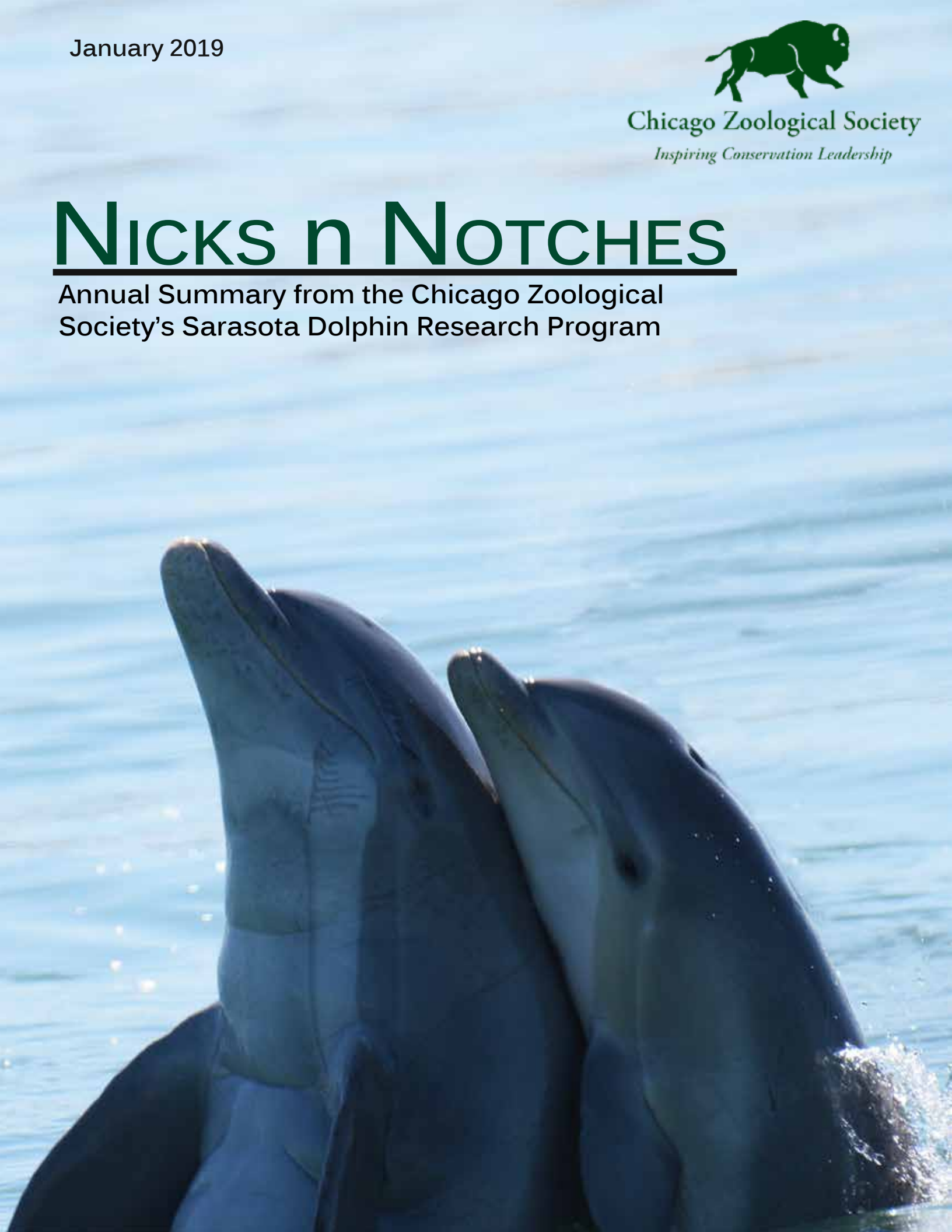
January 2019

Chicago Zoological Society

Inspiring Conservation Leadership

Nicks n Notches

Annual Summary from the Chicago Zoological Society's Sarasota Dolphin Research Program



The mission of the

Chicago Zoological Society

To inspire conservation leadership by connecting people with wildlife and nature

The sound of silence

The sensory world of Sarasota Bay's long-term resident bottlenose dolphins is largely dominated by acoustics, as they move through their murky estuarine range. On a typical day (or night), dolphins whistle to communicate, produce squawks and raspberries while they socialize, and echolocate to navigate and search their environment for prey and predators. Many of the fish they prefer to eat produce grunts and other low frequency sounds that can facilitate locating them for capture. The chorus of cumulative sounds from many fish is overlaid with the loud "bacon frying" sounds of snapping shrimp. Engine and propeller noises from boats have become more common in recent decades. This soundscape defines much of the dolphins' world.

Our colleagues at Woods Hole Oceanographic Institution, the University of St Andrews, and Loggerhead Instruments have developed new ways of listening in on the animals' acoustic environment, through small digital archival DTAGs attached to dolphin backs by suction cups for up to 24 hours, and more recently, through shore-based underwater listening stations that we are distributing around the dolphins' range. These solar-powered listening stations employ hydrophones to pick up such sounds as the dolphins themselves, boat noise, and fish. These sounds are recorded on memory cards, and processed samples are made available in real time through the cloud. The very generous citizen scientists who have allowed us to put the systems on their docks are able to listen in on the dolphins' acoustic environment.

Since the beginning of August, the local underwater soundscape has changed dramatically. With the advent of a severe red tide, fish have died by the millions, and are heard much less frequently at the listening stations. From our ongoing fish surveys, supported by the Charles and Margery Barancik Foundation, we determined that common dolphin prey species declined by 91% between June/July and September. These sudden and dramatic declines in fish abundance in Sarasota Bay are similar to the declines seen during our last severe red tide summers in 2005/2006. Prey losses then led to declines in dolphin body condition and dolphins being increasingly attracted to anglers and dying from ingestion of fishing gear. We hope this pattern does not repeat.

Long after the last rotting fish carcass is removed from the beach, the absence of fish sounds over the listening stations will serve as an ongoing reminder of the true impact of this severe red tide. After 2005/2006, it was two years before fish numbers had returned to pre-red-tide levels. Will we see the same resiliency with the current red tide? How will the local dolphins make a living during this recovery period? How soon will we begin to hear the fish choruses, snapping shrimp, and dolphin echolocation at levels indicative of a healthy ecosystem? How can we leverage the data coming from our ongoing monitoring of the ecosystem to help ensure that changes are made to reduce the pollution that fouls the ecosystem and exacerbates the red tides, in the form of nutrients from urban, lawn fertilizer and agricultural runoff, and septic tank leaching? We hope you will help us to get the word out.

Thank you for caring about the
dolphins of Sarasota Bay!

Director, Sarasota Dolphin Research Program

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

The collaborative work done toward achieving these goals is conducted under the umbrella of the "Sarasota Dolphin Research Program." This name links the efforts of several organizations and individuals that work together to insure the continuity of the long-term dolphin research in Sarasota Bay. The SDRP has been operated by the Chicago Zoological Society (CZS) since 1989. Dolphin Biology Research Institute, a Sarasota-based 501{c}3 non-profit corporation established in 1982, provides logistical support with its fleet of small research vessels, vehicles, computers, cameras, field equipment, etc. Since 1992, the program has been based at Mote Marine Laboratory, with office, lab, storage and dock space within the resident Sarasota Bay dolphins' home range. The SDRP maintains academic connections including graduate student opportunities primarily through the University of Florida, the University of California at Santa Cruz, and Duke University.

All of our dolphin research in the United States is conducted under NOAA Fisheries Service Scientific Research Permit No. 20455 and Institutional Animal Care and Use Committee approvals through the appropriate institutions.

