Nicks n Notches

November 2014

Annual Summary of the Activities and Findings
of the Chicago Zoological Society's
Sarasota Dolphin Research Program

Chicago Zoological Society

Inspiring Conservation Leadership

Chicago Zoological Society Mission Statement

To inspire conservation leadership by connecting people with wildlife and nature

Dolphin Conservation Through Collaboration

Dolphins are fascinating creatures, and much remains to be learned about them and their needs, but their size, large ranges, and aquatic habitat can make research challenging. Over the past 44+ years we have been at the forefront of developing a variety of approaches and techniques that have allowed scientists to better understand these animals. Not the least of these contributions has been the development of an unparalleled base of knowledge about a wild dolphin population. The availability of this unique "natural laboratory" situation in Sarasota Bay, Florida, has leveraged much additional research, attracting some of the finest marine mammal scientists and students from around the world. These collaborators complement and extend the expertise of the staff of the Chicago Zoological Society's Sarasota Dolphin Research Program (SDRP), and they greatly enhance our ability to make a difference for dolphin conservation.

As you will see in the pages that follow, collaborations have been key to much of the work in which we have engaged in the past year. We continue to participate as part of a very large NOAA-led team of researchers investigating the potential impacts of the *Deepwater Horizon* oil spill. Our Sarasota-based health assessment involved the collaborative efforts of more than 100 people, working on more than 30 projects. Our dolphin rescues typically involve more than 30 people from a variety of Florida institutions. Our Gulf-wide bottlenose dolphin identification catalog project, GoMDIS, involves the collaborative input of more than two dozen research organizations from around the Gulf of Mexico, including Mexico and Cuba, and support from a variety of organizations. The groundbreaking work being conducted on dolphin whistle communication and on population consequences of disturbance builds on collaborations forged decades ago. Whether the collaborations have continued for decades, or if they are just through a single field season, these relationships have proved to be highly informative, productive…and fun.

Randall S. Wells
Chicago Zoological Society

In This Issue

Our Approach Toward Helping Dolphins

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,
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 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 ensure 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 five small research vessels, two towing vehicles, computers, cameras, field equipment, etc. Since 1992, the program has been based at Mote Marine Laboratory 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 Florida, the University of California at Santa Cruz, the University of North Carolina at Wilmington, and Duke University.

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.

The Florida-based staff of the Chicago Zoological Society's Sarasota Dolphin Research Program can be reached c/o:
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May 2014 dolphin health assessment team – collaborations for conservation.

Deepwater Horizon **oil spill follow-up**

Randall Wells, Chicago Zoological Society

The Sarasota Dolphin Research Program continued its involvement with NOAA's investigation of the potential impacts of the *Deepwater Horizon* oil spill. A peer-reviewed article by Dr. Lori Schwacke and numerous co-authors was published in the journal *Environmental Science & Technology*, comparing the health of dolphins in heavily-oiled Barataria Bay, Louisiana in 2011 to the health of the Sarasota Bay dolphins, as an unoiled reference population. Disease conditions in Barataria Bay dolphins were found to be significantly greater in prevalence and severity than those in Sarasota Bay dolphins. Many disease conditions observed in Barataria Bay dolphins are uncommon, but consistent with oil and oil byproduct exposure and toxicity.

CZS Sarasota Dolphin Research Program staff assisted NOAA with additional health assessments in Barataria Bay in June 2014. Over the course of two weeks, 32 dolphins were sampled, including 10 recaptures from previous years. Through the first few months of 2014, we continued tracking dolphins we tagged with satellite-linked transmitters in Barataria Bay and in Mississippi Sound during the summer of 2013. Since June, we have been tracking 11 more dolphins we tagged in Barataria Bay. Tracking results over the years suggest a high level of residency to local waters. Support for our participation in the ongoing *Deepwater Horizon* investigation in 2014 was provided by NOAA.

An oiled bottlenose dolphin in Louisiana waters during the Deepwater Horizon oil spill in 2010.
Photo credit: Louisiana Dept. of Wildlife and Fisheries

Dolphin restoration at a polluted site in Georgia

Randall Wells and Bob Lacy, Chicago Zoological Society

We are working as part of a team on a two-year project to: 1) evaluate injuries to bottlenose dolphins in the Turtle/Brunswick River Estuary (TBRE) system of south Georgia, and 2) develop possible restoration alternatives. The injuries are associated with polychlorinated biphenyl (PCB) exposure as part of a natural resource damage assessment (NRDA) of the LCP site near Brunswick, an EPA Superfund site where bottlenose dolphins have been found to have the highest PCB levels ever recorded in a marine mammal. This assessment consists of a number of interrelated tasks. We are primarily involved in developing population models to try to identify the number of dolphin-years lost as a result of the pollution, and to propose alternatives for restoring the lost dolphin-years. The population models, based on the population viability analysis program *Vortex* developed by Bob Lacy, draw extensively from the unique long-term bottlenose dolphin population and life history data sets compiled by the Sarasota Dolphin Research Program for the resident dolphins of Sarasota Bay.

Human interactions with dolphins in Sarasota Bay

Katie McHugh, Chicago Zoological Society

Human interactions (HI) with wild dolphins continue to be a problem throughout the Southeast USA, including Sarasota Bay. Close encounters between bottlenose dolphins and boats or fishing gear have the potential to injure or kill dolphins. In addition, situations where dolphins are intentionally or accidentally fed by humans can contribute to unnatural foraging behaviors such as begging, scavenging, and depredation (when dolphins take and feed on bait or catch from fishing gear) that put dolphins in harm's way.

The SDRP works to study and mitigate human interactions with wild dolphins in a variety of ways, including conducting research in the long-term "natural laboratory" of Sarasota Bay to inform management efforts throughout the region, participating in outreach efforts intended to reach a wide audience (by distributing "*Dolphin Friendly Fishing and Viewing Tips*" cards and the "*Don't Feed Wild Dolphins*" PSA), and creating new educational videos highlighting the impacts of HI through stories of real Sarasota Bay resident animals (available at www.sarasotadolphin.org and on our YouTube channel).

As a part of these efforts, we are wrapping up a pilot study funded by the Mississippi-Alabama Sea Grant Consortium to use long-term archives in concert with new data on human interactions collected in Sarasota Bay to determine the primary factors contributing to HI in our study area. With collaborators Lars Bejder and David Lusseau, we expect to complete analyses over the next few months exploring spatial, temporal, and social contributions to the persistence and spread of unnatural foraging behaviors within the Sarasota Bay community. This research is critical to improving the lives of dolphins in Sarasota Bay and elsewhere by informing future outreach, research, and management efforts.

Long-term records indicate that overall HI rates in Sarasota Bay are increasing, and that ~35% of our resident animals either were observed engaging in behaviors of concern or suffered from HI-related injuries during 1993-2013. Although HI observations in Sarasota Bay remain relatively infrequent as compared to other

HI hotspots in the Southeast USA, we continue to identify new individuals incorporating unnatural behaviors into their repertoires and succumbing to boat or fishing gear-related injuries each year. For example, in June 2014 the Sarasota Bay community yet again lost a long-time resident animal, 58-yr-old Squiggy (FB35), from ingestion of fishing gear. In late 2012, Squiggy lost a daughter to fishing gear ingestion, and Squiggy's 6-month-old grand-calf died soon thereafter because of the loss of her mother. Necropsy of another well-known resident dolphin (juvenile female 1495) revealed that she had ingested fishing gear prior to her death in late 2013.

In addition, we have also recently documented increasing problems with harassment of resident dolphins in our study area, and SDRP staff members have participated in multiple disentanglement operations in Florida over the past year. These trends point to the need for continued focus on reducing potentially dangerous behaviors by both dolphins and humans, and the SDRP remains committed to these efforts in our research and outreach endeavors.

Angler with one of several redfish caught and released in the vicinity of dolphins during a May 2014 sighting (top). Adult males F164 and F242 were observed patrolling fishing lines for the first time during this sighting, and F242 was seen scavenging on a thrown-back redfish (bottom). Situations such as this unintentional feeding of dolphins by recreational anglers can contribute to problem behaviors that put dolphins in danger.

Testing tackle modifications and fish descender tools for reducing dolphin depredation and scavenging of sport fish

Steve Shippee

Bottlenose dolphins interact frequently with recreational fishing, resulting in potential harm to the animals and to fish stocks. Our current study is designed to test if modifications to fishing techniques and gear can reduce these adverse interactions. Some dolphins have become skilled at taking fish directly off hook and line gear while an angler is trying to reel in their catch, which can lead to line entanglement or gear ingestion. Secondly, dolphins scavenge on fish that sport anglers are required to release, which may result in dolphins engaging in this activity as an alternate form of foraging, and which also defeats the purpose of discarding fish to recover depressed stocks. Both types of interaction can cause dolphin injury and deaths.

Studies have shown that stiff wires and streamers attached to fishing tackle could decrease depredation of hooked fish, and coined the term Depredation Mitigation Devices (DMDs). Descender tools have recently become a focus area in fisheries research for recompressing fish suffering from barotrauma, which is caused by the sudden change in pressure as a reef fish is quickly reeled up from depth. By rapidly lowering a caught fish back to depth using a descender on a weighted line, an angler is able to improve fish survival by alleviating barotrauma, while potentially decreasing the opportunity for dolphins to chase down these compromised fish. A number of devices are now available for purchase in tackle stores and outdoor suppliers, such as the Seaqualizer and Shelton Fish Descender, yet their broad public acceptance as essential fishing tools remains to develop. We will be testing the applicability and effectiveness of using these devices aboard recreational fishing vessels as a means to reduce dolphin interactions, which will have long-term benefits if accepted by the sport angler.

Our study will evaluate: 1) use of DMDs attached to fishing tackle to deter depredation; 2) the effectiveness of fish descender tools to reduce dolphin scavenging of released fish; 3) application of using such devices in inshore fishing to alleviate dolphin interactions; and 4) practicality of using these tools by sport anglers. In addition, we will build on our previous study to further characterize the nature of dolphin interactions with recreational fishing using photo-ID and mark recapture methods.

A necessary element in conducting this research will be to collect data in the presence of dolphins that predictably engage in fishing interactions. To accomplish this, we are collaborating with charter captains that can identify hot spots where dolphin interaction problems are common at deep-sea Gulf reefs near Destin, FL and Orange Beach, AL. The Sarasota Bay dolphin community will be the site for experiments to improve fishing tackle modifications to evaluate mitigation potential over time. Underwater video will be used to record the success of DMDs to discourage depredation and descender tools for reducing scavenging. DMD effectiveness will also be measured through observation of fish landing success. Recreational anglers will

be enlisted in the later stages of testing to evaluate mitigation device acceptability aboard typical for-hire reef fishing trips. We anticipate that improvements to the devices and techniques will evolve as anglers are given the opportunity to assist with the study and provide feedback. The results of this project will benefit resource managers conducting outreach to encourage use of mitigation techniques that reduce dolphin interactions, and ultimately will enhance conservation of both dolphins and reef fish stocks. This study is funded by a grant from the Mississippi-Alabama Sea Grant Consortium and support from the Chicago Zoological Society.

Preparing a red snapper for release using a Seaquilizer descender tool to prevent both barotrauma and dolphin scavenging.
Photo credit: SeaQuilizer, LLC

Population Consequences of Disturbance

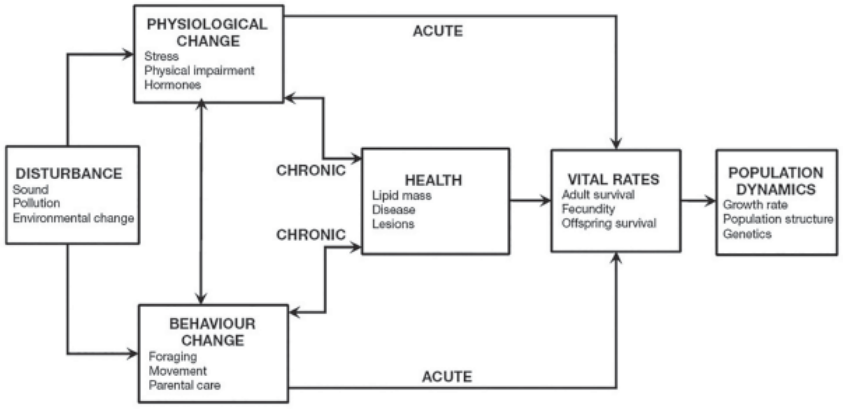
Lisa Schwarz, University of California, Santa Cruz

We are combining and examining the unique, long-term data sets collected by SDRP to determine and model how reduced prey affects foraging behavior, physiology, health, survival, and reproduction in bottlenose dolphins. The results of our efforts will help conservation managers predict how reduced foraging caused by human activities (such as noise exposure) will affect dolphin populations.

When individual animals respond to a stressor (anything that may cause an animal to change its physiology or behavior), what impact will such changes have on an entire population, and how will those changes occur? Those are two questions that have become increasingly important for conservation as the threats to marine mammals have become ever more subtle and pervasive. In addition, there is a need to know how exposure to multiple, seemingly-benign stressors can accumulate in an animal's body and eventually affect reproduction and even survival. In particular, the Office of Naval Research (ONR) is interested in understanding how exposure to noise affects individuals, and how those effects are carried over into the population. To that end, the ONR-sponsored PCAD (Population Consequences of Acoustic Disturbance) working group developed a framework that helps us understand the links between different processes in individuals that lead to population-level changes (see figure). The framework is not limited to acoustic disturbance and recognizes that some types of disturbance are acute, causing almost immediate death or loss of young, or chronic, reducing the health of individuals over time which eventually reduces reproduction and survival.

To determine the relationships that link the processes together, we need an understanding of a species' foraging patterns, behavior, energetics, health, survival, and reproduction. Therefore, it is essential to use well-studied species and populations to validate the approach. The long-term, extensive data collected by SDRP provide a very unique opportunity to study all aspects of the framework for a wild cetacean. By combining photo-ID, health assessment, necropsy, and behavioral data, we have started to piece together how health (such as white blood cell count and body mass index) affect survival and reproduction, which behavioral and physiological changes are linked to changes in health, and how different types of disturbance bring about changes in behavior and physiology. One of the critical behavioral changes we might see in animals exposed to sound is reduced foraging. While we do not want to perform experiments that would actually produce lower reproduction or survival, we can use data about natural disturbances that may create the same effect. In Sarasota Bay, we are investigating how red tide (which reduces prey) affects dolphin behavior, physiology, health, survival, and reproduction.

