support for my project has come from the Von Rosenstiel Endowed Fellowship (2002-2003), USF College of Marine Science Graduate Assistantship (2002-2003), the Frances Peter Fensel Memorial Fellowship (2001-2002), and the UNCW Faculty Summer Research Initiative (2000, 2001).

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

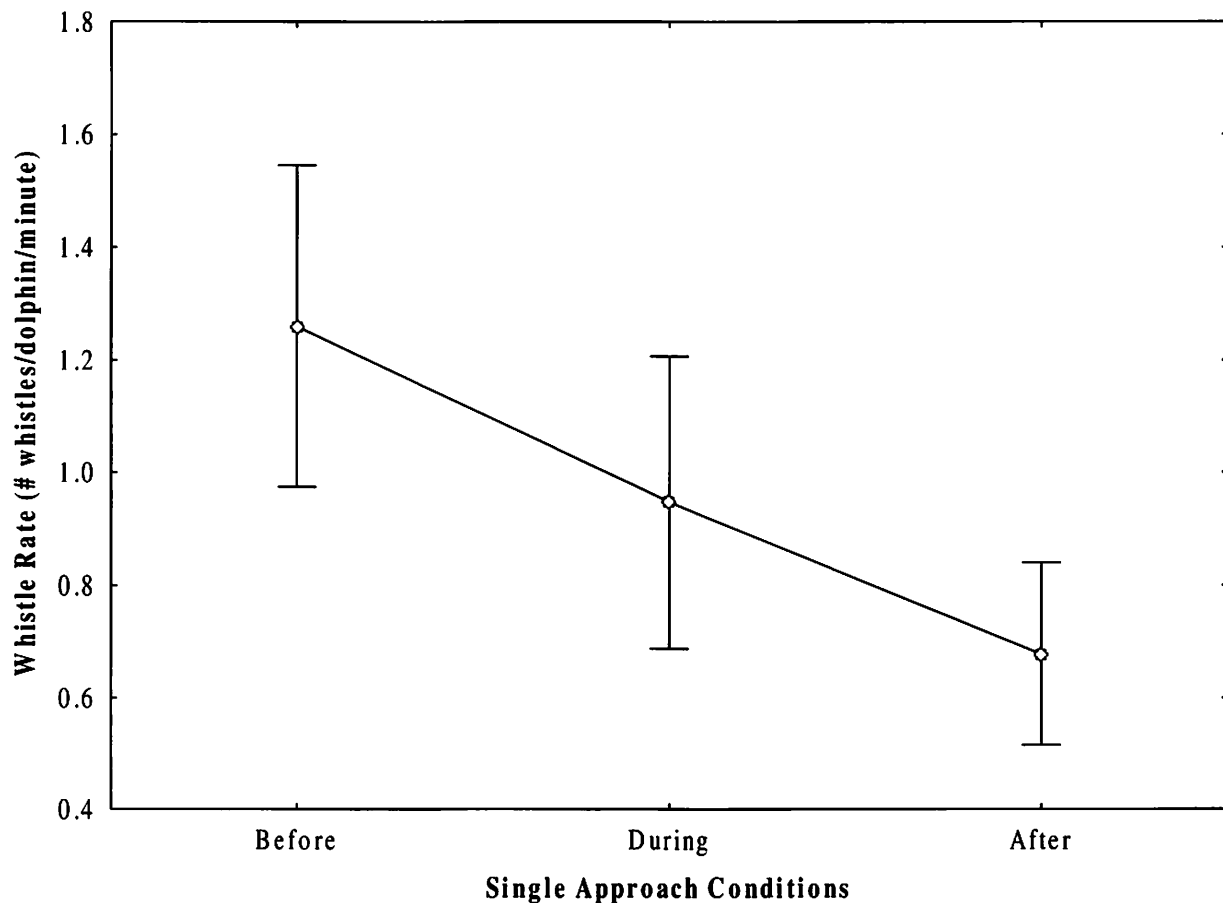
by Kara Buckstaff, Master's Student, University of California, Santa Cruz

There are many forms of man-made noise that contaminate the marine environment. Preliminary studies on cetaceans concentrating on the effects of some types of anthropogenic noise have raised concerns regarding the potentially deleterious effects on these acoustically-sensitive animals. In coastal waters, such as Sarasota Bay, Florida, recreational watercraft provide perhaps the greatest source of anthropogenic noise. In 2001, there were 40,755-registered recreational watercraft in Sarasota and Manatee counties combined, accounting for 95% of total registered vessels.

For my Master's research, I am assessing the effects of boat approaches on the acoustic properties of bottlenose dolphin vocalizations, such as whistle frequency range, whistle rate, and whistle duration. Additionally, comparisons of these whistle parameters are made between habitat types to determine the roles that the physical environment coupled with watercraft noise and degree of risk to the dolphin play on whistle production. Received noise levels of boat approaches are analyzed also to estimate level of exposure from various watercraft types. Preliminary analyses suggest that there are significant changes in whistle rate when a single boat (see figure) or multiple boats approach a group of dolphins, while other structural components of a whistle such as the duration and the frequency range remain unchanged.

Watercraft noise can interfere with vocal communication and perhaps other biologically important sounds that may be associated with bottlenose dolphin foraging, nursing, mating, and group cohesion. Wildlife management agencies tasked with protecting dolphins from human activities will benefit from information regarding potential negative consequences from watercraft noise.

The Disney Wildlife Conservation Fund and NOAA Fisheries have been the primary sources of support for this project, though supplemental support has been received through smaller grants.



*The whistle rate was calculated for single boat approaches passing groups of dolphins. Before and After conditions were defined as a 1 minute interval before and after the boat was audible on the acoustic recording. Whistle rate for the Before condition is significantly higher ( $p=0.00463$ ) than whistle rate for the After condition. The error bars represent standard error of the means.*

## **Reproductive Success of Free-Ranging Bottlenose Dolphins: Experience, Size, and Who You Know Make a Difference**

*By Randall Wells, Deborah Duffield (Portland State University), Michael Scott, Blair Irvine, Sue Hofmann, Stephanie Nowacek, Edward Owen, Caryn Owen, and Aleta Hohn (NOAA Fisheries)*

Knowledge of the factors underlying bottlenose dolphin reproductive success is important to conservation for evaluating and projecting the dynamics of populations, as well as for understanding the evolution of their complex social structure. Collecting such information in the wild is challenging because female reproduction spans more than four decades, and behavioral cues of paternity are largely absent. In Sarasota Bay, Florida, > 30 years of observations and sample collection for genetic tests and age determination have provided an opportunity to evaluate reproductive success within a resident bottlenose dolphin community.