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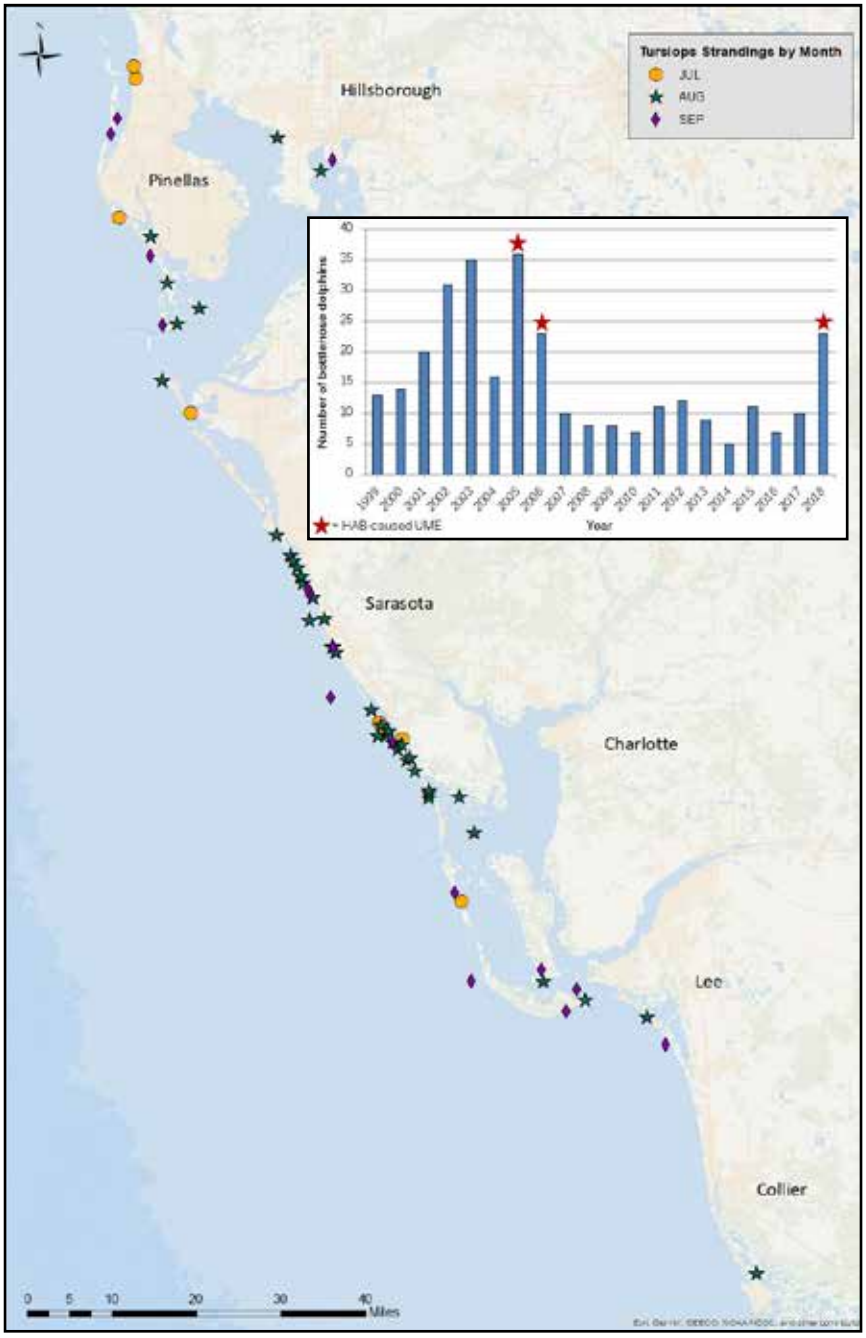
Conservation Research and Action

Marine mammal Unusual Mortality Event along Florida's west coast

Gretchen Lovewell, Mote Marine Laboratory

Since November 2017, Southwest Florida has been experiencing a severe harmful algal bloom (HAB) caused by the organism *Karenia brevis*, more commonly known as red tide. This particular organism produces powerful neurotoxins called brevetoxins. While HABs are common events in our area, when they persist for long periods of time and span a large range, they pose a risk to marine mammals. For bottlenose dolphins, these risks come in many forms. In the short-term, the dolphins can die from eating contaminated prey and inhaling the toxins. In the long-term, issues arise from lack of prey and changes in their home range. Since July, 2018, there have been elevated numbers of dolphin mortalities from as far south as Lee County and as far north as Hillsborough County. As of 11 October 2018, the number of dolphin mortalities documented was at 66. The spike in mortalities associated with the HAB led NOAA Fisheries to declare an Unusual Mortality Event (UME). Twenty-three of the dolphins were necropsied (an animal autopsy) by the Stranding Investigations Program at Mote Marine Laboratory. Two of the dolphins where well-known individuals from the Sarasota Bay population that had been handled previously as part of SDRP dolphin health assessments; FB44, a 45-year old male dolphin observed more than 600 times since 1980, and F252 or "Speck," a 12-year old male seen more than 340 times. A third, "Jetty," was seen more than 100 times since 1989 in the Gulf of Mexico near Venice, FL. Many of the dolphins recovered by our stranding partners have had high levels of brevetoxin in the tested tissues, signifying that this UME is a result of the bloom. This is not the first time there has been a bottlenose dolphin UME associated with red tide. Since 1999, there have been four UME's in the Gulf of Mexico. The last one to occur in central west Florida was from July 2005-November 2006 and claimed 190 dolphins. Following this event, 2% of the local Sarasota Bay resident dolphin population died from interactions with fishing gear. Mote's Stranding Investigations Program is leading the UME Investigative team, which includes CZS staff members Randall Wells and Elizabeth McCabe, and is working closely with NOAA Fisheries and our stranding network partners to document the effects of this current UME to better understand the long-lasting implications these HABs have on our local population and bottlenose dolphins in general.



Top Right: Map shows bottlenose dolphin strandings by month from July 2018 - September 2018. Chart inside map shows the annual number of strandings from January 1, 1999 to October 31, 2018 in Mote Marine Laboratory's stranding response region. The years with stars show when UMEs caused by Harmful Algal Blooms (HABs) were declared.

Community engagement to support dolphin conservation

Katie McHugh, Chicago Zoological Society

With support from the Disney Conservation Fund, the SDRP is maintaining our commitment to better understand and mitigate adverse human-dolphin interactions (HI) in Sarasota Bay and engage community members in conservation. We spent much of last year focused on expanding and improving our outreach activities to better engage key community stakeholders in dolphin conservation to reduce HI. These efforts primarily targeted local user groups who interact with dolphins in different ways (for example, anglers, recreational boaters, boat rental companies, ecotour operators) but whose activities can put dolphins at risk. We provided informal town-hall

style presentations and attended events tailored to each group, providing information on best practices for boating and fishing near wildlife, reducing marine debris to prevent entanglement, and reporting injured animals to facilitate effective intervention.

This year, we also began a new project focused on updating data on boat-based disturbance and evaluating responsible dolphin viewing practices within our study area using both traditional methods and new technology. As part of this effort, we conducted 58 focal follows (behavioral observation sessions) on dolphins of different ages and sexes found within a hotspot of dolphin and human activity to assess how frequently they encountered boats, how well boaters complied with viewing guidelines, and whether dolphin behavior was impacted by these interactions. Because dolphins and boats are frequently observed in this area, we also deployed one of our new listening stations to provide a continuous acoustic record of dolphin and boat sounds, enabling us to assess patterns of human and dolphin activity remotely. Our 2018 NSF Research Experiences for Undergraduates student, Victoria Diaz, conducted land-based observations at this station on weekdays and weekends to ground-truth dolphin and boat acoustic data and determine whether acoustic methods could be used to monitor anthropogenic disturbance or dolphin viewing activity at the site. Boat engine noise was present in nearly all acoustic recordings during daytime observations, with roughly twice the average number of boats present during weekend vs. weekday observations. While engine noise itself was not a good indicator of dolphin viewing activity, the presence of engine gear changes (sound of engine going in and out of gear) in recordings did correspond well with boat-based dolphin viewing at the site. We are still verifying and analyzing data from this project, and will be using the information we learn in future outreach efforts with boaters in our study area.

Top: Listening station set up along a seawall where dolphins frequently feed and boaters often stop to watch them. Bottom: Dolphin tour boat seen next to the listening station location.

Reducing bycatch by expanding a portable electronic monitoring system

Sandra Yaeger, Sarah Alessi, FlyWire Cameras

In 2018, the Sarasota Dolphin Research Program (SDRP) began a collaboration with FlyWire Cameras (www.flywirecameras.com) to test a new electronic video monitoring system (EM) that could be used in either small-scale fisheries or at shore-fishing areas where wildlife interactions are a problem. Initial tests of the system this summer appear promising and we hope to expand the work next year.

FlyWire tested the effectiveness of their novel fisheries EM camera system on the SDRP's R/V Flip during their summer fish monitoring surveys and at five different fixed shore-based stations around Sarasota Bay in June and July 2018. On R/V Flip, we tested whether using two camera views were sufficient to capture the vessel and fish catch data typically required by management stakeholders in traditional EM installations. The shore-based EM stations recorded interactions between dolphins, recreational fishers, and vessels to characterize the benefits of using EM video data to augment ongoing visual and acoustic monitoring efforts by SDRP. The FlyWire team expects to complete analyses of the video data by the end of 2018.

Overall, this project aims to aid cetacean conservation efforts to mitigate bycatch in commercial and recreational fisheries by expanding the use of innovative technology to better detect human-dolphin interactions when human

Top: Single camera view from a small-scale electronic monitoring system deployed by FlyWire Cameras on R/V Flip during fish monitoring surveys in Sarasota Bay. Bottom: Shore-based electronic video monitoring system.

observers cannot be present. This project is funded by a National Fish and Wildlife Foundation Electronic Monitoring and Reporting Grant (NFWF EMR), which aims to integrate technology into fisheries data collection and observations for use in fisheries management, as well as increase the effectiveness of cetacean bycatch mitigation activities by using more inclusive data sets to rapidly and economically identify critical bycatch interactions with minimal disruption to industry. We hope to expand upon this work in summer 2019 to include a wearable camera system on R/V Flip, dependent upon future funding. This research was authorized by the Florida Fish and Wildlife Conservation Commission (16-0809-SR, Special Activity License) and by Mote Marine Laboratory's Institutional Animal Care and Use Committee (17-10-RW2).

Help the SDRP reduce marine debris!