The results of these studies will aid in understanding the relationships we might see for species, or even other bottlenose dolphin populations, for which we have very little data. In addition, the results of these studies may aid in determining the most effective type of data to collect to determine the population consequences of disturbance.



Flow chart depicting the links between different processes in individuals that lead to population-level changes in response to disturbances.

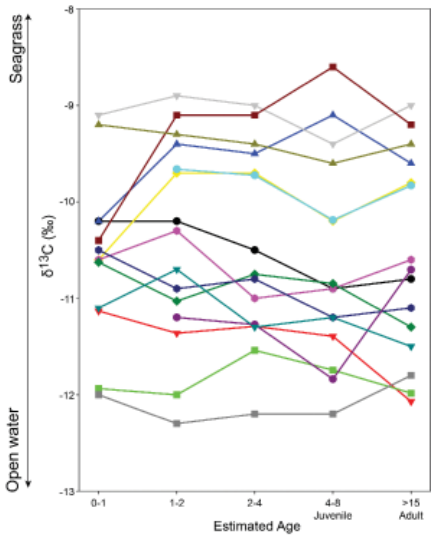
Individual foraging habits of bottlenose dolphins

Sam Rossman and Peggy Ostrom, Michigan State University

Everybody is unique. This is true not just for humans but many other animal species as well. When individuals within a population use different resources such as habitat type, we call that individual specialization. Additionally, special conservation strategies must be employed for populations comprised of individual specialists. Thus, understanding the role of individual specialization in bottlenose dolphin populations is critical. Yet, because dolphins capture and consume prey underwater, knowing if all dolphins find and consume fish in the same habitat type (such as seagrass or open water) is difficult. Fortunately, a laboratory technique known as "stable carbon isotope analysis" performed on small samples of body tissue can give us an indication of where a dolphin foraged over its lifetime. High carbon isotope values ($\delta^{13}C$) indicate foraging on fish associated with seagrasses while low isotope values suggest a dolphin foraged in open water habitat.

We performed stable isotope analysis on annually deposited layers of teeth from dead stranded dolphins. These layers are called growth layer groupings, and they provide a time series of what habitat types dolphins used over their lifetime. Carbon isotope values showed that bottlenose dolphins tended to consume fish in the same habitat type over their lifetime (see figure). This may be because dolphins learn how to capture and consume fish during the long time period a calf spends with its mother. A dolphin reared in seagrass habitat may tend to use seagrass habitat later in life while an individual reared in open water may tend to use open water.

The finding that bottlenose dolphins demonstrate individual specialization has significant implications for conservation. Many conservation strategies focus on protecting one habitat type or prey resource. However, in populations where individuals utilize different resources, promoting a single resource will only help a few individuals. Additionally, specialist individuals will be more severely impacted by disturbances to their preferred habitats.



Carbon isotope values of bottlenose dolphin tooth material over a lifetime indicate individual habitat use. Age estimates are obtained from growth layer groupings of material used for stable isotope analysis. Each line represents a single individual.

Because some specializations in habitat type will increase exposure to disease, assessing individual specialization will play a critical role in understanding both conservation and certain phenomena in disease ecology, including unusual mortality events.

Dolphin communication studies

Laela Sayigh, Woods Hole Oceanographic Institution, and Vincent Janik, Sea Mammal Research Unit, St. Andrews, UK

Bottlenose dolphins produce a variety of whistles, including their individually identifying signature whistles. As in previous years, we recorded a large number of whistles during capture – release sessions, both from animals that we have recorded before, but also plenty from our new recruits. This is a never-ending task that is at the heart of our whistle studies. Without knowing who uses what signature whistle and how these whistles might change, we would not be able to do meaningful playback experiments. It also allows us to look at the bigger picture. Braulio Leon-Lopez, a PhD student at the University of St. Andrews, is currently documenting changes in whistle structure over time. Without our Sarasota Bay dolphin whistle database that reaches back for decades now, we would not be able to ask how dolphin whistles change with age and how parameters like age and sex affect whistle structure.

Our acoustic playback studies continued this year with two different sets of experiments. We completed a multi-year experiment designed to test whether dolphins are able to recognize each other by voice as well as by signature whistles. Most other mammals recognize one another by voice; for example when you get a phone call from someone you know well, they do not need to tell you their name. However, after amassing a large enough sample size of these experiments (39 completed experiments as of May 2014), preliminary analyses of our results suggest that dolphins do not use voice cues to recognize other individuals.

As we described last year, these experiments also produced unexpected findings in the vocal responses several dolphins showed to playbacks. These dolphins produced a stereotyped non-signature whistle – called the "M" whistle based on its characteristic contour - in response to non-signature whistle playback stimuli. This is the first time a shared, stereotyped, non-signature whistle has been reported in bottlenose dolphins, so we (in collaboration with recent University of Pennsylvania graduate Claire Stuhlmann, who completed her senior thesis on "M" whistles in May, and is now continuing her work at WHOI) are painstakingly going through all past playback experiments to look for evidence of this whistle, and documenting the contexts of its production. One hypothesis that we are addressing is that this whistle may be a response to unfamiliar whistles, rather than to specifically non-signature whistles. Thus, our second set of playback experiments this year started to examine this question, by playing back signature whistles of unknown animals to see if these elicit "M" whistle production. We will continue these experiments next year.

Tagging of bottlenose dolphin dyads

Peter Tyack, Sea Mammal Research Unit, St. Andrews, UK, Frants Jensen, Princeton University, Nicholas Macfarlane and Laela Sayigh, Woods Hole Oceanographic Institution, and Vincent Janik, Sea Mammal Research Unit, St. Andrews, UK

During the last 4 years, we have been tagging dolphins with suction-cup-mounted digital acoustic archival tags (DTAGs) at the end of a health assessment to monitor their movement and use of sounds in the wild. We have been especially interested in tagging pairs of individuals to help us investigate the social dynamics and communication of these animals. This season exceeded our best expectations, with 3 mother-calf pairs and 3 male-male pairs tagged, and individual tags lasting for periods of 1.5-22 hours. During the first part of each tag deployment, behavioral observations were collected to visually classify the behavior of the tagged animals, identify other dolphins in the area, and document social interactions with untagged dolphins.

These data are already providing us with an exciting view on group coordination. Some individuals in the Sarasota community form long-term associations such as male-male alliances (where pairs of males bond for decades) or mother-calf pairs (where the calf remains dependent on its mother for the first 3-5 years), bonds that require these animals to continually coordinate their movement and behavior. Tag sensors monitor the movement of both tagged animals over time, and we can use methods from information theory to quantify the influence that each animal exerts on the movement of the other animal. These measures provide us with a functional measure of leadership within an animal pair. Preliminary results show that bonded dolphins indeed coordinate their movement closely so as to remain as a cohesive social unit. The movement of mother-calf pairs seems to be predominantly governed by the mother, although with occasional brief leadership reversals. By digging into the acoustic information in the tag, we can now test whether changes in individual foraging motivation (inferred by eavesdropping on the echolocation clicks of each tagged animal) influences the inclination to follow another animal.

FB197 and her calf surface next to the observation vessel, both tagged with small suction-cup mounted DTAGs to record their sounds and movements

WHOI Graduate student Nicholas Macfarlane and Braulio Leon-Lopez document the location of two tagged bottlenose dolphins using a stereo camera system.

Another important factor in understanding the social communication of animals is the relative spatial location of individuals within a group. From acoustic tags, we can estimate the separation distance between simultaneously tagged individuals, but this requires that all animals are tagged and that they produce sounds. One of the tools we deployed this year that takes a different approach to this problem is a stereo geolocation system. This system uses a 3D camera system to sample the location of dolphins at every surfacing. Using this system, we collected accurate, GPS-referenced positions of tagged animals and other individuals that they interacted with during the behavioral observations. We can then link these spatial positions of animals with the acoustic information from tags to test how different social calls function to coordinate movement and gain a better functional understanding of bottlenose dolphin communication signals. For example, we plan to examine the movements of animals relative to one another when signature whistle copies are made; these whistle copies are a notable feature of the recordings of many of the pairs of tagged animals.

The DTAG data have also provided unprecedented insights into the use of non-whistle sounds, called pulsed sounds, which have thus far been largely ignored in studies of free-ranging dolphins (except for studies of their use in echolocation). We have noted a variety of different types of burst-pulse sounds on the tags; for example, “quacks” were so named based on their distinctive sound. “Quacks” share similarities with sounds found to be associated with aggressive contexts in several studies of dolphins under human care. When these sounds are interpreted in the context of the concurrent social and movement behaviors of the dolphins, we may gain rare insights into their communicative function. While we have still to analyze these data quantitatively, these sounds were observed primarily in the context of male alliances chasing females, supporting a primarily aggressive function in wild animals.

Sarasota Bay dolphin health assessment

Randall Wells, Chicago Zoological Society

We completed one of our most successful Sarasota Bay health assessment sessions to date, in terms of numbers of dolphins and research projects, during 5-9 May. We had a number of goals for the 2014 session, including: 1) collecting samples and diagnostic measurements for maintaining reference health values for comparison to dolphins in other bays; 2) collecting samples for studies of diabetes and dolphin kidney disease; 3) participating in a study of biomarkers of decompression stress; 4) investigating dolphin whistle use and deploying acoustic DTAGs; and 5) examining and sampling residents not previously handled. In addition, we facilitated tests by collaborators of new field techniques, including the use of: 1) a remote controlled helicopter to photograph dolphin body condition, 2) a portable x-ray machine to examine dolphin lungs, 3) ultrasound to examine bone mineral density, and 4) a device to measure metabolic rates from exhalations. In total, we worked with 20 dolphins, and sampled 19 of these, including 8 for the first-time. Our field team included 122 people (including 20 veterinary professionals), from the U.S., Europe, and South America. Support for the health assessment session was provided primarily by Dolphin Quest, Woods Hole Oceanographic Institution, and the Office of Naval Research.

Use of overhead imaging for body condition assessment

Rachel Cassoff, Duke University

The body or nutritional condition of dolphins can significantly affect survival, reproductive success, and susceptibility to disease through impacts on immune function. In addition, it can be a sensitive indicator of prey abundance and individual feeding success, as well as the presence of disease. Thus, assessing the body condition of animals is critical for monitoring the health of dolphin populations. However, current methods of measuring body condition in free-ranging dolphins require capturing, restraining and sampling individuals directly through capture-release health assessments, which are expensive and logistically complex, and are not feasible in many situations. With a grant from the Association of Zoos & Aquariums Conservation Endowment Fund (through funding from the Disney Worldwide Conservation Fund), and a fellowship grant from the Morris Animal Foundation, we designed and built a low-cost remote-controlled unmanned aerial vehicle (UAV) to remotely measure the body condition of cetaceans at sea.

The UAV, which has a digital camera, is designed to be launched from a small boat and to hover precisely over individual animals and collect photographs for detailed measurements of body size and shape (a technique called aerial photogrammetry), which then can be used to derive indices of body condition. Initial field testing of the UAV system was conducted over bottlenose dolphins being temporarily held in large net corrals during capture-release health assessments in Sarasota Bay. These initial trials enabled us to compare measurements (such as total body length and girth) obtained from the aerial photographs with those obtained directly from the animals during capture-release events and, thus, assess the accuracy of our technique.

Our next step will be to use the UAV system to collect measurements of body condition from resident bottlenose dolphins during year-round boat surveys in Sarasota Bay, and to conduct comparisons based on the animals' sex, age, and reproductive class, as well as comparisons between seasons and between healthy and unhealthy individuals. Our novel health assessment technique could be used in the future to help determine whether capture-release health evaluations of bottlenose dolphins are warranted in areas of concern. In addition, our methodology could be applied to a wide variety of marine mammal species that have yet to be studied in this manner.

Unmanned aerial vehicle imaging system, a six-rotor remote-controlled helicopter with a downward-facing digital camera, developed by researchers at the Duke Marine Lab and the Woods Hole Oceanographic Institution to measure dolphin body condition.

Bottlenose dolphin immunology

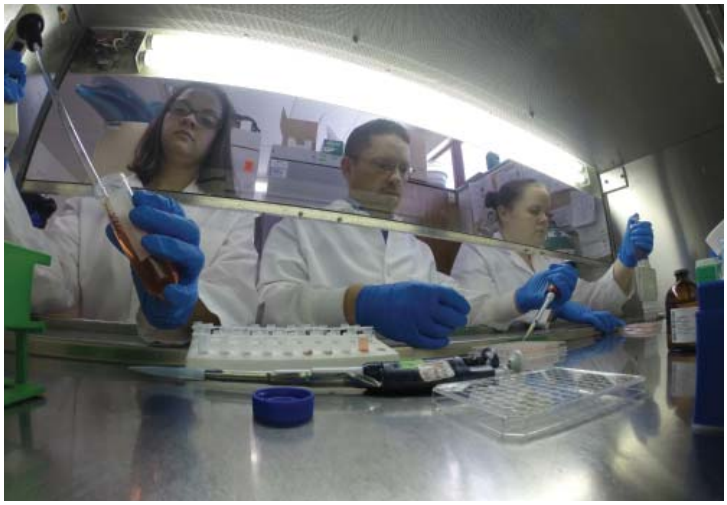
Sylvain DeGuise, University of Connecticut

The immune system is very important in an individual's defense against pathogenic microorganisms that live in one's environment. Our work with Sarasota Bay dolphins has helped us better understand the normal immune system of bottlenose dolphins and establish reference intervals that can be used to assess the potential effects of man-made or natural stressors, such as the *Deepwater Horizon* oil spill in the northern Gulf of Mexico.

Using blood samples collected during bottlenose dolphin health assessment, our lab has measured the function of different white blood cell types using functional assays. These assays include the ability of neutrophils and monocytes to engulf foreign particles approximately the size of bacteria (phagocytosis), as well as

their ability to produce oxygen free radicals to kill such ingested microorganisms (respiratory burst). We also measure the ability of B and T lymphocytes to proliferate upon stimulation, which mimics the early phase of an immune response. Further, following preliminary results obtained in previous years, we started this year measuring serum cytokines, which are small messenger molecules that direct the magnitude and direction for an appropriate immune response. The results obtained in Sarasota have allowed for the first time the determination of confidence intervals ("normal values") for some of those functions for which sufficient numbers of animals have been sampled. Those results in a relatively healthy population are currently used to assess the potential health effects of the recent exposure of dolphins to oil following the *Deepwater Horizon* spill.