Calf survivorship is related to mother's age and experience. Calf success was measured for 62 mothers (172 calves), relative to first year survival (74%), survival to normal separation age (3 yrs, 60%), and survival post-separation (47%). Mothers  $\leq 10$  years old had the lowest calf survivorship, mothers 11-40 years old were intermediate, and mothers > 40 years old were most successful. Primiparous (first-time) mothers experienced poor success, with only 40% of calves surviving the first year, and 12% surviving three years or after separation. In contrast, > 70% of calves of multiparous (experienced) mothers survived their first year, > 60% survived three years; half were identified post-separation.

Male breeding success varies with age, size, and male pair bonding. Blood samples from 62 mother/calf pairs and 47 potential sires were used for paternity exclusion tests. Genetic exchange between communities is significant. Monogamy is not a feature of the Sarasota Bay dolphin community reproductive strategy. Resident males 14 - 41 years old were identified as sires. Body size correlates with breeding success for young males. Both unpaired and paired males bred, and within pairs both males can be sires. Paired males sire disproportionately more calves than unpaired males, suggesting one advantage to this unusual social formation. Many resident males apparently have not bred within the community, so the effective population size is considerably less than the number of residents, a difference of importance when considering the consequences of natural or anthropogenic impacts on resident dolphin communities. Paternity testing is continuing as more matched samples become available and can be linked with behavioral observations (see E. Owens, below). This work was funded by the Disney Wildlife Conservation Fund, the Harbor Branch OI Protect Wild Dolphins Program, and by the Chicago Zoological Society.

## **Why Do Adult Males Form Pair Bonds?**

*By Edward Owen, Doctoral Student, University of California, Santa Cruz*

The focus of my dissertation research through the Ocean Sciences Department at the University of California, Santa Cruz revolves around the question of why do adult male bottlenose dolphins form pair bonds? Researchers with SDRP have documented that adult males form pair-bonds with other males often while in their teens. Paired males are usually within 2-3 years of age, and these pair bonds can last up to the duration of the males' adult lives (one pair of males, Norman (FB26), and Jimmy Durante (FB48) have been pair-bonded for at least 22 years!). Other than the bonds between mothers and calves, these bonds are the strongest relationships between dolphins in Sarasota. Most adult males are pair-bonded for the majority of their adult lives. But in any given year, about 40% of the adult males are unpaired – the majority of these males are either too young to have yet formed a pair-bond, or their partner has died or disappeared and they have not formed a new pair-bond.

The presence of both paired and unpaired males provides the opportunity to examine the function of the pair bond through a behavioral comparison of paired and unpaired males in similar social settings. Two different sets of non-mutually exclusive hypotheses have been suggested to address why males form these bonds. Pair-bonded males may gain increased access to females for mating opportunities, and having a male partner may also result in several ecological benefits, such as cooperative foraging, and increased vigilance and protection against predators and other threatening adult males. To assess these hypotheses, along with a trusty team of student interns, I conducted behavioral observations on both paired and unpaired males throughout the breeding and non-breeding seasons, for two consecutive years (May 2000 – March 2002). I am currently in the process of analyzing the behavioral data to first describe the behavior of paired males and how this may change both from breeding to non-breeding season, and in the presence of adult females and other adult males, and secondly to examine whether there are any behavioral differences between paired and unpaired males.

In addition to these behavioral observations, I am also in the process of conducting molecular genetic analyses using microsatellites with Dr. Debbie Duffield at Portland State University to determine the degree of relatedness between males which form pair-bonds. While it is unlikely that partners are close relatives (full or half brothers), we do not know what, if any, role kinship plays in the formation and maintenance of these pair-bonds.

The overall results of this research, through a quantitative examination of seasonal adult male behavior will greatly enhance our understanding of the mating system of free-ranging bottlenose dolphins. Consequently, this study has important conservation implications. 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 research has been supported by the Disney Wildlife Conservation Fund, NOAA Fisheries, and the UCSC Ocean Sciences Department and Graduate Student Association.



## Whistle Use by Allied Male Bottlenose Dolphins

By Stephanie Watwood, Doctoral Student, MIT and Woods Hole Oceanographic Institution

The goal of this project is to determine how adult, allied male bottlenose dolphins use whistles in social situations. Dolphins have social systems very similar to primates, but are much more dependent on vocal communication than primates. Therefore, dolphins represent a nice contrast to studies of sound use by group living terrestrial mammals.

After three solid years of fieldwork, I am currently in the final stages of analysis and writing. So far, I have found that male dolphins tend to produce whistles that are similar to the whistles of their alliance partners. This parallels findings in group living birds, where animals with close social relationships tend to modify their calls to match those of their group mates. This type of vocal learning is primarily limited to humans, songbirds, parrots, bats, and possibly chimpanzees. This suggests a case of convergent evolution in social animals.

Additionally, preliminary analyses suggest that these signature whistles produced by allied male dolphins function as contact calls. Males are much more likely to produce their shared whistle type when separated from their partners than when they are traveling with their partners or guarding females with their partners. Also, males produce the fewest whistles overall when they are with their partners. These shared whistles appear to be a mechanism for maintaining contact between the alliance partners. A shared call may be the easiest way for alliance partners to stay in contact amidst constantly changing group memberships, despite the ability of dolphins to recognize each other individually. Further analyses are underway. I am currently also looking at whistle stability in male dolphins. Females have been shown to produce the same whistle type for up to 12 years. Males may demonstrate different tendencies, due to the formation of alliance bonds and the whistle similarity between alliance partners. I am also looking at social contexts in detail, such as separations and reunions between partners, to determine if whistle use plays a role in other situations as well. This research has been funded by a National Science Foundation Doctoral Dissertation Improvement Grant, the National Geographic Society, Woods Hole Ocean Ventures Fund, and the National Institutes of Health.



