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NICKS *n* NOTCHES

Chicago Zoological Society

Annual Summary of the Activities and Findings of the Sarasota Dolphin Research Program

Chicago Zoological Society Mission Statement

The mission of the Chicago Zoological Society is to inspire conservation leadership by connecting people with wildlife and nature.

Dolphin Biology Research Institute Mission Statement

Building on the foundation of the world's longest-running study of a wild dolphin population, the Sarasota Dolphin Research Program improves the lives of dolphins through:

- Research on dolphins in the wild to better understand how they live, how they interact with their environment, and how they are affected by human activities.
- Translating scientific research into conservation action.
- Sharing what we have learned, via public education and outreach, scientific publications and presentations, and training researchers and future conservation leaders around the world.

Our approach toward helping dolphins

By Randall Wells, PhD

Our desire with each research or conservation project in Florida or elsewhere is to contribute to a better understanding of the structure and dynamics of populations of small cetaceans (dolphins, whales, and porpoises), as well as the natural and anthropogenic factors (factors of human origin) that impact them. We use an interdisciplinary and collaborative approach in conducting studies of bottlenose dolphins within a unique long-term natural laboratory. The primary goals of our program include:

(1) collecting biological, behavioral, ecological, and health data of importance to the conservation of small cetaceans, especially bottlenose dolphins,

(2) providing requisite information for bottlenose dolphin conservation to wildlife management agencies,

(3) disseminating the information generated by our program to scientific and general audiences in order to aid dolphin conservation efforts,

(4) using our model program to develop and refine hypotheses regarding bottlenose dolphins in other parts of the species' range as well as other species of small cetaceans,

(5) using the established natural laboratory to develop and test new research tools and methodologies of potential benefit to conservation efforts,

(6) training cetacean conservation workers and students from around the world in the use of these techniques,

(7) applying our unique expertise to dolphin rescue operations and post-release follow-up monitoring, and

(8) applying the information we gather from free-ranging dolphins to improve the quality of care for dolphins in zoological park settings.

The collaborative work done in partnerships toward achieving these goals is conducted under the umbrella of the "Sarasota Dolphin Research Program." This name links the efforts of several organizations and individuals that work together to insure the continuity of the long-term dolphin research in Sarasota Bay. The SDRP has been operated by the Chicago Zoological Society (CZS) 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 four 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 opportunities primarily through the University of California at Santa Cruz, the University of North Carolina Wilmington, Duke University, University of Florida, and the University of South Florida.

All of our bottlenose dolphin research in the United States is conducted under NOAA Fisheries Service Scientific Research Permit No. 15543 and Institutional Animal Care and Use Committee approvals through the appropriate institutions.

Chicago Zoological Society
Inspiring Conservation Leadership

MOTE MARINE LABORATORY

In This Issue

What is the value of a unique, long-term dolphin research and conservation program?

By Randall Wells, PhD, Director, Sarasota Dolphin Research Program

2004: More than 100 dolphins wash up on Florida panhandle beaches near St. Joseph Bay, in an unexplained, unusual mortality event (UME).
2009: Scientists find the highest reported levels of PCBs in any marine mammal, in bottlenose dolphins residing near Brunswick, GA.
2010: The BP Deepwater Horizon (DWH) oil spill, the worst environmental disaster in U.S. history, sends massive quantities of oil into estuarine habitat of bottlenose dolphins in the northern Gulf of Mexico, including Barataria Bay, LA.
2012: Adverse human interactions with dolphins are on the rise through much of the southeastern United States (SEUS), leading to increased numbers of dolphin deaths and serious injuries.

Who does the National Oceanic and Atmospheric Administration (NOAA), the federal agency tasked with managing dolphins under the U.S. Marine Mammal Protection Act, contact for assistance when faced with these kinds of large scale threats to dolphins? The Chicago Zoological Society's Sarasota Dolphin Research Program (SDRP) has become one of NOAA's primary "go-to" partners for responding to issues impacting dolphin populations in the SEUS. The SDRP research team has a long-term record of consistently high quality work from extraordinarily skilled and experienced field research staff, and a history of responding quickly and effectively when asked. Our response capability is enhanced by the long-term nature of the field team itself – on average, our eight core staff members have worked with the team for more than 13 years, and several began as undergraduate interns or graduate students. Staff expertise with state-of-the-art field research tools and techniques comes from our ongoing core research efforts in Sarasota Bay, FL, the "natural laboratory" where many now-standard field techniques have been developed, tested, and/or refined over the past 42 years.

Sarasota Bay dolphins as a reference population of national importance

In addition to involving SDRP staff in research projects across the SEUS, NOAA also relies on the SDRP's unique long-term datasets, using Sarasota Bay resident dolphins as a "reference population." These datasets, compiled through continuous and consistent efforts over decades, provide baselines and reference ranges for a variety of parameters related to health, life history, ecology, behavior, and human interactions. Long-term data collection has provided indications of population-level variability over time and different conditions. Repeated observations and sampling of individuals over the course of their lives have established an understanding of potential ranges of variability within an individual. Patterns of significant deviation from these "normal ranges" at a field site where unusual mortality events, anthropogenic (man-made) stressors, or abnormal environmental conditions are occurring, can direct attention to specific parameters or issues of concern, guiding further research or mitigation efforts. Increasing sample sizes from Sarasota Bay over time add precision to the datasets, improving the detectability of significant, meaningful deviations elsewhere.

The oldest and youngest members of the long-term resident Sarasota Bay dolphin community in June 2012, including 62-yr-old Nicklo (far left) and her new grand-calf (head out).

When NOAA wanted to learn about the causes and impacts of the St. Joseph Bay UME, our staff discovered a novel pattern of residency for the area, changing NOAA's previous concept for these dolphins. In addition, SDRP staff assisted with two health assessments in the region that identified, through comparisons with Sarasota Bay reference data, the occurrence of a chronic health issue, potentially linked with a harmful algal bloom that could, over the long-term, produce organ damage and alter immunological status and thereby increase vulnerability to other health challenges.

In response to concerns about dolphins living downstream from four EPA Superfund pollution sites near Brunswick, GA, our staff worked with NOAA to define the ranging patterns of dolphins exposed to high levels of anthropogenic contamination from PCBs. In addition, SDRP staff assisted with a health assessment in the waters of southern Georgia, which identified in part through comparisons with the Sarasota Bay reference population, that dolphins are vulnerable to site-specific toxic effects. These effects appear to be at least partially mediated through the endocrine system. The severity of these site-specific contaminants may be influencing habitat use and overall dolphin abundance in the waters surrounding the Superfund sites as well as extending into areas previously thought to be unaffected by these anthropogenic stressors.

The reference population of Sarasota Bay bottlenose dolphins has played a crucial role in understanding the health status of dolphins in Barataria Bay, LA, a bay heavily impacted by DWH oil. During NOAA health assessments in 2011, Barataria Bay

dolphins exhibited severe health problems that were not observed in dolphins sampled through identical procedures during 2010-2011 from un-oiled Sarasota Bay, and have not been seen in previous studies of dolphins from other sites along the Atlantic coast or the Gulf of Mexico. The Barataria Bay dolphins that were examined were underweight, had low hormone levels, low blood sugar, and some showed signs of liver damage. It remains to be determined if these health effects are directly related to the DWH oil spill. In addition, SDRP was responsible for using telemetry technology developed and tested in part by our program, to determine dolphin habitat use in Barataria Bay. The SDRP is currently providing NOAA with unique long-term data from Sarasota Bay on dolphin reproductive rates, fecundity, and pregnancies, which are being used for comparison to Barataria Bay dolphins.

The SDRP as a model program for addressing conservation issues

Dolphin injuries and deaths from human activities such as those related to provisioning and recreational fishing appear to be on the rise in Sarasota Bay and throughout the SEUS. NOAA is funding a project by the SDRP to develop broadly applicable and transferable approaches for accurately assessing and monitoring human interactions with dolphins. The project is analyzing archived Sarasota dolphin data along with current observational data to understand potential temporal trends and ranges of variability across time. Application of these techniques to suspected hotspots will help NOAA to more appropriately distribute its limited resources for mitigating these issues.

Maintaining a unique natural laboratory for conservation research and training

In addition to NOAA, other scientists from around the world have come to rely on the long-term datasets and natural laboratory opportunities maintained by the SDRP. The sheltered waters and predictably available dolphins of known background residing in Sarasota Bay provide unique opportunities to conduct detailed experiments and tests of hypotheses, and to test new technology before deployments under more challenging field conditions. For example, scientists from Woods Hole Oceanographic Institution and the Sea Mammal Research Unit at the University of St. Andrews have obtained signature whistle recordings of Sarasota Bay dolphins of known sex, age, familial relationships, ranging patterns, and social associations over periods of decades. This has allowed them to define the prevalence and stability of these communication patterns within the dolphin community, and to discover their function as abstract "names" – a highly unusual phenomenon among mammals. Tests of state-of-the-art digital archival DTAGs on Sarasota Bay dolphins have facilitated application of this technology to many difficult-to-study species of whales and dolphins around the world, opening new windows into the lives of little-known animals facing serious threats. The natural laboratory of Sarasota Bay has also provided tremendous opportunities to researchers and students from around the world to learn our approaches and techniques, and increase conservation capacity in their own countries.

Addressing the continuing need for knowledge to benefit dolphin conservation

In all of these examples, the common threads have been the high quality efforts of a dedicated, highly skilled, and well-established research team, and the development and maintenance of unique, long-term datasets and field research situation. The value of the datasets resides in their continuity and consistency, with painstaking attention to detail in data collection, processing, and archiving. Maintaining continuous, consistent efforts into the future will be crucial for improving precision and for identifying shifting baselines. Some of the emerging threats to dolphins, such as climate disruption or exposure to environmental contaminants, will require long time series of consistently collected data for detection of impacts or population responses. As we have learned from the requests we have received to date from around the world for data and collaborations for studies of climate change, few of these datasets exist, making the Sarasota dolphin datasets of immeasurable value going into the future. To maintain this value, it will be necessary to secure ongoing support to ensure the stability of the highly skilled, dedicated SDRP staff, and to sustain their passionate efforts for dolphin conservation.

Merrily's newborn calf, C114, leaping in September 2012.

Understanding mercury and selenium in Sarasota Bay dolphins

By Todd O'Hara, PhD/DVM, University of Alaska, Fairbanks

The Wildlife Toxicology Laboratory at the University of Alaska, Fairbanks (UAF) considers it a great opportunity and privilege to work with the Sarasota Dolphin Research Program as we investigate mercury (Hg) in our ocean systems. Working with colleagues who are experts in marine mammals offers a window (sentinel species) for us, especially when high quality samples are obtained in a well studied population using exceptional handling techniques. This research into Hg in our oceans is similar to some of our efforts in Alaska.

We have addressed aspects of Hg in dolphins in the past related to their feeding ecology and changes in their outer skin (epidermis). Our investigations have turned to addressing Hg and selenium (Se, an essential element) concentrations in blood compartments. We have determined concentrations in serum, plasma, whole blood, and packed cells (*e.g.*, "blood compartments"). We do this in part because Se has been hypothesized to be protective against the effects of Hg, but is likely dependent on species and tissue-type. The dogma considers an abundance of Se relative to Hg as potentially protective or ameliorating to the adverse effects to Hg. In this study we examine Hg and Se on a mass (weight) and molar (number of atoms, more of a count) concentration basis in various blood compartments of bottlenose dolphins to determine how these elements partition in blood and the potential for specific compartmental interactions. One can appreciate that the count of the Hg and Se atoms tells us more about how they interact as elements, especially when we determine the ratio of Se:Hg. However, when we discuss nutritional status and potential toxicity we use mass (ppm) as our measure and since Hg and Se have different atomic weights we need to consider both measures (mass and count).

The distribution within the blood compartments of Se and Hg can provide insight on the potential association of Hg with selenoproteins (Se binding sites, essential enzymes that require Se, etc.) in blood. For concentrations of both Hg and Se, serum=plasma < whole blood < packed cells (e.g., whole blood has lower concentrations than packed cells), however there was a higher proportion of Se in serum and plasma compared to Hg. The Se:Hg molar (count, not mass) ratio was greater than 1.0 in all compartments, with the highest ratios found in serum and plasma and the lowest in whole blood and packed cells. This indicates an abundance of Se relative to Hg in these compartments. As expected age of the dolphin was positively correlated to the concentration of Hg in all blood compartments and to Se concentration in serum, plasma and whole blood only. Age was negatively correlated to Se:Hg molar ratios in all blood compartments indicating a relative change where protective mechanisms may be decreased with aging animals (speculation as functional measures are required to better assess this). The feasibility of calculating packed cell concentrations of Hg and Se using hematocrit (routine measure of blood cellular components relative to whole blood volume) measurements in combination with whole blood and plasma concentrations was validated, making it possible to routinely assess compartmentalization of Hg and Se within erythrocytes (red blood cells) using common clinical measurements.

This research, combined with other animal models, is advancing our understanding of how a toxicant and nutrient interact. Concern is driven by observations in some marine systems that Hg concentrations may be increasing over time. One question is "Will Se and other protective systems continue to offset the potential toxicity of Hg in fish consumers?" Marine mammals may offer some insights into these mechanisms and potential effects, including how nutrients may protect from toxicity.

Sarasota Bay resident, F142, feeding on a mullet, June 2012.

Long-term trends in a coastal northern Gulf of Mexico bottlenose dolphin population in the wake of the Deepwater Horizon oil spill

By Brian Balmer, PhD, and Carolyn Cush, BS, Chicago Zoological Society

The Deepwater Horizon blowout and oil spill began on 20 April 2010 and resulted in the largest oil spill in the history of the U.S., contaminating approximately 800 kilometers of coastline and nearshore waters along the northern Gulf of Mexico, including Louisiana, Mississippi, Alabama, and the Florida panhandle. The oil spill was an additional stressor to bottlenose dolphins in a region that had already been impacted by a series of four Unusual Mortality Events (UMEs) since 1999. Studies to assess the potential impacts to bottlenose dolphins in the Northern Gulf were initiated as part of the Deepwater Horizon Natural Resource Damage Assessment, which included photo-identification surveys to estimate abundance for three estuarine dolphin stocks in the region.

One of these study sites was St. Joseph Bay, along Florida's northern Gulf of Mexico coastline. St. Joseph Bay was impacted by three prior UMEs, and was the geographic focus of the 2004 UME in which more than 100 dolphins stranded during March and April. Since 2004, SDRP researchers have led and/or been involved with multiple projects (health assessments, photo-identification, remote biopsy sampling, and telemetry) focusing on the health and population structure of dolphins within this region. The results of these studies have provided insight into abundance and distribution patterns, identified baseline concentrations of persistent chemical pollutants, and established health parameters for dolphins in the St. Joseph Bay area. Photo-identification surveys conducted during the summer of 2010, when oil was still gushing from the Deepwater Horizon wellhead, identified the highest abundance, greatest number of new individuals sighted, and highest coastal dolphin density for any season surveyed in the St. Joseph Bay region since 2004. Prior to 2010, an influx of coastal dolphins into the region had been observed during the spring and fall, with summer abundance typically lower and primarily consisting of resident dolphins that remained in St. Joseph Bay throughout the year.

Ultimately, significant oiling from the Deepwater Horizon oil spill was not observed along the St. Joseph Bay coastline. However, the bottlenose dolphins in this region are one of the best-studied groups in the Northern Gulf and much was learned by assessing their status during the months following the Deepwater Horizon spill. The presence of oil in nearshore waters west of St. Joseph Bay as well as in offshore waters may have prompted temporary movement of dolphins from oiled sites to those that had less oiling. Comparisons of dolphins sighted during the summer of 2010 to other photo-identification catalogs along the Northern Gulf are necessary to determine if individuals sighted during these surveys were from other sites, and to track potential shifts in ranges as ecological conditions change.

This material is based upon work supported by BP and NOAA. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of BP and/or state or federal natural resource trustees.

Two of the 148 new dolphins added to the St. Joseph Bay catalog following the summer of 2010 photo-identification surveys.

Deepwater Horizon oil spill: Bottlenose dolphin tracking in Barataria Bay, Louisiana

By Brian Balmer, PhD, Chicago Zoological Society

The Chicago Zoological Society's Sarasota Dolphin Research Program was contracted to track 30 bottlenose dolphins tagged with satellite-linked and/or radio transmitters during capture-release health assessments in Barataria Bay, Louisiana during 3-17 August 2011. This research was done to: 1) gain a better understanding of movements and ranges of dolphins in Barataria Bay, an area which has been impacted by oil from the Deepwater Horizon oil spill, and 2) evaluate the conditions of the tags and tagged dolphins throughout the course of the study. Satellite-linked tags transmitted for 48-260 days and overall, tagged dolphins exhibited localized movements within Barataria Bay and the surrounding estuaries. Radio telemetry permitted follow-up monitoring to visually assess animal and tag condition. Of the 30 tagged dolphins, 24 have been resighted post-tag loss; no adverse impacts from the tags were seen. These results suggest that the tags used in this study are a good step toward designing a tag to minimize fin damage and maximize transmission duration.

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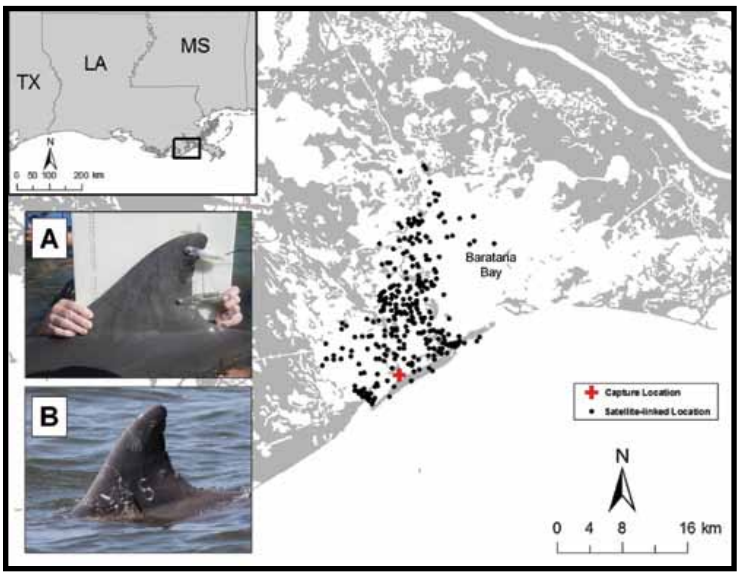


Satellite-linked telemetry locations for dolphin "Y18" from 15 August 2011 - 27 February 2012 (N = 196 days) and dorsal fin images from (A) 15 August 2011 and (B) 17 May 2012.

Collaborative study with NOAA shows some Gulf dolphins severely ill

By Lori Schwacke, PhD, NOAA, National Centers for Coastal Ocean Science

Bottlenose dolphins in Barataria Bay, LA, a site which received significant and prolonged oiling following the Deepwater Horizon oil spill, are showing signs of ill health. The dolphins were evaluated in August, 2011 as part of a collaborative study involving NOAA and CZS. Methods for the assessment were modeled after those developed by the Sarasota Dolphin Research Program. Sarasota Bay, which did not receive significant oil, was used as a reference site for comparison of dolphin health parameters.

Preliminary results based on comprehensive physicals of 32 dolphins found that Barataria Bay dolphins are underweight, anemic, and many have symptoms of liver and lung disease. Nearly half of the dolphins sampled had abnormally low levels of hormones that help with stress response, metabolism and immune function. Many of the dolphins were in such poor health that they likely will not survive. Y12, one of the sampled dolphins, was found dead in January 2012.

NOAA, with CZS and local, state and federal partners, in cooperation with BP, initiated the Barataria Bay dolphin study in 2011 as part of the Natural Resource Damage Assessment (NRDA), the process for studying the effects of the Deepwater Horizon oil spill.

Left: Veterinarians prepare to collect a urine sample from Y12, a 16-year old, adult male bottlenose dolphin caught near Grand Isle during health assessments conducted in August 2011. Y12's health evaluation determined that he was significantly underweight, anemic, and had indications of liver and lung disease.

Right: Y12's carcass was recovered on Grand Isle Beach, 31 January 2012. The visible ribs, prominent vertebral processes, and depressions along the back are signs of extreme emaciation. A necropsy was performed and samples were collected to help determine cause of death and potential contributing factors.

Florida Entanglement Working Group: Tracking impacts of entanglement on marine wildlife and promoting entanglement prevention initiatives

By Kim Bassos-Hull, MS, SDRP/Mote Marine Laboratory

Marine debris is a global problem that has been an ongoing concern for animal conservation. Within Florida state waters, dolphins, manatees and turtles that become entangled in, or ingest, marine debris (especially fishing gear such as hooks, lines, nets, and parts of crab traps) can suffer debilitating and life threatening effects. The Florida Entanglement Working Group (FEWG) was formed in 2003 to focus on these issues in Florida state waters and includes several state (FWC), federal (NOAA), and non-profit organizations as contributing members (the Sarasota Dolphin Research Program has been a contributing member since 2005). The most recent meeting of this group was 3 October 2012 at Mote Marine Lab. Group members reported on regional and statewide events such as coastal cleanup-ups, progress of the Monofilament Recovery and Recycling Program (MRRP), entanglement rescues, and crab trap closures affected by the Gulf oil spill in 2010. FEWG also works with FWC to maintain the MRRP website and access to outreach materials such as MRRP bins, logos, stickers and locations of MRRP bins in the Florida counties and promoting fishing line recycling (www.fishinglinerecycling.org).

One subgroup of FEWG, the Multi Species Analysis working group, has been analyzing stranding data to evaluate entanglement trends, impacts and entanglement problem areas (or "Hotspots") on dolphins, manatees, and sea turtles throughout the state. This study compiled and analyzed entanglement and ingestion data of both active and derelict fishing gear from dolphins, manatees and six species of turtles, using stranding records from Florida (1997-2009). Fishery-related gear was categorized as follows: hook and line (HL) (fishing line, hooks, lures, etc.); trap pot gear (TPG) (any part of a trap pot including buoy and line) and other known fishing gear (OG) not separated into the previous two categories (*e.g.*, net, rope). A

Marine debris (includes ropes, ribbons, balloons, and fishing line) recovered by volunteers from Sarasota Bay during Sarasota Baywatch's Monofilament Cleanup on 29 September 2012.

combined total of 27,323 stranding cases among the three major groups was reported, of which 2,412 were bottlenose dolphins, 4,962 manatees, and 19,949 sea turtles. From these, a total of 1,958 were evaluated to be gear-on entanglement cases and were analyzed; 132 bottlenose dolphins, 433 manatees, and 1,393 sea turtles. For all species combined, entanglements increased significantly and were composed of 69.6% HL, 15.2% TPG, and 15.2% of OG. In addition, both HL and OG entanglements increased significantly. While entanglement strandings occurred statewide, hotspots were observed along Florida's central and southwest and central east coasts, and in the Florida Keys. Results support the need for an increase in statewide outreach initiatives, with targeted actions in "hotspot" areas. Outreach includes educating anglers about safe angling practices including monofilament fishing line recycling and responsible fishing near marine wildlife. Actions include the removal of entangling marine debris such as derelict crab traps and fishing line, especially in high risk entangling areas such as piers and reefs. The cumulative effects of fishing gear debris and entanglements on the recovery and persistence of local marine mammal and sea turtles populations are currently unknown. Management recommendations include working with fishing communities to develop solutions that will be mutually beneficial to fishers, wildlife and habitat.