This work has been supported by the Chicago Zoological Society, who provided logistical support and access to dolphin samples in Sarasota Bay over many years, as well as continued support from NOAA for similar analyses at different locations in the Gulf of Mexico.



University of Connecticut researchers (left to right) Erika Gebhard, Milton Levin, and Lindsay Jasperse process samples for immunology studies.

Markers of decompression stress

Michael Moore, Woods Hole Oceanographic Institution, and Andreas Fahlman, Texas A&M University - Corpus Christi

Recent studies have suggested a link between mass stranding of beaked whales and the use of naval mid-frequency sonar. The whales experienced symptoms that were similar to those caused by gas bubbles in human divers. These reports have increased the concern that anthropogenic sound, such as that created by military sonar or during seismic exploration, may harm marine animals. It has been suggested that alteration in physiology or diving behavior may increase the risk of decompression sickness (DCS). A diagnostic tool for DCS in dolphins is very desirable.

Bubble formation is believed to be the crucial event in the etiology of DCS, but the role bubbles play in the disease process remains unclear. Recent studies have shown that Microparticles (MPs) correlate with the level of decompression stress in both the mouse and human. MPs are particles between 0.3 to 3 µm in size that are shed from various cells. MPs are present in stranded dolphins and they can be detected by standard assays. Thus, MPs may be suitable biomarkers to assess decompression stress. The study is aimed at verifying a relationship between decompression stress and MPs in sea lions and then transferring this knowledge to assess decompression stress of cetaceans in the field. We collaborated with the Chicago Zoological Society health assessments in Sarasota to sample dolphins when they are first restrained, during examination on deck, and back in the water, to get baseline data for shallow-swimming and out-of-the-water dolphins.

In total, 123 blood samples from 58 wild-caught-and-released dolphins in Sarasota Bay, Florida, were analyzed for MPs over the 2012 to 2014 period. The samples were obtained Pre-, Mid-, and Post-procedure. Preliminary analyses of data from the first 2 years of this study found an apparent increase in MP count with removal of the animal from the water, but subsequent analysis of all MP counts now available for this study showed no significant impact of removal from, or return to the water. This work is supported by the Office of Naval Research.

Dolphin lung function, respiration, and metabolic rates

Andreas Fahlman, Texas A&M University – Corpus Christi, Michael Moore and Julie van der Hoop, Woods Hole Oceanographic Institution

Lung and respiration problems are among the most common health issues diagnosed for bottlenose dolphins. Our research team participated in the May 2014 dolphin health assessment in Sarasota Bay with two main objectives: 1) to determine whether the recorded sounds of breathing can be a useful proxy to estimate metabolic rate or other respiratory parameters, and 2) to assess whether a recently developed method to estimate lung function in cetaceans may provide a simple, non-invasive tool to estimate metabolic rate and assess respiratory health.

Lung function, metabolic rate, and other respiratory parameters were measured with a hand-held device that can be placed over the blowhole. This device, called a pneumotachometer, is nearly identical to the system used to assess lung health in humans. For the first objective, respiratory sounds were recorded on a digital acoustic recording tag (DTAG) while lung mechanics data were collected with the hand-held pneumotachometer. Just as in humans, the sounds of breathing in bottlenose dolphins are different when they are breathing faster, or more deeply. The data collected in Sarasota Bay will help the team determine if a relationship exists

between metabolic rate and breath sounds; if so, breath sounds could be a useful proxy for estimating metabolic rates of free-swimming animals.

For the second objective, measurements of lung function were compared to ultrasound evaluations performed by Dr. Cynthia Smith and colleagues (National Marine Mammal Foundation), which provide a standard for non-invasive evaluation of lung disease. The team hopes that future development of lung function testing in cetaceans will provide veterinarians and stranding networks with a tool that can be used to help inform rapid diagnosis and treatment of sick cetaceans. Such development will be made possible through multidisciplinary collaborations such as the Chicago Zoological Society's Sarasota Dolphin Research Program health assessments in Sarasota Bay. If successful, these methods could provide lung function information on dolphin populations that have been exposed to man-made pollutants, such as oil spills, chemical runoff, and other man-made disasters, in the Gulf of Mexico, and elsewhere. This project was funded by the National Oceanographic Partnership Program [National Science Foundation via the Office of Naval Research N00014-11-1-0113].

Dr. Andreas Fahlman collecting respiration data from F185 using a pneumotachometer.

Ultrasound-based assessment of bone mineral density in Sarasota Bay dolphins

James Powell, Portland State University

Bone density has, to date, remained a mostly unexplored health and life history characteristic in bottlenose dolphins. Preliminary studies suggest that bone density values can be used as potential indicators of age, pollutant exposure, and disease. Using a collection of flippers and flipper bones archived in Mote Marine Laboratory's Ruth DeLynn Cetacean Osteological Collection and the Coastal Marine Mammal Strandings Assessment Program at the National Ocean Service laboratory in Charleston, South Carolina, analyses have been completed to define bone density values for both male and female dolphins across a wide range of ages. A non-invasive, ultrasound-based prototype has been developed to estimate bone density in the pectoral flipper of bottlenose dolphins. While the initial prototype was designed for laboratory use on flippers archived from dead dolphins, the ultimate goal is to develop an ocean-ready device that can be readily used in both a laboratory and field setting on both live dolphins and specimens collected during stranding response efforts.

Portland State University PhD student James Powell positions his ultrasound device to obtain a bone mineral density measurement on a dolphin's flipper during the 2014 health assessment project.

To ensure the ultrasound technology would be tolerated well by live dolphins, initial tests were conducted with Dr. Cynthia Smith and research partners at the National Marine Mammal Foundation (NMMF) on a pair of dolphins in the U.S. Navy Marine Mammal Program. During these initial trials, protocols were developed for use during capture-release health assessments. During the 2014 Sarasota Bay health assessments, bone density measurements were conducted on 8 bottlenose dolphins. The data collected during this year's health assessments represents the first-ever bone density measurements performed on live bottlenose dolphins in the wild. The ultrasound device is being redesigned to better withstand the demands of use in this unique open-water, field setting, and plans are being made to continue bone density measurements during the 2015 health assessments.

Deep breaths

Cynthia Smith and Marina Ivančić, National Marine Mammal Foundation

Bottlenose dolphins take rapid breaths that begin with an explosive exhalation and are followed by a deep inhalation. The dolphin then holds its breath while it swims, forages, interacts with others, and then returns to the surface of the water for another

breath. These deep breaths are held for up to several minutes at a time. Dolphins also use more of their lung volume than humans for each breath, being as efficient as possible while they are at the surface to breathe. So now imagine that the air is polluted. What happens when a dolphin takes deep, full breaths of polluted air, and then holds that breath while it swims, forages, or interacts with others? With their deep, prolonged breath holds, and the fact that dolphins don't have noses or nasal turbinates to filter air, we would expect even more contamination to reach their lungs than in a human breathing the same air. While their respiratory adaptations serve them well for diving and living in the ocean, they may also make them more vulnerable to lung injury and infection.

To evaluate lung health in a live dolphin, ultrasound is a valuable diagnostic tool that offers a rapid assessment. The dolphin body is well-suited for ultrasound, as their skin is smooth and hairless, so doesn't require any preparation before conducting the exam. Current ultrasound units are powerful enough to penetrate the blubber of a dolphin and rugged enough to use on a salty research vessel. Exams can either be performed in-water or on the deck of the research vessel. Determining what is 'normal' for a wild dolphin would be challenging if we didn't have decades of experience working with animals in human care. By providing long-term health care to dolphins and routinely performing ultrasound examinations to monitor their well-being, we have characterized variations of normal conditions in the lung and defined disease states. This information now serves as a reference point for interpreting ultrasound results from wild dolphins, and helps us understand how lung health may be impacted in the face of an environmental disaster, long-term contamination, or infectious disease outbreak.

Since 2011, we have been collecting standardized pulmonary (lung) ultrasound data on Sarasota Bay dolphins. Pulmonary abnormalities detected are divided into the following categories: (1) pleural effusion, or fluid surrounding the lungs; (2) superficial pulmonary nodules, or <2cm round/ovoid foci of non-aerated lung; (3) pulmonary masses, or 2cm or greater well-defined areas of non-aerated lung; (4) alveolar-interstitial syndrome, or evidence of reduced air in the lung and replacement of air with cellular infiltrate, and (5) pulmonary consolidation, where fluid or cellular infiltrate is occupying the alveolar spaces in the lungs. During the exam, numerous images are captured to document the findings in each dolphin's lungs. After the field exam is performed and abnormalities recorded, our sonographer (CRS)-radiologist (MI) team goes through each animal's data set and then assigns an overall lung score: normal, mild, moderate, or severe. To date, the vast majority of Sarasota Bay dolphins evaluated have been assigned either normal or mild lung disease scores, and no dolphins have received a severe lung disease score. We will continue to collect lung ultrasound data for each animal as a critical part of their medical record, as well as further develop this baseline of essential data for comparisons to other populations of bottlenose dolphins to study the impact of environmental factors on lung health.

Dr. Cynthia Smith and Dr. Jen Langan performing an ultrasound examination.

Sarasota Bay dolphins shine a light on kidney stone disease

Cynthia Smith, National Marine Mammal Foundation, and Khashayar Sakhaee, University of Texas Southwestern Medical Center

Kidney stone disease is known to affect bottlenose dolphins and can lead to kidney obstruction, failure, and organ death. Certain populations or collections of dolphins appear to be more at risk than others for kidney stone formation. To better understand the problem, we set out to study kidney health in Sarasota Bay dolphins to determine whether or not this population is afflicted with the disease.

Ultrasound provides a rapid assessment of organ health in humans and animals, including bottlenose dolphins. During 2011-2013, we gathered ultrasound data on Sarasota Bay dolphin kidneys to look for evidence of kidney stones. Thirty-nine dolphins were screened for the disease, and none of the dolphins had evidence of stone formation, which is great news for the population.

Sarasota Bay dolphins now serve as an unaffected, control population for kidney stone disease. Studying their urine physiology can help us determine how they are protecting themselves from stone formation. In 2014, we conducted ultrasound exams to confirm that the dolphins being examined had no evidence of stone disease. We also collected urine from

as many of the study dolphins as possible, and then performed sophisticated analyses on the urine samples.

We discovered that Sarasota Bay dolphins have similar urine chemistry to dolphins that form stones, however some key differences exist. First, Sarasota Bay dolphins have higher levels of citrate in their urine, therefore citrate may be playing a role in inhibition of stone formation. Second, Sarasota Bay dolphin urine is supersaturated with ammonium urate, which is the stone type most commonly diagnosed in dolphins. However, the level of supersaturation is greater in a collection of animals with a high prevalence of stone formation. The difference in supersaturation indices may prove critical and is likely related to foraging behavior and prey types. Future studies will focus both on inhibitory factors and the influence of foraging behavior on the risk of stone formation, continuing to utilize Sarasota Bay as a healthy, control population of dolphins. Our collaborators for this project include SDRP, Dolphin Quest, and the University of Florida. We thank the Office of Naval Research for their continued support of this project.

University of Florida veterinarians performing chest x-rays with a portable device aboard the R/V Flip. Proven effective in the field, this will be a welcome addition to the veterinary toolbox for evaluating dolphin health during assessments as well as rescues.

Investigating relationships between dolphin diets and kidney stones

Amanda Ardente, University of Florida

Ammonium urate kidney stones are commonly found in bottlenose dolphins under human care, but not in free-ranging dolphins. These stones can cause obstruction of the urinary tract, pain, kidney failure, and sometimes death. To date, it is unknown how to prevent stone formation or reverse these pathologic changes in dolphins. In other species, we know that ammonium urate stones can form when various dietary nutrient concentrations (e.g., protein, minerals, uric acid) are elevated, causing urine concentrations of nutrient byproducts to increase above a solubility threshold. For example, uric acid is a byproduct of purine metabolism. Purines are contained in DNA, RNA, and ATP. Like other nutrients, they are absorbed from the diet, metabolized to several end-products, and then excreted primarily in the urine, as either insoluble uric acid (humans) or soluble allantoin (other mammals). Thus, the research team from the University of Florida (UF) College of Veterinary Medicine's Aquatic Animal Medicine Program and Nutrition Laboratory is investigating: 1) whether nutrient concentrations differ between the diets of dolphins under human care and free-ranging dolphins, and 2) the urinary end-products of purine metabolism in dolphins under human care and free-ranging dolphins. This work is part of a larger metabolic study led by the National Marine Mammal Foundation (NMMF) investigating ammonium urate stone development in dolphins under human care.

For the diet analysis, eight fish species commonly consumed by free-ranging dolphins in Sarasota Bay, FL, and seven species commonly fed to dolphins under human care have been collected and are being analyzed for nutrient composition, including purine content. The purines will be analyzed using a high-performance liquid chromatography mass spectrometry method that was developed by the UF research team. The free-ranging fish species were primarily collected with the assistance of the SDRP. The diet analysis is being generously supported by several organizations: National Marine Mammal Foundation, Sea World, Dolphin Quest, Mazuri Exotic Animal Nutrition, and Animal Necessity. To analyze the urine, samples have been collected from free-ranging dolphins in Sarasota Bay through SDRP dolphin health assessments and from dolphins maintained by the United States Navy and NMMF. These samples will be analyzed for purine metabolites using the same method developed for fish purine analysis. By combining the diet and urine analytical results with the NMMF metabolic studies, we will better understand why dolphins under human care are predisposed to urate stone development. We hope this work will lead to development of effective preventative and treatment measures for this disease.

Common Sarasota Bay bottlenose dolphin prey fish including a scaled sardine, a type of clupeid. Note: measures are in centimeters and the four photos are not to the same scale.

The Sarasota Bay dolphin diet may provide important clues to prevent diabetes

Stephanie Venn-Watson, National Marine Mammal Foundation

Just like people, some dolphins are susceptible to prediabetes, also called metabolic syndrome. This syndrome includes elevated insulin, glucose, triglycerides, fatty liver disease, and associated iron overload. While metabolic syndrome is not a direct cause of death in dolphins, it is a chronic condition that – when removed – may help dolphins live longer, healthier lives. Thanks to funding from the Office of Naval Research, the National Marine Mammal Foundation has been working with the Sarasota Dolphin Research Program for several years to find out why some dolphins get this disease, while others do not.