Katie McHugh, Chicago Zoological Society

Over the past two years, the Sarasota Dolphin Research Program Debris Team has collected and removed nearly 18,500 debris items from our coast and waterways. We use a simple mobile app called Marine Debris Tracker (available for Apple or Android phones) to log any trash or discarded fishing gear we pick up and later are able to download our data to look at geographic hotspots and most common debris items from the app creator's website: http://www.marinedebris.engr.uga.edu/. Many items could potentially entangle or get ingested by coastal wildlife such as seabirds, sea turtles, and marine mammals, so it is important for all of us to prevent unwanted trash from entering the environment by reducing our use and disposing or recycling of it properly, in addition to removing debris from places where it endangers animals and pollutes waterways. While many groups engage in coastal clean-ups, we wanted to try to increase efforts to remove water-borne trash as soon as possible.

Our SDRP Debris Team includes staff members, volunteers, interns, students, and other concerned citizens in the Sarasota area and beyond (we even used the system in the Gulf of California, Mexico). If you'd like to join, just download the app and log any trash you pick up using the SDRP team list, and we will be able to track the difference we are all making together! So far, our student partners from Mote's High School Alumni Program have done the bulk of debris collection as part of our team during their organized cleanup events on City Island near Mote and while conducting pier and bridge surveys at debris/wildlife hotspots under the mentorship of Kim Bassos-Hull. We've also picked up more than 1,000 items from Sarasota Bay during our dolphin population monitoring and other boat-based fieldwork. Of the many items we've cleaned from our environment, some of the things most likely to injure wildlife by entanglement or ingestion have included: 1,776 fishing lures or lines, 106 rope or net pieces, 93 balloons, 742 plastic bags, 364 straws, 1,896 food wrappers, 830 plastic bottle caps, and 3,051 plastic/foam fragments. That's a lot of dangerous trash! If you'd like to help promote the team and expand our impact, please let us know and we will send you some of our recruitment cards to share with others.

Above: Recruitment card for Marine Debris Team. Left: Screenshots of Marine Debris Tracker app.

Behavioral response of sea turtles to acoustic deterrent devices

Reny Tyson Moore, Chicago Zoological Society

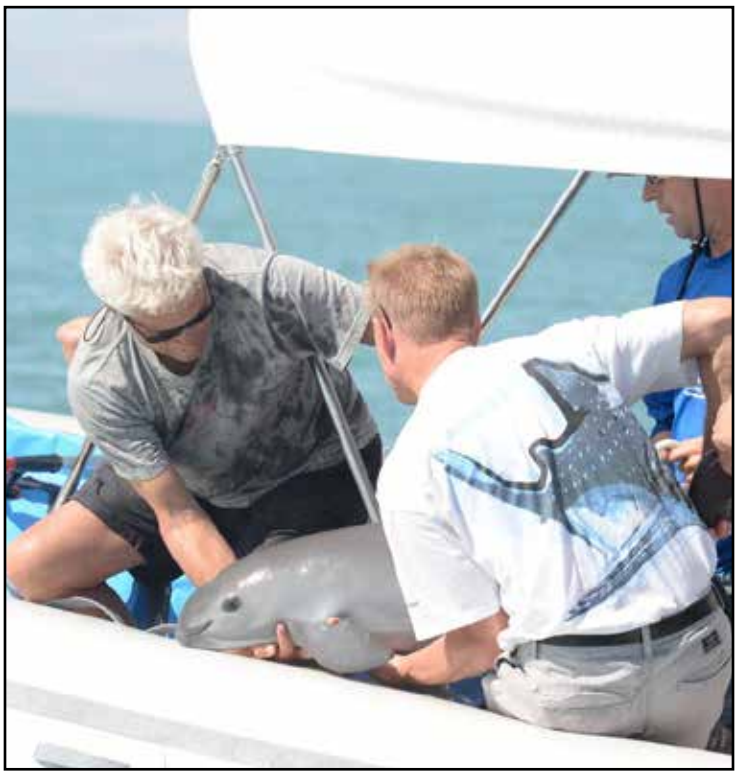
Sea turtles are killed or injured in dredging and marine construction operations around the world. For the past 3 years, I have been working with an international team of collaborators from institutions including Gettysburg College (USA), Duke University (USA), Van Oord (Netherlands), MarBrasil (Brazil), Karumbe (Uruguay), PRICTMA (Argentina), LEC-UFPR (Brazil), and TAMAR (Brazil) to investigate potential technological solutions for minimizing sea turtle interactions with hopper dredging and marine construction projects. Our main goal has been to test the effectiveness of the FaunaGuard, an acoustic deterrent device (ADD) developed by Van Oord and SEAMARCO, Netherlands, in deterring sea turtles from potentially harmful areas. The FaunaGuard is designed to play alarm-like signals within the sea turtle's hearing range in the hope that these sounds may encourage the turtles to leave a dredging or construction site. This year we completed our second field test of the FaunaGuard in the Paranagua Estuary Complex, Brazil, whereby we examined the behavior of turtles before, during, and after being exposed to the FaunaGuard with specially designed acoustic and movement tags (Loggerhead Instruments, Inc.). These tags are similar to the DTAGs we use to study the behavior and acoustics of dolphins in Sarasota Bay, but are specially designed to attach to a sea turtle's shell. During this field season we tagged eight juvenile green sea turtles and exposed them to the FaunaGuard. While I did not get to participate in the field research due to maternity leave, I had the pleasure of analyzing all of the great data collected during the trip. These analyses revealed that the FaunaGuard signals, while louder than during our 2016 field tests, were still too quiet within the sea turtle's range of best hearing to elicit a behavioral response. Therefore the FaunaGuard team will work in the next year to make the necessary modifications to the device for future testing. This groundbreaking research, funded by Van Oord, is very exciting because it is the first assessment of wild sea turtles' behavioral responses to man-made sound.

Vaquita conservation effort update

Randall Wells, Chicago Zoological Society

In October-November 2017, CZS staff participated in an attempt to prevent the extinction of the world's most endangered marine mammal, the vaquita, a tiny porpoise found only in the Upper Gulf of California, off San Felipe, Mexico. The first scientific account of the species was published by my major professor, Ken Norris, in 1958. Sixty years later, following a long decline from entanglement in legal gillnet fisheries, the vaquita population fell to fewer than 30 individuals, due to entanglement in an illegal gillnet fishery that supplies swim bladders of the endangered totoaba fish to Chinese black markets. An emergency ban on gillnets and increased law enforcement failed to slow the decline, triggering an emergency effort to try to catch vaquitas and place them in human care until such time as their natural habitat was free of threats from gillnets. The rescue effort involved 90 experts from nine countries, U.S. Navy dolphins, and cost US$5 million, provided largely by the Mexican government and members of the Association of Zoos and Aquariums. Prior to the beginning of these high-risk field efforts it was not known: 1) if we would be able to find any of the few remaining individuals in this large, open body of water, to try to catch them, 2) if we found them, would we be able to catch them in the deep, murky waters of the Upper Gulf, 3) if we caught them, would they be able to survive transport to the facilities that were built specifically to hold them, or 4) if they would be able to adapt and be maintained in a facility until such time as the Upper Gulf was safe for their return. We succeeded in all that was within our power - we found them on most days in the field. Two animals were caught using light gillnets, and both were transported to our facilities. However, the juvenile female was released four hours after capture and the adult female died of capture myopathy. We suspended the program because of the risk of additional captures to the population.

September 26, 2018 photograph of distinctive presumed mother vaquita (right) seen also in 2017, and her 2018 calf. Photo by Oscar Ortiz, Museo de la Ballena y Ciencias del Mar.



Danish harbor porpoise capture and tagging experts remove the first vaquita captured from the net, a young female. Photo courtesy of SEMARNAT/VaquitaCPR.

Cell cultures were started by San Diego Zoo Institute for Conservation Research from samples from both of the porpoises, for cryobanking and research toward understanding what genes are uniquely adaptive for the vaquita. However, no samples are available from male vaquitas so information about the Y-chromosome is lacking, making it impossible to produce stem cells capable of producing spermatozoa.

The lack of male genetic material led to the deployment of a team of Mexican and NOAA scientists to the Upper Gulf in September 2018 to attempt to obtain this through biopsy dart sampling. The team members were able to approach vaquitas on several occasions, but were unable to obtain any genetic samples. However, they obtained photographs of the dorsal fin of a distinctive adult animal from our 2017 photographic identification catalog, believed to be the mother of the first vaquita caught, associated with a different, smaller porpoise in 2018. If the two smaller porpoises observed with this adult in 2017 and 2018 are indeed serial calves of the same mother, then these photographs suggest that vaquitas produce a calf every year, rather than every two years, as reported in the literature. This effectively doubles the potential population growth rate and is good news for recovery, if increased law enforcement and net removal operations can clear nets from the vaquita habitat.

Pablo Bordino, Disney Conservation Hero Award

Randall Wells, Chicago Zoological Society

I'm very sad to report the unexpected death of a dear friend and colleague, and a conservation hero, Dr. Pablo Bordino, one of the world's foremost advocates for Franciscana conservation, on 18 June 2018.

Pablo began his research on these tiny dolphins in Argentina in 1992. Franciscanas are among the world's smallest and most endangered dolphins. They live in a very narrow strip of coastal waters off Argentina, Brazil and Uruguay. The primary issues facing the franciscanas are death from entanglement in fishing nets, habitat degradation and fragmentation, pollution and overfishing. Recognizing the need for expanding his conservation efforts, Pablo established Fundación AquaMarina in 1998 and served as Executive Director and mentor-in-chief for the many students and volunteers who helped with his franciscana research and education program as well as those who worked with other species. The overall goals of the program were to investigate ways to reduce human-dolphin conflicts, to promote the creation of management areas and to promote public participation in these activities.