Male pair Racing Stripe and Otter in Sarasota Bay 12 July 2001. Paired males are often synchronous in their surfacing patterns.

## Dynamics of Group Fission-Fusion: Acoustic Mechanisms Used by Individuals when Leaving and Joining Temporary Groups

By Ester Quintana-Rizzo, Doctoral 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. The ephemeral nature of these fluid associations, a pattern called group fission-fusion, makes the identification of groups difficult. I am interested in identifying boundaries of communication between associates as a way to understand what defines a bottlenose dolphin group. This research constitutes my dissertation project for the College of Marine Science at the University of South Florida. The study of acoustic signals between dolphins during fission-fusion events will provide insights into the dynamics of groups, because group members are likely to remain within acoustic detection range during temporary separations. The study of communication patterns of group members is important because their acoustic detection range might vary with habitat with different sound propagation characteristics, therefore affecting the spatial dispersion of the group. To understand boundaries of communication between group members, I am examining how wild unrestrained dolphins use whistles to communicate with associates when they separate and reunite. This past summer I conducted a short preliminary study to test some field techniques. For a total of 939 min, I followed 9 female dolphins to record whistles and individual positions in relation to their associates, and to determine how these variables are related to events in which dolphins leave and join an individual female. Dolphins were followed in a 22-foot long boat equipped with a 115 hp 4-stroke engine. A hydrophone was towed on each side of the boat and each hydrophone was separated by a 3-m PVC pipe that was tied across the gunwales at the bow of the boat. Each hydrophone was at approximately 1 m below the water surface when the boat was not moving. Signals from each hydrophone were digitized at 48.8 kHz with a Tucker-Davis Technologies RP2 module, and stored to a field laptop computer hard drive. Although the data analysis is under way, a total of 562 whistles were identified for all females. Results from the preliminary study will help to define research questions as well as field techniques to use next year. Support for this project was provided through NOAA Fisheries.

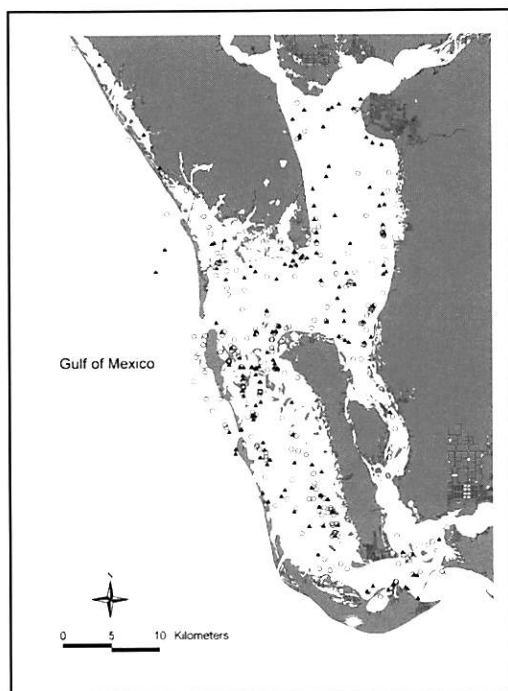
## How Many Dolphins are in Charlotte Harbor?

By Kim Bassos-Hull, M.Sc. Research Associate

The Sarasota Dolphin Research Program and Mote Marine Laboratory initiated boat-based photo-identification surveys in Charlotte Harbor during September 2001 as part of a 5-year study of the health of the Charlotte Harbor ecosystem. We plan to examine dolphin abundance, distribution, and health in the Harbor and integrate our findings with Mote Marine Laboratory's other Research Centers in order to better understand the dynamics of this ecosystem. Two September surveys (2001 and 2002) with funding from the Mote Scientific Foundation and one February survey (2002) with funding from NOAA Fisheries have been completed to date. In addition, 58 biopsy samples have been collected from dolphins in the harbor and are being examined for genetic and contaminant information. We will be comparing abundance estimates across seasons and across years with plans to conduct three more September surveys (2003, 2004, 2005) and two more February surveys (2003 and 2004). In addition we will be comparing to abundance estimates from surveys conducted during 1990-1994 and in 1996.

We have had several preliminary findings with photo-analysis still underway. Many dolphins that were sighted in earlier years (1980's and 1990's) are still being re-sighted today and during both survey periods (September and February). This observation of long-term and year-round residency is similar to what is found in Sarasota Bay and Tampa Bay just to the north of Charlotte Harbor. We have seen a small number of dolphins moving between these three estuaries and in the Gulf of Mexico. One example is RP61 (also known as "Bumpy Fin"), a female dolphin tagged as a calf in Tampa Bay in 1984 and sighted there through 2000. RP61 was then sighted in Charlotte Harbor over 150 kilometers away in February 2001 and September 2001. She was then resighted on 30 May 2002 in southeastern Tampa Bay with a brand new calf. Another group of dolphins initially sighted together in Charlotte Harbor in 1990 has been observed both in Gulf waters and Tampa Bay over the last 12 years. This group shows some interesting genetic variation from most other Tampa Bay and Charlotte Harbor resident dolphins which was learned through biopsy darting efforts in both regions (see Anna Sellas' article).

We have also been able to examine dolphin distribution using a grid transect survey design that allows us to cover the harbor study area with equal effort. Preliminary indications show a shift in distribution between September and February survey periods. We found far fewer dolphins in the upper harbor by the mouths of the Peace and Myakka Rivers during September when this area was hypoxic and less saline. In February we found generally larger groups concentrated nearer to passes, deeper water, and channel areas. By comparing findings with Mote's other Research Centers we hope to better understand these shifts in distribution in relation to both biotic and abiotic factors.



Dolphin sightings in Charlotte Harbor February 2002 (black triangles) and September 2002 (open circles).



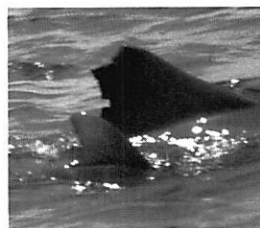
Kim Bassos-Hull

Bumpy Fin in Tampa Bay October 1990.