A local boater taunting Beggar with a fish while a friend snaps a picture during the 2011 HI mitigation experiment.

Sarasota Bay resident dolphin F232 patrolling near the Anna Maria City Pier in October 2012. F232's mother, FB75, died in 2006 after ingesting fishing gear.

Human interaction research in Sarasota Bay

By Katie McHugh, PhD, Chicago Zoological Society

Human interactions (HI) with wild dolphins are an increasing problem for management and conservation of coastal and inshore bottlenose dolphins because of their potential to injure or kill dolphins and contribute to unnatural foraging behaviors such as begging, scavenging, and depredation (when dolphins take or feed on bait or catch from anglers' lines). This year, the SDRP has expanded our efforts to study and mitigate human interactions with wild dolphins in the Sarasota Bay region and beyond. We were awarded a two-year grant from the Mississippi-Alabama Sea Grant Consortium to utilize the "natural laboratory" in Sarasota Bay to conduct a pilot study focused on determining the primary factors contributing to HI causing unnatural foraging behaviors in our study area. This project will also help to develop standardized, transferrable methodologies and identify minimum data requirements to accurately characterize HI in residential inshore dolphin populations in other parts of the Southeast United States and Gulf of Mexico.

Sarasota Bay is a particularly good place to address these questions because the wealth of long-term background information available on the resident dolphin population and their prey provides the appropriate context to characterize factors contributing to HI in unique detail. For example, we will be able to incorporate information on spatial and temporal differences in prey availability, as well as robust estimates of population size and the proportion of individuals engaging in unnatural foraging behaviors over time, with in-depth HI histories and focal observations on individual dolphins into our analyses. As a part of this project, we will work with collaborators Lars Bejder and David Lusseau to draw upon our long-term datasets using new analytical methods to explore spatial and temporal heterogeneity in HI and social factors contributing to persistence and spread of unnatural foraging behaviors within the Sarasota Bay community.

In addition to our long-term datasets, this new project also builds upon several recent SDRP research initiatives, including studies focused on long-term trends in HI in Sarasota Bay, dolphin interactions with recreational anglers, and experimental testing of enforcement and education strategies at an HI hotspot in Sarasota Bay centered on the notorious dolphin Beggar, who passed away in September 2012. Beggar's death, along with several recent boat strikes, repeated need for rescues of entangled animals, and observations of illegal provisioning of dolphins in the area all highlight the need for us to continue working to better understand and reduce HI in Sarasota Bay, and we hope that our efforts here will also help managers and researchers tackling similar issues throughout the region. In addition to our research efforts, we continue to make outreach materials, such as the "Dolphin Friendly Fishing and Viewing Tips" cards and the "Don't Feed Wild Dolphins" public service announcement, available to local businesses and educational partners and hope that we will be able to develop new tools based upon our findings.

Beggar - A human interaction icon meets an untimely end

By Randall Wells, SDRP, Katie McHugh, SDRP, Gretchen Lovewell, Mote Marine Laboratory, and Nadine Slimak, Mote Marine Laboratory

On 10 August 1990, SDRP scientists encountered an unusual phenomenon in the Intracoastal Waterway just north of Albee Bridge, in the southern portion of our primary study area. A lone juvenile dolphin approached our boat and opened his mouth, apparently seeking a food handout. The same distinctive dolphin was seen later that month, in the same place, and engaged in the same activities. We gave him the name "Beggar" and added him to our dolphin identification catalog. Our first thought was that he might have been released from a dolphinarium. It was clear that he could not have been released from Floridaland, a small attraction located nearby that closed down in the early 1970s, because he was not full grown in 1990, and therefore not even alive when Floridaland existed. A phone call to the man who ran the dolphin portion of Floridaland confirmed that they did not leave any dolphins behind when they closed. The other facilities along the Florida coast indicated he did not come from them, leading us to the conclusion that this begging behavior was originating from people feeding Beggar in the wild, and reinforcing his behavior of approaching boats.

Over the next 22 years we saw him nearly 400 times, in the same area between Albee and Blackburn bridges, and nearly always engaged in seeking food from humans. Mostly, he was alone, but on occasion he was seen with other individuals, several of whom were subsequently observed engaging in begging behavior. During 1993-1996, about a quarter of his sightings were with a distinctive dolphin we named "Mooch," so named because of his begging behavior. His closest associate over the years was an adult female named "Bardot." Bardot also solicited food from boaters, beyond the limited geographic range of Beggar. At least one of Bardot's calves also picked up the begging behavior, and when the 4-yr-old male died in 2000, within Beggar's range, it was emaciated, had fish hooks in its stomach, line entanglement scars on all of its fins, a shark bite scar, and fresh, deep, boat propeller wounds on its peduncle (tail stalk) – the young animal was a poster child for all that could go wrong from interactions with humans.

Beggar was the most predictable member of the resident Sarasota Bay dolphin community – if you went to his range, you had a high probability of finding him, often behaving badly. This predictability led the SDRP, Mote Marine Laboratory, and NOAA Fisheries to try to make the best of a bad situation – using Beggar to educate boaters and anglers about the problems of feeding wild dolphins, a growing problem in the southeastern United States. He was the subject of, or impetus behind, a number of research projects, town-hall meetings, and class-room visits, and the posting of signs in the Intracoastal Waterway warning people to not engage in the illegal activities of feeding or petting wild dolphins. He was the focus of numerous local, state, national and international television and print stories, and he was the basis for a 30-sec public service announcement (www.dontfeedwilddolphins.org). His images grace cards, brochures and posters describing the problems associated with feeding wild dolphins, and the rationale for not interacting with them.

Beggar was the most predictable dolphin in the area until his death on 21 September 2012. Mote Marine Laboratory Stranding Investigations Program staff and SDRP staff responded to a call about a dead dolphin. The carcass was identified as that of Beggar, and was brought back to Mote for a necropsy. Beggar's body was moderately decomposed and no definitive cause of death could be pinpointed, but there were a number of indications that his interactions with humans played an overall role in his death:

One of the first sightings of Beggar as a juvenile in 1990.

Beggar being "trained" by boaters in August 1993.

Boaters teaching bad habits to children in August 1993.

Beggar as an adult in 2011, approximately 1 year prior to his death.

- Externally, there were healed boat wounds on the dorsal fin, a healed puncture wound on the right pectoral fin, a possible boat wound on the right side of the body, below the dorsal fin and a healing puncture wound between the blowhole and the dorsal fin.
- Beggar had multiple broken ribs and vertebrae.
- While he did not have much food in his stomachs, there were three fishing hooks and small bits of line in the first stomach, two squid beaks (not a normal prey item for resident Sarasota Bay dolphins) and several ulcers of varying severity in the third stomach.
- He was markedly underweight and dehydrated — possibly because he was not eating a normal dolphin diet.
- In addition to these wounds, internal injuries were noted from two stingray barbs. One barb had migrated through the ribs and embedded near the small intestine with necrotic tissue surrounding the barb. The second barb was found near the right shoulder blade and was very close to puncturing the thoracic cavity (near the lungs).

No one knows exactly when his begging behavior started, but it became the topic of numerous public education campaigns and scientific studies. During the most recent study, Dr. Katie McHugh of the Sarasota Dolphin Research Program spent 100 hours observing his behavior and that of the boaters who encountered him from March to June 2011. Her goal was to test different mitigation strategies to see which was most effective at reducing human interactions with dolphins. She documented these interactions:

- 3,600 interactions between Beggar and humans — up to 70/hr
- 169 attempts to feed him 520 food items — everything from shrimp and squid to beer, hot dogs and fruit;
- 121 attempts to touch him — resulting in nine bites to the humans doing the petting.

McHugh also found that having law enforcement on hand was the most effective means of getting people to stop interacting with Beggar. When officers were on the water, boaters were much less likely to approach Beggar, and Beggar was much more likely to forage for food when humans stopped giving him handouts. Another part of the study involved educational outreach, distributing over 6,200 *Dolphin Friendly Fishing and Viewing Tips* cards to local water-oriented businesses, which made them available to local boaters. Although McHugh found that boaters generally did not respond as dramatically or immediately to the educational campaign as to the visible presence of law enforcement in the area, there were indications that the outreach effort may have been effective for certain segments of the boating community, and suggested avenues to improve future outreach efforts by targeting educational messages to different audiences.

Stacey Horstman, NOAA Fisheries Bottlenose Dolphin Conservation Coordinator, appealed to the public for help on the issue, to ensure that no other dolphins take Beggar's place in the Intracoastal Waterway. "Beggar was a local icon and tourist attraction for over two decades, and the results of this necropsy are a reminder of how people's actions are harmful to wild dolphins," she said. "There is a common misconception that feeding, touching and swimming with dolphins is not harmful and that they don't get hit by boats. Beggar is just one of many wild dolphins in the southeast U.S. that have been fed by people and learned to associate people with food. Responsibly viewing wild dolphins is crucial to their survival and we are asking the public for help, so dolphin populations stay healthy and wild for generations to come."

It is illegal under the U.S. Marine Mammal Protection Act to feed or interact with wild dolphins. Violations can be prosecuted in civil or criminal court and are punishable by up to $100,000 in fines and up to one year in jail per violation. The National Oceanic and Atmospheric Administration recently prosecuted three such cases in Florida.

Sarasota Bay boat strikes in 2012

By Aaron Barleycorn, BS, Chicago Zoological Society

The summer of 2012 was a rough time for many Sarasota resident dolphins. In less than three months, a record 4 resident dolphins (two calves and both members of an adult male alliance) were documented as having been struck by boats in local waters. There were two other probable strikes reported, but never confirmed, near Anna Maria Island and in the Manatee River. The summer is one of the busiest times on the water in Sarasota Bay, especially surrounding holidays like the 4th of July: traditionally the most common time dolphins are hit by boats in the area. At this time, boats and dolphins are frequenting shallow waters where dolphins cannot dive below boats, and new calves are just learning how to be dolphins. Three of the dolphins appear to have survived their boat encounters, though they will bear the scars for the rest of their lives. Unfortunately, one dolphin, a newborn calf, was not so lucky.

On 23 May, F274, the 2-yr-old calf of resident dolphin "Lizzie" was observed with a propeller wound on the leading edge of his dorsal fin. Unfortunately, on the same day, his mother was observed entangled in fishing line. Most likely due to their recent negative human encounters, Lizzie and her calf were extremely elusive for the rest of the summer. Any time a boat would approach, they would quickly disappear, making any attempt to intervene very difficult. Eventually, on 20 July, F274 was temporarily captured and briefly examined during the disentanglement of his mom (see article by Katie McHugh). His wound appeared to be healing well, and he looked to be otherwise healthy. The gash on his fin is permanent and will be used to identify him in the future.

Pi and Noah, a young adult male alliance, are well known to SDRP researchers. They often chase schools of mullet into very shallow water and work together to keep the fish trapped between them while they feast. This behavior may have put them in greater risk of boat strikes because they would have no place to go if a flats boat were to speed over them in the shallows. On 19 July Noah was observed with deep propeller and skeg wounds running down the right side of his body. He appeared to be behaving normally, although he was understandably wary of our boat. Just two weeks later, 1 August, Pi was seen with a fresh propeller gash on the leading edge of his dorsal fin. Both dolphins were closely monitored during subsequent monthly surveys and appear to be recovering from their injuries, although they will be severely scarred.

While Pi, Noah, and F274 appear to have survived and recovered from their injuries, other animals aren't so lucky. On 2 July, the ~1 month old calf of resident dolphin "Murphy Brown" was observed with propeller wounds that had cut deeply into the right side of its body, chopped off the top of its dorsal fin, and severely cut into its fluke. For the most part the calf seemed to be keeping up with its mom, but it would just sit at the surface when its mom went off to feed. Unfortunately, that was the last time it was seen. Its mother, Murphy Brown, has been seen three times since, and appears to be healthy. Sadly, due to the low chance of survival of such a young calf without its mother, we have determined that the calf has died.

We don't know why there was an increase in boat-strike injuries to Sarasota Bay residents this year, but these cases highlight the need for boaters to use caution around wildlife. Marine mammals are legally protected from harassment; the National Marine Fisheries Service recommends staying 50 yards away from dolphins and slowing down when they are in the area. Hopefully, if boaters will follow these guidelines and keep careful watch for wildlife, tragic situations like these can be avoided in the future.

Newborn dolphin 1555 seen with boat strike injuries in July 2012 prior to its disappearance.

Noah with fresh boat strike wounds on 01 August 2012.

Noah's healing wounds 2.5 months later.

Dolphin communication studies

By Vincent Janik, PhD, SMRU, St. Andrews, UK, and Laela Sayigh, PhD, WHOI

During capture-release sessions in 2012, we carried out playback experiments designed to determine the feasibility of using the habituation/dishabituation playback design to study whistle perception. This type of experiment involves playing back a series of one whistle type (*e.g.*, a signature whistle), for a long enough time until the target dolphin stops responding to it (habituates). We then play back another whistle type. If the target dolphin responds to the 2nd whistle type (dishabituates), this indicates that it perceives the 2nd whistle as a different whistle, whereas if no dishabituation occurs, it indicates that the dolphin perceives the 2nd whistle as the same as the 1st whistle. Our ultimate goal is to use this paradigm to look at whether dolphins discriminate between signature whistles and signature whistle copies produced by another dolphin. In 2012 we simply played back two very different whistles, under the assumption that if we do not see predictable dishabituation in such a case, then we should not pursue this experimental design for more subtle discriminations. Analysis of these experiments is currently underway but we can already see there is good potential for using this paradigm. We hope that in future playback experiments we will be able to test whether dolphins can discriminate among "original" vs. "copied" signature whistles. Our ultimate goal is to carry out playbacks with free-swimming, tagged dolphins (see article by Peter Tyack *et al.*) to study how whistle copies function in the natural communication system of dolphins.

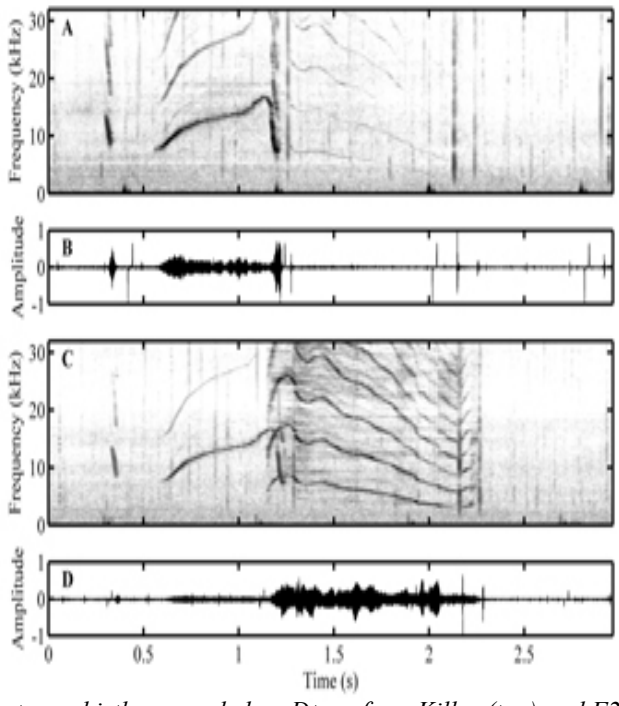
We continue to build up the Sarasota dolphin whistle database, which currently contains signature and other whistles from more than 250 individuals that have been recorded during brief capture-release events over the last 35 years. The database contains multiple recordings of individuals that cover time spans of up to 34 years, with up to 16 recordings of each individual. Using the whistle database, this past year we began a large-scale study of signature whistle development, with Princeton University student Tara Thean. Tara's senior thesis is focusing on social influences on calf vocal development. We have a sample size of more than 100 calves that have been recorded during capture-release, and we are comparing them to the whistles of their associates during their first year of life, thanks to the unique, large, long-term photo-identification database of the SDRP. We are also examining factors such as sex, number of associates, and average group size, among others, as possible influences on vocal development.

Dtagging Sarasota dolphins

By Peter L. Tyack, PhD, SMRU, St. Andrews, UK, Vincent Janik, PhD, SMRU, St. Andrews, UK, Nicholas Macfarlane, PhD student, WHOI, Laela Sayigh, PhD, WHOI

This year we continued our efforts to tag several closely bonded dolphins simultaneously to track patterns of whistling of individual dolphins and responses to their whistles. In 5 days of field work during health assessments in May, we were able to simultaneously tag 7 pairs of dolphins: 3 mother-calf pairs, 3 pairs of adult males, and one pair of juveniles. Building upon last year, we developed a focal animal behavioral follow protocol, and designated one of each pair as the focal animal. Katie McHugh provided critical assistance with the follows, as she was able to identify dolphins as they were sighted near the tagged dolphins.

During this year, Nicholas Macfarlane has analyzed data from two of the pairs of dolphins that were tagged in 2011. The longest tag record was from FB90, 'Killer.' The full 24 hours was audited for whistles, both her signature whistle and other whistles, and echolocation buzzes, which are thought to indicate attempts to forage. Killer's calf F246 was tagged and released at the same time as Killer, but he breached the tag off after 50 minutes. Figure 1 shows how we can identify which dolphin produced the sounds recorded while both Killer and her calf were carrying tags. The upsweep whistle produced at time = 0.4 sec and the signature whistle produced at time = 0.6-1.2 sec are much louder on the top spectrogram and waveform plot (recorded from the tag on Killer) than on the bottom (recorded from the tag on her calf). The signature whistle at 0.6-1.2 seconds, which the tag identifies as more likely produced by Killer than by her calf, matches the signature whistle that has been recorded from Killer every time she has been recorded during health assessments (16 times since 1976). By contrast, the whistle recorded from 1.2-2.2 seconds is much stronger on the lower spectrogram and waveform plot, which was recorded from Killer's calf F246, indicating that this whistle was produced by either the calf or by another dolphin nearer to the calf than to Killer. With this technology we will be able to witness vocal interactions between dolphins and analyze how they communicate with each other.



Signature whistles recorded on Dtags from Killer (top) and F246 (bottom).

Dolphin distribution and sound production on the West Florida Shelf

By Peter Simard, PhD Candidate, and David Mann, PhD, University of South Florida

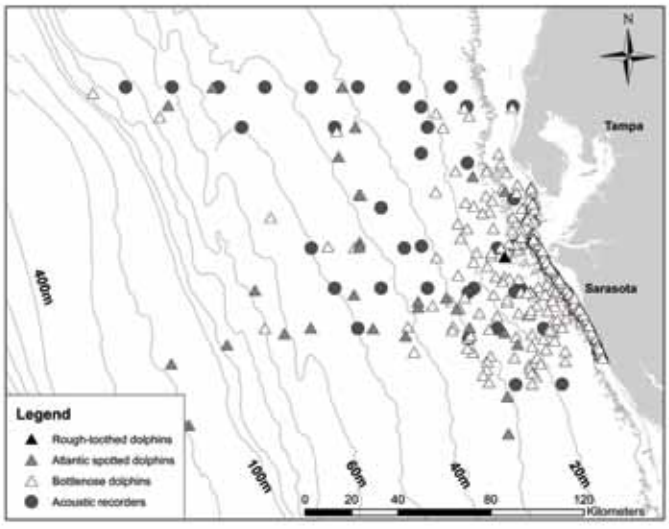
The West Florida Shelf (the continental shelf waters off western Florida) is common habitat for both bottlenose dolphins and Atlantic spotted dolphins (*Stenella frontalis*). Several studies have investigated the distribution, diet and genetic profile of West Florida Shelf dolphins. This study adds to these previous studies by using additional visual surveys, acoustic recordings from autonomous acoustic recorders, and oceanographic measurements from bottom-mounted temperature loggers and satellite temperature and chlorophyll concentration values.

Between April 2008 and June 2010, over 12,000 km (7,500 miles) of visual surveys were conducted by the Sarasota Dolphin Research Program, Eckerd College and the University of South Florida on the West Florida Shelf. These cruises resulted in 477 sightings of bottlenose dolphins, 29 groups of Atlantic spotted dolphins and a single group of rough-toothed dolphins (*Steno bredanensis*). Overall, dolphin density decreased with increasing distance from shore. Bottlenose dolphin density was higher in nearshore waters and was especially high adjacent to Tampa Bay. The waters off Tampa Bay have previously been identified as a potential area of bottlenose community mixing, which may explain the high numbers of bottlenose found in this area. Atlantic spotted dolphins were found in waters deeper than 20 m (66 ft) and appeared to migrate into shallower waters in the spring and summer.

During this same time period, acoustic data were collected from autonomous acoustic recorders at 37 stations on the West Florida Shelf. Like the results from the visual surveys, dolphin sound production decreased with increasing distance from shore. However, coastal areas had lower detection rates than in areas immediately offshore. As visual survey data indicate high dolphin density in these coastal areas, the low acoustic detection rates likely indicate differences in the acoustic behavior of dolphins. Sarasota Bay resident bottlenose dolphins have been found to vocalize less frequently than in other areas in the southeast United States, and this tendency may also be the case on the coastal West Florida Shelf. Sound production was also higher off Tampa Bay in comparison to areas to the north and south, similar to the pattern observed in bottlenose dolphin distribution from visual surveys. The exception to this pattern was detection rates of low frequency narrow-band (LFN) sounds, which were less common off Tampa Bay. LFN sounds are thought to be used for communication and possibly play a role in mating. Although mixed community groups are commonly seen in the waters off Tampa Bay, previous studies indicate that only little genetic exchange occurs between communities. Therefore lower LFN production may reflect a relative lack of mating activity in the mixed community groups off Tampa Bay.

In waters deeper than 20 m, large peaks in sound production occurred at night, and this pattern was stronger in the spring and summer and in the southern part of the study area. This seasonal and spatial pattern matches the seasonal distribution pattern suggested for Atlantic spotted dolphins and some West Florida Shelf resident bottlenose dolphins. These dolphin groups appear to have seasonal migrations into the area in the spring and summer months from offshore or more southerly waters, and therefore may be responsible for the nighttime acoustic activity pattern. The seasonal migration of several species of squid may explain this pattern of dolphin distribution and sound production, as squid move into shallower West Florida Shelf waters in the spring and summer and are active at night. In coastal waters, sound production tended to occur in the day and evening.