Emphases included reducing dolphin bycatch through gear and approach modifications, studying ecology, behavior, health and genetics through examination of carcasses recovered from incidental entanglement and a public education campaign geared toward Argentine fishermen and habitat/wildlife managers at the local, provincial, and national levels. Additionally, Pablo worked to evaluate and enforce better protective laws for franciscanas in Argentina.

The SDRP worked with Pablo to successfully capture, tag and release franciscanas — for the first time — in 2005. With this and our subsequent work with satellite-linked telemetry, we obtained critical information for management. The team found that the animals have small ranges, indicating that the established designation of a single management unit ranging over the entire Argentine coastline was incorrect, with important implications for conservation. The local artisanal fishermen were catching their "neighbors" rather than individuals from a larger pool of dolphins passing through the area. Tracking results showed unrelated males and females remained together or re-associated extensively over months, suggesting a mating system unique among small cetaceans. Genetic analyses found joint entanglement of mother-calf or reproductive pairs, rather than random individuals, which might exacerbate the demographic consequences of bycatch. Significant components of genetic diversity could be lost together, suggesting that by-catch could be more detrimental than previously considered.

Pablo applied his experience to leverage franciscana conservation internationally. For example, in response to a request by a Brazilian colleague for ranging information on franciscanas at a potential major harbor construction site, Pablo provided opportunities in Argentina for Brazilian researchers to learn capture/tagging techniques, assisted

Pablo Bordino, a conservation hero by anyone's measure.

by the SDRP. He then brought his AquaMarina team to Babitonga Bay, Brazil in 2011 and 2013, joining the Brazilians, and with assistance from the SDRP, tagged dolphins. The tags showed the Brazilian franciscanas had even smaller ranges than those in Argentina and they would have been heavily impacted by the harbor development.

During one of our tagging sessions, Pablo's team included two fishermen new to the project, one of whom had been a vocal opponent of the work just a year earlier. His initial objections came from the misperception that Pablo's goal was to eliminate fishing in the area. Pablo invited the fisherman to work with the group so he could disagree from a point of knowledge rather than misunderstanding. That fisherman became an ardent supporter. At the dinner celebration following that tagging session, another fisherman who was new to the project offered a toast to thank Pablo "for helping me learn to appreciate something I did not know to appreciate before." Pablo used this relationship-building approach extensively along the coast to establish bottom-up conservation programs.

Although earning a living as a conservationist in Argentina was very challenging, Pablo was committed to living and working there, to make a difference in his country. His accomplishments were acknowledged when he received a Whitley Award, also known as the "green Oscars," in 2001 and a continuation award in 2002 ("Whitley Awards recognize conservation leaders from around the world who are applying sustained effort to conserve the natural environment"). In September 2018, Pablo received the Disney Conservation Hero Award in recognition of his many contributions to conservation. Among his greatest accomplishments are his many dedicated students and volunteers, who will carry his conservation efforts forward. To this end, Disney Conservation Fund awarded support for a proposal submitted by Pablo and me earlier in 2018 for new franciscana tagging

research in an open coastal area impacted by artisanal fishermen. We will work with members of Pablo's team to complete this work, and we will join forces with Mexican and U.S. researchers and veterinarians who worked on the VaquitaCPR project, and will use nets designed for that project.

Many colleagues from around the world have mentioned how the world is a little worse off today without Pablo – we recognize that he made it a better place while he was here. We and colleagues from around the world miss him terribly, and our thoughts go out to his three sons, his mother and his team members.

Right: The Disney Conservation Fund recognized Pablo Bordino as a Disney Conservation Hero "for unequalled dedication to conservation and enthusiasm to ensure that the wildlife and wild places around the world remain forever."

Potential for collaboration between SDRP and the Ionian Dolphin Project (Greece)

Joan Gonzalvo, Ionian Dolphin Project (Director), Tethys Research Institute, Italy

Collaboration between the Ionian Dolphin Project (IDP) and SDRP is being developed with the aim of setting up comparative studies to improve our knowledge on coastal dolphin species. The IDP has two study areas, which are remarkably diverse in terms of environmental features and threats caused by human activities: The Inner Ionian Sea Archipelago and the Gulf of Ambracia. The latter hosts one of the highest dolphin densities reported for the Mediterranean, offering an ideal "natural laboratory." The extensive research effort conducted for almost 50 years with Sarasota Bay dolphins provides a unique baseline for comparison. Both, Sarasota and Ambracia have exclusively bottlenose dolphins in their semi-enclosed waters, facing significant anthropogenic threats of different kinds, and significant survey and photo-identification effort has been done (and on-going), following basically the same methodologies, in order to monitor their respective dolphin populations. In addition, in open Ionian Sea waters the IDP deals with common dolphins, bottlenose dolphins, monk seals and occasionally striped dolphins. Common dolphins, formerly resident in the Inner Ionian Sea Archipelago, declined dramatically during the past two decades due to the overexploitation of local fish stocks. Although a few animals are still present, they likely roam across a much wider area, occasionally moving into their former wonderland.

Preliminary discussions held during my 2-weeks stay at SDRP in winter 2017, and a visit by Randall Wells to our project in Greece during summer 2018, made clear that the possibilities for a fruitful collaboration between our programs are many. Some of our ideas for future collaboration include: adaptation of the current photo-identification IDP dataset to the modified FinBase used by SDRP; training of IDP personnel in Sarasota on remote biopsy sampling techniques to safely sample Ionian dolphin populations to conduct not only genetics, age, and toxicological analysis but also to study their stress levels, by looking at different indicators historically studied at SDRP during their dolphin health assessment projects (for example, cortisol and reproductive hormones); and applying remote dolphin satellite-linked tagging techniques developed by SDRP to shed light on dolphin movements across the Ionian Sea and better define their home range in order to define the most adequate conservation measure for the protection of these increasingly fragile species. In addition, this synergy between our two well-established programs will also provide opportunities for exchanging personnel to provide opportunities to those researchers willing to develop their own research, to increase our knowledge on these charismatic marine mammal species and their conservation needs.

Top: Bottlenose dolphins in the Gulf of Ambracia. Bottom: Endangered Mediterranean monk seal seen during SDRP site visit in August 2018.

Behavior, Social Structure, and Communication

Dolphin communication studies

Laela Sayigh, Woods Hole Oceanographic Institution; and Vincent Janik, Julie Oswald and Brittany Jones, University of St Andrews

This year we continued to collect recordings for our long-term catalog of signature whistles of Sarasota dolphins. The catalog now contains 908 recording sessions of 288 individual dolphins, each recorded an average of 3 (and up to 18) times. We decided to mine this amazing resource for two undergraduate research projects at WHOI this past summer. One matched whistles from the catalog to whistles recorded from follows of free-swimming dolphins, in order to continue our study of stereotyped non-signature whistles. For this work, we assigned signature whistles to all of the animals identified in the followed groups, and then looked at those left unassigned, in order to begin exploring this poorly understood aspect of dolphin communication. The second project built on a study carried out more than two decades ago, in which we compared whistles of 42 calves to those of their mothers, to look for evidence of vocal learning. In that study we found that males were more likely than females to produce whistles highly similar to those of their mother, and females were more likely to produce whistles highly dissimilar from those of their mothers. We now have a sample size of 159 mother-calf pairs, and spectrograms of these whistles are currently being assessed for similarity. When viewing the mother-calf whistles that were compiled for this study, we were struck by strong similarities among some siblings, so we are also assessing all sibling pairs for similarity as well.

Julie Oswald from the University of St Andrews concentrated on species recognition and we described the setup of this study in last year's Nicks'n'Notches. While animals were being held by the SDRP team, we played sequences of whistles of unknown bottlenose dolphins and spotted dolphins to them to see whether they showed a reaction when the whistling species changed, indicating that they could tell the two species apart just by listening to them. In collaboration with Andreas Fahlmann (Oceanografic de Valencia), Julie van der Hoop (Aarhus University) and Craig Harms (North Carolina State University), we measured dolphin heart rate during these playbacks. However, these measurements showed no change when the playback species changed. This was surprising, since Julie Oswald found changes in swimming speed when we played the same whistles to free-swimming bottlenose dolphins under human care at the Zoo Duisburg in Germany. This shows that they do notice the difference when another species is calling. We think that while hearing unknown dolphins in the distance is very common for an animal in the wild, dolphins in an aquarium rarely hear unknown animals, making this a more unusual situation for them. We will continue to measure reactions to whistles of other species in aquaria and in the wild to understand under what circumstances dolphins react to them.