Kim Bassos-Hull

Bumpy Fin with changed fin in Charlotte Harbor February 2001.



Kim Bassos-Hull

Bumpy Fin and YOY in Tampa Bay May 2002.

## Using Genetics to Examine Population Structure of Bottlenose Dolphins along the Central West Coast of Florida

By Anna Sellas, M.Sc.,

University of California, Santa Cruz

With the official completion of my thesis research in May 2002, many interesting facts have been revealed regarding the population structure of bottlenose dolphins in the inshore and coastal waters near Sarasota Bay. Using mitochondrial DNA and nuclear microsatellite markers, significant population differentiation was detected between the Sarasota Bay residents and bottlenose dolphins sampled in the nearshore coastal Gulf waters. This result is surprising given the short geographical distance between these areas and the lack of obvious geographic barriers to prevent gene flow. Analyses were also run for males and females separately and these results revealed a significant amount of male-biased dispersal between the coastal Gulf and Sarasota Bay. This latter result further supports previous findings based on photo-identification documenting resident males of Sarasota Bay having wider ranging patterns and more frequent interactions with dolphins of neighboring areas than resident females. In November of 2001, this research was presented at the 14<sup>th</sup> Biennial Conference on the Biology of Marine Mammals held in Vancouver B.C. In addition, these results are currently being prepared for journal publication.

In an effort to expand our understanding of the population structure of bottlenose dolphins along the central west coast of Florida, we collected over 50 biopsy samples in both Charlotte Harbor and Tampa Bay, FL, during field sessions conducted in both 2001 and 2002. We are now able to compare the genetic data that we have collected from these Tampa Bay and Charlotte Harbor samples with the data from Sarasota Bay and the coastal Gulf of Mexico. Comparative analyses of population differentiation and genetic diversity are currently underway for all four of these areas and these results should aid conservation managers in their decisions regarding stock delineation and management. Funding for this research was provided by the Florida Fish and Wildlife Conservation Commission, Chicago Zoological Society, Mote Marine Laboratory, Harbor Branch OI Protect Wild Dolphins Program, NOAA Fisheries. All molecular analyses were conducted at the NMFS SEFSC Marine Mammal Molecular Genetics Laboratory under the leadership of Dr. Patricia Rosel.



*SPTP is one of a few dolphins that have been sighted in Tampa Bay, Charlotte Harbor, and the Gulf of Mexico. Genetic samples from dolphins often sighted with SPTP show interesting genetic differences when compared with typical resident dolphins.*

## Community Structure of Bottlenose Dolphins in Tampa Bay, Florida

By Kim Urian, M.Sc.,

University of North Carolina, Wilmington

I have been working to define community structure of bottlenose dolphins in Tampa Bay. In some areas, such as the west coast of Florida, populations of coastal bottlenose dolphins are comprised of discrete communities, defined by patterns of social association and long-term site fidelity. This paradigm has been demonstrated most clearly by the work of the Sarasota Dolphin Research Program. Based on the results of this work, NOAA Fisheries has identified communities of bottlenose dolphins as management units, or stocks, that should be managed separately. We examined home ranges and patterns of association of individual dolphins to test the hypothesis that bottlenose dolphins in Tampa Bay form a single community. The long-term study of dolphins in Sarasota allowed us to ground-truth our definition of community and test whether our approach was robust to small sample sizes.

We conducted photo-identification surveys in Tampa Bay during 1988-1993 through the support of NOAA Fisheries and identified 102 dolphins with 10 or more sightings. We calculated mean values of latitude and longitude of each dolphin's sighting locations and coefficient of association (CoA) values for these dolphins. We then used a hierarchical cluster analysis to determine if certain animals clustered together based on association indices and location, and the multi-response permutation procedure (MRPP) and discriminant analysis to validate cluster membership. Finally, we used ANOVA to test for differences in the mean location of the clusters and to test the hypothesis that mean CoA values within a community were higher than between communities.

Dolphins in Tampa Bay clustered into 5 communities with significant differences in their ranges and association patterns; some communities had no overlap at all in their ranges. This fine-scale intra-population structure exists in the absence of physiographic barriers to movement. Tampa Bay is a relatively large, open embayment and there are few obstacles to the movement of individual dolphins; yet considerable structure exists among ranges and social interactions of dolphins inhabiting this area. Our results show that there are discrete communities that differ in their patterns of association and ranges within Tampa Bay. We conclude that five discrete communities of bottlenose dolphins exist within Tampa Bay and that such fine-scale structure may be a common feature of bottlenose dolphin populations throughout the southeastern United States. Planned work will examine the genetic structure of these putative communities through the support of NOAA Fisheries.

Our findings in Tampa Bay support the paradigm of bottlenose dolphin communities, defined by the home ranges and patterns of association of individual dolphins. Management of bottlenose dolphins in the southeastern United States, and elsewhere, should acknowledge the existence of this fine-scale population structure. This research was supported by the Chicago Zoological Society.



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

By Salome Dussan-Constantine, M.Sc.

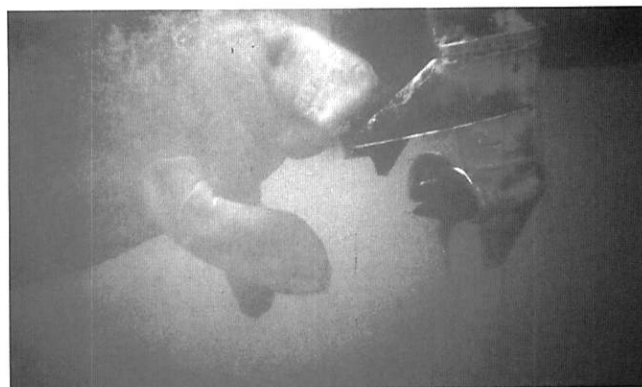
The marine tucuxi (*Sotalia fluviatilis*) is one of the lesser-known delphinids. Many aspects of this species natural history and behaviour remain unknown. It has been included in the Appendix I of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) as "Data Deficient" (CITES Red List, 2002). In Colombia, Tucuxi have been cataloged as a "vulnerable" species due to loss of habitat, deforestation, pollution, and incidental mortality in local fisheries and direct takes for use as shark bait or to be sold on the black market. Tucuxi is one of the top predator species along the Caribbean coast of Colombia. These species contribute to maintain the population dynamics of their prey and as a consequence, the balance of the different ecosystems. Human activities have modified the movement and abundance of the Tucuxi's prey along with the behaviour and habitat use of this species. The main goal of this research project is to study and analyze, under a scientific perspective, the actual situation of the Tucuxi in Colombian waters, in search for clues for its management and long-term conservation.