When dolphin sound production was compared to oceanographic measurements, we found that in waters deeper than about 35 m (115 ft), dolphin sound production increased with decreasing surface and bottom temperature and with increasing chlorophyll concentration. This suggests that dolphin density increases during episodes of cooler, nutrient rich water and higher growth of phytoplankton communities. However, in waters shallower than about 25 m (80 ft), the opposite pattern was observed, and dolphin sound production increased with increasing surface and bottom temperature and decreasing chlorophyll concentration. This suggests that dolphin density in shallower waters is not as dependent on a phytoplankton based food web. Previous stable isotope level studies on bottlenose dolphins suggested that West Florida Shelf dolphins were part of a phytoplankton based food web, while Sarasota Bay resident dolphins were part of a benthic (seagrass) based food web. The results of our study suggest that the ecology of dolphins on the shallower West Florida Shelf may be similar to bay and estuary communities. This hypothesis is supported by the large number of hard bottom structures in waters shallower than 20 m which support benthic algae and fish communities and the similarity of fish species composition between the shallow West Florida Shelf and adjacent bays and estuaries.



Map of the West Florida Shelf study area showing positions of dolphin groups and autonomous acoustic recorders (June - September 2008 and June 2009 - June 2010).

Bottlenose dolphin health assessments in Sarasota Bay

By Randall Wells, PhD, Deborah Fauquier, DVM, MPVM, Brian Balmer, PhD

We conducted two highly successful dolphin health assessment sessions in Sarasota Bay during 2012. The first, during 7-11 May, was funded primarily by Dolphin Quest and the Office of Naval Research (ONR). A team totaling 110 researchers, veterinarians, students, and dolphin handlers participated in the project, with some coming from as far away as Brazil, Canada, Australia, Malaysia, South Korea, Scotland, England, Spain, Germany, Denmark, Guatemala, and Trinidad/Tobago. We sampled 16 dolphins, including four for the first-time. All of the dolphins sampled appeared to be in good condition, far different from those sampled in Barataria Bay, Louisiana, last August. A recapture of juvenile female Nellie, a 9-month-old calf when we disentangled her from line in 2010, found her to be in good health. For one of the five ONR projects involved in the health assessment, we tagged 10 dolphins with real or "dummy" satellite-linked transmitters of an experimental single-pin attachment design. These dolphins were closely monitored prior to re-capture in July to remove the tags and evaluate their condition.

The second health assessment project was conducted during 16-20 July, with a research team including more than 104 researchers, veterinarians, students, and dolphin handlers. We recaptured 10 of the dolphins examined in May 2012, and removed experimental satellite-linked tags from eight. In general, all eight animals appeared to be in good health and had no health impacts attributable to tag deployment. The overall attachment sites of the tags had evidence of normal healing with little adverse impacts on the dorsal fin. Additionally, we documented the difference between the four recovered tags coated with *PropSpeed* anti-fouling paint versus the four tags that had been untreated. Overall, the four coated tags showed very little barnacle or algae growth except in untreated areas, and there were no obvious skin reactions to the coating. However the un-coated tags showed extensive barnacle growth, some of which were causing erosions of the underlying skin of the dolphins. Our preliminary findings from this study support the current design of the experimental electronic tags for reducing negative impacts to the dorsal fin, such as mechanical trauma and infection, seen with some previous tag designs. Additionally, the application of the anti-fouling coating significantly decreased the accumulation of barnacles and algae minimizing any mechanical impacts these organisms might have on dolphin skin.

During both sessions, we collected data for research on diabetes, being conducted by Dr. Stephanie Venn-Watson and Dr. Cynthia Smith of the National Marine Mammal Foundation. Bottlenose dolphins appear to have a switch that can turn Type 2 Diabetes on and off. This switch is likely an evolutionary adaptation to temporarily help dolphins when they unexpectedly have lots or little food available. For humans, however, this switch could help lead to a cure for a disease affecting an estimated 26 million people in the U.S. alone. Blood samples collected from the Sarasota dolphin health assessment are helping scientists better understand their metabolic health, including when the diabetes switch is turned on or off. This three-year project started in January 2011, in collaboration with the National Marine Mammal Foundation, with funding from the Office of Naval Research.

Additional research included tests of new designs for suction-cup mounted tags, studies related to kidney disease, investigations of whistle communication and hearing abilities, and development of a technique for assessing body condition from photographs, without needing to capture and release dolphins. The July health assessment project also provided us with an opportunity to disentangle a 16-yr-old, long-term resident mother, named Lizzie, from fishing line that was cutting deeply into her fluke and would have severed the fluke in the absence of our intervention.

Research team prepares to initiate a health exam on a dolphin aboard "R/V Flip" in May 2012. A hydrophone on a soft suction cup is recording the dolphin's sounds.

Bottlenose dolphin visual health index update

By Mary Gryzbek, MS Student, University of Florida and Chicago Zoological Society

The goal of the bottlenose dolphin visual health index project is to create a method that allows researchers to determine the condition of individual dolphins by examining external features visible in photographs take remotely, as during photo-identification projects. If photos are taken of enough individuals to form a representative sample of a population, the collective information obtained from the index may offer insight to the health and status of the population. The hope is that once the index is created, it will become a tool available to field researchers to provide an initial evaluation of the health of populations. This initial evaluation may motivate researchers to further investigate the status of populations that have a significant portion of individuals with signs of poor condition. Further investigations may include more comprehensive capture-release health assessment efforts and/or the identification of sources of negative anthropogenic or environmental impacts.

During the initial stages of the creation of the visual health index, I considered using a combination of several external features visible in photos that would be indicative of both body and skin condition but would emphasize the former. As the project has progressed, I have become increasingly focused on investigating the "peanut head" characteristic, defined as a depression behind an individual's skull, for a few reasons. First, this particular feature is typically used by dolphin experts as a sign of poor body condition. In addition, it can be noticed in photos of individuals taken in the field, although certain positions of an animal and angles of the photo are more desirable for noticing the trait than others. Focusing on the peanut head area has also streamlined the process of analyzing photos, making it more efficient. Other features may eventually be incorporated into the visual health index, but for now, the main focus will continue to be on the examination of peanut heads.

Although the peanut head characteristic is commonly considered to be an indicator of poor body condition by dolphin experts, its identification by the human eye has not yet been related to any physical body condition measurements (weight, girth, blubber thickness, and body mass index). Examining these relationships will demonstrate whether or not the body condition measurements of animals identified as having peanut heads significantly differ from those animals that are identified as not having this trait. In order to make the connection between animals with and without peanut heads and their body condition measurements, I have been analyzing photos taken during Sarasota Bay health assessments, where a range of morphometric measurements are regularly taken. I have also been examining photos from rehabilitation and necropsy cases that include morphometric measurements provided by the Stranding Investigations Program at Mote Marine Laboratory. For the necropsy cases, I am only including animals where body condition was thought to not be greatly impacted by decomposition at the time of examination. If animals with peanut heads are found to have significantly lower body condition measurements, then the use of a peanut head as a sign of poor body condition and a parameter in the visual health index will be supported.

This project has been made possible by an anonymous donation to the Chicago Zoological Society and by the University of Florida. I would like to thank all of the past and present Sarasota Dolphin Research Program (SDRP) volunteers, interns, and staff for collecting decades of photographs and health assessment data. I also want to thank Jason Allen and the rest of the SDRP staff for their help with the data collection process and Gretchen Lovewell for her help with the stranding cases data.

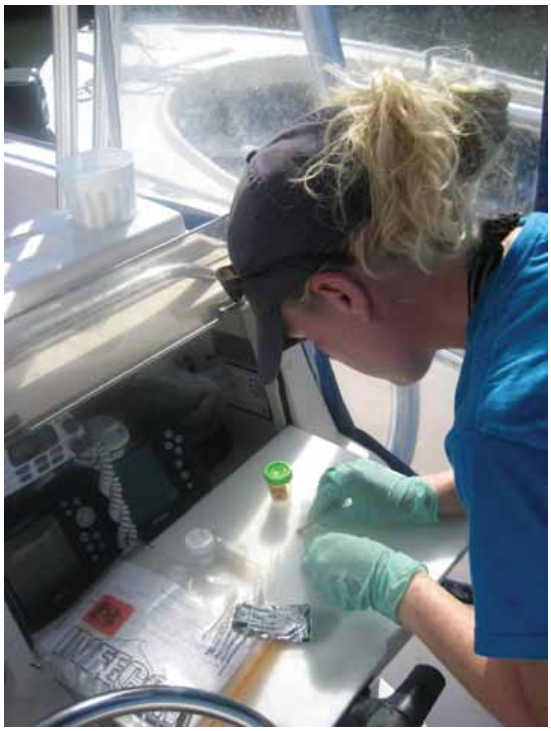
Measurements regularly taken during health assessments and necropsies, like the girth being measured here during the May 2011 Sarasota Bay health assessments, will allow for the comparison of body condition measurements between animals with and without "peanut heads."

MML0319, a fresh dead male bottlenose dolphin necropsied by the Stranding Investigations Program at Mote Marine Laboratory in April 2003, is an example of an animal with a well-defined "peanut head" or depression behind its skull. Photo credit: Mote Marine Laboratory Stranding Investigations Program.

Studies of stress hormones in wild bottlenose dolphins

By Leslie Hart, PhD and Lori Schwacke, PhD, NOAA, National Centers for Coastal Ocean Science, and Randall Wells, PhD

Throughout their lifetime, free-ranging bottlenose dolphins are exposed to a variety of natural (*e.g.*, changes in water temperature and prey availability) and anthropogenic (*e.g.*, boat traffic, pollution) stressors. This exposure results in a physiological response that can be identified by hormone concentrations measured in their blood and blubber tissues (*e.g.*, cortisol, aldosterone, T3, T4, Free T4). The Sarasota Dolphin Research Program has partnered with scientists from NOAA's National Center for Coastal Ocean Science at the Hollings Marine Laboratory in Charleston, South Carolina to better understand and characterize stress-related hormonal changes in bottlenose dolphins. The objectives of this multifaceted project are to develop baseline stress-related hormone reference ranges, examine factors influencing stress hormone levels (*e.g.*, season, sex, age), determine relationships between different hormones, and compare hormone concentrations between blood and blubber samples. The samples used for this project include blood and blubber collected from Sarasota Bay, coastal Georgia, Barataria Bay (LA), Charleston (SC), and the ACE Basin National Estuarine Research Reserve (SC). Over 200 blubber samples are being used to quantitatively determine hormone associations with influential factors, and over 100 samples have been collected to determine correlations between blood and blubber concentrations. Blood-based analyses will rely on over 2,100 hormone measures collected from Sarasota Bay dolphins since 1987.



Leslie Hart processing samples during health assessments. Photo Credit: Amanda Moors

Figure 1: Analytical framework for examining associations between individual hormones and influential factors.

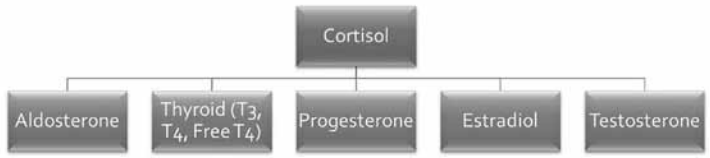


Figure 2: Analytical framework for examining associations between individual hormones.

Statistical analyses and modeling are underway to examine demographic factors associated with stress hormones measured in blood (Figure 1), find linkages with other health parameters, as well as determine correlations between individual hormones (Figure 2). For example, serum cortisol, a hormone produced by the adrenal gland and released in response to stress, was evaluated between males and females, sexual maturity classes, and between capture-release sessions conducted in February and June. Results of statistical analyses did not reveal significant differences between sexes, seasons, or maturity classes; however, cortisol was significantly associated with body mass index, sampling year, and elapsed time between capture and sampling. In addition, cortisol was significantly correlated with aldosterone (another adrenal-based hormone) and various sex hormones including progesterone, testosterone and estradiol. Because of the association with elapsed sampling time, 95% cortisol reference ranges were developed for animals sampled within 30 minutes and greater than 30 minutes. The cortisol analysis and subsequent tests for other stress-related hormones (*e.g.*, T3, T4, Free T4, and aldosterone) will be used to determine influential factors contributing to individual hormone concentrations and establish baseline reference ranges for the assessment of endocrine function among individuals in other populations.

This project is funded by the Office of Naval Research and is a collaborative effort in conjunction with Eric Zolman, NOAA/ National Ocean Service, Hollings Marine Laboratory, Dr. Ashley Boggs, NIST, Hollings Marine Laboratory, Dr. Nicholas Kellar, NOAA Fisheries Southwest Fisheries Science Center, Dr. Patricia Rosel, NOAA Fisheries Southeast Fisheries Science Center, Dr. Stephanie Venn-Watson, National Marine Mammal Foundation, and Dr. Teresa Rowles, NOAA Fisheries, Office of Protected Resources.

Dolphin diving and microparticles

By Michael Moore, Vet MB, PhD, Woods Hole Oceanographic Institution

Whenever a mammal submerges below the surface of the water, there is an increasing pressure as the water gets deeper. The liquid and solid components of a mammal's body are incompressible, but the gas filled portions, such as the lungs, are compressible. As the pressure increases, the gas dissolves more readily in the blood and tissues. Once the animal returns towards the surface the reverse occurs. If a surfacing diver does not manage the surfacing suitably it runs the risk of the dissolved gas coming out of solution and forming bubbles, which may or may not be damaging. If painful, this may cause the signs of the bends. Recent work has suggested that marine mammals need to manage gas while diving as do humans.

Our objective in this study at Sarasota health assessments is to obtain blood samples from wild dolphins before and after they have been briefly placed on a boat for a health examination to allow us to look for molecular evidence of bubble damage, for as bubbles pass though the blood vessels, they can knock off parts of various cells, resulting in microparticles for which Stephen Thom at the University of Pennsylvania has an assay.

With support from the Office of Naval Research Andreas Fahlman from Texas A&M Corpus Christi and I have been receiving blood samples from the Sarasota Dolphin Research Program team, as well as stranded dolphins and free swimming Steller sea lions, to learn what we can about microparticles in marine mammals. We have much to learn and need more samples before we can say much, but the initial results are intriguing.

Tests of suction cup temporary tag attachments

By Michael Moore, Vet MB, PhD, Woods Hole Oceanographic Institution

Suction cups are a central part of non-invasive tagging of marine mammals. For short term attachment of technology such as the WHOI Dtag they are the attachment method of choice. They do not penetrate the skin and can be easily dislodged by programming the device to lose suction in the cups at the desired time. However sometimes they come off prematurely.

With support from the National Science Foundation, via the National Ocean Partnership Program, we are exploring the biomechanics of the interface between suction cups and the skin and blubber of dolphins. As the cup sucks, it is deformed, but so is the underlying skin and blubber. The extent to which the latter happens is critical to understand, as if it were infinitely stretchable, the cup would not stick at all. Thus we have been undertaking a series of different low pressure tests using a rigid cup that measures the biomechanical properties of the skin and blubber, without any interference from the cup properties, as we would see with a regular flexible cup. We have also been looking at the behavior of regular cups as their suction fails. We are learning that there are significant differences between the cup skin/blubber interface in different parts of the body.

Suction cup testing during Sarasota Bay health assessments.

Investigating patterns of bottlenose dolphin growth

By Sarah Mallette, MSc student, University of North Carolina – Wilmington

The bottlenose dolphin is a long-lived, apex predator that is considered a sentinel of coastal ecosystem health. The goal of my study is to describe patterns of growth of bottlenose dolphins utilizing two complimentary methods, ontogenetic allometry and body composition. Ontogenetic allometry describes the rate of growth of a given body component, whereas the body composition technique offers a snapshot of how the developmental rates are manifested in the distribution of body mass over time. The dataset I will use for this study consists of 175 stranded individuals, and dolphins incidentally killed in fishing operations, collected along the coasts of North Carolina and Virginia from 1990 to the present. All specimens have undergone a systematic mass dissection protocol, which separates the body into discrete anatomical components, including: integument and blubber, functional muscle groups, viscera, and skeleton.

To determine how the body conditions of the specimens in this sample compare to those of wild, free swimming bottlenose dolphins, a body mass index, (total body mass/total body length^2 * 1000) will be used to compare the stranded sample to analogous data collected from wild individuals during health assessments in Beaufort, NC and Sarasota Bay, FL.

The Sarasota Bay population provides a unique reference for comparison, as it is one of the few areas where long-term, longitudinal data exist for a free-ranging population of dolphins (> 42 yrs). These dolphins undergo temporary capture-release and health assessments, from which body mass indices have been generated. I will compare the body mass index from the Sarasota

Bay population to the body mass index I generate from the stranded sample. I will also compare mass/length ratios of a subset of the Sarasota animals (with known age and maturity status), to mass/length ratios of the stranded individuals in the North Carolina and Virginia sample.

I had the unique opportunity to participate in the July 2012 health assessment and observe the dynamics of the process and that of data collection. The opportunity allowed me to participate in this world-renowned research program and observe first-hand how the data I will use as a reference in my research is collected in a wild, free swimming population of bottlenose dolphins. The product of this study will contribute a comprehensive analysis of growth in bottlenose dolphins and provide a quantitative baseline reference for the distribution of body mass to its components in a sentinel species of ecosystem health.

Sarasota Bay dolphin community status

By Jason Allen, BS, SDRP Field Coordinator, Chicago Zoological Society

One of the more important discoveries of the SDRP with regards to dolphin social structure was that of long-term adult male pair bonds. Most adult males form pair bonds soon after they become sexually mature. The bonds are helpful for finding and catching food, acquiring suitable mates, and avoiding predation. Previous studies have shown that the dolphins in these pairs are typically similar in age and unrelated. Most male pairs stay together until one dolphin dies, with some finding another partner and others remaining alone for the rest of their lives. For example, Petey and Otter recently paired up, after Otter lost his buddy Racing Stripe in 2005, and Petey lost FB36 last year, with whom he associated only after his first buddy, FB46, died in 2003.

During the late spring/summer breeding season, the male pairs begin to spend a lot of time with adult females. They escort one female at a time to (presumably) mate with her while keeping other males away. There were quite a few of these 'dates' this past summer; some last mere hours while others for several weeks.

F219 started the summer off hot and heavy with F182 and Pokey, a couple of good looking guys. However, she was with FB44 and Bark towards the end of the summer. Pokey and F182 started cruising in Palma Sola Bay where they quickly found Aya. She had been with F164 and F242 earlier in the summer, perhaps those boys wanted to head back north to the Manatee River and Aya would not follow?

Will all of the 'quality time' between male pairs and females this summer result in another fruitful calving season next summer? Only time will tell. What we can say is that this summer was very productive; eleven new calves were born into the population. Most notably, Eve (age 14) finally had her first calf (that we know of), an event we had expected for several summers. Eve was the last calf of Nicklo (age 62), our oldest dolphin, who gave birth to her at the age of 48!

FB05's (1963-2009) lineage added three new members as well as a fourth generation. Both of her living daughters (FB55 and Murphy Brown) and one of her granddaughters (F197) all produced new little ones this summer. Sadly Murphy Brown's calf did not survive after it was hit by a boat around the 4th of July holiday. See Aaron Barleycorn's article for more information about this newborn and other resident dolphins struck by boats this year. In addition to the loss of this newborn, we were saddened by the death of Beggar in September (see article by Wells, McHugh, Lovewell and Slimak).

We have been able to continue our year-round monthly monitoring of the Sarasota bottlenose dolphin community thanks largely to support from the Batchelor Foundation, the Disney Worldwide Conservation Fund, and private donations, as well as the continued dedication of our core volunteers and undergraduate interns. Thanks to these efforts, this community is one of the most thoroughly studied free-ranging dolphin populations in the world.

F219 and calf with Pokey in July 2012.

F155 with her daughter (F197) and first grand-calf (1971) as they travel together in Sarasota Bay in June 2012.

Introducing GoMDIS: The Gulf of Mexico Dolphin Identification System

By Carolyn Cush, BS, and Randall Wells, PhD, Chicago Zoological Society

Following the Deepwater Horizon oil spill and several Unusual Mortality Events (UMEs) in the northern Gulf of Mexico, it was found that there was insufficient information to manage bottlenose dolphins as mandated by the U.S. Marine Mammal Protection Act. Problems such as the current stock delineations being based arbitrarily on geography rather than dolphin biology have undermined efforts to assess large scale events such as these. With an initial 3-year pledge of support provided by the Disney Worldwide Conservation Fund, we are well on our way towards creating a database which will serve as a standardized and centralized catalog for bottlenose dolphins from Texas to the Florida Keys, known as the Gulf of Mexico Dolphin Identification System (GoMDIS). This will facilitate identification matches among collaborators across research sites to better monitor dolphin populations of the Gulf region. The GoMDIS database is modeled after the Mid Atlantic Bottlenose Dolphin Catalog (MADBC) curated by Kim Urian, which encompasses bottlenose dolphin identifications along the Atlantic coastline extending from New Jersey to Florida. The GoMDIS database will maximize the use of existing data by establishing a collaborative program from which individual researchers around the Gulf can access and easily share data. SDRP has made significant strides towards our first entry into this collaborative program. By converting our aging 42-year database into a more powerful Microsoft Access database called FinBase, developed by Jeff Adams through NOAA, our first submission to GoMDIS is nearly ready for inclusion.

An introductory workshop was convened at Mote Marine Laboratory in August 2012. This workshop brought together an initial set of 23 researchers with photographic identification catalogs of bottlenose dolphins from around the Gulf of Mexico, to discuss the creation of this collaboration. Collaborators will submit basic data such as the best fin images per animal, sighting location/date, and animal specific information such as sex and/or size class. Images will be scored for quality and fin distinctiveness. In total, we are looking at the possibility of processing upwards of 20,000 images to be submitted by the various research groups. These data will be maintained by the Curator in an offline database and will periodically be uploaded to the OBIS-SEAMAP website which will facilitate data sharing amongst our colleagues around the Gulf of Mexico. OBIS-SEAMAP has a variety of spatially and temporally interactive features and includes many different types of datasets, one of which being a secure photo-identification interface where researchers can log-in, view and identify individual animals via a web browser.

Potential collaborators come together for a workshop introducing GoMDIS in August 2012.

Over time, the GoMDIS database will evolve into a powerful conservation tool to examine potential long-range movements of animals, help identify stock delineations based at least in part on the ranging patterns of the dolphins themselves, and track the fates of individuals through documented sightings over time, or strandings. This database will also ensure that brief photographic identification projects (such as those by a graduate student) will be archived as these types of data have been lost in the past. As we progress, we will look to involve stranding networks, identify both old datasets and new projects as they come online, and seek participation from our neighbors, Cuba and Mexico, to fully incorporate the Gulf.