Through a series of publications featured in a special *Frontiers in Endocrinology* issue, 'Marine mammals as outside the box models for insulin resistance and type 2 diabetes,' some important clues have been discovered. First, Sarasota Bay dolphins had lower insulin, glucose, triglycerides, and iron in their blood compared to dolphins with metabolic syndrome. Second, Sarasota Bay dolphins and the fish they eat had different types of nutrients compared to dolphins with metabolic syndrome (and the fish *they* eat). Third, metabolic syndrome in dolphins was not associated with either higher stress (indicated by a stress-related hormone, cortisol) or higher body mass index (i.e. body weight).

Current studies are focusing on nutrients in dietary fish that may protect dolphins against developing prediabetes. If we can find the right combination of nutrients that prevent or treat prediabetes in dolphins, this may provide critical clues on how to prevent and treat diabetes in people.

Influence of genetic variation on susceptibility to harmful algal blooms

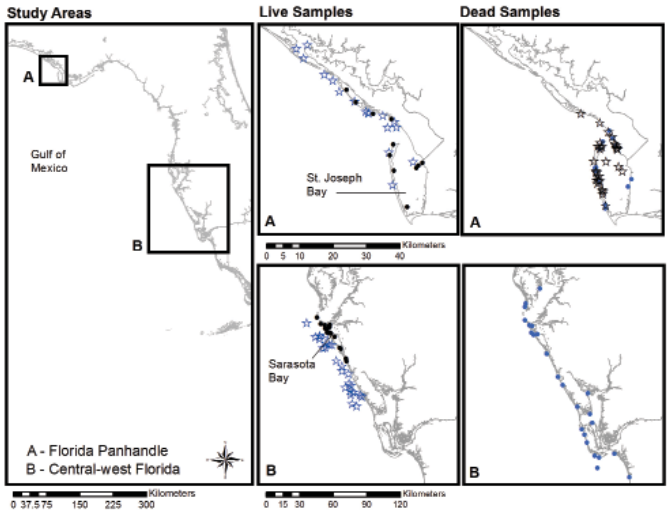
Kristina Cammen, Duke University

This past year marks the successful completion of my dissertation research on bottlenose dolphin susceptibility to harmful algal blooms (HABs), otherwise known as red tides. Over the past five years, through collaboration with the Sarasota Dolphin Research Program and NOAA Fisheries, I have used genetic techniques to investigate apparent differences in red tide resistance among bottlenose dolphins from central-west Florida and the Florida Panhandle.

Red tides in the Gulf of Mexico refer to naturally occurring dense blooms of the dinoflagellate algae, *Karenia brevis*, which produce neurotoxins. Exposure to these toxins can be lethal to fish, sea birds, sea turtles, and marine mammals, and can cause illness in humans. Several unusual mortality events (UMEs) of dolphins in Florida have been attributed to red tides. The goal of my research was to investigate if dolphins that have been frequently exposed to red tides historically have evolved resistance to the algal toxins. To test this hypothesis, I compared genetic variation between dolphins that died due to red tides and dolphins that survived red tide exposure, looking for a genetic signal that was more commonly observed in one group over the other. I included dolphins from both estuarine and coastal populations of bottlenose dolphins in central-west Florida (including Sarasota Bay) and the Florida Panhandle (see map).

I found that the frequency of some genetic markers varied significantly between live and dead dolphins, suggesting there may be some genetic basis to red tide resistance. The significant genetic markers were found within the dolphin genome nearby to genes involved in immune, nervous, and detoxification systems. A closer look at dolphin sodium channel genes, which encode the biological binding site of the toxin, revealed no significant differences. Unlike other neurotoxin-resistant systems (e.g., garter snakes that prey on toxic newts and clams exposed to HABs in New England), bottlenose dolphins have not adapted to red tide exposure via adaptations to the toxin binding site. Instead, the dolphin immune system, particularly the major histocompatibility complex, may play a previously undescribed role in red tide resistance. Overall, I conclude that genetics is likely one of several factors that influence the susceptibility of individual bottlenose dolphins to red tide exposure.

This research was supported by the Duke University Marine Lab, the American Fisheries Society, the PADI Foundation, and a Katherine Goodman Stern Fellowship. Samples were generously provided by the NOAA Fisheries SEFSC DNA Archives and the Sarasota Dolphin Research Program.



Map of study areas in the Florida Panhandle (A) and central-west Florida (B) indicating the location of sample collection for live coastal (blue stars) and estuarine (black circles) bottlenose dolphins and dolphin strandings during UMEs in the Panhandle in 1999 (blue circles) and 2004 (black stars) and during HABs between 1992 and 2006, including a UME in 2005-2006, in central-west Florida (blue circles).

Sarasota Bay dolphin community status

Jason Allen, Chicago Zoological Society

We keep track of the dolphins of Sarasota Bay through monthly boat-based photographic identification (photo-ID) surveys. One of the primary goals of our monitoring is to track additions and losses to the resident Sarasota Bay dolphin community. After several consecutive years with 11 or more births, including 17 in 2013, it is not necessarily surprising that we have had only seven new dolphin calves this summer. To date, only one of these has disappeared and is presumed dead.

One of the dolphin births reported last year was to a well-known resident female named Lizzie. Surprisingly, she was seen in May 2014 with that calf and another newborn! Though biologically possible, it is very uncommon for bottlenose dolphins to give birth in consecutive years when the first calf survives through the breeding season. There are other equally rare possibilities, such as either of the two calves actually originating from a different mother. We will continue to monitor Lizzie and the 2014 calf along with the rest of the Sarasota Bay population through boat-based observations and photo-ID. Once it is old enough to be included in health assessments (at least 2 yrs old), a genetic sample will be obtained from the second calf to determine if Lizzie is indeed the mother. Unfortunately, this will not be possible with the 2013 calf because it disappeared several weeks after our first sighting of the new calf, and is presumed dead.

One of the oldest resident female dolphins, Squiggy, died this summer at 58 years of age. Sadly, this was due to fishing gear ingestion, an all too frequent occurrence. More details about Squiggy and others involved in negative human interactions are included on pages 5, 6, and 21. Four other Sarasota Bay resident dolphins died since our last report, including a male observed since 1984 and F179's yearling calf. At the time of this writing, our two oldest males (ages 49 and 51) and females (ages 61 and 64) are alive and well.

F284 surfaces in calf positon with his mother, Moonfin Look-a-like. The white scratches behind his eye are called 'rake marks' and are caused by the teeth of other dolphins during social interactions.

Juvenile male dolphins F222 and Jocko surface together in March 2014. They have been seen together with increasing frequency and may be forming a life-long pair bond, like many other male dolphins in Sarasota Bay.

Our monthly surveys represent the core effort of our program, supporting all other projects. More than 44,800 dolphin group sightings since 1970 have yielded more than 132,000 identifications of more than 5,200 individual dolphins. In support of these identifications, more than 590,000 dolphin photographs are currently archived by the Sarasota Dolphin Research Program. Data from monthly monitoring surveys and all of our photo-ID efforts are archived in a relational Access database (FinBase) designed specifically for bottlenose dolphin photo-ID data and images. Work has begun to integrate this database with our focal animal behavioral follow database, which contains 2,140 follows on 156 individual dolphins from 16 projects during 1992 to 2014. This database now also includes current and historic opportunistic respiration data taken on potentially compromised individuals. We will begin integrating our dolphin health database in the near future as well. Many thanks to NOAA's Jeff Adams for his continued support as our database guru!

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 the Mississippi-Alabama SeaGrant Consortium, as well as the continued dedication of our core volunteers and undergraduate interns. Thanks to these efforts, this community remains one of the most thoroughly studied free-ranging dolphin populations in the world.

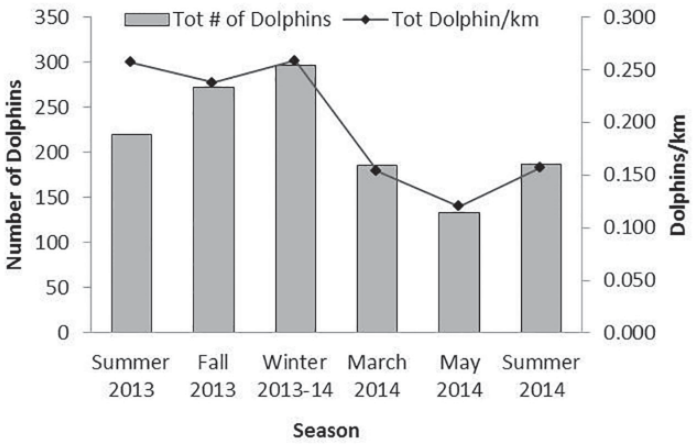
Pensacola Bay bottlenose dolphins: Seasonal abundance and report of a major flood event

Christina Toms, University of Central Florida

The past year of bottlenose dolphin photo-identification surveys in the Pensacola Bay system offers the first comprehensive data set for seasonal abundance in this area, providing much-needed data for population assessment and management. Spring data also coincided with the largest flood event in Pensacola's history, leading to observations of the potential influence of the flood on the local dolphin population.

The Pensacola Bay system, in the Florida panhandle, has a history of man-made disturbances. Unfortunately, very little is known about the size or stock structure of many bay, sound and estuary bottlenose dolphin populations in the Northern Gulf of Mexico. As such, our ability to evaluate threats to the animals is limited. Previous surveys in southern Pensacola Bay provided evidence for a substantial bottlenose dolphin community for which no previous baseline population information existed. My dissertation is aimed at filling this gap. I have just finished my first year of data collection. Boat-based photo-identification surveys, consisting of a total of about two weeks each, were conducted during the following time periods: summer 2013, fall 2013, winter 2013-2014, early spring 2014 (March), spring 2014 (May) and summer 2014. The survey area consists of the inshore bay systems (Pensacola, Escambia, East, and Blackwater Bays). These surveys followed mark-recapture methodology, which involves 'marking' individuals by taking photographs of the natural dorsal fin markings and 'recapturing' them over time. The proportion of 'marked' animals that are re-captured is used to estimate the total population.

Data analyses are currently in the initial phases. However, preliminary estimates for the total number of dolphins seen for each time period are presented (see graph). In addition to abundance estimates, data will be used to track individuals over time, examine site fidelity patterns and to compare data from a neighboring system to the east, which will allow me to determine whether the Pensacola system is home to a group of distinct local residents. These data will also be used to evaluate the utility of a new mark-recapture statistical model that relaxes many of the strict population assumptions that are required for current mark-recapture models.



Raw estimates of total number of dolphins seen over time, based on field estimates of dolphins seen. Numbers have not yet been adjusted for repeated sightings of the same individuals or for other screens, such as photo quality. Totals for dolphins seen per kilometer are presented to account for potential variation in the amount of effort spent at each time period.

Skin lesions on dolphins in the Pensacola Bay system following the flood in Spring 2014.

Data collection coincided with the largest flood event in Pensacola's history (April 29, 2014), when more than 24 inches of rain fell on Pensacola in 24 hours, leaving the bay waters completely fresh for several weeks. The flood came at a critical time during dolphin calving season and several neonates were lost soon after the flood. Furthermore, numerous dolphins developed minor to severe skin lesions. Several Pensacola Bay estuaries are known to have high levels of pollutants that likely flushed into the system, adding to the known high levels of mercury, PCBs and other toxins. The flood event could have left dolphins susceptible to infections. It may also have led to the surprising decrease in the number of dolphins in the area in May (suggested by the decrease shown in the graph) at a time when abundance would be expected to be high to coincide with the breeding season. I am in the unique position to have data from before the event and immediately following. The lab is in the process of going through spring and summer data of this year to evaluate the presence, spread and, hopefully, decrease in the skin lesions for individuals we've been able to track over time. I hope to conduct follow up surveys in October of this year to determine the continued survival of the neonates that made it through the flood.

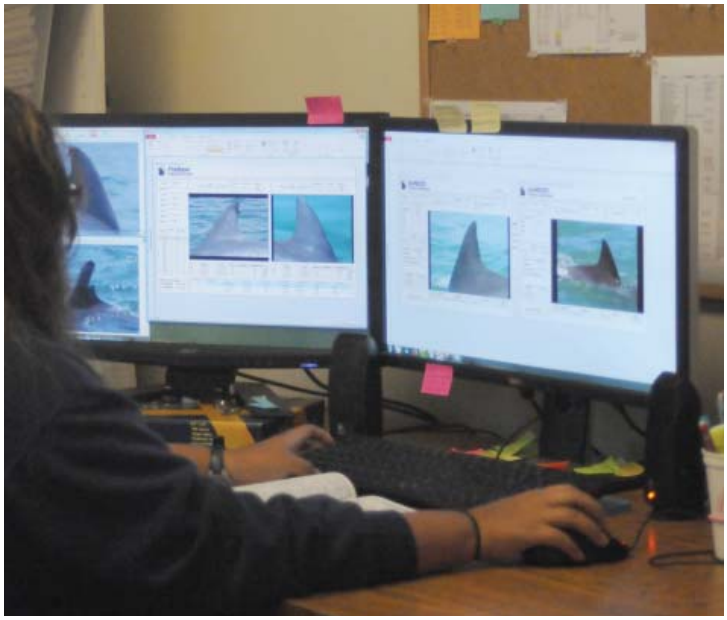
This research has been supported by funding from the UCF Physiological Ecology and Bioenergetics Lab, the UCF Arnold Haverlee Exploration Endowed Scholarship, and a charitable donation from Frank Toms. Thank you to the numerous interns and volunteers that have helped over the past year. This research wouldn't be possible without you!

GoMDIS- Gulf of Mexico Dolphin Identification System developments

Carolyn Cush and Allison Honaker, Chicago Zoological Society

GoMDIS is a database that serves as a standardized and centralized catalog for identifying bottlenose dolphins throughout the Gulf of Mexico. With funding assistance from the Disney Worldwide Conservation Fund and NOAA, this repository is continually expanding by integrating data submitted from collaborating groups around the Gulf which have location-specific photo-identification catalogs.