Field data will be collected during the months of November, March, July and October of 2002-2003, in the Gulf of Morrosquillo in Colombia. The research methodology will include photo identification along with the use and analysis of Geographic Information Systems (GIS). All data will be analyzed under an ecological and ethological perspective. I hope this will be the beginning of many years of research with coastal Tucuxi in Colombian waters resulting in the understanding and preservation of its habitat in the future. This research has been supported by the Chicago Board of Trade, Cetacean Society International, Fundacion Omacha, Conservacion Internacional, CVS and INVEMAR.

In a separate project, marine Tucuxi are under study by colleague Paulo Flores in southern Brazil, near Florianopolis. Flores is conducting this work for his doctoral degree, with the support of Earthwatch Institute. Randall Wells serves as a co-Principal Investigator on the project, and as a dissertation advisor to Flores.

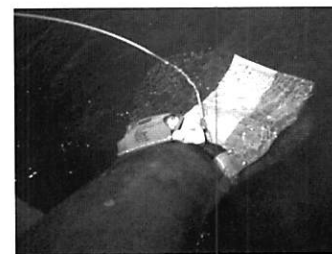


*Tucuxi dolphins near Florianopolis, Brazil, are studied by photographic identification.*



*Boat collisions are responsible for more than 30% of manatee deaths.*

*DTag attached to a male manatee in Southern Lagoon, Brazil.*



## Manatee Responses to Approaching Boats: An Update

By Stephanie Nowacek, M.Sc., Lab Manager

Manatees were killed in record numbers by boats during 2002. The effectiveness of current mitigation strategies has not been determined as specific behavioral responses to watercraft are still largely unknown. With support from the State of Florida, our team of researchers (me, Doug Nowacek, Randy Wells) traveled to Belize in March of 2001 and March of 2002 to piggyback on a long-term manatee capture-release effort in Southern Lagoon led by Dr. James (Buddy) Powell, of Wildlife Trust. There we attached non-invasive digital acoustic recording devices (DTAGs) to existing peduncle belts on temporarily restrained manatees. The DTAGs, developed by Woods Hole Oceanographic Institution, recorded heading, depth, pitch, and roll of the manatee as well as the sounds reaching the manatee during preprogrammed times.

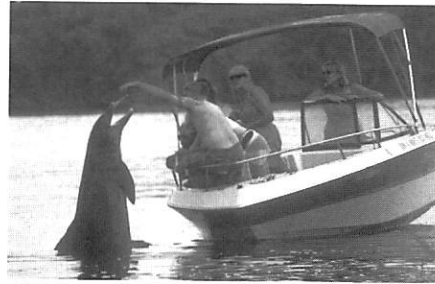
Despite heroic efforts by Powell in catching manatees and Mark Johnson and Alex Shorter in developing good deployment and release mechanisms for the tag and belt, our sample sizes remained small after the two years. Our successful deployments did show marked differences in behavior by the manatees during boat approaches as compared to periods when no boats were present. Changes in heading and fluke stroke (pitch) were more likely during boat approaches. Preliminary results indicate that manatees are detecting watercraft at much greater distances than previously thought.

We have high expectations that this methodology will provide conclusive data that will help management to develop better strategies for protecting this endangered species. To that end, we will continue our research by now deploying tags in Florida waters. Comparing responses of manatees in the relatively quiet waters of Belize to those of animals in the busy waters of Florida will hopefully provide information needed to reduce manatee mortality and serious injury from boat collisions.

# A Demonstration of the Need for Increasing Public Awareness of the Problems Associated with Human Interactions with Wild Dolphins: A Case Study near Sarasota, Florida

By Petra Cunningham-Smith, Deborah E. Colbert, Randall S. Wells, and Todd Speakman

Boaters have provisioned wild bottlenose dolphins, *Tursiops truncatus*, for more than 10 years in the Intracoastal Waterway near Nokomis, Florida. One dolphin, referred to as Beggar, is a well-known attraction to tourists and local boaters because of his predictable presence in the area. From 1997 to 2001, a study was undertaken to document boater interactions with Beggar and occasional dolphin associates. We also evaluated the effectiveness of efforts to curtail these illegal activities through public education and law enforcement. In spite of a public relations campaign and limited law enforcement efforts, illegal interactions including provisioning, physical contact, and other forms of harassment have continued. In fact, since the cessation of the docent program we conducted as part of the public relations campaign, interaction rates have increased from fewer than 2% of passing boaters to nearly 7%. We queried a sample of those who chose to interact illegally with the dolphins and found that 39% claimed no knowledge of the laws. Many of the other 61% who were aware of the legal ramifications expressed a lack of understanding of the problems associated with interacting with wild dolphins. We suggest that increased law enforcement efforts, including the application of well-publicized punitive sanctions, along with increasing awareness of the problems associated with feeding wild animals, may be required to bring about any further reduction in this problem.



Boaters "encourage" one of Beggar's trained behaviors. These activities are illegal and bad for the dolphin.

This work was conducted through the support of NOAA Fisheries and John and Ronnie Enander. The presentation based on a version of this Abstract won the 2002 Education and Conservation Award at the 30<sup>th</sup> Annual International Marine Animal Trainers Association Conference, in November in Orlando, FL.



Law enforcement agents distribute educational brochures about Beggar.



Dead severely emaciated 4 year-old begging calf of a begging dolphin. The calf had fresh propeller cuts, entanglement scars, and had ingested fishing gear.