West Florida Shelf bottlenose dolphins: Population structure, health, oil spill impacts

By Randall Wells, Chicago Zoological Society and William Hurley, IV, Georgia Aquarium

In contrast to the decades of information available from bottlenose dolphins inhabiting some of southwest Florida's bays, sounds, and estuaries, little is known about the health, stock structure, ranging patterns, and dive patterns of bottlenose dolphins in West Florida Shelf waters, 10-30 miles offshore. Information is needed to define population units for management purposes; data on ranging patterns, genetics, and contaminant profiles can help to refine stock identification. Dolphins living in these offshore waters may have been impacted by oil from the 2010 Deepwater Horizon spill. It is important that baseline information be collected on shelf dolphins to allow for future evaluation of changes that may be associated with long-term impacts from the spill. With support from the Georgia Aquarium, Dolphin Quest, and Dolphin Connection, we plan to perform standard health assessments and sample collection for 6 bottlenose dolphins over the shelf, and we will tag them with satellite-linked transmitters that will provide data on movements and dive patterns for up to several months post-release. Remote tracking of the dolphins via satellite will allow evaluation of their movements, dive depths, duration of dives, and time spent at depth. Dolphins riding at the bow of Mote Marine Laboratory's *R/V Eugenie Clark* will be captured via standard hoop-net technique, and brought aboard the *Clark* for brief health assessment and tagging by an experienced team of researchers and veterinarians, and then released immediately onsite. Sample collection will follow

established NOAA protocols to facilitate comparisons with samples collected elsewhere in the Gulf of Mexico in association with oil spill research, such as Barataria Bay, Louisiana. Efforts to initiate this research in October 2011 and May/June 2012 were thwarted by persistent high winds and rough seas; the project has not yet been rescheduled.

An analysis of shark bite scars on the Sarasota Bay resident bottlenose dolphin community and implications for habitat use

By Krystan Wilkinson, MS Student, University of Florida

Predator-prey relationships have long been an interest of ecologists. Such relationships are dynamic. One false move may result in an individual being taken out of a community, or a predator may go hungry if unsuccessful. Predation itself is difficult to study due to predation events rarely being observed. We are left to rely on evidence of predation attempts through wounds and scars on the surviving prey, and on wounds on carcasses. The frequency of scars and wounds has been used to measure predation risk, with an obvious disadvantage in that we only have evidence of failed predation attempts. Thus rate of predation will be greater than that measured by wound and scar frequencies. Regardless of this disadvantage, bite frequency is still a useful measure to determine relative risk and proves useful in comparisons among populations and allows us to further our understanding of these complex species interactions.

Predator-prey interactions are evident among sharks and cetaceans, and frequency of shark-inflicted wounds and scars has been reported from many locations, such as South Africa and Australia. In Sarasota Bay, the bull shark (*Carcharhinus leucas*), is thought to be the most frequent predator to Sarasota Bay's bottlenose dolphin residents. A 1998 analysis by Kim Urian and colleagues of shark-inflicted injuries on resident Sarasota Bay dolphins found that of 151 dolphins sampled during 1975-1997, 31% had shark bite scars, and a male sex-bias in scaring frequency was observed. One objective of my Master's thesis is to update these analyses with more recent data from health assessments through 2012. Furthermore, I propose to answer the following questions, 1) what relative threat are sharks to the Sarasota Bay resident bottlenose dolphins and 2) is there a differential occurrence of shark bites for animals with home ranges in different habitat types?

Scar and wound data gathered over 30 years of dolphin health assessments conducted in Sarasota Bay, along with more than 25 years of stranding data collected by Mote Marine Laboratory's Stranding Investigations Program will be examined. I will build on previous analyses to determine shark-inflicted bite mark frequency. In addition, I will quantify the number of bites per body area to clarify if the distribution of bites on the body is equal. I will also determine if differential bite frequencies exist for different sex-and age-classes, determine a rate of accumulation of scars for animals with multiple bites, and investigate if frequency of shark-inflicted injuries has changed through time. These data will assist me in assessing the risk sharks pose to dolphins in the Sarasota Bay area. I will then investigate if individual dolphin home ranges in differing habitat types are correlated to presence or absence of shark bite scars, to see if some areas are less desirable ranges from a predation risk perspective.

Asking questions in regards to predator-prey interactions have several important ecological and behavioral implications. Predator-prey dynamics are often taken into consideration while looking at population dynamics, growth rates, evolutionary functional morphology and reproductive success within an ecosystem. Predation risk has also been suggested by as an important element shaping dolphin group size, habitat use, and distribution for Sarasota Bay animals. Ultimately these ecological and behavioral characteristics of complex ecosystems will help us understand and predict how animals will respond to the inevitable environmental and anthropogenic changes in their environments.

Young calf 1331 with shark bite wound in 2012.

F133, mother of 1331, with healing shark bite wounds from 2005.

Passive acoustics and abundance estimation

By Goldie Phillips, PhD Student, Duke University

Reliable estimates of population abundance are fundamental to the effective management and conservation of any species. However, estimating abundance of wild populations is seldom an easy feat. This holds true for cetaceans, which spend the large majority of their lives concealed underwater, and thus are rarely available for visual detection. For many of these species however, this problem can be circumvented by the use of acoustic detections, particularly via fixed passive acoustic sensors. Such sensors can offer greater spatial and temporal coverage than, for example, towed hydrophone arrays, and are often the only viable solution in locations where abundance estimation involving visual observation methods are impractical (*e.g.*, due to rough seas, darkness). Despite this, the use of fixed passive acoustic sensors for obtaining absolute abundance estimates is still in its developmental stages. My thesis project seeks to expand on the latter by applying current abundance estimation methods to the signature whistles of the Sarasota Bay bottlenose dolphin population, and evaluating resulting estimates through a series of comparisons, including comparisons to a complete census of the population.

Current methods of absolute abundance estimation of cetaceans primarily fall into the categories of distance sampling and mark-recapture. In the former case, distances to the animal of interest along line or point transects are used to estimate the probability of detection given a certain distance. This detection function is then used to scale up the number of detected animals to get an abundance estimate for the entire study area. Animals can be counted directly (if individually identifiable) or their cues (*e.g.*, onset of a signature whistle) can be counted, in which case a cue rate must also be obtained to translate the number of cues produced to the number of animals producing them. On the other hand, mark-recapture in its simplest form involves capturing and 'marking' (natural marks are often used with cetaceans) a sample of the population. The proportion of 'marked' animals that are re-captured on a later occasion is used to obtain the total number of animals in the population. This is often achieved through the use of photo-identification methods. However, in recent years, new techniques such as spatially explicit mark-recapture (SECR) methods have evolved. Abundance estimation using SECR relies on the capture history of animals at traps of known locations, and thus, within a known area. Using the methods described above, an array of bottom-mounted acoustic recorders (DSG, Loggerhead Instruments) arranged in a systematic random design will be used to detect bottlenose dolphin signature whistles within Palma Sola Bay. Detected whistles will be used to estimate abundance so that the following comparisons may be made: 1. Distance Sampling vs. SECR, 2. Distance Sampling: Cue-counting (counting cues) vs. Snapshot Method (counting animals directly), and 3. Conventional Distance Sampling (using distances obtained from whistle localization to obtain the detection function) *vs.* Using the Passive Sonar Equation to obtain the Detection Function. Results will also be compared to that of a census conducted by visually monitoring the entrance of Palma Sola Bay during the same time period.

The well-studied nature of the Sarasota Bay dolphins and their long-term "natural laboratory" situation make them ideal for such a study and thus, presents a valuable opportunity to assess current population abundance estimation methods for reliability and validity. Project results will provide valuable insight not available from independent applications of each method, and is intended to assist population management agencies in selecting the most appropriate methods of abundance estimation given their location and population of interest.

Indo-Pacific bottlenose dolphins in Bunbury, Western Australia: Predictive habitat modelling and population dynamics

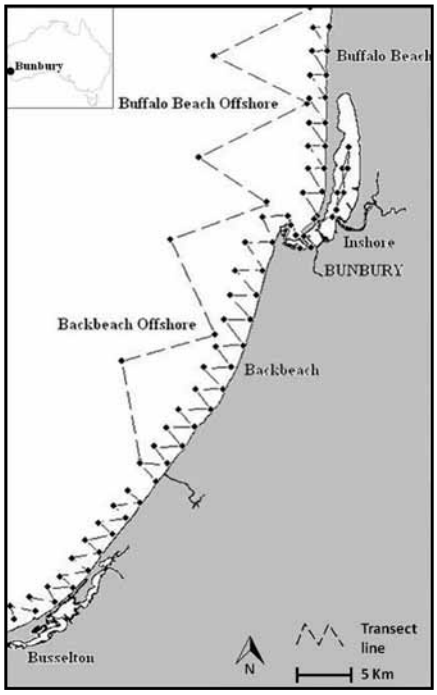
By Kate Sprogis, previous SDRP intern, PhD Candidate, Murdoch University Cetacean Research Unit (MUCRU)

Bunbury is located approximately 170km south of Perth and is the fastest growing regional center in Australia. Its waters are home to a population of Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) that MUCRU researchers have been studying since 2007. The local dolphin population is subject to increasing pressures as the city expands, including coastal development, increased shipping, targeted boat-based dolphin tourism and a general increase in human activities on the water, *e.g.*, fishing and boating. This has resulted in increased threats, such as entanglement in fishing gear, vessel strikes, poor water quality and illegal food-provisioning. The local dolphin population has also recently experienced an unusual mortality event. It is therefore important to continue long-term data collection to inform management and industry to minimize human impacts on the population.

For my PhD, I am focusing on population dynamics and predictive habitat modelling of the dolphin population. Along with my assistants, I conduct year-round boat-based photo identification surveys. Our study area covers 520 km^2 and it is divided into six zones that extend 10 km^2 offshore. Over the past 18 months, I have conducted 164 surveys and encountered 374 dolphin groups where we have catalogued more than 440 individuals.

A dolphin leaping in Bunbury.

To investigate the abundance of the Bunbury dolphin population, the survey has been designed to allow input into Pollock's Robust Design model, which takes into account the temporary immigration of animals. Previous research by Dr. Holly Raudino (nee Smith) estimated that the abundance reached a high of about 139 individuals in autumn, whereas it dropped to a low of about 65 individuals in winter. I aim to further explore this trend by determining the seasonal abundance for adult females and males separately. To date, we have over 230 confirmed sexes through either DNA biopsy sampling, viewing of the genital area or the presence of a calf consistently in baby position.



Study area near Bunbury, Western Australia

The lower abundance of dolphins in the study area during winter might be explained by seasonal differences in adult male ranging patterns. We have recently expanded the study area, in order to investigate the seasonal movements and home ranges of dolphins, particularly of adult males. Excitingly, in winter 2012 we sighted adult males up to 10km offshore in deeper and warmer waters.

It appears that adult male dolphin home ranges differ from females and the use of their environment changes seasonally. Generally, dolphin habitat preferences are influenced by the physical environment, food availability, protection from predators and suitability as a calving ground. Documenting critical areas and exploring factors that may influence habitat use are important for conservation and management efforts. Before analysing data, in 2013 I will be attending Duke University to receive training in habitat modelling. My field work will also be finalized in 2013 and I aim to submit my thesis in 2014.

This research is made possible through funding from the South West Marine Research Program's non-profit and industry partners, including, the Dolphin Discovery Centre, Bemax Cable Sands, BHP Billiton Worsley Alumina, Bunbury Port Authority, City of Bunbury, Cristal Global, Department of Environment and Conservation, Iluka, Millard Marine, Naturaliste Charters, Newmont Boddington Gold, South West Development Commission and WAPRES.

Genetic susceptibility of dolphins to red tides

By Kristina Cammen, PhD student, Duke University

Research on the genetic susceptibility of Florida bottlenose dolphins to red tides has continued over the past year with some interesting new developments involving the addition of a genomics approach. This project investigates populations of estuarine and coastal bottlenose dolphins in the Florida Panhandle and central-west Florida, including Sarasota Bay. Dolphins in these two regions appear to differ in their susceptibility to harmful algal blooms, or red tides, of the toxic algal species *Karenia brevis*. My research tests the hypothesis that this difference in susceptibility is due to the evolution of resistance over time in areas, like central-west Florida, that have been historically and regularly exposed to red tides.

To search for evidence of evolved resistance, I initially analyzed a set of candidate genes that are thought to be involved in the process of toxin exposure, including immune system genes, detoxification enzymes, and the biological target of the toxin. This past year, I added a new complementary approach to the research project in order to search for evidence of evolved resistance across the dolphin genome more broadly. This genomics approach uses a newly developed technique known as restriction site associated DNA (RAD) sequencing, which provides DNA sequence information from thousands of sites located throughout the genome. I will look for variation in this sequence data and analyze the frequency of variants in different groups of bottlenose dolphins. For example, I will compare dolphins from central-west Florida to those from the Florida Panhandle, and compare dolphins that survived red tides to those that died due to toxin exposure. Although the sequence data provided by RAD sequencing is not necessarily linked to a function, like the candidate genes listed above, it may be possible to determine the function of any sequence that shows an interesting pattern of variation by comparing it to the dolphin genome available online and genes of known function in other organisms.

While the candidate gene approach takes advantage of previous knowledge of red tide intoxication to select genes of interest, RAD sequencing is an unbiased approach to searching for a signal of evolved resistance across the genome. The analysis of both complementary approaches, which is still in progress, will help us determine if there is a genetic basis for resistance to red tide in bottlenose dolphins. Any genetic biomarkers of susceptibility that we identify could be used to evaluate the susceptibility of additional dolphin populations and estimate the likelihood of dolphin mortality events should future red tides occur.

This research has been supported by funding from the Duke University Marine Lab, the PADI Foundation, and the American Fisheries Society. Samples were provided by the Sarasota Dolphin Research Program and the NOAA Fisheries SEFSC Marine Mammal DNA Archives.

Stable isotopes reveal bottlenose dolphin dietary diversity

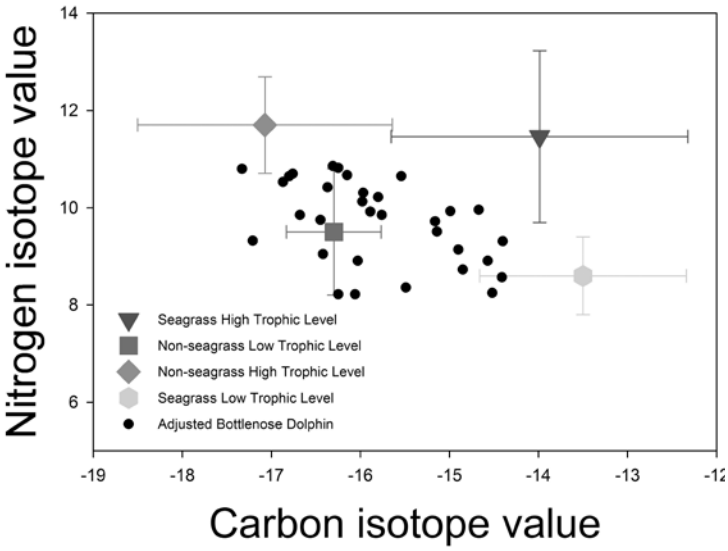
By Sam Rossman, PhD student, and Peggy Ostrom, PhD, Michigan State University, Craig Stricker, PhD, United States Geological Survey, Elizabeth Berens McCabe, MS, and Randall Wells, PhD, Chicago Zoological Society

The continued success of predator populations, such as the bottlenose dolphins of Sarasota Bay is dependent on prey availability. Because bottlenose dolphins frequently capture and consume prey underwater, assessing their diet by observation is difficult. When a dolphin dies and strands ashore its stomach contents contain the prey it most recently consumed. However, stomach contents are often empty and can be influenced by cause of death. Stable isotope analysis expands our abilities to investigate diet, is particularly useful for investigating long-term diet, and can complement information from stomach contents or observational methods.

Stable isotopes are alternate forms of elements, which differ in their atomic mass. When we consider the element carbon, we often think of the most abundant isotope, ^{12}C or "carbon 12". The other stable isotope of carbon is ^{13}C or "carbon 13". This isotope is similar to the more abundant ^{12}C except that it possesses an additional neutron giving it a larger mass. We can then measure the ratio of ^{13}C to ^{12}C found in animal tissues. As with carbon, nitrogen has an abundant isotope, ^{14}N, and one that is rare, ^{15}N. In ecological studies the isotope ratios of $^{13}C/^{12}C$ and $^{15}N/^{14}N$ are commonly expressed in delta (δ) notation ($\delta^{13}C$ or $\delta^{15}N$). You will see that, $\delta^{13}C$ values can be negative but $\delta^{15}N$ values are typically positive, a phenomenon that results from the mathematics behind the expression. Regardless, the important point is that isotope values are used to assess foraging habits of bottlenose dolphins. This is possible because different prey species vary in their $\delta^{13}C$ and $\delta^{15}N$ values and dolphin isotope values are similar to or differ by a consistent amount to the average isotope value of their diet. In the latter case, we can correct the isotope value of a consumer so that it matches that of its average diet and we call this the adjusted isotope value. When the adjusted isotope value of a bottlenose dolphin is similar to that of a diet item, it indicates that the diet item predominates in the diet of the dolphin. In the figure, the adjusted isotope values of all bottlenose dolphins fall within the gray ellipse.

In the figure, we can see that the isotope values of dolphins inhabiting Sarasota Bay vary greatly. This indicates that Sarasota Bay bottlenose dolphins don't all consume the same diet, they vary in their use of prey fish species. Some dolphins making up the lower right of the graph rely on low trophic level species highly associated with seagrass. Low trophic level seagrass associated species are represented in the light grey hexagon. Other members of the Sarasota Bay dolphin population, making up the upper left of the graph, forage on high trophic level fish species less associated with seagrass, these prey are depicted in dark grey diamond. These data indicate that different dolphins within the Sarasota Bay community utilize unique subsets of prey fish species and may not share a single common diet. This has important implications for acquiring energy, reproductive success and exposure to contaminants.

We thank the many interns and volunteers that assisted in fish collection and sample processing at MSU as well as our funding sources, NSF GRF and Michigan State University's Environmental Science and Policy Program.



Carbon and nitrogen isotope values of adjusted bottlenose dolphins resident to Sarasota Bay plotted with groups of prey fish.

Status of fish populations in Sarasota Bay

By Elizabeth Berens McCabe, MS and Sunnie Hart, BS, Chicago Zoological Society

The Sarasota Dolphin Research Program operates an ongoing, standardized, multi-species fish survey to monitor temporal changes in fish abundance, distribution, and body condition in the Sarasota Bay estuary system. These data are needed to relate possible changes to environmental variables, such as harmful algal blooms and extreme temperature fluctuations, and to changes in the health/body condition and distribution of resident bottlenose dolphins in Sarasota Bay. Due to the complex interactions involved, a long-term, continuous, and consistent data set is required to be able to detect changes and trends over time.

This multi-species fish survey consists of a winter fishing season, January-March, and a summer season, June-September, during which we catch, measure, count and release fish from the *R/V Flip* using a 183 m purse seine. Since its inception in 2004, we have completed 396 field days and 1,189 purse seine sets. Over 480,790 fish have been caught consisting of 132 different species. This summer we completed 40 seine sets in seagrass habitat, catching a total of 24,989 fish and 69 different species. Our 30 seine sets this past winter yielded a total of 6,139 fish and 61 different species. After limiting the influence of small schooling fishes on the mean catch-per-unit-effort (CPUE) by excluding clupeids, 2012 summer and winter CPUEs were 450 and 128, respectively

(Fig. 1). Based on this measure, summer fish abundance in Sarasota Bay recovered quickly after the severe 2005 *Karenia brevis* red tide bloom, hitting a high of 797 fish per set in 2008. Abundances have remained fairly steady since 2009, ranging from 431-524 fish per set. Winter fish abundance has been slowly increasing since 2010 (range=84-128), when record-breaking cold weather drastically lowered water temperatures causing widespread fish mortality throughout Florida. Within each season, species-specific abundances have increased steadily since 2010 for mullet, a commonly consumed wild dolphin prey species, and pigfish, a selectively consumed soniferous prey species (*i.e*. noise-making fishes). Seasonal pinfish abundance decreased from 2011 to 2012, however their 2012 abundance compares favorably with that of 2010. The abundances of other important prey species, including Gulf toadfish, spotted seatrout, and spot, have remained fairly steady since 2010.

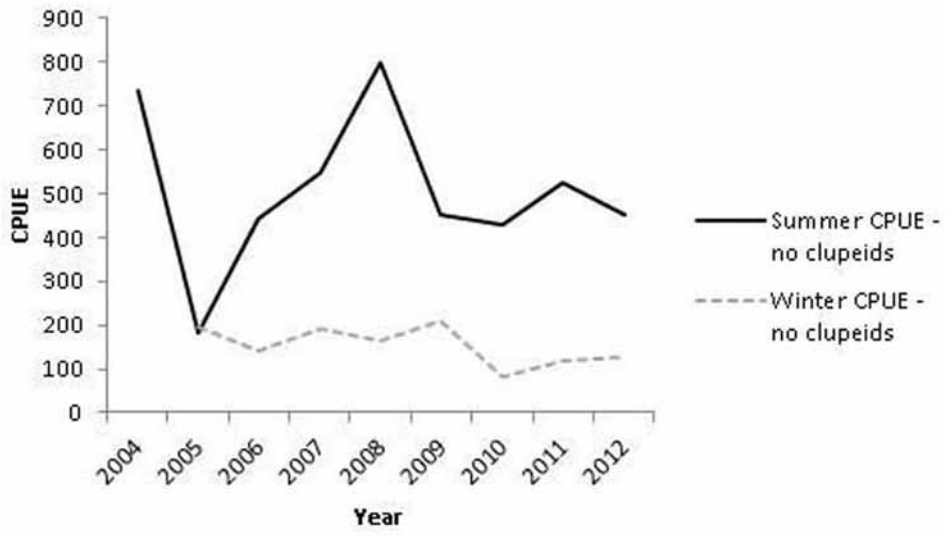


Figure 1: Mean number of fish caught at each sampling station (CPUE), excluding small schooling fishes (i.e. clupeids), in sea-grass habitat in Sarasota Bay, Florida from 2004 to 2012.

Data from this fish survey have allowed us to look at fine-scale habitat and prey selection by dolphins and at how red tides affect different fish species and community structure in estuarine systems. Additionally, this project has facilitated novel research on the diet of wild dolphins (Sam Rossman, Michigan State U.), mercury content in dolphin prey (Yongseok Hong, Johns Hopkins U.), and comparisons of iron (Melissa Zabojnik, Chicago Zoological Society) and nutrient content (Amanda Ardente, U. of Florida) in fish consumed by wild and captive dolphins. In the future, data from this project will be used for comparisons with data from a similar study being initiated by Harbor Branch Oceanographic Institute (HBOI), addressing questions on dolphin foraging ecology, predator-prey relationships, behavior and genetics in Indian River Lagoon estuarine system on the east coast of Florida. This new and exciting collaboration began this past January when HBOI members participated in our fish sampling survey and learned purse seine methodology.