Brittany Jones added studies to her PhD work on how dolphins adjust their whistles when interacting with others. In an earlier study Stephanie Watwood, Peter Tyack and Randall Wells reported that the overall frequency modulation patterns (or melodies) of signature whistles of males in an alliance in Sarasota are more similar to each other than to those of other males. Brittany looked at how this comes about by looking at our whistle catalogue over the years for any changes that might occur when males enter into a new alliance. Interestingly, she found that males don't show any changes when entering alliances, but that they seem to choose partners with signature whistles that are already similar to their own. But Brittany did find changes when males engaged in counter-calling. In those exchanges, males made subtle parameters of their whistles even more similar to those of their alliance partner, a phenomenon called communication accommodation, which is also known from human language studies. In humans, such accommodation strengthens the social bond between partners and it appears to be a mechanism that dolphins use as well. We are very happy to report that Brittany has now submitted her PhD thesis to the University of St Andrews for final examination.

Drone footage of dolphins during a playback experiment.

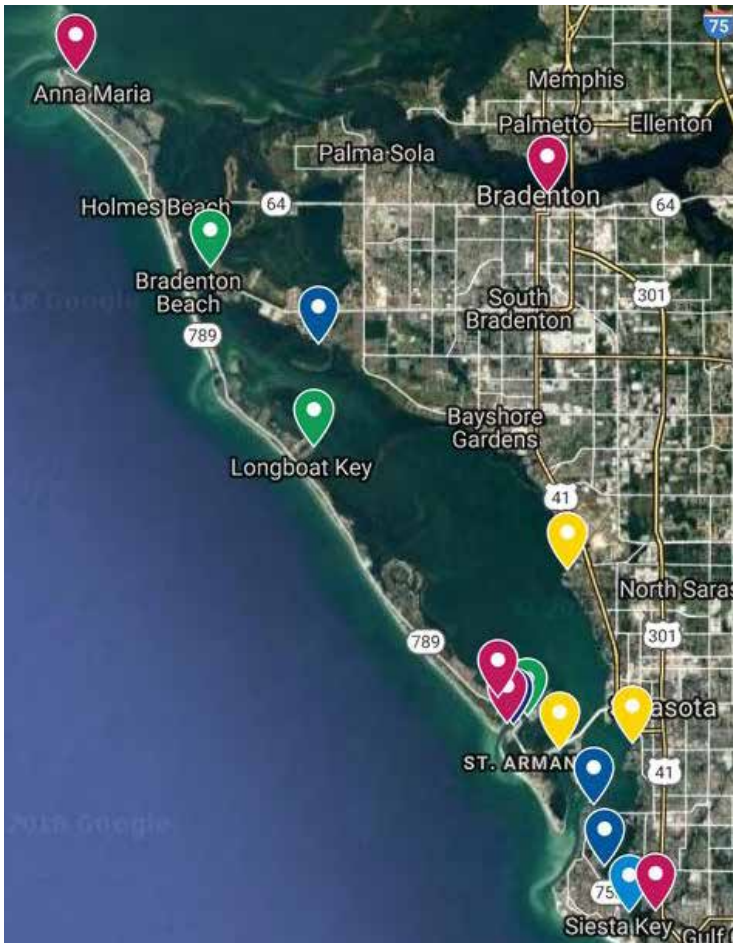
Using a drone for playback experiments with wild dolphins

Marco Casoli, Peter Tyack, and Vincent Janik, University of St Andrews; Michael Moore and Laela Sayigh, Woods Hole Oceanographic Institution; Frants Jensen, Aarhus University; and Katie McHugh, Chicago Zoological Society

Playback experiments are a powerful tool for studying the function of animal sounds, and represent an important research approach for species that communicate mainly with acoustic signals. Dolphins are certainly among those species, but assessing their responses to playbacks in the wild is difficult because of their aquatic lifestyle. We can only observe them for short periods when they come to the surface, and when underwater it is almost impossible to

precisely monitor by eye what they do and how they move. In May 2017, we started to use a drone (or UAV, unmanned aerial vehicle) to film the responses of dolphins to playbacks of conspecific sounds. As we expected, drone videos proved to be very useful for short, detailed behavioral observations, and were able to capture subtle details of responses such as head turns, changes in swimming direction, fluke and breathing rates that could not be assessed visually from a boat.

Our goal for the 2017 field season was to establish robust responses to playback stimuli, such that we could then study the impact of introduced noise on these responses. Experiments involved two types of sound played to each subject: the signature whistle of a familiar dolphin from the Sarasota population, and the signature whistle of an unfamiliar dolphin from a different population (see previous article from Sayigh and colleagues about signature whistles). We predicted that dolphins would approach familiar stimuli and avoid unfamiliar ones. We carried out 14 paired and 7 unpaired trials. Experiments varied greatly with respect to visibility of the subjects, which was affected by turbidity, glare, and percentage of time animals were in view of the drone camera (we used these data to improve visibility for playbacks in 2018). While we did see some obvious avoidance responses, some followed familiar as well as unfamiliar stimuli. Overall, there was enough variability in responses to conclude that a larger sample size is needed, in order to account for factors such as group composition, size, activity, and whether or not subjects had recently been involved in health assessments. In addition, further study is needed of suitable source levels for playback stimuli, as well as the context in which stimuli were recorded (for example, during health assessments or not). We hope to obtain funding to continue this work, so that we can achieve our goal of studying how noise affects dolphin communication.



Map of current and proposed listening stations throughout Sarasota Bay.

In the 2018 field season, we designed a new playback protocol to study the function of signature whistle copies. Bottlenose dolphins present remarkable skills at vocal imitation of sounds of conspecifics, an ability that is fundamental for the language of our own species, but rare among other mammals. Studies have shown that dolphins sometimes imitate the signature whistle of others, typically of close partners, and it has been suggested that they do so in order to label the signature whistle's owner. We aimed to test this hypothesis by comparing responses of dolphins to playbacks of a copy of their own signature whistle, and playbacks of the signature whistle of the animal that produced the copy. We were able to perform experiments with nine different subjects, and we are currently analyzing these data. Testing the function of signature whistle copies in the wild ideally requires detailed knowledge of the signature whistles of individuals and of the social relationships within the study population, and the long-term research program in Sarasota Bay provides a unique opportunity for this work.

We plan to continue our playbacks in the next field season, and are excited to keep exploring the potential of drones for this type of research. Other applications of drone footage aside from playbacks would also be possible, such as detailed observations of natural behaviour during foraging events or social interactions.

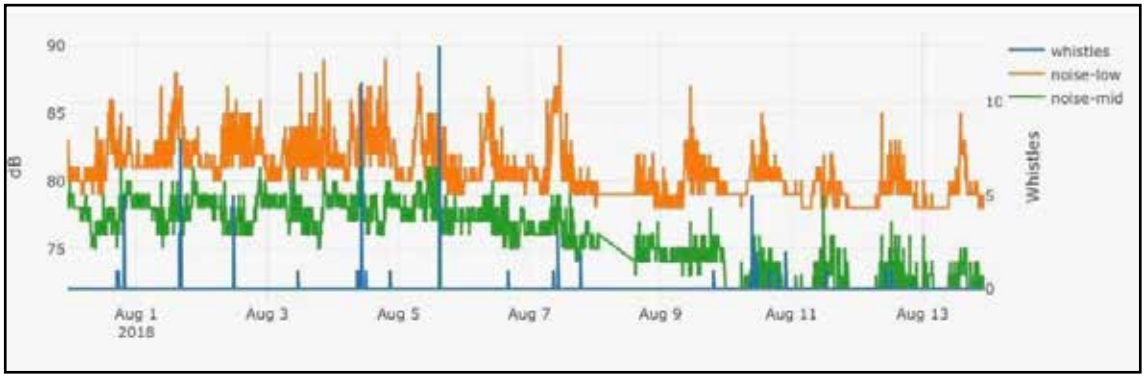
Sarasota Bay Listening Network

David Mann, Loggerhead Instruments; Katie McHugh and Randall Wells, Chicago Zoological Society; Athena Rycyk, New College of Florida, Kim Bassos-Hull, Mote Marine Laboratory

Dolphins produce a wide variety of sounds including echolocation clicks to find prey, and whistles to communicate. By eavesdropping on these sounds we are able to study dolphins at times when visual observations are difficult and learn how dolphins may be influenced by boat noise, noise-making prey fish, and severe environmental events, like red tide or hurricanes.

Chicago Zoological Society, Mote Marine Laboratory, New College of Florida, and Loggerhead Instruments are collaborating to expand a unique listening network in Sarasota Bay. Each solar-powered listening station records sounds to flash memory cards that are retrieved three times per year and added to our historical dataset that is a resource for scientists throughout the world. They also remotely report summary sound levels and dolphin whistle counts every five minutes.

This past year the Sarasota Bay Listening Network recorded dramatic changes in the soundscape when red tide entered the Bay. Within two days there was a sharp decrease in biological sound as reflected by the falling sound levels. This suggests that the preferred prey of dolphins, sound-producing fish, has also declined. The listening network continues to monitor the soundscape and as red tide moves out of the Bay we anxiously await the recovery of sound-producing fish. By the end of 2018 we expect to have six stations up and running, and hope to more than double that in 2019 as we expand our geographic coverage around the bay.



The listening stations provide unique real-time monitoring of the acoustic environment. Red tide caused a large drop in sound level between August 7th and August 9th at Longboat Key.The upper line is low frequency noise, middle is mid-frequency noise, and spikes from the bottom are dolphin whistles.