## 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 Randy Wells have recently completed a book entitled, "Dolphins, Whales, and Manatees of Florida: A Guide to Sharing Their Waters." This inexpensive book, to be published in 2003, is designed to fill a niche for teaching people about how to better appreciate and treat marine mammals in their environment.

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 initiating a program of educating fifth grade students in Sarasota about dolphins and manatees, their needs, and how to treat them in the wild, through classroom visits by Randy Wells. The program has been accepted as part of the 5<sup>th</sup> grade curriculum for Sarasota County, and will begin this spring. In preparation for these classroom visits, each class will be provided with free copies of Wells' book "Dolphin Man: Exploring the World of Dolphins."

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 (17 thesis or dissertation projects have been conducted in association with our program since 2000). 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 5<sup>th</sup> year.

Our efforts to provide information to our colleagues and wildlife management agencies continues, through publication of numerous scientific articles (18 since 2000), through invited presentations at scientific conferences such as the Biennial Conference on the Biology of Marine Mammals (20 presentations at the December 2001 conference in Vancouver resulted from our team's efforts), and through participation in national/international panels such as the Atlantic Scientific Review Group, the IUCN Cetacean Specialist Group and the IUCN Reintroduction Specialist Group.

## 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. In press. Dolphin social complexity: Lessons from long-term study and life history. In: F.B.M. de Waal and P.L. Tyack, eds., *Animal Social Complexity: Intelligence, Culture, and Individualized Societies*. Harvard University Press.
- Owen, E.C.G., S. Hofmann, and R.S. Wells. In press. Ranging and social association patterns of paired and unpaired adult male bottlenose dolphins, *Tursiops truncatus*, in Sarasota, Florida, provide no evidence for alternative male strategies. *Canadian Journal of Zoology*.
- 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*.
- Reynolds, J.E., III, and R.S. Wells. In Press. *Dolphins, Whales, and Manatees of Florida: A Guide to Sharing Their World*. University Press of Florida.
- Nowacek, S.M., R.S. Wells, D.P. Nowacek, E.C.G. Owen, T.R. Speakman, and R.O. Flamm. In review. Manatee behavioral responses to vessel approaches. Submitted to *Marine Mammal Science*.
- Hill, M.L., L.S. Sayigh, and R.S. Wells. In review. Signature whistle production in undisturbed free-ranging bottlenose dolphins (*Tursiops truncatus*). Submitted to *Animal Behavior*.
- 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*.
- Harper, C.G., M.T. Whary, Y. Fang, H.L. Rhinehart, R.S. Wells, S. Xu, N.S. Taylor, and J.G. Fox. In review. Comparison of diagnostic techniques for detecting *Helicobacter cetorum* infection in wild Atlantic bottlenose dolphins (*Tursiops truncatus*). *Journal of Clinical Microbiology*.
- Urian, K.W., R. S. Wells, and A.J. Read. In review. Community structure of bottlenose dolphins in Tampa Bay, FL USA. *Marine Ecology Progress Series*.

## Peer-reviewed Journal Articles and Book Chapters

- Schwacke, L.H., E.O. Voit, L.J. Hansen, R.S. Wells, G.B. Mitchum, A.A. Hohn, and P.A. Fair. 2002. Probabilistic risk assessment of reproductive effects of polychlorinated biphenyls on bottlenose dolphins (*Tursiops truncatus*) from the southeast United States coast. *Environmental Toxicology and Chemistry* 21(12):2752-2764.
- Meagher, E.M., W.A. McLellan, A.J. Westgate, R.S. Wells, D. Frierson, Jr., and D.A. Pabst. 2002. The relationship between heat flow and vasculature in the dorsal fin of wild bottlenose dolphins, *Tursiops truncatus*. *Journal of Experimental Biology* 205:3475-3486.
- Noren, S.R., G. Lacave, R.S. Wells, and T.M. Williams. 2002. The development of blood oxygen stores in bottlenose dolphins (*Tursiops truncatus*): Implications for diving capacity. *Journal of Zoology* 258:105-113.
- Duffield, D.A. and R.S. Wells. 2002. The molecular profile of a resident community of bottlenose dolphins, *Tursiops truncatus*. Pp. 3-11 In: C.J. Pfeiffer, ed., *Molecular and Cell Biology of Marine Mammals*. Krieger Publishing Company, Melbourne, FL.
- Wells, R.S. 2002. Identification methods. Pp.601-608 In: W.F. Perrin, B. Würsig, and J.G.M. Thewissen, eds., *Encyclopedia of Marine Mammals*. Academic Press, San Diego, CA.
- Wells, R.S. and M.D. Scott. 2002. Bottlenose dolphins (*Tursiops truncatus* and *T. aduncus*). Pp. 122-128 In: W.F. Perrin, B. Würsig, and J.G.M. Thewissen, eds., *Encyclopedia of Marine Mammals*. Academic Press, San Diego, CA.
- Nowacek, S. M., R. S. Wells and A.R. Solow. 2001. The effects of boat traffic on bottlenose dolphins, *Tursiops truncatus*, in Sarasota Bay, Florida. *Marine Mammal Science* 17:673-688.
- Quintana-Rizzo, E. and R.S. Wells. 2001. Associations and habitat use of resident and non-resident bottlenose dolphins, *Tursiops truncatus*, in the Cedar Keys, Florida: Insights into social organization. *Canadian Journal of Zoology* 79:447-456.

- Nowacek, D.P., P.L. Tyack, and R.S. Wells. 2001. A platform for continuous behavioral and acoustic observation of free-ranging marine mammals: Overhead video combined with underwater audio. *Marine Mammal Science* 17:191-199.

## Theses and Dissertations

- Meagher, Erin M. 2001. Respiration, heart rate and heat flux across the dorsal fin in bottlenose dolphins, *Tursiops truncatus*. M.Sc. thesis, University of North Carolina, Wilmington.
- Urian, Kim W. 2002. Community structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida, USA. M.Sc. thesis, University of North Carolina, Wilmington.
- Owen, Caryn F.W. 2001. A comparison of maternal care by primiparous and multiparous bottlenose dolphins, *Tursiops truncatus*: Does parenting improve with experience? M. Sc. Thesis, University of California, Santa Cruz. 36 pp.
- Sellas, Anna B. 2002. Population structure and group relatedness of bottlenose dolphins (*Tursiops truncatus*) in the coastal Gulf of Mexico using mitochondrial DNA and nuclear microsatellite markers. M. Sc. Thesis, University of California, Santa Cruz.
- Hill, Mandy L. 2002. Signature whistle production, development, and perception in free-ranging bottlenose dolphins. M.Sc. thesis, University of North Carolina, Wilmington.