Scooping drift algae out of the purse during winter 2012 fishing.

We thank the many interns and dedicated volunteers who have worked on this project. This work would not be possible without them. The Batchelor Foundation, Disney Worldwide Conservation Fund, NOAA's Fisheries Service, Harbor Branch Oceanographic Institution's Protect Wild Dolphins Program, and Florida's Fish and Wildlife Research Institute provided funding for this work. This research was authorized by the Florida Fish and Wildlife Conservation Commission (Special Activity License nos. 03SR-809, 04SR-809, 04SR-809a, 11-0809-SR) and by Mote Marine Laboratory's Institutional Animal Care and Use Committee (protocol nos. 06-10-DG1, 07-10-DG1, 09-09-RW2, 11-09-RW2).

Bottlenose dolphin "Edna" rescue, rehabilitation, and release

By Aaron Barleycorn, BS, Chicago Zoological Society

June 6th was a stormy day; the strong west wind was creating a very high tide. Concerned by the potential for nest washouts, three Mote Marine Laboratory sea turtle patrol volunteers decided to check on the turtle nests on their local Longboat Key beach. When they got to the beach they found something completely unexpected: a stranded bottlenose dolphin! The volunteers called Mote, and the Stranding Investigations Program asked SDRP personnel to respond and keep the dolphin stable until they could arrive. The dolphin was determined to be a juvenile female with no obvious signs of poor health (other than her poor choice of location). She was nicknamed "Edna" after Ed Mueller, SDRP staff member Dr. Katie McHugh's grandfather who passed away the same day. Edna was transported back to Mote's Dolphin and Whale Hospital for rehabilitation. She spent 2 months in rehabilitation, where she was cared for around the clock by hospital staff and volunteers, including several SDRP interns and local volunteers. During that time Edna progressed from needing constant human support to remain upright and swimming, to being able to swim quite actively and feed on her own.

On 14 August, after she was deemed releasable by the National Marine Fisheries Service, Mote and SDRP staff transported Edna 2 miles off New Pass for release. SDRP staff affixed a satellite-linked transmitter to her dorsal fin to keep track of her movements and dive patterns post-release. Unfortunately the tag only transmitted for 3 days. During that time, she did not travel far, but appeared to be slowly expanding her range. Several boat surveys were made to relocate her visually, but these were unsuccessful. On 17 August, the same day the transmissions stopped, a vacationing couple reported Edna swimming close to them off a beach at south Longboat Key. We do not know why her transmissions stopped. Hopefully Edna will be seen in the near future during monthly survey efforts. If not, we may never know what really happened to her.

SDRP staff stabilized and monitored Edna on the beach prior to the arrival of the Mote rescue team.

Edna being transported to her release site aboard Mote Marine Laboratory's R/V Eugenie Clark.

Bottlenose dolphin "Vidalia's" happy ending: conservation success then and now

By Ann Weaver, PhD, Argosy University Sarasota and USCG Captain John Heidemann

Free-ranging marine mammals like bottlenose dolphins handle many objects at sea, from fish to seaweed toys, but among the most unfortunate objects they're forced to handle is discarded fishing line. Once tangled in it, dolphins don't "handle" it. They can only endure it. In the summer and fall of 2011, a little bottlenose dolphin calf named Vidalia endured a body noose of fishing line for four months. Each time he moved forward, which dolphins do continuously, fishing line sliced a little deeper into the corners of his mouth, right pectoral (arm) fin, left eye and dorsal fin like a saw cutting wood. A trailing wad of fishing line slapped his side unceasingly. Vidalia often wearied of his struggle and tried to clamber up on his mother's back. Such behavior is typical of baby monkeys but certainly not of baby dolphins. And baby he was: still young enough to be living solely on his mother's milk.

In November 2011, Vidalia was successfully captured in a tiny St. Petersburg, Florida cove, cut free of fishing line and set free by a 38-member collaborative team of marine mammal biologists and veterinarians from around the state, organized and coordinated by the SDRP. This maritime rescue was even more successful because Vidalia and his mother Valiant stayed in the study area after the rescue, which meant that researchers have been able to observe them regularly and provide rare follow-up data. The news was good: young Vidalia returned to the normal life of a young dolphin growing up at his mother's side and provided valuable evidence of healing times at sea.

Behaviorally, Vidalia went through the stages of healthy calf development more quickly than normal – as if he had some catching up to do, which indeed he did. While entangled, Vidalia swam mostly at his mother's side. After the rescue, he got a little bolder each month, at first swimming nearby his mom as she foraged for food, and finally speeding around her at greater and greater distances. One day at the end of January, Vidalia was particularly

lively: he embellished his speedy swims around mom with a brief slide down the wake of a passing yacht, surfing, caught a fish that a tern then stole, and goosed a cormorant into flight. By May, Vidalia may have focused more on foraging than nursing. One day, his mom rolled over and revealed that she'd accumulated a great deal of milk; when he went over to nurse, some milk spilt into the green seas! As spring turned to summer, Vidalia showed further normal behavior by increasing the time he spent interacting with other dolphins besides his mom, intermingling with a variety of dolphin schoolmates from younger calves to adult males.

Physically, Vidalia's delicate dolphin skin is primarily designed to touch water, so the sawing and chafing of fishing line took 4-6 months to heal into scars. The trailing wad of fishing line that slapped his side chafed his skin until it produced a large patch of big white bumps; this patch showed little sign of healing for three months and took half a year to heal completely (November 2011 to May 2012). The fishing line probably cut deepest into the bottom front of his dorsal fin. It took six months for the swelling to go down and the lighter discolored pigment to match the rest of his body color. The asymmetrical severing action created a large dent or gap in the tissue. Almost a year later as of this writing, the gap has yet to fill in completely. The furrow-like dents created by the sawing action of fishing line across the corners of the mouth and left eye are still clearly visible when Vidalia pokes his head out or leaps out of the water like any other normal dolphin.

Vidalia's entanglement injury shown during his 2011 rescue (inset) and in September 2012 after healing.

Bottlenose dolphin "Lizzie" disentanglement a success – she's swimming free and clear!

By Katie McHugh, PhD, Chicago Zoological Society

This year, the SDRP successfully rescued one of our own resident dolphins, Lizzie (F113), during our July health assessment project. Lizzie is the 16-year-old daughter of well-known Sarasota female "Killer," and she is now a young mother with calves of her own. Lizzie was one of ten dolphins outfitted with an improved satellite-linked tag design during the May 2012 heath assessment (see article by Wells, Balmer, Howle). During her exam on 7 May, she was observed to be in good health and free of any signs of entanglement. However, during the course of follow-up observations on 23 May, we observed Lizzie with monofilament fishing line trailing from her dorsal fin near the tag attachment to the back portion of her body. Lizzie and her calf had been seen the previous week, both in good condition, but had an unlucky weekend during which both Lizzie became entangled and her calf appeared to be struck by a boat, displaying a fresh wound on the leading edge of his dorsal fin (see article by Barleycorn). Because of these unfortunate human interactions, both animals understandably became extremely evasive and wary around boats, making further detailed observations by SDRP staff difficult over the next month.

Fortunately, with brief observations during the month of June, we were able to confirm that the fishing line had cleared itself from the tag attachment point. However, as Lizzie's evasiveness waned and she allowed us to approach and observe her more regularly, it became clear by early July that there was still some line wrapped around her fluke, with a small ball of monofilament and algae trailing behind her body. Although Lizzie's behavior and body condition did not appear to be affected substantially by this entanglement, she was at risk of losing a large portion of her fluke so we made her disentanglement a top priority during the July follow-up health assessment. After looking for Lizzie without any luck all week, we finally located and successfully disentangled her on the morning of our final day – 20 July! Everyone breathed a huge sigh of relief as Lizzie was released, free and clear of line, alongside her calf, who also appeared to be healing well from his May boat strike injury.

Although we were able to successfully rescue Lizzie, her story highlights the dangers of fishing line and marine debris in the local environment and the importance of follow-up monitoring of tagged animals in areas where line may be a problem. In addition, monofilament recycling and clean-up programs can be extremely helpful in making our waterways safe for dolphins and other marine life.

Monofilament fishing line wrapped around and cutting deeply into Lizzie's fluke just prior to disentanglement on 20 July 2012.

Bottlenose dolphin "Seymour" rescue and tracking

By Aaron Barleycorn, BS, Chicago Zoological Society

In December 2011, Seymour, a juvenile dolphin in near Marco Island, Florida was reported with fishing line entangled around his peduncle. The line was wrapped tightly and appeared to be cutting deeply just in front of the tail. After consulting with local researchers and dolphin experts, the National Marine Fisheries Service decided an intervention was necessary. The team, led by NMFS, consisted of several different organizations including personnel from the SDRP. On 9 March 2012, after a long day of searching, Seymour was temporarily captured and the line was removed. The veterinarians on scene decided the best course of action was to release Seymour and let him recover in the wild. In order to keep track of Seymour, a satellite-linked tag was attached to his dorsal fin.

Through satellite-linked tracking and local observations, Seymour was tracked daily through 31 May, a total of 84 days with 328 "good" quality locations. Dive data were also recorded, with almost 57,000 dives documented. The location and dive data were consistent with what would be expected from a normal inshore bottlenose dolphin. His range was shown to be slightly larger than local researchers had realized, although most of his time was spent in or near the waterways of Marco Island. At the time of last transmission, Seymour seemed to be well on the road to recovery. He was seen later in the summer, and the tag had come off his fin, as planned. We all hope he will live a long life and stay away from fishing line in the future.

Left: Seymour's injuries from the fishing line, shortly after the line was removed. Right: Seymour with satellite-linked tag, prior to release.

Update on previously rescued animals

By Aaron Barleycorn, BS, Chicago Zoological Society

The Sarasota Dolphin Research Program has rescued many dolphins over the years. These rescues vary from remote disentanglement of fishing line, to treatment and release in the field, to transport for rehabilitation at Mote's dolphin and whale hospital. An important part of any intervention is post-release monitoring in order to learn what works and what does not in each situation, and to be able to intervene if necessary. Below are updates on four success stories of rescued dolphins:

Scrappy: In July 2006, Scrappy, a juvenile male was observed entangled in a men's Speedo bathing suit. He had managed to put his head through the waist and one of the leg holes, and the suit had worked its way back to the point where it was cutting into his pectoral fins. On 3 August 2006, Scrappy was temporarily captured, and the suit was removed. Injuries from the entanglement were considered potentially life-threatening. Now 14 years old, Scrappy has been seen 14 times in 2012. He was seen most recently on 10 September in Big Pass, with three other young male dolphins.

FB28: In June 2007, FB28, an adult male originally tagged in 1971, was seen entangled in monofilament fishing line. The line was tightly wrapped three times from his fluke to his dorsal fin. On 6 July 2007, SDRP staff members were able to use a long handled cutting tool to remove much of the line while FB28 was free swimming (not an easy task). Some line was left on the fluke, but the tension had been released, and the line later cleared completely from the fluke. FB28 is now 47 years old - the oldest known living male in Sarasota Bay. He has been seen 7 times in 2012, most recently on 20 July in Palma Sola Bay.

Ginger: In December 2008, Ginger, a recently independent juvenile female dolphin stranded on Siesta Beach. After being stabilized on the beach by SDRP staff, she was taken to Mote, treated for complications from the stranding, and released two months later. The SDRP radio-tagged her and closely monitored her for two months post-release until the tag transmissions ceased, as designed. Ginger has since been regularly seen during our monthly population monitoring surveys. She is now 7 years old, and was seen most recently on 14 September with another female of similar age. She has been seen 24 times in 2012, further expanding her range as she matures. On several of her recent sightings she has been on a "date" with a local male alliance. Maybe there will be a little Ginger next year?

Nellie: In February 2010, the 9-month-old calf of resident dolphin FB25 was seen with plastic twine and a metal hook tightly wrapped just behind her head. She was temporarily captured, disentangled and released on 1 March 2010. She was named "Nellie" in honor of Dr. Nelio Barros, a great friend and colleague, who had recently passed away. This year, Nellie was one of the ten dolphins involved in the new tag design study (see article in this edition). She was found to be in very good condition. She has been seen 23 times in 2012, most recently on 10 September, close to where she was rescued.

Ginger (left) swimming with Nellie (with an experimental tag) in July 2012.

Development and tests of new and improved satellite-linked tag designs for dolphins

By Randall Wells, PhD and Brian Balmer, PhD, Chicago Zoological Society, Laurens Howle, PhD, BelleQuant Engineering, and Michael Scott, PhD, InterAmerican Tropical Tuna Commission

Early in 2012, we received a grant from the Office of Naval Research to refine designs for satellite-linked dolphin tags. Our goal was to produce a safe and reliable, single-pin attachment, satellite-linked tagging system for deployment on small cetaceans over periods of months, with minimal risk of harm to the animals. The project built on recent advances involving a transition from larger tags mounted by multiple pins to the side of the dorsal fin, to a single plastic pin holding a smaller tag trailing behind the dorsal fin. The project examined the results of previous deployments of single pin designs, and determined the optimal location on the fin for such tagging to be in the lower third. Laurens Howle of BelleQuant Engineering then engaged in computational fluid dynamics modeling to refine the design of the current Wildlife Computers Splash10 tag and attachment to reduce drag and improve attachment performance. Modifications were made to the tag shape and size, and at the suggestion of Wildlife Computers, lock nuts were replaced with thread-forming flat-head screws, further reducing drag. In combination, these changes reduced drag by about 50% from the previous design.

Wildlife Computers incorporated these suggestions into an experimental design for field testing. They also recommended a silicon-based antifouling coating, *PropSpeed,* as a means to prevent drag-producing biofouling and improve post-deployment tag performance. Field tests of the tag design resulting from evaluation of previous deployments and computational fluid dynamics modeling were conducted during May-August 2012. Ten experimental tags were deployed on long-term resident bottlenose dolphin adults or juveniles in Sarasota Bay, Florida, in conjunction with health assessment operations during 7-10 May. Three of these were Wildlife Computers Splash10 satellite-linked time-depth recording (TDR) tags. The other seven were VHF tags in similar configurations as the TDR tags, prepared by Wildlife Computers (Figure 1). Half of these were treated with *PropSpeed* antifouling coating, and the other half were left uncoated. In three cases, both members of bonded male pairs were tagged, with one receiving a coated and the other receiving an uncoated tag, to control for potential differences in exposure to biofouling organisms related to differential habitat use. The dolphins were observed, photographed, and video-recorded over the 69-92 days they carried tags. Eight of the dolphins were recaptured in July 2012, the tags were removed, and health assessments were performed, 69-75 days after deployment. The remaining male pair (F242 and F164) was observed until the tags came off their fins, as designed, sometime between post-deployment day 92 and day 119.

Preliminary analyses indicate that the new tag design worked very well. Fin damage was minimal compared to earlier tag designs, with little or no migration of the attachment pin through the fin. Observations of the tagged dolphins with the tags found no behavioral differences associated with the tags, in terms of respiration patterns or ranging patterns. No differences in social patterns were observed. Both tagged adult females became pregnant while carrying tags. Follow-up assessments in July found no indication of health problems associated with the tags. The anti-fouling coating worked very well. Minimal growth occurred on coated tags as compared to the heavy growth on uncoated tags (Figure 1).

Figure 1. Adult males F164 (left) and F242 (right) 92 days post-deployment, showing heavy biofouling on F164's uncoated tag, and no growth on F242's coated tag.

Adult male F276 with coated tag showing minimal biofouling, 69 days post-deployment.

Preliminary indications are that the tag design, attachment, and coating combination developed during this project are a significant improvement over previous designs, in terms of performance and reduction of risk of injury to the animal. The results of this project suggest that researchers or cetacean rehabilitation facility managers may now have a small cetacean satellite-linked tag (and potentially other electronic tags) option that can be applied with a high level of confidence for optimal data collection over periods of months with minimal concern about impacts of the tag on bottlenose dolphins. However, the design has only been tested on a few individuals of a single species; more testing would be warranted.

One year later: Results of Franciscana dolphin tagging and tracking in Brazil

By Marta J. Cremer, PhD, Universidade da Região de Joinville, and Randall Wells, PhD, Chicago Zoological Society

In October 2011, an effort involving Brazil, Argentina and USA succeeded in capturing and tagging with satellite-linked transmitters five Franciscana dolphins in Babitonga Bay, southern Brazil. It was a great experience, involving a tri-national effort to work together to help endangered dolphins.

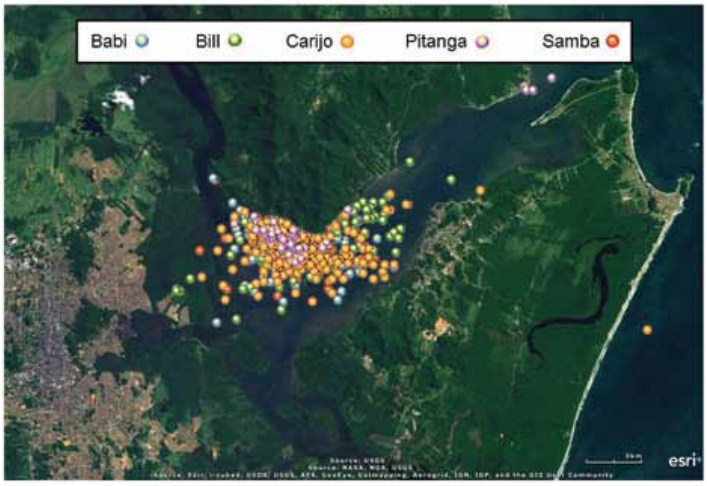
One year later we have important results to report. In the scientific field, we generated new information on the ecology of Franciscana dolphins in Babitonga Bay. But we also had practical results in the conservation field – as was the intention of the work, conservation science contributed to the promotion of conservation actions.

The scientific information was obtained by the satellite-linked transmitters' signals that were received during 7 to 61 days. Unfortunately, we have strong evidence that two animals died as a result of accidental capture in fishing nets; one carcass was recovered. Many artisanal driftnets were being used in the same period in the area of Franciscanas´ occurrence. Our previous hypothesis was confirmed: data indicated that Franciscanas are resident in Babitonga Bay and no movements in and out of the bay were recorded, at least during spring and early summer. Home ranges were very small, ranging between 10 and 26 km^2. The tagged individuals remained in the same region where they were captured, without leaving the area after the procedure.

In this work we also expect to contribute to the understanding of any impacts the tags might have on the dolphins. The visual monitoring of tagged individuals from a small boat started soon after the tagging and continued over nine months. No behavioral changes were observed. In one of the captured groups two individuals (male and female) were tagged, who were subsequently in the same group in 73% of visual records. Three individuals were monitored visually after the loss of the transmitter, which remained attached to the dorsal fin for at least 15 days, 6 months and 9 months. These three animals, now recognized individually by the marks left on the dorsal fin, may be monitored by photo-identification and will continue to provide data.

Conservation results were obtained more recently. In April 2012 we sent a document with the results of this work to the Brazilian Institute of the Environment (IBAMA). This agency is analyzing a proposal for the construction of a new harbor in the inner area of the bay, within the Franciscanas´ home range. This would be the first of several new planned harbors in the bay. Recently, in October 2012, the local mayor signed a letter requesting the IBAMA not give any license to install harbors in this area of the bay. Among the reasons, the importance of the area for the Franciscanas´ population confirmed by the results of the satellite telemetry work was emphasized. This is very important support for conservation in this area.

Challenges remain. The continuity of research using satellite-linked transmitters in this population is important given the seasonal variations that exist in the region, mainly due to the availability of resources, and that may modify the Franciscanas´ home range. Fortunately we have wonderful partners to help us move forward, and our challenge in this sense is to get financial resources that make possible this research. On the other hand, consolidating conservation actions is a constant challenge in a country like Brazil, where the pressure for accelerated economic growth is very strong. We need to continually generate scientific information to support decisions for conservation, and work to have this information to be considered.



Locations of Franciscana dolphins in Babitonga Bay, from satellite-linked tracking during 2011-2012. Locations in extreme upper right and lower left are locations of tags following fishery interactions.

AquaMarina Franciscana dolphin project accomplishments in 2012

By Pablo Bordino, Lic., MSc, AquaMarina Director

Due to funding constraints, the year 2012 did not include any systematic field work as part of our ongoing research program, except beach surveys looking for stranded dolphins every month, and educational activities at the "Escuela del Mar" in Pinamar and Bahia Blanca during the summer. Beach surveys reported a total of 18 dolphin carcasses, all of them with clear evidence of entanglement in gillnets. Samples were collected for genetic and age determination and skeletons recovered as part of regular procedures. Educational activities were mostly focused on kids and teenagers, and included not only talks but also field assistance in sampling collection during beach surveys. However, 2012 was in some sense an active year for the Franciscana dolphin project in Argentina and abroad. The Franciscana dolphin is currently the most threatened cetacean in the Southwestern Atlantic. Considering that the current bycatch in Argentina is over 600 dolphins a year in Northern Buenos

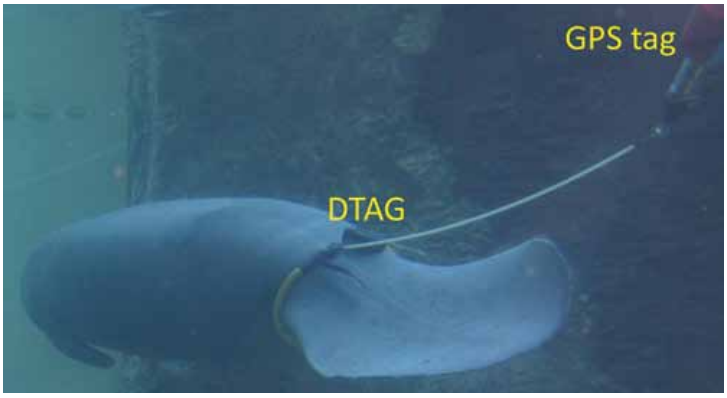
Aires, strategies to mitigate such bycatch is our main goal. Two papers on the effectiveness of experimental "reflective" gillnets and bottom hand-lines to reduce dolphin bycatch were submitted for publication. Although the "reflective" gillnets were not effective at reducing the dolphin bycatch, the strategy to switch gillnets to bottom hand-lines was supported by an economic analysis indicating how profitable it could be for fishermen, while reducing dolphin bycatch. Papers updating dolphin bycatch and habitat use in two protected areas are currently being improved. Our experience in the field of bycatch mitigation has been recognized for other colleagues outside Argentina. We were invited to collaborate with the "Projeto Biopesca" to evaluate experimental gillnets in Praia Grande, Brazil. Also, we were invited to participate in a Workshop on Harbour Porpoise from the Baltic Sea organized by WWF in Poland, to explain our strategies to deal with the dolphin bycatch issue in Argentina. Perhaps, the most relevant accomplishment this year has been to work with the Argentinean Federal Government on the Marine Mammals National Conservation Plan. This plan is mainly focused on bycatch mitigation and is being developed in collaboration with many researchers from different institutions, including AquaMarina. During discussions, it was very clear that the Franciscana dolphin status in Argentina is critical. Bycatch in gillnets represents a major conservation concern for many small cetacean populations, and it is particularly serious given the high sociality, slow life histories and limited potential for population growth. The majority of global small cetacean bycatch is believed to occur in gillnets, which are one of the most popular fishing gears used worldwide. Our efforts to evaluate bycatch mitigation tools since 2002 have been relevant for the Plan. We hope it helps to establish strategies in consensus with the government and the fishermen for the first time, not only to protect Franciscana dolphins in Argentina but also other marine mammals being bycaught in gillnets in many parts of the world.