Following the 2010 *Deepwater Horizon* oil spill and several Unusual Mortality Events (UMEs) in the Gulf of Mexico, it was recognized that a database of this magnitude was necessary in this region to better monitor bottlenose dolphins as mandated by the U.S. Marine Mammal Protection Act. A workshop convened in August 2012 proved there was interest from numerous organizations in becoming part of a collaborative effort to form this database. We have now expanded to 22 collaborating groups with 32 potential catalogs. We are excited to say this is now a truly Gulf-wide collaboration as we have welcomed participants from the National Aquarium of Cuba and the University of Veracruz in Mexico. Eight catalogs from the possible 32 have already been submitted to GoMDIS; we anticipate more to come as each group finishes preparing their datasets for submission. These submissions include basic data such as the best dorsal fin images of each animal, sighting location/date, and animal-specific information such as sex and/or size class. This has yielded a repository of approximately 6,700 individuals and 10,300 images. These data are maintained by the Curator in the offline GoMDIS database and are periodically uploaded to the OBIS-SEAMAP website, facilitating data-sharing and providing our colleagues with a secure, fin-matching interface. Organizations will be able to compare sighting histories of matches between catalogs if desired, and better determine the ranging patterns of these animals.



Allison Honaker comparing images from two of the different catalogs that have been submitted to GoMDIS.

Although we expect several long-term photo-identification projects will send yearly catalog updates, we anticipate the database will eventually maintain approximately 25,000 images, and the usage level of the OBIS-SEAMAP interface will increase as more catalogs are contributed. We will continue to process and incorporate catalogs into this evolving conservation tool which in turn will allow management agencies to better assess stock structure, determine possible movement patterns and obtain more accurate abundance estimates.

Do dolphins 'talk' louder in noisy environments?

Goldie Phillips, Duke University

As noise in the marine environment is substantially increasing, it is important to understand the extent to which its inhabitants are able to compensate for this change – particularly for cetaceans such as dolphins, which rely on sound for vital activities such as foraging and communication. My dissertation research examines the effects of noise on various dolphin whistle characteristics with the aim of elucidating any adaptive mechanisms employed by these animals, which may have important implications for their conservation.

The "Lombard effect" refers to the increase in call amplitude (louder vocalizations produced by the animal) with increased environmental noise. It is just one of several compensatory mechanisms that have been reported for various species subjected to increased environmental noise. Animals have also been reported to alter call rates, change the frequency characteristics of their calls, increase call redundancy, and/or increase call duration. The effects of environmental noise on these variables are currently being examined for 16,541 bottlenose dolphin whistles recorded by four bottom-mounted acoustic sensors. These sensors were deployed in Sarasota Bay between September 4th, 2012 and May 15th, 2013. Analyses for this project are still underway. However, preliminary results suggest that while their call durations appear to be unaffected by increased noise levels, Sarasota Bay dolphins may alter the frequency characteristics of their whistles. As noise level increases, the general trend observed is an increase in the peak frequency (frequency of the sound at maximum power), as well as an overall increase in the bandwidth of whistles. In addition to the various whistle characteristics being investigated, environmental noise will be classified into different categories (for example, whether it is man-made) to determine whether the type of noise plays a role. Support for this project was largely provided by the Chicago Zoological Society, Duke University, and Loggerhead Instruments.

Status of fish populations in Sarasota Bay

Elizabeth Berens McCabe and Sunnie Brenneman, Chicago Zoological Society

Integrated long-term research on dolphins and their prey fish has taught us much about the influence of the food supply on the abundance, activities, and condition of dolphins in Sarasota Bay. This year marks the 10th anniversary of the initiation of a program to monitor fish abundance, distribution, and body condition in the bay. Data from this multispecies fish survey have allowed us to investigate fine-scale habitat and prey selection in wild dolphins, and to explore the effects of *Karenia brevis* red tides on different fish species and community structure. This project has facilitated a variety of novel research, including studies of the diet of wild dolphins (Sam Rossman, Michigan State Univ.), mercury content in dolphin prey (Yongseok Hong, Johns Hopkins Univ.), modeling work involving human interactions with dolphins (Katie McHugh, Chicago Zoological Society), dolphin population modeling (Bob Lacy, Chicago Zoological Society), and comparisons of iron (Melissa Zabojnik, Chicago Zoological Society) and nutrient content (Amanda Ardente, Univ. of Florida) in fish consumed by wild dolphins and dolphins under human care. In the future, data from this project will be used for comparisons with data from a similar study planned by Harbor Branch Oceanographic Institute, addressing questions on dolphin foraging ecology, predator-prey relationships, behavior and genetics in Indian River Lagoon estuarine system on the east coast of Florida. Due to the many complex interactions involved, a long and continuous data set is required to detect changes and trends over time.

Our standardized multi-species fish survey consists of a winter and summer fishing season (January-March; June-September), during which we catch, measure, count and release fish from the *R/V Flip* using a 183 m-long purse seine net. This summer we completed 40 seine sets in seagrass habitat. Preliminary data indicate a total of 13,984 individuals of 51 different species were caught through August. Our 30 seine sets this past winter yielded a total of 3,834 fish and 59 different species. After correcting for the influence of small schooling fishes on the mean number of fish caught per seine set (CPUE, or catch-per-unit-effort) by excluding clupeids, our preliminary 2014 summer CPUE was 398.

Sarasota resident dolphin 1315 with a freshly caught flounder.

After drastic declines in fish abundance from severe red tides in 2005 and 2006, summer fish abundance increased until 2009 and has remained fairly steady since, ranging from 360-524 fish per set. Winter fish abundance has varied little since our survey began (range=81-211), despite sampling through three distinct red tide periods (2004-2005, 2006-2007, and 2012-2013). This winter, CPUE recovered modestly to 122, following the 2012-2013 winter red tide event (CPUE=81). Interestingly, mullet, a relatively abundant and commonly consumed wild dolphin prey species, had the lowest abundance since 2004. Summer mullet abundance has ranged from 5-114 individuals per seine set since 2004. This year we caught only two individual mullet, resulting in a CPUE of 0.03. Additional analyses are needed to determine trends in species-specific abundances and body condition.

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 (13-0809-SR, current Special Activity License) and by Mote Marine Laboratory's Institutional Animal Care and Use Committee (14-6-RW2).

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

Krystan Wilkinson, Chicago Zoological Society and the University of Florida

My Master's research focused on shark bite scar and wound frequencies in the Sarasota Bay resident bottlenose dolphins as an indirect measure of the threat sharks pose to this dolphin community. Using photographs taken during Sarasota Dolphin Research Program (SDRP) capture-release projects from 1975 to 2013, I found that of the 246 resident dolphins that have been handled, 37% had shark inflicted scars or wounds. I found no difference in shark bite frequency between males and females, and the frequency of shark bites on the resident dolphin community has remained relatively unchanged during 1984 through 2013.

Previous studies of the Sarasota Bay dolphin community – along with common predator-prey theories – suggest animals may modify habitat use and social behaviors to adjust for increased risk from potential predators. I tested to see if differential habitat use existed among dolphins with and without shark bite scarring, and if so, in which habitats would we predict to see higher and lower shark bite scar and wound occurrence. In 2013, Boyd Carnal

Fresh shark bite wounds on a female bottlenose dolphin, F245, in Sarasota Bay, September 2014. Her mother, F133, also bears bite scars from earlier encounters.

(Duke University) and I classified coastal habitat from Apollo Beach to Venice Inlet into eight categories – seagrass, sandflat, pass, Gulf, open bay, mangrove, channel, and river. Using updated GIS techniques, I calculated each individual dolphin's lifetime home range, so long as they had a minimum of 100 sightings from the age 6 years or greater. Because other factors may influence a dolphin's risk to negative shark encounters, I also tested for the influence of water depth, average group size, sex and home range size on the probability of an individual dolphin having a shark bite wound or scar. Using GIS and statistical modeling, I concluded that there was a difference in habitat use between individual dolphins with shark bites and those without shark bites.

I assessed whether habitat type or social- or ranging behavior influenced the probability of a dolphin having a shark bite scar over two spatial scales – the core range, or area of intense use, and the overall home range. In the core area, I found that as an individual's average group size increased, the probability of a dolphin having a shark bite decreased. I also found that as the proportion of channel habitat making up the core area increased, the probability of a dolphin having a shark bite decreased. The opposite was found with open bay habitats –as the proportion of open bay habitat increased, the probability of a dolphin with a shark bite increased. Other tested variables were not significant indicators for shark bite presence in the core range model. For the overall home range, I found that as the proportion of open bay and mangrove habitats increased in the home range area, the probability of a dolphin having a shark bite increased; where-as increasing the proportion of seagrass habitat in the home range decreased the probability of shark bite occurrence. Additionally, an increase in average depth increased the probability of a dolphin having a shark bite. Other variables were not significant indicators for shark bite presence in the home range model.

This project has been made possible by an anonymous donor to the Chicago Zoological Society and by the University of Florida, Department of Wildlife Ecology and Conservation.

Indo-Pacific bottlenose dolphins in Bunbury, Western Australia: Sex-specific home ranges and abundance estimates

Kate Sprogis, Murdoch University, Western Australia

My research is a part of the South West Marine Research Program (SWMRP) in Bunbury, Western Australia. For a section of my thesis, I investigated if there were sex-specific differences in home ranges and abundance patterns of the local Indo-Pacific bottlenose dolphin population. To answer these questions we conducted year-round, boat-based, photo-identification surveys from 2007 through 2013.

Our interest in home ranges was partly sparked through the variation in bottlenose dolphin home range characteristics across geographic locations. We wanted to explore if males and females shared similar home ranges, like some bottlenose populations, or if males range further than females, like in Sarasota Bay. To analyse our data, we applied a new approach that accounted for absolute barriers such as land, and performed analyses on dolphins that were sighted ≥ 30 times, were of known sex and were within the adult age class throughout the duration of the study. Results indicated that adult males had a 99% probability of having larger home ranges than adult females, helping explain population dynamics.

Considering that males had larger home ranges than females, we then wanted to find out if the abundance estimates differed between the sexes. We therefore applied separate male and female abundance models, and found that the abundance estimates and temporary emigration rates for males and females differed and both were seasonally dependent. We found that during the warmer months, both males and females showed an increase in abundance, coinciding with the peak breeding season.

Our research would not have been possible if it was not for the help from our dedicated assistants and funding bodies for the SWMRP: 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.

Porpoising Indo-Pacific bottlenose dolphins along remote coastal beaches in Western Australia.

Dolphin rescues, releases, and follow-up monitoring

Aaron Barleycorn, Chicago Zoological Society

CZS staff members have been involved in several dolphin interventions in the past year. In three cases staff directly participated in the rescue attempt. Two of the cases involved calves that had become entangled in fishing gear, and one was a dolphin that had become trapped in a shallow lake in the Everglades. All of the rescues involved coordination with several different agencies including NOAA's National Marine Fisheries Service (NMFS), Florida Fish and Wildlife Conservation Commission (FWC), Mote Marine Laboratory, University of Florida, Disney's Animals, Science and the Environment, SeaWorld, Clearwater Marine Aquarium, and Rookery Bay National Estuarine Research Reserve. None of the rescues would have been possible without the hard work and dedication of the participants.

In November 2013, a dolphin calf was observed near Lover's Key State Park entangled in fishing line. The line had wrapped around the calf's tail stock and was cutting deeply into the insertion of the fluke. The gear had also begun to grow algae and the weight was restricting the dolphin's movement and hastening the embedding of the line in the dolphin's tissues. NMFS determined that without intervention, the calf would likely not survive. On November 8th, CZS led a team to try to rescue the dolphin. The mom and calf were quickly located, and once they swam into shallow water, they were encircled in a net so that the team could temporarily restrain and disentangle the calf. The gear and algae removed weighed more than a pound! Both mom and calf were determined to be in good enough health to be released on site, and they swam off strongly together.

The effects of dragging around more than a pound of gear and algae are clearly evident in the deep lacerations on this calf's tail stock and flukes.

In July 2014, a guide from Speedy's Airboat Tours in Everglades City came across a dolphin in a rarely visited system of shallow lakes. The dolphin likely entered the system during a period of extreme high tide and rainfall, as there was no water deep enough for the dolphin to get back out into deeper river or bay waters. NMFS determined the dolphin needed assistance to get back into its normal habitat, so CZS staff joined a team including representatives from Florida Fish and Wildlife Conservation Commission (FWC), Rookery Bay Research Reserve, and Speedy's to rescue the dolphin. We rode several airboats through a maze of mangrove tunnels to the lake and were able to quickly locate the dolphin, and walk a seine net along the lake in order to restrain it (while dodging an 8 foot-long alligator). That turned out to be the easy part.

Speedy proved that his superior maneuverability under the unique conditions could render our traditional net-setting methods ineffective. So staff from CZS, FWC, and Rookery Bay Research Reserve adapted to the circumstances and took to the water with seine nets in tow, braving thigh-deep mud and alligators in an effort to temporarily capture Speedy for transport to open waters.

The dolphin was loaded onto the front of an airboat, and we started to make our way out of the system of mangrove tunnels. Unfortunately, airboats don't steer very well when all the weight is in the bow, and they never have reverse. This meant the return trip was a very slow journey bouncing off of mangroves, hand-walking the boat around corners, and trying (unsuccessfully) not to fall from the boat.

After about 2 hours and some very skillful driving, we made it into Chokoloskee Bay, where the dolphin was released with a satellite-linked tag to track his movements. The dolphin, a large adult male, was named Speedy in honor of the tour company that made his rescue possible. Speedy continues to travel from open water back into the marsh islands and creeks, but so far has kept to areas where he can easily return to the bay.

Dr. Andy Stamper and Randy Wells support Speedy on the bow of FWC's airboat during transport from the rescue site to the release site. Speedy was draped in wet sheets for the duration of the trip to protect his skin from burning and drying out.

In August 2014, employees from The Dolphin Explorer Eco-Tour near Marco Island reported an 11 month old calf, Skipper, of a well know dolphin mom, Halfway, had been observed entangled in fishing line. Halfway is also the mother of "Seymour," a dolphin that had to be disentangled in 2012. In an all too familiar situation, line had become wrapped around the tailstock of the calf with several feet of line trailing behind. Because the line was not yet tightly wrapped, and some was trailing behind, NOAA asked CZS staff to try using a long-handled cutting tool to cut the line free while the dolphin was free swimming.