## Popular Articles, Books

- Pringle, L. and R.S. Wells. 2002. *Dolphin Man: Exploring the World of Dolphins*. Honesdale, PA: Boyds Mills Press. 42 pp. (revised and reprinted from 1995 volume)

## Presentations at Professional Meetings

- Wells, R.S., T.K. Rowles, J.C. Sweeney, H.L. Rhinehart, W.M. Jarman, S. Hofmann, A.A. Hohn, D.A. Duffield, G. Mitchum, J. Stott, A. Hall, and P. Fair. 2002. Assessment of contaminant loads, toxic effects, health condition, and reproductive success of bottlenose dolphins. Annual Meeting, Society for Ecotoxicology and Chemistry, 16-20 November 2002, Salt Lake City, UT.
- Cunningham-Smith, P., D.E. Colbert, R.S. Wells, and T. Speakman. 2002. A demonstration of the need for increasing public awareness of the problems associated with human interactions with wild dolphins: A case study near Sarasota, Florida. 30<sup>th</sup> Annual Conference, International Marine Animal Trainers Association, 11-15 November, Orlando, FL. Presented by Cunningham-Smith, Education and Conservation Award.
- Stott, J.L., M.T. Blanchard, and R.S. Wells. 2002. Immunologic health assessment of free-ranging dolphins (*Tursiops truncatus*) in Sarasota Bay, FL. Florida Marine Mammal Health Conference. 4-7 April 2002, Gainesville, FL.
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- Wells, R.S., D. Duffield, and A.A. Hohn. 2001. Reproductive success of free-ranging bottlenose dolphins: Experience and size make a difference. 14<sup>th</sup> Biennial Conference on the Biology of Marine Mammals, 28 Nov-3 Dec, Vancouver, BC (Oral Presentation).
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- Wells, R.S., T.K. Rowles, and H.L. Rhinehart. 2001. Pollution 2000+: Bottlenose dolphin sampling progress during 2000-2001. 53<sup>rd</sup> Meeting of the Scientific Committee of the International Whaling Commission, July 6-12, Hammersmith, U.K.
- Wells, R.S. 2001. Evaluating health risks in free-ranging bottlenose dolphin populations. Invited Plenary Presentation, 32<sup>nd</sup> Annual Conference of the International Association for Aquatic Animal Medicine, April 28 – May 2, 2001, Tampa, FL.
- Urian, K.W., R. S. Wells, and A.J. Read. 2002. Community structure of bottlenose dolphins in Tampa Bay, FL USA. Southeast Atlantic Marine Mammal Symposium, Coastal Carolina University, Conway, SC. April 2002.
- Urian, K.W., R. S. Wells, and A.J. Read. 2000. Home on the Range: Methods for estimating home range for bottlenose dolphins, *Tursiops truncatus*. Southeast Atlantic Marine Mammal Symposium, Conway, SC. March 2000. University of North Carolina, Wilmington.
- Watwood, S.L., Owen, E.C.G., Miller, P.J.O., and Tyack, P.L. 2001. Using a hydrophone array to examine use of sound by bottlenose dolphins in social contexts. 14<sup>th</sup> Biennial Conference on the Biology of Marine Mammals, 28 Nov-3 Dec, Vancouver, BC

#### Invited Public and University Lectures

- 12 Sep 2002 Bottlenose dolphin conservation based on long-term behavior, ecology, life history, and health research. Biology Dept., University of North Carolina, Wilmington.
- 16 Jul 2002 Bottlenose dolphin conservation based on long-term behavior, ecology, life history, and health research. Sanibel-Captiva Conservation Foundation, Sanibel, FL.
- 14 May 2002 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.
- 19 Apr 2002 Bottlenose dolphins and human interactions. NMFS Southeast Regional Office, St. Petersburg, FL.
- 13 Apr 2002 Conservation Matters, Brookfield Zoo, Brookfield, IL.
- 25 Jan 2002 Bottlenose dolphin conservation based on long-term behavior, ecology, life history, and health research. University of South Florida, St. Petersburg, FL.
- 26 Oct 2001 Bottlenose dolphin conservation based on long-term behavior, ecology, life history, and health research. University of Michigan, Ann Arbor, MI.
- 22 Oct 2001 Bottlenose dolphin conservation based on long-term behavior, ecology, life history, and health research. University of Miami.
- 15 Oct 2001 Odontocete life history. Biology of Marine Mammals course, Eckerd College, St. Petersburg, FL.
- 9 Oct 2001 Hawaiian spinner dolphins: Acrobats of tropical seas. *M/S Paul Gauguin*, Bora Bora, French Polynesia.
- 19 Apr 2001 Exploring careers in wildlife science. Fort Wayne Children's Zoo, IN.

## Staff and Volunteer Perspectives

### Chrissie Craven, SDRP Intern

The internship program at the Sarasota Dolphin Research Program has given me the unique opportunity to learn about the specific hypotheses being examined in efforts to promote the conservation of cetaceans. My experiences at SDRP have permitted me to observe the protocol involved in designing and implementing cetacean field studies in both the laboratory and field settings. During my initial internship period, my primary responsibility was to assist doctoral student Ester Quintana-Rizzo in collecting data for her dissertation examining the processes of group fission and fusion in the Sarasota dolphin community. In addition to collecting data each day, I gained valuable experience by participating in focal animal follows, setting up acoustic equipment, and photographing and identifying Sarasota dolphins. My experiences in the field exposed me to the commitment and organization involved in marine mammal science as well as the various methodologies employed by the SDRP staff. My current internship period focuses largely on the dolphins residing in the Charlotte Harbor study area. I participated in the September 2002 Charlotte Harbor field surveys and I have devoted the majority of my time since then to identifying the animals photographed in previous Charlotte Harbor surveys. Additionally, I completed an independent project that involved identifying Charlotte Harbor dolphins that have been sighted ten or more times and plotting their sightings using GPS data obtained during field surveys. My time at SDRP has been beneficial in countless ways. I have developed many important skills, met numerous new people, and acquired a deeper understanding of the research conducted at SDRP and elsewhere. More importantly, while contributing daily to the research conducted at SDRP, I have strengthened my own desire to contribute on a scientific level to the conservation of small cetaceans and I feel that my internship at Mote through SDRP will help me to one day realize my goal.