Franciscana dolphin in a gillnet. Photo Credit: P. Bordino, AquaMarina.

From Belize to Florida: how manatees react to boats

By Athena Rycyk, PhD Student, Florida State University; Charles Deutsch, Margaret Barlas, Stacie Koslovsky, and Katherine Frisch, Florida Fish and Wildlife Conservation Commission; and Douglas Nowacek, Duke University

Boat collisions are the largest source of human-caused manatee mortality in Florida. We set out to investigate this problem by looking at how manatees react to boats. We tagged and monitored 18 wild manatees in southwest Florida. This included a technologically sophisticated DTAG that recorded underwater behavior and acoustics and a satellite-linked GPS tag that recorded the manatee's location at 5-min intervals. The tags and their attachment system were tested on a captive manatee at Mote Marine Laboratory and the results of this test helped us refine the gear prior to deployment on wild manatees (see photo). While the tags were collecting data, our field team conducted focal follows to record manatee behavior and habitat and to map out the boat traffic around each manatee. These data were combined to create detailed reconstructions of manatee-boat interactions that will allow us to better understand what factors affect how a manatee reacts to boats. Possible factors include environment, manatee behavior, group size, boat speed, and many more.



Hugh tests out the DTAG and GPS tag attachment system in his tank at Mote Marine Laboratory. Photo Credit: FWC.

The SDRP has previously attached DTAGs to manatees in Belize, a population that has a lower level of exposure to boats, and is sharing data from this pilot study with us. This collaboration will allow us to describe the reactions of manatees to boats in different locations. Hopefully, as we come to better understand manatee-boat interactions, we can reduce the occurrence of manatee deaths from boat collisions.

Funding for this project comes from the FWC-Florida Manatee Avoidance Technology Grant Program, FWC-Save the Manatee Trust Fund, FWC-Division of Law Enforcement, Disney Wildlife Conservation Fund, and Florida State University.

Helping dolphins in Cambodia

By Randall Wells, PhD, Chicago Zoological Society

SDRP Director Randall Wells went to Kratie, Cambodia, in January as part a team advising on conservation efforts to save the critically endangered Mekong River population of Irrawaddy dolphins, one of only three remaining freshwater populations of this species. This dolphin's range has been reduced from being distributed through river, lake, and delta waters extending from Laos through Cambodia into Vietnam, down to an isolated 190 km section of the Mekong River south of the Laos border with Cambodia. It is estimated that only about 85 dolphins remain, living in 9 deep pools in the river.

In recent years, unsustainably high numbers of calves have died from this population, leading to international concern about the continued existence of the Mekong River population. Little is known about why the calves are dying in high numbers. A small group of invited biologists and veterinarians gathered in Kratie, near the largest group of dolphins, for a 3-day workshop. The purpose of the workshop, funded by the World Wildlife Fund and the U.S. Marine Mammal Commission, was to try to identify the reasons for the dolphin deaths, if possible, and to design a program to gather further information as necessary. This would provide the basis for conservation and policy decisions that can be made to improve protection.

While no clear cause of all of the unusual mortalities could be identified during the workshop, some of the dolphins have clearly died from net entanglements. It was reported that illegal fishing operations, including gillnetting and electro-fishing, continue in the river within the range of the dolphins. A declaration signed by Cambodian governmental agencies and WWF as a result of the workshop established new efforts to reduce illegal fishing, to study the live animals in the field, and to more expeditiously collect and examine carcasses to try to learn what is happening.

As a result of this workshop, an offer has been made to have Cambodian conservation researchers visit the U.S. to learn more about our techniques. In the past, workers from Asia and Latin America have spent weeks or months with SDRP researchers learning field data collection and laboratory data processing techniques. The protocols they learn are useful for developing a knowledge base about a species such as the Irrawaddy dolphin.

An Irrawaddy dolphin in the Kampi deep pool of the Mekong River, north of Kratie.

An Irrawaddy dolphin in Kampi pool using a unique "spitting" technique to facilitate prey capture.

Dolphin trackers take a ride with sea turtles

By Tony Tucker, PhD, Sea Turtle Conservation and Research Program, Mote Marine Laboratory

Satellite-linked telemetry has revealed novel insights into the behaviors of many marine animals. SDRP biologists have tracked bottlenose dolphins, Risso's dolphins, rough-toothed dolphins, pilot whales, and Franciscana dolphins. Other Mote scientists regularly deploy satellite-linked tracking devices in specific configurations suited to the study whale sharks, bull sharks, manta rays, sawfish, tarpon, and sea turtles. The fundamental technology used by ARGOS or GPS satellite technology can often allow scientists to collectively share their empirical knowledge. However a tracking tag's hydrodynamic shape or sensor devices are ideally matched to a particular species under study which can constrain the rare opportunities for scientists to creatively reuse or redeploy a tag.

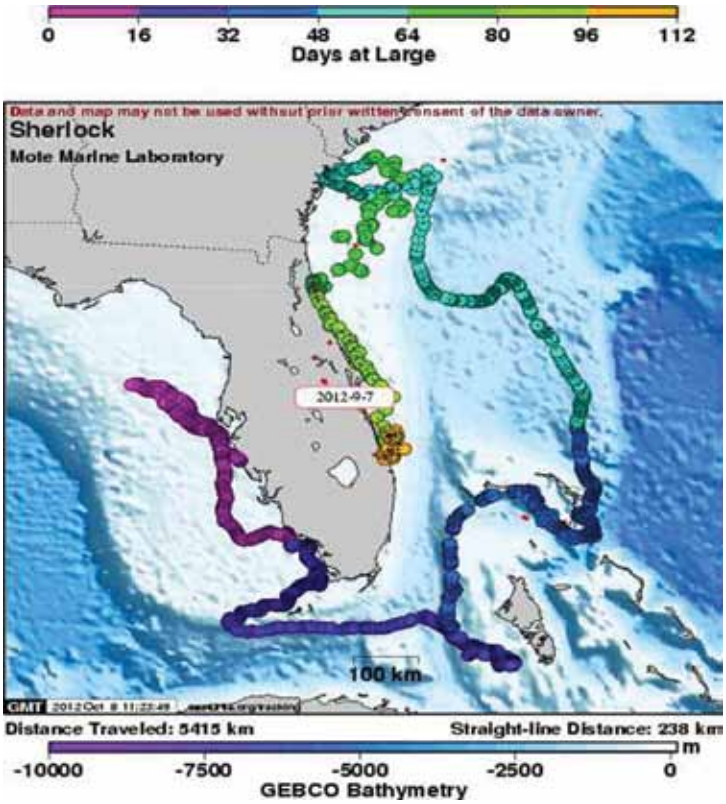
SDRP recently disproved that notion when they retired satellite-linked tags considered outdated and too large for their primary purposes of dolphin tracking. Before decommissioning the tags, SDRP considered whether tag technology unsuited to an agile swimming dolphin might still be useful with a more ponderous

swimmer such as a sea turtle. Mote's Sea Turtle Conservation Research Program (STCRP) was contacted by Dr. Wells to inquire if unused dolphin fin-mounted tags might function just as well if glued to a sea turtle carapace. Dr. Tony Tucker gratefully accepted the SDRP donation, not knowing if the dolphin tags could be salvaged or not, but willing to try. The tags were returned to Wildlife Computers for inspection and several were successfully refurbished and returned to STCRP. Although functionally the same device, small dolphin tags carried less battery capacity than found in larger sea turtle tags, and a shorter tracking lifespan was predicted.

From this innovative partnership to repurpose satellite tracking technology, STCRP is pleased to report the refurbished dolphin tags were successfully deployed on three separate turtle tracking projects on three turtle species, with excellent preliminary results (more than 100 days of tracking, with some still transmitting). These projects included loggerhead turtles nesting in Sarasota County (the longest running and largest satellite-linked tracking project for loggerheads worldwide), Kemp's ridleys swimming in Charlotte Harbor (collaboration of STCRP and Conservancy of Southwest Florida), and green turtles nesting in Cuba (collaborating with Univ. Havana and the Ocean Foundation, and a first with that species in that country!).

STCRP thanks SDRP for donating their 'old' sat tags for recycling. These donated resources played a key role to support multiple statewide and international study collaborations. Novel investigations on slow and steady swimmers can now spring from devices considered too 'old' or large for dolphin swim speeds.

Sherlock's tag is a repurposed Argos dolphin-fin mount tag donated by SDRP. The blue antifouling paint protects the slow swimming turtle's transmitter from barnacle growth. Sherlock was outfitted with the transmitter during STCRP's ongoing tagging study on Casey Key, Sarasota County. Photo Credit: T. Tucker- Mote Marine Laboratory



Sherlock's transits across the Gulf Stream show strong current influences of the Gulf Stream. However, turtle navigation is guided by magnetic orientation to the earth's magnetic inclination and field strength, so Sherlock navigated and repositioned despite the displacement by oceanic currents. Map Credit: STCRP, unpublished data.

Online sites for public viewing of these turtle tracking projects include:

Casey Key loggerheads http://www.seaturtle.org/tracking/?project_id=700
Charlotte Harbor ridleys http://www.seaturtle.org/tracking/?project_id=569
Cuba green turtles http://www.seaturtle.org/tracking/?project_id=539

Earlier work on sea turtle migration was published in:

Girard C, AD Tucker, and B Calmettes. 2009. Post-nesting migrations of loggerhead sea turtles in the Gulf of Mexico: dispersal in highly dynamic conditions. Marine Biology 156: 1827-1839.

Education continues to be a major component of our program's activities, directed toward the general public, students, colleagues in the United States and abroad, and wildlife management agencies.

Public Education and Outreach: We work to educate the general public regarding bottlenose dolphins and conservation issues through public presentations at the Chicago Zoological Society's Brookfield Zoo, Mote Marine Laboratory and Aquarium, and elsewhere, articles and interviews, and through volunteering opportunities. We also produce books for the general public and students. One of these, *"Dolphins, Whales, and Manatees of Florida: A Guide to Sharing Their Waters,"* by John Reynolds and Randall Wells, was published in 2003 to fill a niche for teaching people about how to better appreciate and treat marine mammals in their environment. Another, *"Dolphin Man: Exploring the World of Dolphins,"* by Laurence Pringle and Randall Wells, was published in 2002 to provide middle school students with an opportunity to learn about Sarasota Bay's dolphins and about one pathway for becoming a marine biologist engaged in dolphin biology research and conservation.

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

In response to an increase in dolphins taking bait, catch and discarded fish from anglers, we worked with NOAA Fisheries Service, Hubbs-Sea World Research Institute, and fishing guides and anglers to develop an educational card displaying 10 tips intended to improve the experience of the angler or boater while enhancing protection for dolphins. By making these cards available to boaters, anglers, and the general public, we hope that more individuals will become aware of the risks and legal issues involved when interacting with wild dolphins and choose to engage in responsible viewing and fishing practices when dolphins are present. These *"Dolphin-friendly fishing and viewing tips"* cards were initially developed through the support of the Disney Worldwide Conservation Fund, with additional funding for re-printings coming from Marineland: Dolphin Conservation Center, Harbor Branch Oceanographic Institution, and Fish Florida. Distribution throughout Florida and the southeastern United States has been coordinated by the SDRP, and the United States Coast Guard and Coast Guard Auxiliary recently began distributing our cards to fishermen and marinas up and down the eastern seaboard. More than 304,000 cards have been distributed since January 2008, including 13,450 in Spanish. Please contact our website if you have any further questions or would like to help distribute the cards. We will continue to make them available at no cost to those who can effectively distribute them to people likely to come into contact with wild dolphins. The cards are available in English and Spanish as downloads at: www.sarasotadolphin.org.

With the help of a generous donation from Wing and Jan Park, we also worked with Mote Marine Laboratory to update their marine mammal educational display materials. One phase of this effort involved placing a display near Mote's Dolphin and Whale Hospital that features the *"Don't Feed Wild Dolphins"* public service announcement (developed in 2009 in part by the SDRP), presented alongside the list of 10 *"Dolphin-friendly fishing and viewing tips"* discussed above. This display is located in a high-traffic area of the aquarium and highlights the dangers of feeding wildlife along with ways that members of the public can interact with wild dolphins in a more responsible manner. This PSA is also available online at: www.dontfeedwilddolphins.org.

Sharing Scientific Findings and Participation on International and Government Panels: Our efforts to provide information to our colleagues and wildlife management agencies continues, through publication of numerous peer-reviewed scientific articles, through invited presentations at various scientific conferences and through participation in national/international panels such as the Atlantic Scientific Review Group, Bottlenose Dolphin Take Reduction Team, the IUCN Cetacean Specialist Group, the IUCN Reintroduction Specialist Group, and the Board of Governors of the Society for Marine Mammalogy, the largest association of marine mammal scientists in the world (Randall Wells, President, through June 2012).

International Training Opportunities: The SDRP is a component of the Chicago Zoological Society's Conservation, Education and Training group. As such, we provide training opportunities for scientists and students from outside of the United States. These sponsored training opportunities allow foreign scientists to participate in SDRP field and laboratory research activities and discuss with staff how such activities might be applied to their own situations at home. Standardized research methodologies facilitate comparisons across research sites. During 2012, we hosted five people for extended training periods: Celeste Bollini and Yamila Rodriguez from Argentina, Camila Domit and Beatriz Schulze from Brazil, and Yujiang Hao from China. Celeste and Yamila each spent one month in Sarasota finishing work on the senior thesis projects they began in 2011 and assisting with lab activities. Beatriz spent 2 ½ months and Camila spent 1 ½ months in Sarasota learning about field and lab techniques. Finally, Yujiang began his training in Sarasota in September and will work with the SDRP through January 2013. In addition, a number of international trainees participated in our 2012 bottlenose dolphin health assessment in Sarasota Bay, including three researchers from Malaysia, seven scientists and veterinarians from Brazil, two researchers from South Korea, and researchers from Australia, Canada, Denmark, Germany, and Spain.

Graduate Students: As described throughout this newsletter, graduate students from a variety of institutions, especially the University of California-Santa Cruz, the University of South Florida, the University of North Carolina Wilmington, the Medical University of South Carolina, Michigan State University, Duke University, the University of Florida, and the University of St. Andrews involve the resources of our program as they conduct their thesis or dissertation research. To date, about 25 doctoral dissertation and 30 master's thesis projects have benefited from association with our program, through field research opportunities or access to data, samples, or guidance. During 2012, two doctoral students involved with our program, Glenn Dunshea and Peter Simard, successfully defended their dissertations. Currently, eight doctoral students and three master's student are making use of resources provided by our program.

Undergraduate College Internships and Other Volunteers: 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 2-3 months at a time (for more information on internships, please contact Katie McHugh, SDRP Intern Coordinator, at: kmchugh@mote.org). During 2012, 16 interns and out-of-town volunteers provided approximately 7,200 hours of assistance to the program. In addition to the five international training participants from Argentina, Brazil, and China described above, we also provided training to interns from outside the USA, including Russia. Many of our undergraduate interns apply their training with the SDRP towards advanced study in the areas of marine animal conservation, research, and management, including five 2011-2012 interns who are now either graduate or veterinary students. During 2012, we also had 12 local volunteers assist with our surveys, prey sampling, and capture-release operations.

High School Programs: We offer both formal and informal educational opportunities for high school students. A formal curriculum, *"The Secret Life of Dolphins,"* was developed by the Chicago Zoological Society in collaboration with Mote Marine Laboratory, and focuses on high interest dolphin research ongoing at the two institutions. The formal curriculum models a set of technology-based educational components, enabling students and teachers to work with real dolphin data from Sarasota Bay and Brookfield Zoo dolphins, using interactive data analysis software. It has been designed to offer teachers and students a dynamic array of experiences and scientific inquiry tools that can be used together or independently, centered on an overall theme of understanding the nature of science and the role of research in conservation. The curriculum immerses students in scientific investigation. They can manipulate and analyze real dolphin data, while gaining an appreciation for the uncertainty of science. The downloadable curriculum unit (approximately 4 weeks long) includes background information for the teachers and classroom-based activities and lesson plans related to: 1) basic content on dolphin research, 2) computer software, and 3) a field trip to either Mote Aquarium or the Chicago Zoological Society's Brookfield Zoo. The materials are available as downloads at no cost at www.sarasotadolphin.org.

SDRP staff and 2012 summer interns.

Mote high school intern involvement in SDRP activities

By Kim Bassos-Hull, MSc, Sarasota Dolphin Research Program

Mote's High School Intern Program first became involved with the Sarasota Dolphin Research Program in 2007 as part of a grant from the Association of Zoos and Aquariums (AZA) Conservation Endowment Fund. Students helped researchers collect sighting and behavioral data as well as photographs and video clips of Sarasota resident dolphins during weekend surveys when fishing and boating pressures on the dolphins was highest. This year (2012-2013) Mote High School Interns will again help researchers collect video of Sarasota dolphins on weekends to contribute to SDRP's video library. Another objective of this program is to engage these interns to participate in coastal cleanups, removing potentially entangling lines, rope, and marine debris from Sarasota Bay. Twenty-three interns participated in such a cleanup on 15 September 2012 as part of the Ocean Conservancy's International Coastal Cleanup and removed more than 12 bags of trash and fishing line from Roberts Bay. During spring of 2013 these interns will create outreach activities about dolphins to be used in Mote's education programs and at environmental festivals. Dr. Randy Wells met with this most current intern group at the kickoff meeting on 11 September 2012 to share his background and words of encouragement for their involvement in SDRP activities as he too was once a Mote High School Intern!

Mote high school interns help clean-up Sarasota Bay during the September 15th International Coastal Cleanup.

Marine debris collected during the 2012 Coastal Cleanup.

Dolphin danger!!

By Chip Phillips, Southside Elementary School, Sarasota, FL

I was honored to be selected to help prepare a curriculum for 5th grade students dealing with the threat to dolphins from entanglement in human fishing lines, ropes, and paraphernalia, as part of the SDRP's project funded by the Disney Worldwide Conservation Fund. And what better way than to have the students see it from the dolphin's perspective? The students learn about this serious problem through discussion, media, and an experiential activity, framed in the dolphin's underwater world. Students will learn about dolphin conservation issues from SDRP staff, and they will see animations and video from our underwater "dolphin cam."

For the activity, the students play a game, pretending to be dolphins. They are hungry dolphins, in search of food, only to be confronted with the all-too-recurring danger of entanglement. The students attempt to navigate, as a dolphin must, through a veritable jungle of cotton clothesline strung in front of them in their classroom. At the other end of the room lies the bounty: food, play, and safety. But the clothesline can prove to be a most formidable opponent; you cannot touch it with any part of your body while underway, or you're injured.

Through a subsequent lively discussion, spiced with video and a slide show of real-dolphin entanglement examples, the point is clearly made that dangers are real, but also preventable. The teaching objective is that the students become knowledgeable about the problem, and motivated to take action by telling their parents and friends about both the threat and the solutions. The students leave with copies of the *"Dolphin-friendly fishing and viewing tips"* cards prepared and distributed by the SDRP.

5th graders and SDRP staff member Sunnie Hart at Fruitville Elementary School's Career Day.

International Training Perspectives

Team MareCet participates in the Sarasota Bay dolphin health assessment project

By Louisa S. Ponnampalam, PhD, Fairul Izmal Jamal Hisne, BS, and Grace S. Duraisingham, BS, The MareCet Research Organization, Malaysia

We are a small and young team from a newly established marine mammal research and conservation non-governmental organization in Malaysia called The MareCet Research Organization, with concurrent affiliations with the Institute of Ocean and Earth Sciences, University Malaya and Environmental Resources Management, an international environmental consultancy. In March 2012, we were offered the opportunity of a lifetime by Dr. Jay Sweeney, one of SDRP's lead vets, with an official invitation from Dr. Randy Wells, to join the Sarasota Dolphin Health Assessment Project that was going to take place in May 2012. The SDRP is well-known globally, and we had seen the name "Randall Wells" on many scientific publications, so it was rather surreal that we would be making the trip halfway across the world from Malaysia to partake in the world's longest running study of a dolphin population and meet the man himself.

For five days, we assisted the SDRP team in the field and were able to participate in most aspects of the fieldwork, which included releasing the net from the boat, holding the dolphins in the water, assisting in the animals' subsequent releases and helped the acoustic tracking team record data on *R/V Nai'a*. We also got to witness first-hand the various ways in which morphometric and physiological measurements were taken, how biological samples were collected, the methods of trying to develop a better suction-cup tag for dolphins, and most exciting of all, to observe how ultrasound is conducted on dolphins and to see its outputs on the computer screen.

Participating in this project has sparked many new ideas for our future research work in Malaysia, especially in our core project area in the Langkawi Archipelago. We were especially inspired by all the dedicated vets working so professionally in tandem with each other onboard *R/V Flip*. Observing such skill and professionalism in marine mammal veterinary care has reinforced our hopes and dreams of providing training in this field, through our organization and with the tutelage of Dr. Sweeney, to keen and dedicated vets in Malaysia. Although there are many qualified vets in Malaysia, none have ever been trained in marine mammal husbandry, resulting in a lack of know-how when it comes to dealing with stranded animals, dead or alive.

We already have a catalog of dorsal fins of 120 Indo-Pacific humpback dolphins from Langkawi, which we started in November 2010, and would like to improve the ways in which we manage our database by following some of the examples set by the SDRP team. Someday, hopefully not too long from now, perhaps we will be able to emulate the health assessments efforts of the SDRP team by doing the same with our dolphins and Indo-Pacific finless porpoises in Langkawi. Although not exactly dolphin-related, we were also motivated by the Intracoastal Waterway channel (ICW) and speed zone systems in Sarasota Bay, and hope to suggest similar vessel traffic guidelines to the authorities in Langkawi in areas where we will ascertain to be critical habitats for cetaceans.