Skipper, as first observed with her entanglement in mid August. The trailing line extending behind her flukes was eventually lost, complicating our efforts to remotely disentangle the young calf. Photo credit: Kent Morse

On August 28th, we traveled to Marco Island to attempt to cut Skipper free. With the help of The Dolphin Explorer crew, we located Halfway near Big Marco Pass. We quickly observed that most of the trailing line was now gone, and the wrapped gear had begun to embed into Skipper's tail. This made remote disentanglement much less likely, but we tried for about 2 hours until Halfway stopped letting our boat approach closely. At the request of NOAA, a team was organized by CZS to try to catch and disentangle Skipper. On September 4th, the CZS team was joined by staff from NMFS, FWC, Mote, University of Florida, SeaWorld, Clearwater Marine Aquarium, and Rookery Bay to attempt a rescue. The Dolphin Explorer crew found Halfway and Skipper near Little Marco Pass. The rest of the team joined them, and followed the dolphins until they swam over a shallow bar. The dolphins were encircled in a net, restrained, and Skipper was quickly cut free. The remaining gear turned out to be a wire leader that was quickly cutting deeply through Skipper's flesh. Mom and daughter were released on site, and they swam off together quite vigorously. Since then, they have been seen repeatedly in their usual haunts, doing well.

We and our colleagues continue to monitor previously rescued dolphins as possible. Rescued dolphins including Scrappy (2006), FB28 (2007), Ginger (2008), Nellie (2010), Vidalia (2011), and Lizzie (2012) have been observed this year and are all doing well. Lizzie even had a new calf in May!

What remained of Skipper's entanglement at the rescue. The wire leader can be seen cutting into her flesh. Despite the damage caused by the entanglement, Dr. Mike Walsh from the University of Florida was able to successfully remove the gear and deemed her sufficiently healthy for immediate release with her mother.

Echo update: 24 years back in the wild

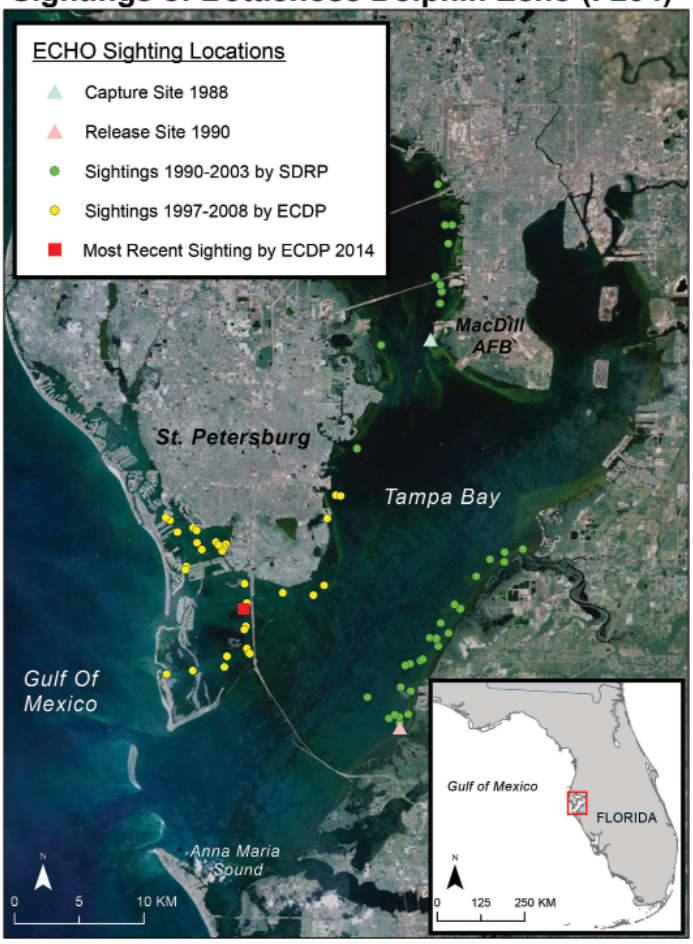
Kim Bassos-Hull, Sarasota Dolphin Research Program

It has been nearly six years since the Eckerd College Dolphin Research Program last observed Echo in their study area (southwest Tampa Bay and Boca Ciega Bay) during June 2008. On May 19th, 2014 the Eckerd team, under the leadership of Dr. Shannon Gowans, confirmed a sighting of Echo in a large group of dolphins in Boca Ciega Bay and shared this information with the Sarasota Dolphin Research Program (SDRP). SDRP researchers had last seen Echo on August 20th, 2003 in southwestern Tampa Bay.

Echo and another young male Tampa Bay dolphin, Misha, were the subjects of a unique two-part scientific experiment. Echo and Misha were initially collected in Tampa Bay in July 1988 and spent two years at the University of California at Santa Cruz's Long Marine Laboratory, where researchers studied their echolocation processing abilities and behavior patterns. Then, as planned prior to collection, on October 6th 1990 they were released back into Tampa Bay after a transition process in a seapen at Mote Marine Laboratory. During intensive monitoring over the first year following their release, both Echo and Misha were observed feeding, interacting with other local dolphins, and in general displaying typical behavioral, ranging, and social association patterns as well as excellent body condition. Echo and Misha separated after the first few months back in the wild, but researchers continued to observe both dolphins through opportunistic sightings. Misha was sighted on 70 days since release along the southeast coastline of Tampa Bay. The last sighting of Misha by SDRP before his death (his carcass was recovered in 2006) was on August 16th, 2005 in the Manatee River (southeastern Tampa Bay) where he was observed with longtime associate, KATT. With Echo's most recent May 2014 sighting he has now been re-sighted 59 times since release in 1990. The Eckerd research team has observed Echo with many associates since 1997 but one dolphin, DUCK, has been in several repeat sightings since 2002, perhaps indicating the development of a male pair bond. The records of Misha through 16 years post-release, and now Echo through 24 years post-release, provide additional confirmation of the success of this experimental return of dolphins to their native waters after a brief period under human care.

Echo in May 2014, after a six-year break in his sighting history. Photo credit: Eckerd College Dolphin Project

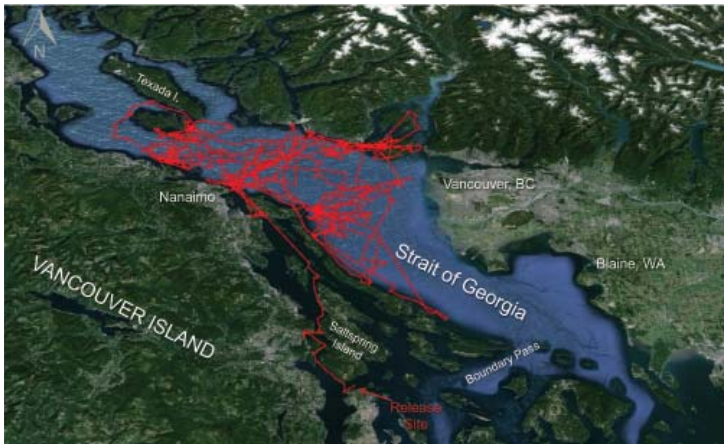
Sightings of Bottlenose Dolphin Echo (F204)



Levi harbor porpoise update

Brad Hanson, National Marine Fisheries Service, and Marty Haulena and Chad Nordstrom, Vancouver Aquarium

The Vancouver Aquarium Mammal Rescue Centre rescued a stranded harbor porpoise, rehabilitated him, and released him back to the inland waters off Vancouver Island in September 2013. Equipped with a satellite-linked tag attached to his dorsal fin that provided location and dive information over the two months following release, we were able to determine that he successfully transitioned back to life in the wild.



Red lines indicate Levi's movements during 63 days of tracking.

A young male harbor porpoise (nick-named Levi), was found stranded on the shoreline of Saanich Inlet on the southeast coast of Vancouver Island, Canada on March 26, 2013, and brought to the Vancouver Aquarium Marine Mammal Rescue Centre, as part of a collaborative rescue effort with Cetus Research and Conservation Society and Fisheries and Oceans Canada (DFO). Too weak to swim on his own, Levi was placed in a specially-designed flotation sling and hand-fed nutrients to sustain him.

After a series of diagnostic tests, the veterinary team at the Rescue Centre determined that, in addition to severe health problems caused by stranding, Levi had a large, lung-parasite infection and was suspected to have hearing loss. Over the following months, the veterinary team treated Levi's lung infection, and worked intensely with him to regain his strength such that by late summer, Levi had begun to display marked improvements. He was swimming on his own, foraging for live fish, and tests showed that his hearing issues had resolved with time. By early September, his health had improved dramatically and he was deemed releasable by DFO.

On September 10, 2013, the veterinary team outfitted Levi's dorsal fin with a satellite-linked tag (provided by the Sarasota Dolphin Research Program), which enabled the Rescue Centre team to closely monitor his behavior in the wild. Levi was transported by boat back to near his stranding location in Saanich Inlet, where veterinary staff released him back to his native habitat. The tag provided data to track Levi's travels and dive behavior for 63 days. During this time he traveled approximately 2,175 km in the Strait of Georgia between the east coast of Vancouver Island and mainland British Columbia near the city of Vancouver. He dove nearly 500 times per day and to a maximum depth of 235 m. Levi's extensive movements and active dive behavior indicated that he successfully transitioned back to life in the wild.

Follow-up monitoring of rehabilitated Guiana dolphins in Colombia

Randall Wells, Chicago Zoological Society, and David Kieckbusch, Fundacion Omacha

In June, two Guiana dolphins (*Sotalia guianensis*) were tagged and released in the Pozos Colorados (Santa Marta) area of Colombia, following rehabilitation from injuries believed to have been incurred from fishing nets. The dolphins, an adult female and a juvenile female, had been rescued by fishermen in September 2013 and brought to the Aquarium and Sea Museum in Rodadero for treatment.

Over the months, 'Luna' and 'Karolina' nearly doubled their weight at admission, all their wounds were healed and there was even a visible recovery of lost tissue, making it clear that they were ready to be released. The Fundacion Omacha (acting as technical advisors) began to evaluate various scenarios for release, and suggested holding a soft release, i.e., a process in which individuals are gradually adapted to a change in the food and confinement space in order to free them. In order to minimize potential problems from extended transport time, it was decided to release them in the nearby area of Pozos Colorados in Santa Marta, near where they were found. They were both tagged with Wildlife Computers SPLASH tags provided by SDRP to provide location and dive data, and they were released on 8 June 2014. One of the dolphins was tracked for 2 days before transmissions ceased for unknown reasons. The other was tracked for 80 days in coastal waters known to be frequented by Guiana dolphins, making dives to more than 10 m depth. This represents the first time this species has been tagged with satellite-linked transmitters.

Guiana dolphins Luna and Karolina during the rehab process, shortly before release.

Education, Outreach, and Training

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. The Sarasota Dolphin Research Program is a component of the Chicago Zoological Society's Conservation Education and Training group.

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. For more information on our program's books and publications, please visit www.sarasotadolphin.org.

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. We coordinate distribution of the cards, and 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.

As a complement to the cards, we helped to develop a 30-second public service announcement (PSA), "*Don't Feed Wild Dolphins.*" This animated PSA 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, along with more information on issues surrounding people feeding wildlife, is available online at www.dontfeedwilddolphins.org.

We are producing brief (2-4 min) educational videos about dolphin conservation and biology, through support from the Disney Worldwide Conservation Fund. These videos are available through the SDRP website, www.sarasotadolphin.org, and with new Disney funding we will begin developing educational kiosks for presenting the videos at institutions visited by people with an interest in dolphins and their conservation. The South Florida Museum, in Bradenton, Florida, will help with the design and construction of prototype kiosks over the next few months.

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 NOAA/USFWS Atlantic Scientific Review Group, the NOAA/NMFS Bottlenose Dolphin Take Reduction Team, and the IUCN Cetacean Specialist Group.

International Training Opportunities: As a component of the Chicago Zoological Society's Conservation Education and Training group, we provide training opportunities for scientists and students from outside of the United States. These 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 2014, we hosted Alberto Delgado-Estrella and Maria del Rocio Barreto, from Mexico. In addition, a number of foreign researchers participated in our bottlenose dolphin health assessment in Sarasota Bay, from Brazil, Denmark, Germany, and Scotland.

Alberto and Rocio, our colleagues from Mexico, assisting with the prey survey by "flaking" the seine net after a set.

Graduate Students: As described throughout this newsletter, graduate students from a variety of institutions, especially the University of California-Santa Cruz, Michigan State University, Duke University, the University of Florida, and the University of Central Florida involve the resources of our program as they conduct their thesis or dissertation research. To date, 32 doctoral dissertation and 31 master's thesis projects have benefited from association with our program, through field research opportunities or access to data, samples, or guidance. During 2014, three doctoral students involved with our program, Kristina Cammen (Duke), Sam Rossman (Michigan State), and Steve Shippee (U. of Central Florida), successfully defended their dissertations, and one Master's student, Krystan Wilkinson (U. of Florida), successfully defended her thesis. Currently, seven doctoral students are making use of resources provided by our program.

Undergraduate College Internships and Post-Graduate Trainees: At the college level and beyond, we are fortunate to have access through Mote Marine Laboratory to high quality, dedicated 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 2014, 12 interns and post-graduate trainees (including the two Mexican colleagues mentioned above) provided approximately 5,500 hours of assistance to the program. We also provided training to five interns from outside the USA, including Canada, India, Ireland, Scotland, and Switzerland. Many of our interns apply their training with the SDRP towards advanced study in the areas of marine animal conservation, research, and management.

Elementary School Curriculum: Wild dolphin conservation for 5th graders has been introduced into Sarasota, FL schools. Students are presented with videos focused on the dolphin's underwater perspective around boats and fishing lines, and on the problems caused by humans feeding dolphins. An experiential activity helps students understand what it's like for wild dolphins to swim through multiple fishing lines. And there is also plenty of time for the students to ask questions about wild dolphins. The curriculum was developed by long-time Sarasota County K-5 Science Lab Instructor Chip Phillips, who worked with SDRP staff to develop the course content. Chip also wrote a teacher's guide, and he made the course available to teachers throughout the District. So far, the curriculum has been presented to 931 students, and the teachers were very positive and enthusiastic about it. We expect to have it used even more broadly in the next school year. The curriculum is available as a download at www.sarasotadolphin.org.

Graduate Student and Intern Updates
Where are they now?