### Jason Allen, Field Research Assistant

I began working as a research assistant with the SDRP in May 2001. My primary duties have been to assist with data collection and processing, and field program logistics. I also work closely with Kim Bassos-Hull on our dolphin distribution and abundance surveys in the Charlotte Harbor estuary. I have a B.S. in marine science, biology track, from Eckerd College, St. Petersburg, FL. While at Eckerd College, I worked with a dolphin research program similar to the SDRP where I focused on estimating the survival rate and size of the bottlenose dolphin population in that area.

### Brian Balmer, Lab Research Assistant

I started as a research assistant for the SDRP in May 2002. I work on various aspects of the project, specifically duties relating to the Dolphin Capture and Release Project, biopsy darting, sample handling, and processing. I received my bachelors' degrees in wildlife science and biology, from Virginia Tech in Blacksburg, Virginia. My undergraduate research focus was in black bear den reuse and home range studies in the SW Appalachian Mountains. I've worked with over 50 radio-collared female black bears in the four years I was on project.

## Sarasota Dolphin Research Program 2001-2003

### Staff

Randall Wells, Ph.D., Program Manager  
Sue Hofmann, B.S., Field Coordinator  
Stephanie Nowacek, M.Sc., Lab Manager  
Kim Bassos-Hull, M.Sc., Research Associate  
Kristi Fazioli, M. Sc., Research Associate  
Howard Rhinehart, AHT, Veterinary Technician  
Jason Allen, B.Sc., Field Research Assistant  
Brian Balmer, B.Sc., Lab Research Assistant  
Chrissie Craven, B.Sc., Technician  
Todd Speakman, B. Sc., Research Assistant  
Douglas Nowacek, Ph.D., Post-Doctoral Investigator  
Michael Scott, Ph.D., Secretary-Treasurer, DBRI  
Blair Irvine, Ph.D., President, DBRI

### Master's Students

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  
Mandy Hill, University of North Carolina, Wilmington  
Erin Meagher, University of North Carolina, Wilmington  
Caryn Owen, University of California, Santa Cruz

### Doctoral Students

Spencer Fire, University of California, Santa Cruz  
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-Rizzo, University of South Florida  
Stephanie Watwood, MIT/WHOI

### Interns

Kristina Alexander	Shelby Moneysmith
Rebecca Bearman	Julia Orth
Kathryn Cobb	Kelly Price
Chrissie Craven	Athena Rycyk
Veronica DeCamp	Melynda Schneider
Salome Dussan-Constantine	Petra Schneider
Virginia Fuhs	Debbie Salmon
Lauren Giese	Jordan Sanford
Brendan Hurley	Shauna Sharpe
Michelle Lamping	Ari Shapiro
Sarah Layton	Maki Tabuchi
Kellie Margot	Vanessa Van de Wyngard
Jennifer Mawson	Carrie Wall
Katie McHugh	Jessica Weiss
Monika Merriman	Amy Whitt

# How You Can Make a Difference!

## Charitable Donation Opportunities

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. Over the next year we need your assistance in replacing a 31-year-old research vessel, a projected expense of about \$25,000, and in providing the balance of funding needed for archived organochlorine contaminant sample analyses, \$100,000. Over the longer term, 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 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.

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.**  
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**William Spence**  
**Disney Wildlife Conservation Fund**  
**NOAA Fisheries**  
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**Don and Lee Hamilton**  
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**Marletta Darnall**  
**Indianapolis Zoo**  
**Mote Scientific Foundation**  
**Stephen Bartram**

**Ronnie and John Enander**  
**Harbor Branch OI Protect Wild Dolphins Program**  
**Cannons Marina, David and Lucille Miller**  
**Dolphin Quest, Jay Sweeney and Rae Stone**  
**Earthwatch Institute/Center for Field Research**  
**John and Karen Buckstaff**

### 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 during 2003. To purchase copies, please contact your local bookseller, or look for them on-line.

Reynolds, John E., III. In press/2003. *Mysterious Manatees*. University Press of Florida, Gainesville, FL.

Reynolds, John E., III, and Randall S. Wells. In press/2003. *Dolphins, Whales, and Manatees of Florida: A Guide to Sharing Their World*. University Press of Florida, Gainesville, FL.

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

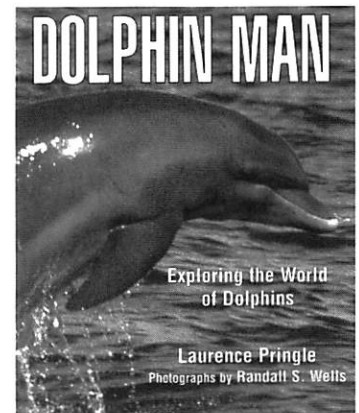
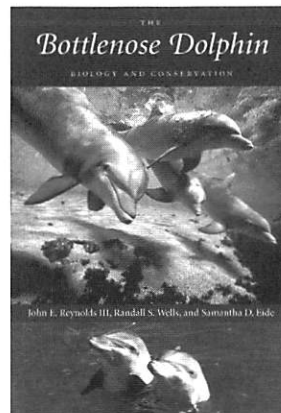
Pringle, Laurence and Randall S. Wells. 2002. *Dolphin Man: Exploring the World of Dolphins*. Boyds Mills Press, Honesdale, PA. 42 pp. ISBN 1-59078-004-3

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 Sentiell A. Rommel, (eds.). 1999. *Biology of Marine Mammals*. Smithsonian Institution Press, Washington, DC. 578 pp. ISBN 1-56098-375-

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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