After eight days of being in Sarasota, we were enriched with new knowledge on dolphin research, made wonderful new friends and gained what we'd like to call new MareCet partners (*i.e.*, all of you at SDRP). Our warmest heartfelt Malaysian greetings and thank you goes out to Randy, Blair and Michael for having accommodated our participation in the most generous and kind manner. Last but not least, to the wonderful and multi-talented Jay Sweeney, an infinite thank you for taking us under your wings (or should we say fins!). We hope to welcome all of you at SDRP to our shores someday.

Top and Bottom: Malaysian team participating in 2012 Sarasota Bay health assessments.

Chinese scientist trains with the SDRP

By Yujiang Hao, PhD, Institute of Hydrobiology, Chinese Academy of Sciences, Wuhan, China

The Yangtze River is the longest river in China and the third longest river in the world. The River is very important for China, and it is called the *River of Mother* by the local people, not only because it nourishes hundreds of millions of Chinese people, but also because of its rich biodiversity. Moreover, the Yangtze River is also unique because it is one of the only two river systems in the world with two endemic cetacean species living in it, the Yangtze River Dolphin or baiji, and the only freshwater subspecies of finless porpoise, or Yangtze finless porpoise. However, due to the population explosion and economic boom in this region, the natural habitats and resources have been drastically exploited in the past several decades. The biodiversity of the Yangtze ecosystem has been devastatingly destroyed. The Institute of Hydrobiology (IHB), Chinese Academy of Sciences (CAS) is one of the distinguished research units for conservation of the hydro-biological diversity of the freshwater system in China, located in Wuhan, the biggest city in central China along the middle reaches of the Yangtze River.

I became a PhD candidate of IHB in 2003, and met Dr. Randall Wells for the first time in 2004 when he was invited by Dr. Wang Ding to attend a workshop at IHB on rescue of the Yangtze River dolphins. He generously shared his expertise on research and conservation of the dolphins during the workshop. I was assigned as a coordinator of this workshop and got a chance to talk with Dr. Wells and to get a glimpse of his research program. As one of the outputs of the workshop, one of our research staff was generously invited by Dr. Wells to learn dolphin capture and soft-release skills with the Sarasota Dolphin Research Program (SDRP) in 2005. He presented a brief report on the SDRP and his two-week training in Sarasota Bay after he came back to China, which gave me a vivid view of the beautiful city and distinguished research institution. Since then, I decided to look for chance to visit the beautiful city and join the outstanding research program some day. In 2006, I got my PhD and began to work in IHB as a permanent staff member. In 2011, I got a funding opportunity from CAS to support me to study in the U.S. At the end of November 2011, I attended the 19th Biennial Conference on the Biology of Marine Mammals, in Tampa, and was given a chance to present our work by speed presentation right after the opening ceremony. After the presentation, Dr. Wells walked to my table, asked me about the exchange situation with the interested researchers and gave me some warm encouraging words on my presentation. I took the chance to talk about my plan to visit Sarasota. He kindly accepted my application, and finally made my dream come true in 2012!

Yujiang participating in Sarasota Bay dolphin surveys with former intern Mridula Srinivasan and SDRP research assistant Aaron Barleycorn.

Finless porpoise. Photo Credit: Wang Xiaoqiang

In 2006, suggested by the 2004 workshop, a whole range survey was conducted to search for any baiji possibly still living in the Yangtze River. Frustratingly, however, no baiji was sighted during the 48-day expedition. The baiji was announced to be functionally extinct in 2007. It was the first cetacean species to go extinct because of human influences, and this event was listed as the top 10 man-made disasters by the *New York Times* in 2007. The Yangtze finless porpoise is now likely the only cetacean species still living in the Yangtze River. Due to the similar threats faced by the baiji, the population of the porpoise has also declined drastically in the past several decades, and the present population is only about 1,000. The Chinese people and government can no longer tolerate the loss of the only cetacean in the Yangtze. How to identify their key habitats and their major threats, how to quantify and relieve the various human impacts on this endangered species amid the booming economy? These are the main urgent questions needed to be answered by Chinese researchers, and these are also my objectives to visit and study in Sarasota Bay.

I arrived in Sarasota on 25 September. Dr. Wells gave me a brief introduction to Mote Marine Laboratory and guided me on an introductory visit to the dolphin hospital, Stranding Investigations Program and manatee care and training program, etc. I participated in the monthly photo-ID and human interaction surveys that have long been conducted by the dolphin program. I was astonished when I participated in the field surveys that the staff members, including Dr. Katie McHugh, Aaron Barleycorn, Jason Allen, Dr. Brian Balmer and Sunnie Hart, can recognize nearly all of the more than 160 animals in the Bay just by a quick glimpse of their dorsal fins. It is really amazing! I'm sure one couldn't get this ability without long time and studious practice. During the field trips, I also learned

from Aaron to recognize lots of animals particularly birds in this region. I do really admire that he can recognize almost all of the animals and plants in this region. He is truly a nature lover and a real biologist! Most importantly, I think, I got the chance to learn the ArcGIS system guided by Dr. McHugh. It is powerful software for cetacean field research and management, and it will be very helpful for my research on finless porpoise. Taking this opportunity, I also got chance to talk with some researchers, trainers, and interns in other Mote programs, which vastly broaden and improve my perspective on marine mammal research.

I think I'm lucky to have this opportunity to work with a group of such lovely, enthusiastic and dedicated people in such a beautiful place. Particularly I want to express my sincerest thanks to Dr. Wells for giving me this opportunity to work with his group and making my long time dream become true. I'm confident that what I learned and felt in Sarasota Bay will help me in my future career. More importantly, this visit also made a new dream for me, which is to make my city and my country to become a harmonious and beautiful home of human and wildness!

Perspectives of a Brazilian scientist

By Camila Domit, PhD, Ecology and Conservation Laboratory of the Marine Study Center, Brazil

Since 2008, the Ecology and Conservation Laboratory (LEC) of the Marine Study Center has been studying marine mammals and sea turtles in the coastal area of Parana, Brazil. In this area, Guiana dolphins (*Sotalia guianensis*) and Toninha (Franciscana dolphins) are the most frequent dolphins inside the bay and in the shallow waters. Both are considered "threatened species." The LEC team takes an ecological and ethnoecological approach to studying dolphins. We use a variety of methods to analyze population structures and dynamics, habitat use, social behaviors, foraging behaviors, diet, and health conditions. We also evaluate human interactions and their impact on the dolphins. Through the collaboration of the LEC and different institutions such as ICMBIO, IBAMA, UERJ, UEL, UNIVILLE, FURG, FIOCRUZ (GEMM-LAGOS), GEMARS and UERGS, over 20 academic studies have been conducted using samples from Parana dolphins. I have recently had the wonderful opportunity to train with the Sarasota Dolphin Research Program (SDRP) and learn from the experience of Dr. Randall Wells and his staff. The training I have received in Sarasota will translate well to our work at the LEC, thereby improving our knowledge and skills.

I was glad to be part of this team during spring 2012. I was in Sarasota for six weeks and I participated in focal dolphin behavioral follows, dolphin photographic identification surveys, and the health assessment program. I accompanied the SDRP team to collect behavior and bioacoustics data, to track tagged animals, and to capture and release dolphins. I also learned about handling techniques and sample collection. Additionally, I learned more about photo-identification techniques, how to organize and integrate data to make the analyses easier, new methods to analyze social behavior data and I have had the opportunity to meet some incredible people that study and are really involved with the conservation of these animals. The time here has been a lesson of involvement, respect, dedication and hard work for conservation of marine mammals. I hope I can transmit the knowledge that I acquired to the LEC team and make our work better...I hope to come back next year!

International training perspective

By Beatriz Schulze, Projeto Toninhas/UNIVILLE, Brazil

I have worked with dolphins since 2007 in Brazil, but we still have more to learn about the wonderful world of small cetaceans! Sarasota Bay is a natural laboratory where the Sarasota Dolphin Research Program has worked for more than 40 years with a population of bottlenose dolphins, and it is a world reference for research on cetaceans. Therefore, training with the team of researchers from the SDRP was a great opportunity to improve my knowledge.

The first time that I came to Sarasota, in 2011, was to participate in the Dolphin Health Assessment Project. It was an unforgettable experience! Then I came back in 2012, and this time, I had the opportunity to understand all that is behind the capture and release of wild dolphins.

I participated in synoptic surveys, focal animal behavioral follows, photo-identification, helped in the fish survey boat, learned to do radio-tracking and could see what the dolphins do under the water! I also had my first experience going offshore on the Gulf of Mexico.

I came back to Brazil two months later, full of new ideas and perspectives of how I can study more and better the population of dolphins that I work on!

I want to thank Randy for the enriching experience, and all the SDRP friends, for the attention and for teaching me during the time I spent with you!

Beatriz Schulze radio tracking tagged dolphins in summer 2012.

Dolphin rescue cross training

By Katie Moore, MEM, Manager, IFAW Marine Mammal Rescue and Research

IFAW, the International Fund for Animal Welfare, rescues and protects animals around the world. Our international headquarters is based on Cape Cod - one of the rare hot spots in the world where mass strandings of dolphins and whales occur on a regular basis. IFAW's Marine Mammal Rescue and Research (MMRR) team responds to an average of 240 stranded marine mammals here each year. What makes our work truly exciting is that 47% of the cetaceans we find are alive, giving us the opportunity to learn a great deal about the health of the populations.

Learning from our colleagues is one of the best ways to constantly improve our stranding response techniques. Our goal is to return as many healthy animals as possible back to the wild immediately. We focus on providing excellent supportive care, conducting in-depth health assessments and collecting as much data as possible from each animal. Working with the SDRP was a logical step in our efforts to constantly improve our response and assessment protocols. The long-standing health assessment program in Sarasota is a great model for combining animal welfare and science. By working with the SDRP team, we hope to learn ways to streamline our health evaluations, while also increasing the amount of data we gather.

In the winter of 2012, IFAW's MMRR team experienced the largest stranding in recorded history for our region, in which 216 common dolphins stranded over 80 days. With hard work, determination and sound science, we were able to successfully release 73 of the 98 dolphins that stranded alive! That's a 74% success rate which demonstrates a huge step forward when compared to the 14% success rate of just over a decade ago. Improved supportive care, development of new response equipment, and refinement of techniques have resulted in faster and more effective responses which were the keys to this improvement. An equally important aspect of the work has been the use of satellite-linked tags to monitor animals after release. Tracking the animals allows us to determine survivability, behavior, and habitat usage. During this busy season, we deployed 19 satellite-linked tags, using every tag we had in stock. SDRP came to our assistance by providing us with four additional tags to help us track more dolphins. This project not only yields new information about dolphin habitat, but it also helps us measure the success of our health assessment techniques. It is the ultimate union of good animal welfare and good science.

Responding to stranded common dolphins on Cape Cod. Photo Credit: IFAW.

Intern and graduate student updates - Where are they now?

Former SDRP intern engages in science communication

By Ari Daniel Shapiro, PhD, Science Reporter for PRI's The World and PBS NOVA, and an Independent Producer

Ari interviewing the renowned biologist and ant expert, E.O. Wilson. Photo Credit: Tracy Barbaro.

My internship with the SDRP in the summer of 2001 was my first stint of serious marine mammal fieldwork. I had just graduated from college, and was working with the SDRP and Woods Hole Oceanographic Institution (WHOI) on a project exploring the acoustics and behavior of female dolphins and their calves. I enjoyed being out on the water, and learning to work in a science team. That summer got me revved up for my upcoming graduate work – first as a Master's student at the University of St. Andrews in Scotland studying grey seal vocalizations and then as a Ph.D. student at MIT and WHOI working on the social and vocal behavior of Norwegian killer whales.

As the end of my Ph.D. loomed, I thought back over my time in graduate school. I had enjoyed doing the fieldwork and research, but my favorite moments from those years had involved teaching and telling others about my science. So I decided to switch fields

to science communication, and enter the world of public radio and audio storytelling. I began working with Atlantic Public Media (APM), a creative audio storytelling collective in Woods Hole. Their offices are situated next door to the location where I'd had regular meetings with one of my committee members for several years. I'd never noticed APM before. It was as though they grew out of the Earth right when I needed them.

My early stories for APM were short 60 or 90-second science spots called "science minutes" that aired on WCAI, the Cape and Islands NPR station. It was my first opportunity to interview scientists with a digital recorder and microphone, and then edit the audio into a story. I fell in love with it. I was using the same software I'd used to listen to the killer whale calls. But now, I understood what my subjects were saying.

For the last 4 years, I've been freelancing as an independent reporter and producer, contributing radio stories to national programs including The World, Radiolab, Morning Edition, All Things Considered, and Studio 360, and multimedia pieces to science departments, research organizations, and non-profits. I love my work – it's the perfect blend of learning new things about science, meeting new people, travel, combining my creative and analytical sides, and being independent.

I've even reported a couple of radio stories on cetaceans, and one featuring Mote Marine Lab scientist Barb Kirkpatrick. You can follow my work on my website: www.aridanielshapiro.com.

A former SDRP fish-sampling intern's perspective

By Genine Lipkey, MSc student, Towson University

When I arrived at SDRP as part of an undergraduate internship in 2007, I was assigned to a project that was investigating the effects of red tide on dolphin prey species. At first I was disappointed. I had been anticipating that I would be working closely with dolphins, but as it turned out my summer would be filled with long hard days of fishing with a large mesh net, called a purse seine. Boy was I in for a surprise. I never could have anticipated how exhilarating it would be to sample fish in Sarasota Bay. I spent, by far, one of the best summers of my life learning about boating, seining, and fish. I can still remember bringing up our first net and grabbing hold of my first pinfish, trying not to get pricked by spines while trying to get a good length measurement.

Dr. Damon Gannon was the lead scientists on this project, and he was truly an inspiring mentor. He, along with Elizabeth Berens and Sandy Camilleri, taught me the skills to sample, measure, identify species, and collect/organize data. He also shared priceless advice on applying and succeeding in graduate school. I am truly thankful for the skills, which I now use on a daily basis that I learned while an intern at SDRP. My summer in Sarasota introduced me not only to some amazing people I will never forget, but also to the boundless world of fish biology.

After that summer, I started orienting my course work towards fish biology, taking ichthyology, fish ecology, etc., eventually deciding I wanted to get a Master's degree. I applied to Towson University to work with Dr. Jay Nelson, in his fish physiology lab in the fall of 2010. I somehow managed to talk him into working on an estuarine species he had never worked with in his lab before, the striped bass, more commonly known as rockfish. We designed my project to explore what factors contribute to the hypoxia tolerance in this species. Hypoxia (2 mg O_2 L^{-1}) occurs annually in the Chesapeake Bay, which is an important spawning and nursery habitat for this species. Therefore, it is important for managers to understand how this commercially and recreationally important species responds and copes with low oxygen concentrations.

Like many budding scientists, I had heard that experimentation is not an easy road, but experiencing it yourself is another story. I had a few bumps along the way, but came out on the other side with some novel and exciting results. I am currently finishing up writing the final chapter of my thesis, writing manuscripts for publication (including a letter published in *Science* magazine in July 2012!), and preparing to defend in the next couple months. In my spare time, I am applying to jobs that will allow me to continue researching and learning about the incredible things fish are capable of. I found my passion for research while with SDRP, I have honed those skills as a master's student, and I hope to continue in research in the future. Someone once told me that "effective management is predicated on sound science." I hope my research will contribute to our knowledge of how these creatures utilize the environment, to help us better manage human impact.

I am very thankful that I got to spend a summer fishing with SDRP. I am proud to say that I belong to the SDRP family, and I hope that one day I will find myself again on *R/V Flip*, heading out into Sarasota Bay to seine, watching the resident dolphins jump in our wake.

Former SDRP research assistant Genine holding a striped bass.

SDRP helped to prepare me for my current work on dolphins as sentinel species

By Leslie Burdett-Hart, PhD, NOAA, National Centers for Coastal Ocean Science

Photo Credit: NOAA/NOS/NCCOS/CCEHBR

I suppose that I'm not the typical marine biologist because I did not grow up dreaming of working with marine animals, much less marine mammals. In fact, in middle school I planned on a pre-med and theater double-major in college, which I suppose would have meant practicing medicine during the week and community theater on the weekends. Thankfully for theater audiences across Virginia and elsewhere, my career pursuits took a dramatic turn when I took a marine mammals course at the Duke Marine Laboratory during the summer between my Junior and Senior years at the College of William and Mary. I loved everything about the course and wanted to learn more. Several of the instructors (Andy Read, Kim Urian, Doug Nowacek, Damon Gannon, Danielle Waples) hailed from the Sarasota Dolphin Research Program and strongly encouraged me to pursue an internship if I was 'truly serious about wanting to work with marine mammals.' So, I applied for the internship with Randy and made my way down to Sarasota the day after college graduation. My friends, many of whom were business majors and moving to large cities were confused by my post-graduate career choice as they were being offered signing bonuses and on their way to becoming a departmental VP, while I was heading to a smaller town in Florida to spend the summer 'volunteering on a boat.' That opportunity to 'volunteer on a boat' for the SDRP during the summer of 2000 turned out to be the best decision of my career. I say this because the SDRP internship was, without a doubt, a springboard that propelled me towards future graduate and professional opportunities.

My internship during the summer of 2000 focused primarily on the graduate work of Caryn Owen, who was examining maternal investment strategies of adult female dolphins and their new babies (YOYs). The brand new and shiny *R/V Nai'a* was our home away from home that summer and the platform for two other acoustic projects for which Dr. Katie McHugh was also an intern. That summer we all experienced the rigors of field work (*i.e*., long days in the hot Florida sun), but also the satisfaction of contributing to research that was aiming to understand reasons for poor survival of first-born calves and anthropogenic threats to Sarasota Bay dolphins. In the summer of 2000, I learned how to drive a boat, participated in my first health assessment, enhanced my dolphin-spotting abilities, learned how to conduct focal animal behavioral follows, and developed lab skills for post-field data processing. Unbeknownst to me at the time, the skills that I developed during my SDRP internship became critical to my graduate school pursuits, and eventually integrated into my normal career routine today.

After leaving Mote and the SDRP internship, I travelled around North and South Carolina and the east coast of Florida targeting short-term environmental jobs and another marine mammal summer internship until I started a Master's program (in Environmental Studies) at the College of Charleston (SC). My thesis research used stranding data to quantify the level of interaction between bottlenose dolphins and the blue crab fishery in South Carolina under the advisement of Wayne McFee and in collaboration with Eric Zolman and Todd Speakman (two more people closely affiliated with SDRP). Although the SDRP internship was not directly related to my Master's research, Randy's conservation message that underlies all of the research conducted by SDRP was a prominent theme throughout my thesis. Following the completion of my Master's education, I was hired as a contractor for NOAA to assist with marine mammal necropsies and stranding response, a 4.5-year opportunity that strengthened my understanding of marine mammal biology and physiology and piqued my interests in bottlenose dolphin health and disease.

In August of 2007, I left my strandings position with NOAA to pursue a Ph.D. in epidemiology at the Medical University of South Carolina (Charleston). Since leaving Sarasota in 2000, I maintained contact with a few interns and staff, and met new staff members over the years during NOAA-related research projects, but the real reunion with the SDRP lab and Randy occurred when I began my Ph.D. Thankfully, Randy agreed to serve a major role on my committee (along with my primary advisor, Dr. Lori Schwacke – another person affiliated with SDRP!) and contribute over 2/3 of the data to my project that examined the prevalence, persistence, and factors contributing to skin lesions and skin disease (particularly lacaziosis) in wild bottlenose dolphins. I spent the next four years searching for lesions in thousands of photographs of Sarasota Bay dolphins, participating in Sarasota Bay dolphin health assessments to collect skin lesion samples, and modeling environmental and biological factors associated with skin lesion occurrence. Once again, the skills necessary for my long-term career as a wildlife epidemiologist were rooted in Sarasota.

I am now working as a contractor again for NOAA in Dr. Schwacke's Sentinel Species Program at the Hollings Marine Laboratory in Charleston, SC. Our program uses studies of bottlenose dolphin health to identify ecosystem and human health risks in southeastern coastal estuaries. Our research group routinely collaborates with the SDRP for remote biopsy and capture-release health assessment projects, as well as studies that take advantage of Randy's long-term data set to define quantitative measures of health. Twenty-five years ago I would have never imagined myself as a marine mammal scientist, especially an epidemiologist. Twelve years ago, I wouldn't have guessed that I would still be driving a boat during field projects, participating in dolphin health assessments, or using any of the other skills I learned during the summer of 2000. I love what I do and consider myself extremely fortunate for the many opportunities that I have had over the past 12 years, many of which I am certain are attributable to my experience as a SDRP intern.

Professional Activities 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 annual report, including the relevant work of our collaborators from partner institutions. Copies of specific papers can be obtained upon request, as electronic pdf files.

Peer-reviewed Journal Articles

Burdett Hart, L. B., D.S. Rotstein, R.S. Wells, J. Allen, A. Barleycorn, B.C. Balmer, S.M. Lane, T. Speakman, E.S. Zolman, M. Stolen, W. McFee, T. Goldstein, T.K. Rowles, and L.H. Schwacke. 2012. Skin lesions on common bottlenose dolphins (*Tursiops truncatus*) from three sites in the northwest Atlantic, USA. PLoS ONE 7: 1-12. doi: 10.1371/journal.pone.0033081.

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Doctoral Dissertations

Dunshea, G. 2012. Ecological diagnostics for marine mammals: Appraisal of molecular-based methods for dietary and age estimation. PhD Thesis. University of Tasmania.

Simard, P. 2012. Dolphin sound production and distribution on the West Florida Shelf. PhD dissertation, University of South Florida, St. Petersburg.