A device for attaching satellite-linked tags to bow-riding dolphins – the TADpole

Michael Moore, Woods Hole Oceanographic Institution, and Randall Wells, Chicago Zoological Society

Satellite-linked tags can provide incredible data on dolphin ranging and dive patterns, allowing researchers to learn about the behavior of animals that may live well beyond the logistical limits of researcher access. The SDRP has been involved in developing and testing small electronic tags for dolphins for decades, leading to a current small finmount tag design by Wildlife Computers that is attached by a single pin to the trailing edge of a dolphin dorsal fin. Field tests have shown this tag to be safe for the animals and to remain attached to the fin for many months, approximating the tag's battery life. Typically, we attach tags to dolphins when we are able to handle them, during capture-release operations, or in association with interventions such as rescues or release following rehabilitation. However, there is a strong need to be able to attach tags to free-swimming dolphins under circumstances where capture is not possible or logistically feasible, for example in deep water, and/or with species that do not respond well to capture and handling. Currently, the only available remote application system involves a tag that is delivered as a projectile and implants in the animal by means of two darts.

We wanted to develop a less-invasive tool that takes advantage of our tried and true tag and attachment designs. With the support of Dolphin Quest, we have worked with Woods Hole Oceanographic Institution engineers to develop a tag attachment device mounted on a pole for securing a standard finmount tag to the trailing edge of the dorsal fin of a bow-riding dolphin, a system known affectionately as the TADpole. The device is operated pneumatically, and as it cores the fin and attaches a tag, it collects the resulting dorsal fin core as a tissue sample for genetic analyses. The prototype has been tested extensively with cadavers with good success. Several attempts to test it in the field so far this year have been thwarted by poor weather, red tide, and/or a lack of bow-riding dolphins. Additional field tests are planned for November 2018.

Michael Moore preparing the TADpole in Sarasota Bay.

Health and Physiology

Health assessment project summary: 2018

Randall Wells, Chicago Zoological Society

We participated in five bottlenose dolphin capture-release health assessment projects in 2018, two on Florida's Gulf coast, one on Florida's east coast, one in Louisiana, and one in Alabama.

During 11-15 June, the Chicago Zoological Society's Sarasota Dolphin Research Program successfully led and completed a dolphin health assessment project involving the long-term resident dolphins of Sarasota Bay. Such capture-release health "check-ups" are a key part of the data collection conducted through our program. This year, a new component involved testing and refining cardiac assessment techniques (see pg. 15) and developing baseline information that would be applied in comparative dolphin health assessments in July, involving a dolphin population heavily impacted by the Deepwater Horizon oil spill. The work was funded in large part by the Gulf of Mexico Research Initiative through the Consortium for Advanced Research on Marine Mammal Health Assessments (CARMMHA) project, led by the National Marine Mammal Foundation. Over the course of the week, we had 123 participants, with about 95 people on the water each day, including 30 veterinarians and techs, along with biologists, and dolphin handlers from around the world. Our team included many members of stranding networks from around the SE United States who, along with local volunteer participants, work with us on dolphin rescues throughout the year – this project provided a great opportunity to develop collaborations and rescue team coordination. The team represented more than 20 institutions from the U.S. and other countries working for universities, research institutions, aquariums and federal agencies. Ultimately, we collected samples from 20 dolphins (10F:10M), ranging in age from 2 to 48 years, including 6 sampled for the first time. More than 40 research projects benefited from each animal sampled.

During 10-20 July, Randall Wells, Jason Allen, and Aaron Barleycorn participated in a CARMMHA dolphin health assessment project in Barataria Bay, Louisiana, as a follow-up to the Deepwater Horizon oil spill. The data are being used for comparisons with dolphins in the reference population in Sarasota Bay sampled in June to evaluate long-term impacts and recovery of the dolphins in heavily oiled bays and coastal waters. This year, the new cardiac assessment techniques that were tested in Sarasota were implemented to expand health evaluations. The Barataria Bay project sampled 34 different individuals (13F:21M) over ten days in the field. While health comparison conclusions await return of sample analysis results and subsequent interpretation, initial impressions were that the dolphins of Barataria Bay continue to exhibit poorer health than those in Sarasota Bay. We attached satellite-linked tags to 19 of these dolphins, and so far they are continuing to exhibit strong residency to Barataria Bay and vicinity.

SDRP Postdoctoral Scientist Krystan Wilkinson records health data during our Sarasota Bay health assessment project.

During 20-28 September, Jason Allen and Aaron Barleycorn assisted the National Marine Mammal Foundation with a third 2018 CARMMHA health assessment and tagging project, this time off Dauphin Island, Alabama. The project was shortened by a few days due to hurricanes, but the team was able to deploy 18 satellite-linked tags on dolphins in coastal waters around the barrier islands. To date, the dolphins have remained in these waters.

During 27-29 August, Aaron Barleycorn participated in the Georgia Aquarium's Health and Environmental Risk Assessment (HERA) near Marineland, Florida. This was the first time a HERA has been performed on dolphins in the Matanzas River system. The entire project lasted 8 days, and 18 dolphins were processed. This project contributes

F228, a long-term male resident, and participants during the Sarasota Bay capture-release health assessment in June.

to 15 years of HERA projects conducted along the inshore waters of the east coast of Florida that are helping us understand the health of dolphins in this highly urbanized area.

During 9-13 April, with the support of Dolphin Quest and Disney, we attempted to conduct a dolphin health assessment project offshore of Sarasota Bay. We wanted to: 1) determine if we have the capability to hoop-net dolphins from our own small vessel for health assessment and tagging purposes, a capability that would greatly reduce costs and increase efficiency for work over the West Florida Shelf and elsewhere, 2) begin to learn about, and develop baseline data for, health, ranging patterns, and dive patterns of bottlenose and/or Atlantic spotted dolphins over the West Florida Shelf through tagging with time-depth recording satellite-linked tags, and 3) begin to relate lung health to dive patterns through comparison of tracking, pneumotach, and ultrasound data. Unfortunately, high winds, rough seas, and poor dolphin bow-riding behavior precluded capturing or tagging any dolphins during this session. One dolphin was in our hoop-net briefly but escaped before it could be retrieved.

Development of cardiac assessment techniques for dolphins

Forrest Gomez, National Marine Mammal Foundation, Sharon Huston, San Diego Veterinary Cardiology, and Craig Harms, North Carolina State University

While studies conducted to date in the wake of the Deepwater Horizon (DWH) oil spill represent a significant step forward in our understanding of oil-associated toxic endpoints in dolphins, many questions still remain unanswered. Toxic impacts on heart function have been documented in fish and birds but until recently, there has not been a strong indication for cardiotoxicity in cetaceans. In 2016 however, 10 of 37 dolphins (27%) living in Barataria Bay, Louisiana, an area affected greatly by DWH, were diagnosed with heart murmurs. Aside from the detection of the murmur, little could be determined about cardiac health of the dolphins due to the lack of cardiac diagnostic techniques in existing field protocols. Through the CARMMHA project we are trying to fully evaluate the cardiac health of dolphins to determine if exposure to DWH oil-associated chemicals led to a sublethal cardiac injury.

Initial cardiac technique development was performed in San Diego, CA with the Navy Marine Mammal Program's population of bottlenose dolphins. These animals have known health histories, making them an excellent group to refine previously developed diagnostic techniques for cardiac evaluation and test them for field use. Technique development was accomplished by a team of specialized marine mammal veterinarians and scientists, working alongside board certified veterinary cardiologists. During the 2018 Sarasota Dolphin Health Assessment Project, cardiologists Sharon Huston and Adonia Hsu joined the health assessment team in the field with a goal of completing cardiac evaluations which consisted of four steps: 1) Auscultation (listening to the heart with a stethoscope), 2) Cardiac echocardiogram (ultrasound of the heart), 3) Electrocardiogram (examining the heart rate and rhythm), and 4) Blood-based cardiac biomarkers (evidence of heart disease in the blood).

Using efficient and comprehensive methods, heart health data were collected on all dolphins studied. The team documented heart sounds in an innovative way, allowing a new understanding of dolphin murmurs. Next came the echocardiograms, which--using only sound waves--allowed a completely non-invasive "look" inside the chest and heart of the dolphins. The team of cardiologists worked together: one in the water at the dolphin's side and one on deck collecting the images. Complete collections of numerous cine loops (live movies of multiple beats of the heart) were recorded quickly and digitally for later analysis. Four cardiac chambers, four valves, and Doppler data of blood moving through the heart were all studied. The cardiology team also consisted of Dr. Craig Harms and his ECG unit. ECG data were incorporated for better overall understanding of heart health and real time patient status.

With this type of analysis, we can begin to learn what is normal for healthy dolphins and diagnose cardiac disease when it occurs. These techniques were subsequently brought to Barataria Bay in July 2018 so we could further study the dolphins affected by DWH. We are thankful to the Sarasota team and the animals they study, for supporting this important work and providing a healthy wild dolphin control population to use for comparison as we try to continue to understand the lasting impacts of oil on cetaceans. We will provide updates as the data are analyzed and any conclusions are made!

Simultaneous in-water echocardiography and ECG. Cardiologist Adonia Hsu is in water performing echocardiogram while cardiologist Sharon Huston is on deck capturing the data. Meanwhile, ECG is collected continuously and monitored by Craig Harms (see his article on next page). Bluetooth connection allows the ECG to be monitored and recorded on a laptop at some distance from the dolphin without a wire connection.