From the beach to the nation's capital

Deborah Fauquier, NOAA Fisheries, Marine Mammal Health and Stranding Response Program

It is with pleasure that I write this note to *Nicks'n'Notches* to say hello to the Sarasota Dolphin Research Program community that supported me throughout my graduate studies. I have served as the coordinating veterinarian for the SDRP health assessments in Sarasota Bay for a number of years. While completing my doctoral degree from the University of California, Santa Cruz, on the effects of red tides on sea birds in Sarasota Bay, I had the opportunity to become a Knauss Marine Policy Fellow in Washington, D.C. The National Sea Grant College Program, John A. Knauss Marine Policy Fellowship, was created in 1979, and provides a unique educational experience to students, exposing them to national policy decisions affecting ocean, coastal, and Great Lakes resources (http://seagrant.noaa.gov/FundingFellowships/KnaussFellowship.aspx). After the completion of my Knauss fellowship in early 2013, I was able to continue working for the National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service's Marine Mammal Health and Stranding Response Program (MMHSRP; http://www.nmfs.noaa.gov/pr/health/). The MMHSRP was established by Congress to facilitate the collection, dissemination, and correlation of reference marine mammal data and assess health trends as well as coordinate responses to unusual mortality events (UMEs).

My current work at the MMHSRP involves interacting with our partners from the National Marine Mammal Stranding Network, marine mammal researchers from government, academia and non-governmental organizations, the public health community, and international colleagues on issues relating to marine mammal health, mortality events, public health including emerging diseases, and global issues such as the impact of increased anthropogenic activities on marine mammal habitats and health. During the past year I have been actively involved in managing the response to the Mid-Atlantic UME which is a caused by a morbillivirus outbreak (a disease similar to measles) that has killed more than 1,400 bottlenose dolphins since July 2013 along the Atlantic coast from New York to Northern Florida (http://www.nmfs.noaa.gov/pr/health/mmume/midatldolphins2013.html).

I have also spent time assisting with the Natural Resource Damage Assessment (NRDA) process for marine mammals from the *Deepwater Horizon* oil spill in the Gulf of Mexico. Additionally, I have been able to continue working with SDRP staff on both NRDA and bottlenose dolphin health assessment projects. The marine ecosystem is undergoing rapid changes, some natural and some man-made, including increases in harmful algal blooms, changes related to climate change, increased industrial utilization of the oceans, and the impacts of marine debris. In the future, I plan to continue to work on both national and international issues related to marine mammal health and conservation, and to highlight the role of marine mammals as sentinels of the changing ocean environment.

Applying SDRP approaches to dolphins in India

Abhishek Jamalabad, India

My curiosity in marine mammals was aroused after repeated sightings of Indo-Pacific humpback dolphins from fishing boats on the west coast of India, and on reading and seeing anecdotal reports of several other marine mammals rarely studied or even hitherto unknown from the region. Soon after, I participated in a pilot survey of coastal small cetaceans, but dearth of the required resources, experience and expertise (marine mammal research in my country still being in the nascent stage) made me hesitant to attempt dolphin research on my own. I then happened to read about the Sarasota Dolphin Research Program and the internships they offer, and realised that this would be the opportunity I was looking for.

Coming to the U.S. from halfway across the world, I was a bit apprehensive about life in Sarasota (this was my first visit to the States and the first time I travelled to a foreign country on my own). During the journey from home to Sarasota I was besieged by the worry that my lack of practical experience would pose a hurdle in my internship. Those worries were soon put to rest when I met the genial staff at SDRP and my very friendly co-interns. Needless to say, the following twelve weeks with the SDRP at Mote Marine Lab were an immensely valuable learning experience.

Although I had participated in the field-based work of similar dolphin surveys in India, I acquired many additional skills here – essentially the "backroom" skills – photo-ID, data management, an introduction to using GIS software, and organising fin images for an ID catalogue. The prey base survey project (read "going fishing") was an amazing experience too- not just to know about the kind of fish preferred by the Sarasota Bay bottlenose dolphins, but to explore the immense fish diversity of the region too. Getting to know more about the kind of research done with the prey base data, such as studies into prey selection by dolphins and deductions regarding the caloric value of certain areas for dolphins, was eye-opening. The huge library of marine mammal articles available at the lab was an added advantage that I cannot be too grateful for. And a big thank you to Dr. Randy Wells, Dr. Katie McHugh and Krystan Wilkinson for their kind guidance and for having patient chats with me in reply to all my questions!

SDRP volunteer Bill Tiffan and Abhishek Jamalabad aboard the R/V Flip for a day of prey sampling.

While at Mote, I was thrilled to have an opportunity to learn to drive boats- thanks to Aaron, Katie and Jason. I also had great opportunities to chip in at other departments at the Lab- the time spent at the sea turtle hospital, osteological collections, and assisting a turtle necropsy were valuable experiences to take back home. It would be amiss on my part to not mention the free time I spent indulging in two favourite hobbies- bird watching around Lido (courtesy of Aaron) and treating my tastebuds to Sarasota delicacies (thanks to Jason)!

I hope to put to good use the knowledge I acquired from the SDRP, towards marine conservation research in India. The coastal waters of India suffer from unregulated, unsustainable commercial fishing, the result of relatively recent introduction of large-scale mechanised fisheries. My aim in the near future is to systematically study the interactions between commercial fisheries and cetaceans, and to suggest fishing community-invested measures for conflict mitigation and conservation. Simultaneously, by increasing public and stakeholders' awareness of the marine mammal diversity in Indian waters and projecting them as flagship marine animals for sustainable recreational activities, such as responsible whale and dolphin watching, it would be much easier to protect marine areas, whilst providing employment to the coastal population currently dependent solely on fisheries.

How Sarasota Bay's dolphins helped prepare me for humpback whale research (and conquer seasickness)

Natalie Mastick, Oregon State University

When I began my 16-week internship with the Sarasota Dolphin Research Program (SDRP) in January 2014, I had just graduated college with degrees in marine biology and environmental studies, and was queued to start postgraduate study of humpback whales in the fall. I had always been interested in working to protect marine mammals in their natural habitats, and I was fortunate to have the opportunity to study humpback whales as an undergraduate. I knew I wanted to focus my graduate work on humpback behavior and conservation in foraging grounds. The only concern I had was that all of my marine mammal field experience had been with seals and sea lions on land-based studies. Unfortunately, I had never set foot on a boat without getting seasick, which is problematic for studying whales in the wild! Though I had read what seemed like hundreds of papers on the methods of cetacean research and conservation, I felt ill equipped in practical experience—on the water, observing and studying whales.

My time with the SDRP changed all of that. It was clear on the first day of my internship that the SDRP is run like a well-oiled machine, with everyone collaborating to add to the decades of data and discoveries about the resident dolphins. I was thrilled to be a part of the team, and quickly found my footing not only on the (mercifully flat) water, but also behind a camera, on a fishing boat

sampling prey, and in front of a computer analyzing thousands of photos of dolphin dorsal fins. While at the time it felt so specific to the program, later I realized how many of the skills I learned during my internship were applicable to what I was planning on studying in grad school.

The whales I will be studying that live in well-known populations are photo-identified, much like the dolphins in Sarasota Bay. Unlike the dolphins, their surfacings are much more predictable and slower-paced, which will make getting an identifiable photo for long-term studies much easier. The measures the SDRP implements to study human interactions with the dolphins in the area are directly applicable to the human interactions whales face from boats and fishing vessels in their foraging grounds. These encounters are necessary to assess for conservation of the whales and management of the areas they migrate to for food. The time I spent on the water not only equipped me with my sea legs, but also experience steering boats and navigating waterways through animal sightings. These skills are necessary for whale tagging during my masters program. Working with the SDRP was a life-altering experience, which has equipped me with the knowledge and experience I need to progress my research in whale conservation. I look forward to strengthening and refining these skills and am thankful for the experience the SDRP provided me.

Winter 2014 SDRP interns (left to right) Marie Duffy, Mariah Vane, and Natalie Mastick on the R/V Flip en route to a prey sampling site.

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.

Theses and Dissertations

Cammen, K.M. 2014. The influence of genetic variation on susceptibility of common bottlenose dolphins (*Tursiops truncatus*) to harmful algal blooms. Doctoral dissertation, Duke University.

Rossman, S. 2014. The foraging habits of bottlenose dolphins: Insights into temporal, demographic, and individual variation. Doctoral dissertation, Michigan State University.

Shippee, S.F. 2014. Movements, fishery interactions, and unusual mortalities of bottlenose dolphins. Doctoral dissertation, University of Central Florida.

Stuhlmann, C. E. 2014. The M whistle: A stereotyped non-signature whistle in free-ranging bottlenose dolphins (*Tursiops truncatus*). Senior thesis, University of Pennsylvania.

Wilkinson, K.A. 2014. An analysis of shark bites on resident bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida, and implications for habitat use. Master's thesis. University of Florida.

Manuscripts In Press or Accepted for Publication

Aksenov, A., L. Yeates, A. Pasamontes, C. Siebe, Y. Zrodnikov, J. Simmons, M. McCartney, J-P. Delplanque, R. Wells and C. Davis. Metabolite content profiling of bottlenose dolphin exhaled breath. Analytical Chemistry.

Helm, R.C., D. Costa, T.J. O'Shea, R.S. Wells and T.M. Williams. In press. Effects of Oil Spills on Marine Mammals. *In*: Handbook of Oil Spill Science and Technology. M. Fingas, ed. Singapore: Springer.

Mancia, A., J.C. Ryan, F.M. Van Dolah, J.R. Kucklick, T.K. Rowles, R.S. Wells, P.E. Rosel, A.A. Hohn, and L.H. Schwacke. Accepted. Machine learning approaches to investigate the impact of PCBs on the transcriptome of the common bottlenose dolphin (*Tursiops truncatus*). Marine Environmental Research.

Manuscripts Submitted: In Review/Revision

Cammen, K. M., T. S. Schultz, P. E. Rosel, R. S. Wells and A. J. Read. In revision. Genome-wide investigation of adaptation to harmful algal blooms in bottlenose dolphins. Molecular Ecology.

Cammen, K. M., P. E. Rosel, R. S. Wells, and A. J. Read. In revision. Lack of variation in voltage-gated sodium channels of common bottlenose dolphins exposed to neurotoxic algal blooms. Aquatic Toxicology.

Cammen, K. M., L. A. Wilcox, P. E. Rosel, R. S. Wells and A. J. Read. In review. From genome-wide to candidate gene: An investigation of variation at the major histocompatibility complex in bottlenose dolphins exposed to red tides. Immunogenetics.

Cook, M., R. Wells and D. Mann. In revision. Auditory evoked potential hearing measurements of free-ranging bottlenose dolphins (*Tursiops truncatus*). J. of the Acoustical Society of America.

Hart, L. B., R. S. Wells, N. Kellar, B. C. Balmer, A. A. Hohn, T. Rowles, E. Zolman and L. H. Schwacke. Submitted. Adrenal hormones in bottlenose dolphins (*Tursiops truncatus*): influential factors and reference intervals. PLoS One.

Mallette, S. D., W. A. McLellan, F. S. Scharf, H. N. Koopman, S. G. Barco, R. S. Wells and D. A. Pabst. In review. Ontogenetic allometry and body composition of the common bottlenose dolphin (*Tursiops truncatus*) from the U.S. mid-Atlantic. Marine Mammal Science.

Mancia, A., L. Abelli, J. R. Kucklick, T. K. Rowles, R. S. Wells, B. C. Balmer, A. A. Hohn, J. E. Batz and J. C. Ryan. In review. Microarray applications to understand the impact of exposure to environmental contaminants in wild dolphins (*Tursiops truncatus*). Marine Genomics.

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Published Peer-Reviewed Journal Articles, Book Chapters

Adimey, N.M., C.A. Hudak, J.R. Powell, K. Bassos-Hull, A. Foley, N.A. Farmer, L. White and K. Minch. 2014. Fishery gear interactions from stranded bottlenose dolphins, Florida manatees and sea turtles in Florida, USA. Marine Pollution Bulletin 81(1):103-115.

Balmer, B. C., R. S. Wells, L. H. Schwacke, J. H. Schwacke, B. Danielson, R. C. George, S. M. Lane, W. A. McLellan, D. A. Pabst, K. Sparks, T. R. Speakman, F. I. Townsend, and E. S. Zolman. 2014. Integrating multiple techniques to identify stock boundaries of common bottlenose dolphin (*Tursiops truncatus*). Aquatic Conservation: Marine and Freshwater Ecosystems 24:511-521. DOI: 10.1002/aqc.2357.

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Dr. Jay Sweeney and Dolphin Quest staff prepare to release a dolphin after health assessment.

Tornero, V., K. Taranjit, R.S. Wells and J. Singh. 2014. Eco-toxicants: A growing global threat. Pp. 309-332 *In*: J. Yamagiwa and L. Karczmarski (eds.), Primates and Cetaceans: Field Research and Conservation of Complex Mammalian Societies, Primatology Monographs, Tokyo, Japan: Springer. DOI 10.1007/978-4-431-54523-1_8.

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Contract and Other Reports

Wells, R.S., B.C. Balmer, A. Barleycorn and K. Wilkinson. 2014. 2013 Barataria Bay and Mississippi Sound Dolphin Tracking. Final Report for NOAA Order No: AB133C-11-CQ-0050; Title: Deepwater Horizon; Activity: A3i MMST70/170 - *Estuarine Dolphins*. 39 pp.

Presentations at Professional Meetings

Bassos-Hull, K. 2014. Marine Wildlife Entanglements in Florida Waters: Impacts and Trends. NOAA Florida Marine Debris meeting, St Petersburg, FL. 20-22 May 2014.

Cammen, K., P. Rosel, T. Schultz, R. Wells and A. Read. 2013. Genome-wide investigation of adaptation to harmful algal blooms in bottlenose dolphins. 20th Biennial Conference on the Biology of Marine Mammals, 9-13 December, Dunedin, New Zealand.

Cammen, K., P. Rosel, T. Schultz, R. Wells and A. Read. 2014. An investigation of adaptation in bottlenose dolphins exposed to harmful algal blooms using complementary genome-wide and candidate gene approaches. American Genetic Association Symposium: Evolution & Plasticity. Seattle, WA.

Chicago Zoological Society staff members photographing dolphins during a routine population monitoring survey in Sarasota Bay, FL.

Costa, D.P., G.A. Worthy, R.S. Wells, A.J. Read, D. Waples and M.D. Scott. 2013. Patterns of seasonal metabolic rate variation for bottlenose dolphins in Sarasota Bay, Florida. 20th Biennial Conference on the Biology of Marine Mammals, 9-13 December, Dunedin, New Zealand.