Presentations at Professional Meetings

Cammen, K., P. Rosel, R. Wells and A. Read. 2012. Genetic variation in detoxification enzymes of Florida bottlenose dolphins exposed to harmful algal blooms. Florida Marine Mammal Health Conference IV. 24-27 April 2012, Sarasota, FL. (poster)

Cremer, M.J., A.C. Holz, B. Schulze, C.M. Sartori, C.C. Rocha Campos, O.C. Simões-Lopes, P. Bordino and R.S. Wells. 2012. Satellite-linked telemetry and visual monitoring of tagged franciscanas in south Brazil. 15ª Reunión de Trabajo de Expertos en Mamíferos Acuáticos de América del Sur and 9º Congreso SOLAMAC. 16-20 September 2012, Puerto Madryn, Argentina. (poster)

Gryzbek, M.K., R.S. Wells, W.E. Pine, III, D.A. Pabst. 2012. Methods for creating a bottlenose dolphin (*Tursiops truncatus*) visual health index. Florida Marine Mammal Health Conference IV. April 24-27 2012. Sarasota, FL. (poster)

Gryzbek, M.K., R.S. Wells, W.E. Pine, III, D.A. Pabst. 2012. Methods for creating a bottlenose dolphin (*Tursiops truncatus*) visual health index. Second Annual Symposium of the Florida Student Chapter of the Society for Marine Mammalogy. April 27-28 2012. Sarasota, FL. (spoken presentation)

Gryzbek, M.K., R.S. Wells, W.E. Pine, III, D.A. Pabst. 2012. Methods for creating a bottlenose dolphin (*Tursiops truncatus*) visual health index. 32nd Annual Florida Cooperative Fish and Wildlife Research Unit Coordinating Committee Meeting. May 9 2012. Melrose, FL. (poster)

Hart, L.B., L.H. Schwacke and R.S. Wells. 2012. Sizing it up: Body mass index and maximum girth reference ranges for health assessment of bottlenose dolphins (*Tursiops truncatus*) in the southeastern United States. Florida Marine Mammal Health Conference IV. 24-27 April 2012, Sarasota, FL. (poster)

Mann, D., M. Hill-Cook, C.A. Manire, D. Greenhow, E. Montie, J. Powell, R.S. Wells, G. Bauer, P. Cunningham-Smith, R. Lingenfelser, R. DiGiovanni, A. Stone, M. Brodsky, R. Stevens, G. Kieffer and P. Hoetjes. 2012. Hearing loss in stranded odontocete dolphins and whales. Florida Marine Mammal Health Conference IV. 24-27 April 2012, Sarasota, FL. (spoken presentation)

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Sayigh, L., R. Wells, and V. Janik. 2012. Whistle perception and individual recognition in bottlenose dolphins. Spoken presentation scheduled for 13 October 2012, Conference on Sensory Biology of Aquatic Mammals, Rostock University, Germany. (spoken presentation)

Wells, R.S. 2012. Small cetacean disentanglements: Changing knotty to nice. Southeast Regional Stranding Meeting, 15-17 February, Charleston, SC. (invited spoken presentation)

Wells, R.S. 2012. What do I want to do when I grow up? Reflections on 4 decades as a marine mammal scientist. Keynote address, Florida Student Chapter of the Society for Marine Mammalogy 2nd Annual Research Symposium, 28 April 2012, Sarasota, FL. (Invited spoken presentation)

Wells, R.S. 2012. Longitudinal health assessment as a tool for examining dolphin population responses and resilience to ecological change. Florida Marine Mammal Health Conference IV. 24-27 April 2012, Sarasota, FL. (spoken presentation)

Wells, R.S., P. Bordino and M. Cremer. 2012. Franciscana dolphin ranging patterns and habitat use as determined by satellite-linked telemetry. 15ª Reunión de Trabajo de Expertos en Mamíferos Acuáticos de América del Sur and 9º Congreso SOLAMAC. 16-20 September 2012, Puerto Madryn, Argentina. (invited spoken presentation)

Invited Public, University, School Lectures

McHugh, K. 2012. The SDRP: the world's longest running study of a dolphin population – right in your backyard! Biology, Conservation, and Management of Marine Mammals class, New College, 13 Mar 12.

McHugh, K and A. Zahniser. 2012. Brown bags to Beggar the dolphin. Mote Marine Laboratory Science Café Discussion, 7 Jun 12.

McHugh, K. 2012. Integrating behavior and conservation of dolphins. Mote Marine Laboratory, High School Alumni Program, 25 Sep 12.

Wells, R.S. 2012. The world's longest-running study of a dolphin population: Lessons from four decades and 5 generations. Mote Marine Laboratory Volunteer Class. 5 Mar 12.

Wells, R.S. 2012. Factors influencing wild bottlenose dolphin health and survival. SEAVET, U. of Florida, College of Veterinary Medicine. 12 Jun 12.

Wells, R.S. 2012. The bottlenose dolphins of Sarasota Bay, Florida: Lessons from 4 decades and 5 generations. Brevard Zoo. 13 Jun 12.

Wells, R.S. 2012. The bottlenose dolphins of Sarasota Bay, Florida: Lessons from 4 decades and 5 generations. Alliance of Marine Mammal Parks and Aquariums Education Committee Annual Meeting, Orlando, FL. 2 Oct 12.

Team members from Argentina and Brazil after the Franciscana tagging presentation by Randall Wells at the 15ª Reunión de Trabajo de Expertos en Mamíferos Acuáticos de América del Sur and 9º Congreso SOLAMAC, held 16-20 September 2012,in Puerto Madryn, Argentina.

Want to Learn More?

The Sarasota Dolphin Research Program website contains archived articles from previous issues of *Nicks'n'Notches* as well as updates.

http.//www.sarasotadolphin.org

Another excellent resource is the Society for Marine Mammalogy (SMM) website, which provides up-to-date descriptions of marine mammal species (fact sheets) at:

http://www.marinemammalscience.org/factsheets

In addition, the SMM provides the most current accepted marine mammal taxonomy list at:

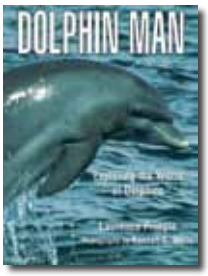
http://www.marinemammalscience.org/taxonomy

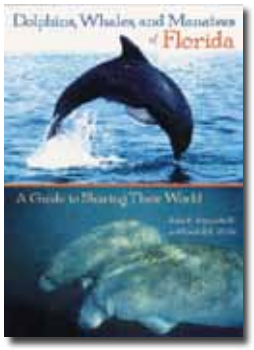
The IUCN develops and maintains the most widely-accepted descriptions of the status of animal and plant species around the world. For the most up-to-date information on the status of cetacean species, please visit:

http://www.iucn-csg.org/

THE IUCN RED LIST
OF THREATENED SPECIES™

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





Marine, Cathy. 2012. No Dead Fish for Ginger! Eifrig Publishing, LLC, Lemont, PA. ISBN 978-1-936172-44-3
Proceeds from the sale of this book go to support the Sarasota Dolphin Research Program and Mote Marine Laboratory's Dolphin and Whale Hospital.

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

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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

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

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

Long-term datasets

Research since 1970 has been based on compiling longitudinal records of individually distinctive bottlenose dolphins from the central west coast of Florida. Identification efforts have occurred from Tampa Bay through Charlotte Harbor and Pine Island Sound and associated Gulf of Mexico waters. The most intensive efforts have focused on the long-term resident community of dolphins in Sarasota Bay, spanning at least five concurrent generations. During 1970-1976, individual identifications were made primarily through tagging and resighting or tracking. Since the mid-1970s, photographic identification has been the primary tool for compiling individual records. Dolphins are identified from photos showing natural markings, tag scars, and from freeze-brands applied during capture-release activities for health assessment. Freeze-brands, applied to the dorsal fin and to the body below the dorsal fin, serve as a kind of "medical ID bracelet" and facilitate unambiguous identifications of dolphins through time, even if the identifying features on their dorsal fins change. Over 260 dolphins have been freeze-branded since the inception of the program in 1970.

More than 480,000 dolphin photographs from 1970 to the present are currently archived by the Sarasota Dolphin Research Program. They have been collected during more than 41,000 dolphin group sightings. Our digital photographic identification catalog currently includes over 7,500 images, including over 4,800 distinct individual dolphins (alive and dead) plus some of their calves (young animals are often not individually distinctive). The sighting database results from photographic records yielding more than 113,000 sightings of these identifiable individuals, over periods of more than 42 years. Some individuals have been identified more than 1,400 times.

This year, we have transitioned our long-term photo identification data sets into FinBase, a relational database designed specifically for bottlenose dolphin photo identification data and images. This database should improve our work-flow as well as the accessibility of data and images for reference and analysis. It will also facilitate submission of images and associated data for GoMDIS, discussed elsewhere in this issue. In the future, we hope to integrate this new photo-ID database with our dolphin health and focal follow databases.

Field and laboratory methods available on-line

Our program's "Manual for Field Research and Laboratory Activities" published in 2006 is available as a downloadable pdf file at our website, www.sarasotadolphin.org. This 62-page document provides detailed documentation of the protocols used for field operations and data processing. It includes chapters on: 1) Field survey protocols, 2) Post-survey lab protocols, 3) Photo-identification protocols, 4) Database entry, verification, and management, and 5) Operations protocols. The accessibility of these protocols to colleagues and students promotes and facilitates standardization of methodologies across research sites, and provides incoming students and interns with background materials prior to their arrival. This is considered to be a "living document" that will be constantly evolving as we improve and refine our approaches.

SDRP website: 2012 update

By Blair Irvine, PhD, President, Dolphin Biology Research Institute

The SDRP website (www.sarasotadolphin.org) is designed to bridge public and professional audiences. Brief articles written for the public describe SDRP conservation activities and recent news. New science publications are summarized, and they include the scientific abstract (written for the professional) plus a downloadable pdf or a link to the journal.

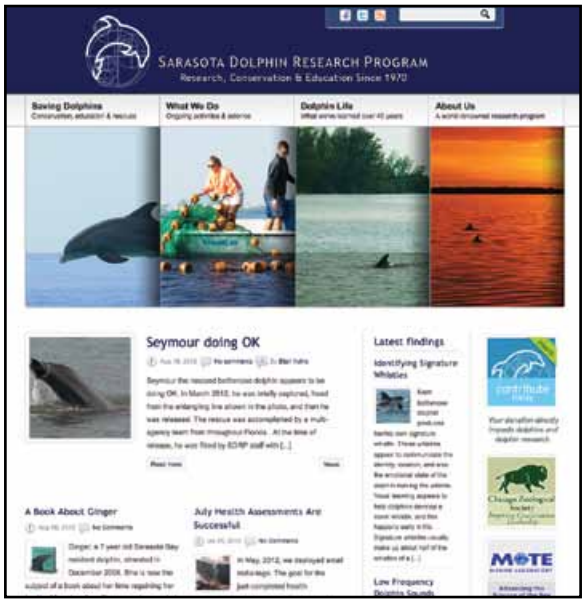
The website was developed with funding from the SDRP's founders, the Dolphin Biology Research Institute (DBRI), and it is maintained by volunteer effort. We're now joined by former SDRP Masters Student Kristi Fazioli, who has volunteered her graphic design and technical skills to help keep it functioning smoothly. Lead designer Michel Fougeres, husband of former SDRP Master's and PhD student Erin Fougeres, continues to watch over us and offer ideas.

Visitors can learn about Saving Dolphins, How Dolphins Live, and What We Do, which includes publications by SDRP staff and collaborators. There are also lots of pictures and several search functions.

The website is designed to help fulfill DBRI's educational mission. It's a great place for students to find content for school projects at all levels. Several school curricula are available, and more will be added, with a special one under development to address dolphin entanglements.

As of September, we're averaging about 1,700 new visitors a month from all over the world, which is up from about 1,000 in January. A growing list of more than 860 friends now keep track of the SDRP through Facebook. The website also is a resource. Through 15 October, we have responded to 164 email communications with questions for school projects, inquiries about internships, and requests for guidance about careers in marine mammalogy.

Follow us on Facebook or Twitter to receive updates on what the SDRP crew is doing year round. And if you have ideas or time to help, please contact me at info@sarasotadolphin.org.



Homage to the blimp

By Damon Gannon, PhD, Bowdoin College, former SDRP Post-Doctoral Scientist

I first met Doug Nowacek in the spring of 1995. I was finishing my master's degree and he was just starting his Ph.D. When he described his proposed dissertation research with bottlenose dolphins in Sarasota Bay to me, my first reaction was: "You're crazy!" An unmanned blimp, remote-controlled video cameras, hydrophones, and a couple of boats… "ambitious" didn't begin to describe the project. "Hopelessly complex and unwieldy" was more like it. I don't think I was the only one who was skeptical. But of course, I never mentioned this to Doug. He was so excited about his project; I didn't want to burst his bubble (or his blimp!). I figured he'd learn how hopeless it was soon enough.

Clearly I had underestimated Doug's technical skills and his sheer tenacity. So it was more than a little ironic when I started to collaborate with him five years later on a project using the blimp system to perform acoustic playback experiments on wild bottlenose dolphins. The goal of the project was to find out whether bottlenose dolphins use passive listening to locate noise-making prey, and how they trade off between using passive listening and echolocation. This work resulted in a paper published in 2005 in *Animal Behaviour* and in many amusing "Blimp Stories." Here is a good Blimp Story from that playback project…

One of the biggest challenges of field work in Florida is dealing with frequent thunderstorms. Squalls are bad enough when you just have a boat to worry about. But things get really dicey when your boat has a 200-foot tether attached to a 30-foot-long blimp. It's like an extreme version of Ben Franklin's kite experiment, except that it takes place at sea.

On one particular afternoon during September of 2000, we had been conducting sound playback trials with dolphins in Palma Sola Bay. The work was going well; by mid-afternoon we had several successful trials under our belt. But our luck soon ran out. A thunderhead sprouted up right over us. Caught in a down-draft, the blimp suddenly took a nose dive toward the water. Doug's instruction manual hadn't prepared us for this! As the rest of us froze in horror, Doug leapt up to Hobo's foredeck and started hauling in on the blimp's tether to get it lined up over its cradle before it crashed into the water. As we were madly retrieving the blimp, a funnel cloud began form, like a finger pointing down from the sky. Thanks to Doug's decisive action, we managed to get the blimp secured in its cradle in time to avert disaster. Fortunately, by the time we got everything tied down, the storm had already moved off.

As I was catching my breath, I thought to myself that we'd had enough excitement for one day and that we should probably head back to the dock before the next squall hit us. But as I remember it, Doug's reaction was: "I think we have time for another playback before the next storm comes." It turned out that he was right…again.

The Blimp played an important role in a number of research projects, including studies of dolphin foraging patterns, behavior, and acoustics, dolphin and manatee responses to boat approaches, dolphin behavior around fishing nets, manatee life history, and human interactions with manatees. In summer 2012, former Blimp fliers Randy Wells, Doug Nowacek, and Damon Gannon agreed that the Blimp would likely never fly again, and, sadly and respectfully, it was decommissioned…

Population Structure and Dynamics (of SDRP staff and students)

By Sunnie Hart, BS

The SDRP community social structure has seen many exciting changes over the past year. Both lab manager Jason Allen and post-doc Brian Balmer received Distinguished Achievement Awards from CZS in recognition of ten years as dedicated employees. These same two studs were on a roll in 2012, as Jason wed long-time love and Mote Development Officer, Stacy Alexander, and Brian announced his engagement to Mote Marine Lab post-doc and recent SDRP PhD student Jennifer Yordy. Former SDRP research assistant Robin Perrtree and her husband, Frank, welcomed 2012's only young of the year, an adorable set of twins, and - last but not least - GoMDIS Curator Carolyn Cush and her husband, Brian, announced the impending arrival of Baby Cush next spring!

Jason and Stacy Allen enjoying their honeymoon in Italy.

Robin Perrtree and her husband Frank Unger with new twins Zachary and Nora.

Chicago Zoological Society Staff

Jason Allen, BS, Lab and Field Coordinator
Brian Balmer, PhD, Post-Doctoral Scientist
Aaron Barleycorn, BS, Research Assistant
Elizabeth Berens McCabe, MS, Research Associate
Carolyn Cush, BS, Research Assistant
Sunnie Hart, BS, Research Assistant
Katie McHugh, PhD, Post-Doctoral Scientist
Randall Wells, PhD, Program Director

Mote Marine Laboratory Staff

Kim Bassos-Hull, MS, Research Associate

Dolphin Biology Research Institute Officers

Blair Irvine, PhD, President
Michael Scott, PhD, Secretary
Randall Wells, PhD, Treasurer

Doctoral Students During 2012

Amanda Ardente, U. of Florida, College of Veterinary Medicine
Kristina Cammen, Duke University
Glenn Dunshea, University of Tasmania
Salomé Dussan-Duque, University of Saint Andrews
Deborah Fauquier, University of California-Santa Cruz
Goldie Phillips, Duke University
Sam Rossman, Michigan State University
Steve Shippee, University of Central Florida
Peter Simard, University of South Florida
Christina Toms, University of Central Florida

Master's Students During 2012

Mary Gryzbek, University of Florida
Sarah Mallette, University of North Carolina Wilmington
Krystan Wilkinson, University of Florida

Undergraduate Thesis Students in 2012

Celeste Bollini, University of Mar del Plata, Argentina
Yamila Rodriguez, University of Mar del Plata, Argentina
Madelaine Verbeek, New College, Sarasota

Interns and Other Visiting Trainees and Volunteers During 2012

Dee Allen
Stan Balmer
Jennifer Beane
Meghan Blumstein
René Byrskov (Denmark)
Sydni Coleman
Camila Domit (Brazil)
John Hamilton
Yujiang Hao (China)
Katy Holmes
Trevor Jensen
Caitlin Karniski
Lauryn Levy
Gina Lonati
Kelly Patton
Ashley Ross
Aliya Rubinstein
Beatriz Schulze (Brazil)
Daria Spirina (Russia)
Mridula Srinivasan
Jeff Stover
Jenna Testa
James Thorson
Donna Why

SDRP intern Trevor Jensen with a bonnethead during purse seining.

Local Volunteers During 2012

Sondra Fox
John Harrison
Jeff Hollway
Charlie Key
Cathy Marine
Nigel Mould
Norma Pennington
Ian Ramsbottom
Sally Senger
Brad Trajnowski
Madelaine Verbeek
Diana Weber

2012 interns Jennifer Beane and Jenna Testa with Dr. McHugh during a dolphin survey.

SDRP interns Caitlin Karniski, Gina Lonati, and Sydni Coleman.

Opportunities for You to Help Dolphin Research and Conservation

We need your financial help to continue our important work. Continuity is the essence of a long-term research program. We rely on competitive grants and contributions from donors to keep our program operating. Funding opportunities through competitive grant programs have declined in recent years, and competition for the few remaining grant programs is fierce. Our projected program budget for 2013 is about $890,000, including support for staff and graduate students, facility and administrative costs, boat operations, international training programs, dolphin rescues and follow-up monitoring, field research supplies, and travel to field sites and conferences. Examples of some of the expenses for which we are seeking your assistance include:

- 1 year of stipend/tuition/fees for a UFL grad student = $27,000
- 1 year of research expenses for one graduate student = $5,000
- Digital camera replacement = $1,700 each (2 needed)
- Replacement 4-stroke outboard engine = $10,000
- Rescue of entangled dolphin = $5,000
- Replacing 10-yr-old program pick-up truck = $25,000
- Support for Franciscana research in South America = $25,000
- Support for foreign intern training in Sarasota = $5,000

Donations should be sent to the Chicago Zoological Society or Dolphin Biology Research Institute, as described below.

A word of thanks from the Chicago Zoological Society

The Chicago Zoological Society is honored to recognize the following donors and funding organizations for their generous contributions to the Sarasota Dolphin Research Program through donations, research grants and/or contracts.

Donations
Anonymous
The Batchelor Foundation
In honor of Edward McCormick Blair, Jr.
Merrick Elfman
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Dolphin Biology Research Institute

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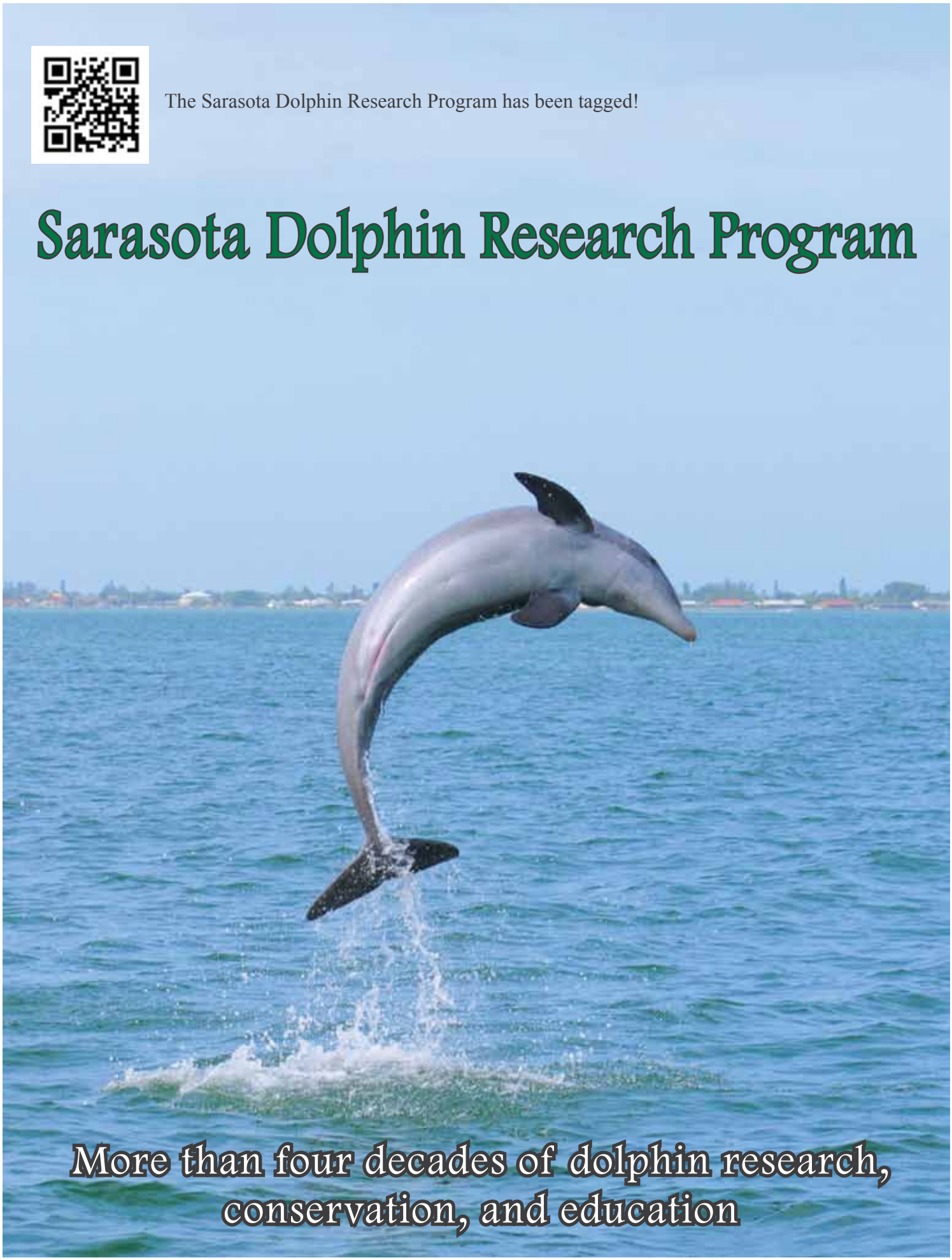

More than four decades of dolphin research, conservation, and education