Dolphin heart monitoring through electrocardiography

Craig Harms, North Carolina State University

Out on the water for health assessments, investigators are often defined by features of their equipment, because it is not always obvious what scientific purpose the many varied devices serve. This past year my identity was beeps and suction cups. In previous years I was beeps and stickies, but thanks to Andreas Fahlman molding suction cups around my passive sensory electrodes, I can now monitor and record electrocardiograms (ECG or EKG - examining heart rate and rhythm) in the water as well as when the dolphin is brought on deck for more thorough evaluation. The audible beeps generated with each heartbeat provide an extra layer of reassurance that the dolphin is doing well through its examination procedures. The very best monitor of a dolphin's condition is the experienced eye of a lead veterinarian like Dr. Sweeney or Dr. Townsend, but technology can provide a useful supplement, and in addition, can provide a record for further evaluation and documentation. Although the ECG is employed largely for real-time monitoring of the dolphin's status during the exam, it is also an integral part of assessing their cardiac health. The two main features that are evaluated are heart rate and rhythm. Heart rate should be neither too fast nor too slow (about 50 to 110 per minute is normal for free-ranging dolphins in this situation), and in general, rhythm should be regular and predictable. There is, however, one arrhythmia, or irregular rhythm, that we like and expect to see with dolphins. That is the respiratory sinus arrhythmia (RSA). In the RSA, the heart rate increases just prior to and for a short period after each breath, in order to distribute that fresh new supply of oxygen to all tissues, and then gradually slows down until the next breath. All air-breathing vertebrates can exhibit RSA to some extent, but it is particularly pronounced in these athletic divers as part of their dive response and breath holding. A healthy dolphin that is tolerating handling and examination well should exhibit an obvious "split" in heart rates immediately before and after a breath. This is something that can also be assessed by an experienced dolphin restrainer with a hand in the axillary space (flipper pit) feeling the heartbeat through the chest wall. The presence of arrhythmias other than the RSA, like second or third degree atrio-ventricular blocks or ventricular premature contractions (VPCs), require ECG recordings to assess adequately. These arrhythmias, if present in clinically significant numbers and evaluated in conjunction with other measures of cardiac health, may indicate underlying heart disease in the individual or population. Besides real-time monitoring of a dolphin's status during the exam, and being a component of cardiac health evaluation, having an ECG recording providing some redundant heart rate data has also been helpful for other studies such as acoustic play-back and respiratory physiology responses, because working around saltwater, sensitive electronics can fail at the most inopportune times, but data collected by other means can always be shared.

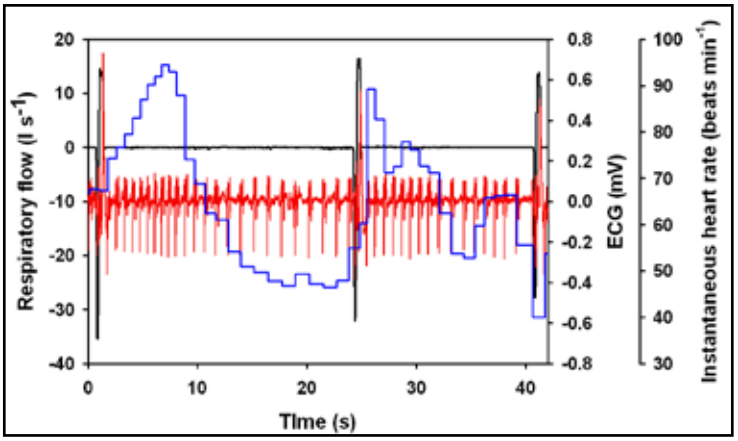
Suction cup sensory electrodes positioned on a dolphin's back for ECG monitoring and recording.

Using heart rate to understand how dolphins breathe

Andreas Fahlman, Alicia Borque-Espinosa, and Fabien Cauture, Fundación Oceanogràfic; Randall Wells, Chicago Zoological Society, Jay Sweeney, Dolphin Quest; Craig Harms, North Carolina State University

The number of breaths and the volume of air inhaled or exhaled, the tidal volume, are potential indicators of lung health and energy use in animals. However, both of these variables are difficult to determine in free-ranging bottlenose dolphins. In mammals, the heart rate changes with each breath. Following a breath, the heart rate first increases and then slowly decreases towards a stable value if the duration between breaths is long enough, as shown in the graph on the next page. In humans, it has been shown that these changes in heart rate are related to the tidal volume. In a previous study we showed that the heart rate changes associated with respiration could be used to predict the volume of air inhaled in the bottlenose dolphin. To assess this, we measured heart rate, and the flow-rate of each breath in trained bottlenose dolphins under human care. The data collected from the dolphins showed that we could predict the tidal volume from the heart rate with an error of only 2%. We are now extending this work to validate this method in free-ranging dolphins. During the 2018 health assessment we began to measure heart rate and tidal volume in the Sarasota dolphins. Our objective was to first validate this method. Next, we hope to equip dolphins with data loggers that can measure and record heart rate while they are swimming and diving freely. Data on heart rate alone will provide important

clues about how circulation changes with different activities, for example during diving, swimming, and resting. With the results from our new study we expect that the heart rate changes will also allow us to determine how dolphins vary lung volume before and after diving and while swimming, and could potentially be used to assess lung health, similar to lung function testing in humans.



Representative data showing respiratory flow, ECG trace, and instantaneous heart rate in a bottlenose dolphin during three breaths.

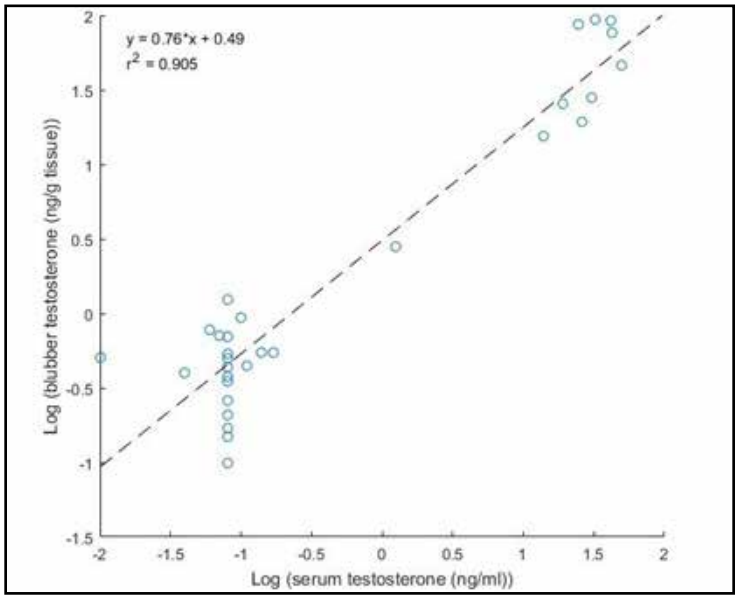
Blubber testosterone in bottlenose dolphins

Keiko Sherman and Nick Kellar, Southwest Fisheries Science Center

The ability to determine sexual maturity status in male cetaceans can improve understanding of age structure and help assess the overall health of wild populations; too few older animals suggest adult survival may be poor whereas too few young animals is indicative of low reproductive rates or poor early life health. The measurement of hormones in wild animals represents a potential solution. Just as the concentration of the progesterone hormone can help diagnose whether or not a female animal is pregnant, the concentration of testosterone can help inform whether or not a male is sexually mature. Moreover, because skin samples (which often include blubber) are the most commonly obtained biological samples taken from live cetaceans, the ability to quantify testosterone from this tissue would be particularly helpful.

Fortunately, during live-capture-release health assessments of Sarasota Bay bottlenose dolphins, blood and blubber are routinely collected and evaluated for their composition and additional blubber is collected via minimally invasive dart biopsy during other field operations. In previous studies, testosterone levels have been measured in either blood or blubber samples but no study has compared the results from both matrices simultaneously. To this end, with support from Harbor Branch Oceanographic Institution/ Florida Atlantic University, we attempted to assess the maturity status of known male bottlenose dolphins using blubber obtained via surgical biopsies and examine how the associated testosterone concentrations compared with those measured in the blood.

Here we present the serum and blubber testosterone data from 60 combined samples, representing 30 sampling events and 24 individual male bottlenose dolphins. These findings show a strong correlation between blubber and serum testosterone concentrations and the amount present in either matrix appears to be a robust indicator of maturity status. In total, these findings represent advancement in a tool to help evaluate the age structure of wild dolphin populations outside of Sarasota Bay. Additionally, recently published research has provided evidence that testosterone production is impaired in dolphins with higher persistent organic contaminant loads; as such, the biochemical methods we are developing here can help in the monitoring of pollutant impacts on biological functions of other wild cetacean populations.



The relationship of blubber testosterone to serum testosterone in male bottlenose dolphins in Sarasota Bay, Florida.