De Guise, S., M. Levin, E. Gebhard, L. Jasperse, L. Burdett Hart, C. Smith, S. Venn-Watson, F. Townsend, R. Wells, B. Balmer, E. Zolman, T. Rowles and L. Schwacke. 2014. Immune changes in northern Gulf of Mexico bottlenose dolphin populations associated with the Deepwater Horizon oil spill. International Association for Aquatic Animal Medicine, Gold Coast, Australia.

Gonzalez, L.E., M. Moore, S. Dennison-Gibby, A.W. Trites, D. Rosen, M. Haulena, N. Waller, T. Neale, S.R. Thom, A. Fahlman and R.S. Wells. 2013. Blood microparticles in Steller sea lions (*Eumatopias jubatus*): a new method for diagnosing decomperession stress in marine mammals. 20th Biennial Conference on the Biology of Marine Mammals, 9-13 December, Dunedin, New Zealand.

Janik, V.M. 2014. Studying bottlenose dolphin communication: challenges and discoveries from the wild. Invited plenary talk at the symposium "Dolphin acoustics, behavior and cognition," Tokai University, Japan, 2 Feb 2014.

Janik, V.M. 2014. Reference with learned signals in cetacean communication. Invited plenary talk at the Conference of the Japanese Society for Animal Psychology. Kyoto University, Japan, 19-21 July 2014.

Jensen, F.H., S.A. Levin, D.I. Rubenstein, K.A. McHugh, R.S. Wells, P.L. Tyack, and I.D. Couzain. 2014. Coordination of pair movement in bottlenose dolphin dyads. 51st annual Animal Behavior Society meeting, Princeton, NJ.

McHugh, K.A., G.N. Lovewell, A.A. Barleycorn, S. Brenneman, J.B. Allen and R.S. Wells. 2013. Interactions between bottlenose dolphins (*Tursiops truncatus*) and crab fisheries near Sarasota, Florida, USA. 20th Biennial Conference on the Biology of Marine Mammals, 9-13 December, Dunedin, New Zealand.

Powell, J.W.B., J. J. Kaufman, W. E. McFee, and D. A. Duffield. 2013. Establishing a primary bone density dataset for the common bottlenose dolphin. 20th Biennial Conference on the Biology of Marine Mammals. 9-13 December 2013. Dunedin, New Zealand.

Powell, J.W.B., D. Duffield, W. McFee, and J.J. Kaufman. 2014. Assessing bone mineral density in the common bottlenose dolphin (*Tursiops truncatus*). 2014 Southeast and Mid-Atlantic Marine Mammal Symposium (SEAMAMMS). 28-30 March 2014. Wilmington, NC.

Sayigh, L. S. 2013. Invited talk at the "Analyzing Animal Vocal Communication Sequences" NIMBioS Investigative Workshop, Knoxville, USA, 21-23 Oct 2013.

Sayigh, L. S. 2014. Insights into the complex communication system of the common bottlenose dolphin (*Tursiops truncatus*). Invited plenary talk at the symposium "Dolphin acoustics, behavior and cognition," Tokai University, Japan, 2 Feb 2014.

Sayigh, L. S., V. Janik, F. Jensen, K. McHugh, R. Wells, and P. Tyack. 2013. Insights into a complex communication system from DTAGs on bottlenose dolphins. Invited spoken presentation at the Acoustical Society of America special session on "Broadening Applications of Tags to Study Animal Bioacoustics," San Francisco, CA. 3 Dec 2014.

Sprogis, K.R, H.K. Smith, R.S. Wells, H.T. Kobryn, D.W. Johnston, K.H. Pollock and L. Bejder. 2013. Sex-specific differences in the ranging patterns of Indo-Pacific bottlenose dolphins in southwest Australia. 20th Biennial Conference on the Biology of Marine Mammals, 9-13 December, Dunedin, New Zealand. (poster)

Stuhlmann, C.E., L. S. Sayigh, R. S. Wells, and V. M. Janik. 2014. The M whistle: A stereotyped non-signature whistle in free-ranging bottlenose dolphins, *T. truncatus*. 51st annual Animal Behavior Society meeting, Princeton, NJ, 11 Aug 2014. (poster)

Taylor, B.L., M. Amano, A. Friedlaender, M. Dunphy-Daly, P. Hammond, K.M. Kovacs, L. Lowry, B. Morales, S. Norman, G. Phillips, L. Pimper, R. Reeves, B. Smith and R.S. Wells. 2013. All the ingredients – how to succeed at marine mammal conservation. 20th Biennial Conference on the Biology of Marine Mammals, 9-13 December, Dunedin, New Zealand.

Wells, R.S., B.C. Balmer, L.H. Schwacke, E. Zolman, A. Barleycorn, F. Townsend and T.K. Rowles. 2014. Deepwater Horizon tagging and tracking update. NOAA Deepwater Horizon Principal Investigator Meeting, 11 April 2014, Miami, FL.

Dr. Forrest Townsend monitors a dolphin during health assessments.

Wells, R.S., B.C. Balmer, L.E. Howles, M.D. Scott, D.A. Duffield, A.A. Barleycorn, K.A. McHugh, J.B. Allen, A.B. Irvine, F.I. Townsend, J.C. Sweeney and S. Wilton. 2013. Experimental tests of small electronic tags for dolphins. 20th Biennial Conference on the Biology of Marine Mammals, 9-13 December, Dunedin, New Zealand.

Invited Public, University, School Lectures

Bassos-Hull, K. 2013. Mark Me Match Me: How scientists use identifiable markings on animals to estimate population sizes. Youth Ocean Conservation Summit workshop presenter. Mote Marine Laboratory, Sarasota, FL. 16 Nov 2013.

Bassos-Hull, K. 2013. Dolphins of Pine Island. Sanibel Captiva Conservation Foundation, Captiva FL. 5 Dec 2013.

Janik, V. M. 2013. The role of acoustic learning in marine mammals. Invited departmental talk at the University of Exeter, UK, Oct 2013.

Janik, V. M. 2014. Vocal learning under the sea: Acoustic communication in bottlenose dolphins. Invited departmental talk at the University of Southern Mississippi. USA, Jan 2014.

McHugh, K. 2014. Please don't feed the dolphins! Lessons from long-term dolphin research and efforts to reduce harmful human interactions with wild dolphins. Chicago Zoological Society's Fall Lecture Series, Brookfield, IL. 13 Nov 2013.

McHugh, K. 2014. Meet the dolphins next door: Lessons from long-term research on Sarasota Bay's multi-generational resident community. Biology, Conservation, and Management of Marine Mammals, New College of Florida, Sarasota, FL. 19 Feb 2014.

McHugh, K. 2014. Meet the dolphins next door: Lessons from long-term research in Sarasota Bay. Charlotte Harbor Environmental Center, EcoCamp, Englewood, FL. 6 Jun 2014.

Sayigh, L. S. 2014. Dolphin communication. Invited talk at the Robbins Library, Arlington, MA, USA, 14 Jul 2014.

Wells, R.S. 2014. The world's longest-running study of a dolphin population – Lessons from 4 decades and 5 generations. Duke University Talent Identification Program (TIP) – New College, Sarasota, FL. 21 Jul 14.

Wells, R.S. 2014. The world's longest-running study of a dolphin population – Lessons from 4 decades and 5 generations. University of South Florida – St. Petersburg Marine Mammal Seminar. Mote Marine Laboratory, Sarasota, FL. 8 Jul 14.

Wells, R.S. 2014. The world's longest-running study of a dolphin population: Lessons from 4 decades and 5 generations. Mote Marine Laboratory Volunteer Class. 5 Mar 14.

Wells, R.S. 2014. The world's longest-running study of a dolphin population – Lessons from 4 decades and 5 generations. Dolphin Quest – Hawaii, Waikoloa, HI. 19 Feb 14.

Wells, R.S. 2014. Sarasota Bay's resident dolphins. G.R.E.E.N. SRQ, Sarasota, FL. 27 Feb 14.

Wells, R.S. 2013. Discovering dolphins and manatees in our backyards. Anna Maria Elementary School (three 2nd grade classes), Holmes Beach, FL. 3 Dec 13.

Wells, R.S. 2013. The world's longest-running study of a dolphin population: Lessons from 4 decades and 5 generations. Mote Marine Laboratory Volunteer Class. Nov 13.

As the lab turns...

Sunnie Brenneman, Chicago Zoological Society

Since the last edition of *Nicks N Notches* professional, personal, and personnel developments have abounded for the SDRP team. Shortly after publishing the newsletter last November, Don and Lee Hamilton generously provided for one of our lab's pressing equipment needs with the donation of a brand new white Chevy Silverado 2500 pickup truck to replace its beloved, albeit aging, predecessor.

In January of this year we bid farewell to Brian Balmer, who took a position with the Oceans and Human Health Branch of NOAA/NCCOS Hollings Marine Laboratory in Charleston, SC. Brian was a tremendous asset to our team and his absence has been felt, but we wish him the best!

May brought news that Elizabeth Berens McCabe and her husband, Mike, would be welcoming their first child, a baby boy, in early January! Shortly thereafter Krystan Wilkinson successfully defended her master's thesis and later graduated from the University of Florida. She now continues with our program as a PhD student.

Sadly, on July 8th we lost Ruth DeLynn, a dear friend and colleague fondly known as "The Bone Lady". During her 30 years as a volunteer and adjunct scientist with Mote Marine Laboratory Ruth created and curated the Ruth DeLynn Osteological Collection of dolphin and whale skeletons, which includes many specimens from the Sarasota Bay population. It is a key element of our "cradle to grave" philosophy of studying these animals and also serves as an excellent example of the partnership between SDRP and the Stranding Investigations Program at Mote Marine Laboratory. Though Ruth has passed, her legacy lives on through her timeless contributions to cetacean research.

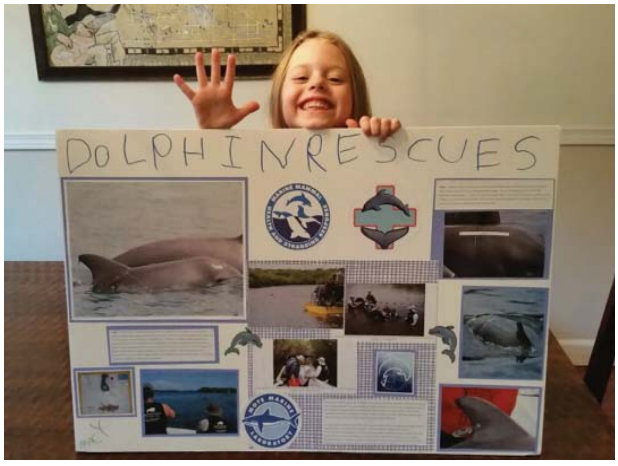
As summer drew to an end so did our time with Nicole Lee, SDRP's seasonal research assistant. She moved back to California with her new husband to embrace a fantastic promotion opportunity given him.

Dedicated volunteer Nigel Mould, recipient of Sarasota Magazine's 2014 Volunteer of the Year award. Photo credit: Mark Farmwald

We received news in August that our nomination of local volunteer Nigel Mould for Sarasota Magazine's Volunteer of the Year had been selected for the win! Nigel is an invaluable asset to our program as well as to Mote Marine Laboratory. Between assisting with both our dolphin population monitoring and prey monitoring projects, he has contributed countless hours of service to the SDRP. We are thrilled that his efforts have been so widely recognized and publicly acknowledged!

In September Macy Powell, daughter of long-time friend and graduate student James Powell, celebrated her 5th birthday. In lieu of birthday presents, Macy requested that her friends and family donate the money they would have spent on gifts to the SDRP to support dolphin rescues! Macy succeeded in raising $212 for the program, no small accomplishment for anyone, let alone a 5-year old! Thank you, Macy!

Left to right: Gretchen Lovewell, Randy Wells, and Ruth DeLynn



Macy Powell displaying the poster she made and presented at her birthday party to raise awareness and funding for our cause.

Program Operations

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Aaron Barleycorn, BS, Field Coordinator (since 2003)
Elizabeth Berens McCabe, MS, Research Associate (since 2004)
Sunnie Brenneman, BS, Research Assistant (since 2010)
Carolyn Cush, BS, Research Assistant (since 2010)
Allison Honaker, MPS, Research Assistant (since 2013)
Nicole Lee, MS, Research Assistant (since 2013)
Katie McHugh, PhD, Staff Scientist (since 2000)
Randall Wells, PhD, Program Director (since 1970)

Mote Marine Laboratory Staff

Kim Bassos-Hull, MS, Research Associate (since 1990)

Dolphin Biology Research Institute Officers

Blair Irvine, PhD, President (founded SDRP in 1970)
Michael Scott, PhD, Secretary (since 1974)
Randall Wells, PhD, Treasurer (since 1970)

Doctoral Students

Amanda Ardente, University of Florida
Kristina Cammen, Duke University (grad. 2014)
Rachel Cassoff, Duke University
Goldie Phillips, Duke University
James Powell, Portland State University
Sam Rossman, Michigan State University (grad. 2014)
Steve Shippee, University of Central Florida (grad. 2014)
Kate Sprogis, Murdoch University (Australia)
Christina Toms, University of Central Florida
Krystan Wilkinson, University of Florida

Master's Students

Krystan Wilkinson, University of Florida (graduated 2014)

Allison Honaker at the helm of the R/V Nai'a.

Intern, Natalie Mastick, and local volunteer, Norma Pennington, hard at work during a dolphin survey.

Interns and Other Visiting Trainees & Volunteers

Elodie Debons (Switzerland)
Alberto Delgado-Estrella (Mexico)
Maria del Rocio Barreto (Mexico)
Marie Duffy (Ireland)
Rebecca Hamilton (Scotland)
Christopher Hessell
Anne Honeywell (Canada)
Abhishek Jamalabad (India)
Lindsey Jones
Natalie Mastick
Mariah Vane
Lindsay Wickman

Local and Returning Volunteers

Stacy Albin
Dee Allen
Ralph Arden
Perfecto Barba
Trevor Barleycorn
Ed Blair, Jr.
René Byrskov (Denmark)
Wayne Curtis
Michael Duranko
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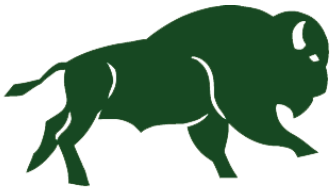

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