Hearing measurements of bottlenose dolphins in Sarasota Bay

Mandy Cook, Portland State University and David Mann, Loggerhead Instruments

Bottlenose dolphins can hear sounds from about 75 Hertz (Hz) to more than 160,000 Hz, well beyond the range of human hearing (20-20,000 Hz). Noise in the marine environment—both naturally-occurring and man-made—can negatively affect a dolphin's ability to hear, and can potentially cause temporary or permanent hearing loss. This is especially concerning for these animals because dolphins rely heavily on their hearing to successfully navigate through their environment, find food, and communicate with each other.

Since 2003, we have been measuring the hearing abilities of the bottlenose dolphins in Sarasota Bay using auditory evoked potential (AEP) techniques similar to the ones used to test the hearing of newborn human infants. We attach a

jawphone (an underwater speaker embedded in a suction cup) to the lower jaw of the dolphin, and play short tones that vary in frequency and loudness. Sensors (also embedded in suction cups) attached to the head of the dolphin detect the brain waves produced in response to the tones. We then analyze these responses to determine each dolphin's hearing abilities.

We tested the hearing of eight dolphins (five males and three females, 2-26 years old) during the June 2018 health assessments. To date, our findings show that bottlenose dolphins in Sarasota Bay do not present significant hearing loss with increasing age, nor are male dolphins more likely than female dolphins to experience hearing problems. In addition, these animals are not exhibiting hearing losses due to chronic environmental noise exposure, including man-made noise. Continued testing during future health assessments will allow us to determine if the hearing abilities of individual animals change over time. We are grateful for funding provided by a Phi Kappa Phi Love of Learning Award to support this work.

F213 showing placement of suctions cups for the jawphone on the lower left jaw and AEP sensors on the dolphin's head.

Plastic-related pollutants discovered in Sarasota's bottlenose dolphins

Leslie Hart, College of Charleston

Phthalates are a group of man-made chemicals commonly used in the manufacturing of plastic, pesticides, and other consumer goods, such as cosmetics, personal care products (shampoo, body wash), and cleaning products. Because phthalates are not strongly bonded to these products, they are easily leached into the environment making them readily available for human and wildlife exposure. Concern over phthalates stems from laboratory and human studies suggesting associations with endocrine disruption and reproductive impairment. Once exposed, phthalates are rapidly broken down into metabolites and excreted in feces and urine. In humans, urinary concentrations of phthalate metabolites are considered to be the most reliable indicator of short-term exposure. Parent phthalate compounds and their metabolites have been detected in blubber samples of several marine mammal species; however, urinary phthalate metabolite concentrations have never been quantified in cetaceans prior to this study. Phthalates can enter the marine environment via runoff from developed areas, atmospheric deposition during manufacturing, and the degradation of plastic waste. Given these myriad exposure routes and the potential for adverse health impacts, this study sought to assess and quantify phthalate exposure among dolphins inhabiting an urbanized estuary.

Urine samples of 17 bottlenose dolphins sampled in Sarasota Bay (2016-2017) were screened for nine different metabolites of phthalate parent compounds most commonly added to consumer products. More than 70% of these dolphins had measurable urinary concentrations of at least one metabolite, and several dolphins were exposed to multiple phthalate types. The most commonly detected metabolites were from parent compounds added to personal care products and plastic. Bottlenose dolphin concentrations of these metabolites were compared to findings from human studies, revealing a reduced exposure to phthalates commonly used in personal care products and cosmetics, but an equivalent and sometimes higher exposure to phthalates often added to plastic.

While the source of exposure and health impacts are currently unknown for Sarasota Bay dolphins, this study confirms suspected environmental contamination and serves as a foundation for continued study of phthalate exposure in these dolphins and elsewhere. Because this study is the first to document urinary phthalate metabolite concentrations, our findings lack context. Continued screening of Sarasota Bay

Leslie Hart and SDRP staff members Katie McHugh, Randall Wells, and Jason Allen photograph dolphins during filming for BBC's Blue Planet II series.

dolphins will expand our understanding of localized exposure and allow for comparisons between sexes and age classes, while comparisons to bottlenose dolphins sampled in other locations will facilitate the identification of high risk stocks.

This study has received widespread media attention from outlets such as the BBC's Blue Planet II series, National Geographic, The Daily Mail, College of Charleston Magazine, and local Sarasota news stations. In addition to collaboration with the Sarasota Dolphin Research Program, this study involved partnerships with faculty in the Department of Geology and Geosciences at the College of Charleston, the National Oceanic and Atmospheric Administration (NOAA), and the National Institute of Standards and Technology (NIST).

Funding for this research and travel was provided by the College of Charleston's Faculty Research & Development Grant, the School of Education, Health, and Human Performance Research and Development Grant, the Department of Health and Human Performance Research and Development Grant, and the Department of Geology & Environmental Geosciences.

Leslie Hart examining a water sample for microplastics, aboard the SDRP's R/V Martha Jane during filming for BBC's Blue Planet II series.

A new era for estimating the age of free-ranging dolphins, the bottlenose epigenetic aging tool (The BEAT)

Andria Beal, Jeremy Kiszka, and Jose Eirin-Lopez, Florida International University; Randall Wells, Chicago Zoological Society

Being able to estimate the age of wild dolphins is crucial for understanding population dynamics and how environmental and man-made factors affect individuals through their development. The most widely adopted method for cetacean age determination today is to use growth layer groups (GLGs) that accumulate in the teeth. However, this method requires access to dead individuals or, if performed on live-caught free-ranging animals, it requires the removal of a tooth under local anesthesia. The use of remote biopsy sampling has greatly supplemented our knowledge of the ecology and social structure of cetaceans, as well as on the impact of chemical pollution on their populations. However, in most cases, the influence of age on their trophic interactions, kinship or pollutant levels remains poorly understood. Thus, there is a need for a fast, less-invasive, and accurate way of estimating age. The isolation and analysis of DNA from small samples of skin has provided a way to develop such a tool for use with remote biopsy samples, specifically through studying epigenetic changes correlated with age in these organisms. Epigenetics is the study of biological mechanisms that will switch genes on and off. DNA methylation constitutes one such epigenetic mechanism, involving the addition of a methyl group to a cytosine in the DNA sequence. This mechanism has been used to estimate age in humans and later was adapted for use in humpback whales. However, in order for this technique to be useful in other species, it must be calibrated to the species of interest.

We quantified DNA methylation at several CpG sites (a cytosine occurring next to a guanine, where DNA methylation occurs) within different genes that were previously found to have a correlation between amount of DNA methylation and age for other mammals. Using archived skin samples from individual bottlenose dolphins with known age from Sarasota Bay, we generated models that can reliably estimate age. We found a significant correlation between methylation and age for all samples, combined (R = 0.77), but the correlation was higher when the analyses discriminated between males (R = 0.88) and females (0.90). These models will be able to enhance the way we can study wild populations of small cetaceans; it is likely that they can be applied to other small dolphin species sharing similar life expectancy. The preparation of a scientific paper is underway and it should be submitted by the end of 2018.

Andria Beal (left) and team analyzing dolphin skin samples.

Ecology, Population Structure and Dynamics

Sarasota Bay dolphin community status

Jason Allen, Chicago Zoological Society

We keep track of the dolphins of Sarasota Bay through photographic identification (photo-ID) surveys conducted on ten boat-days each month. One of the primary goals of our monitoring is to track additions, losses, and condition of the resident Sarasota Bay dolphin community members. There have been eleven births in 2018, seven of which have survived. These include a thirteen-year-old first time mom and Saida Beth who, at 36 years of age, gave birth to her eleventh known calf! Seventeen of the 21 calves born in 2017 are still alive and well. Sadly, we have not observed our oldest dolphin, 67-year-old Nicklo, since September 2017 and presume that she is dead. Born in 1950 and observed more than 800 times by SDRP since 1982, she was the oldest known free-ranging bottlenose dolphin in the world. She is survived by her daughter Eve and grandson F286.

The biggest story in the lives of Sarasota dolphins this year is red tide. A large bloom arrived in Sarasota Bay waters in August, killing much of the dolphins' prey. Though analysis is ongoing, we seem to be seeing similar patterns to the last severe red tide in 2005-2006. Sarasota community members appear to be staying in their ecological cul-de-sac, but using it in different ways. They appear to be in larger groups at times and are redistributed, presumably to the areas with live fish to eat. We have lost at least two Sarasota community members due to red tide or brevetoxicosis. Our oldest male, FB44, and a 12-year-old male named Speck.

Our long-term, monthly photo-ID surveys are the core effort of our program, supporting all other projects. More than 50,900 dolphin group sightings since 1970 have yielded more than 154,000 identifications of more than 5,600 individually distinctive dolphins. In support of these identifications, more than 750,000 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 2,614 follows on 211 individual dolphins from 25 projects dating back to 1989. 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 Bay bottlenose dolphin community thanks largely to support from the Barancik Foundation, as well as the continued dedication of our core local volunteers and undergraduate interns. Thanks to these efforts, this community remains one of the most thoroughly studied free-ranging dolphin populations in the world.

Top: Saida Beth with her eleventh known calf, C33A. Second: Lizzie's seventh calf was seen in July 2018, within its first week of life. Third: FB44 surfaces with his long-time buddy, Bark. At 44 years old, he was the oldest living male in the Sarasota Bay community before his red-tide related death in July 2018. Bottom: F292 tosses a fish.

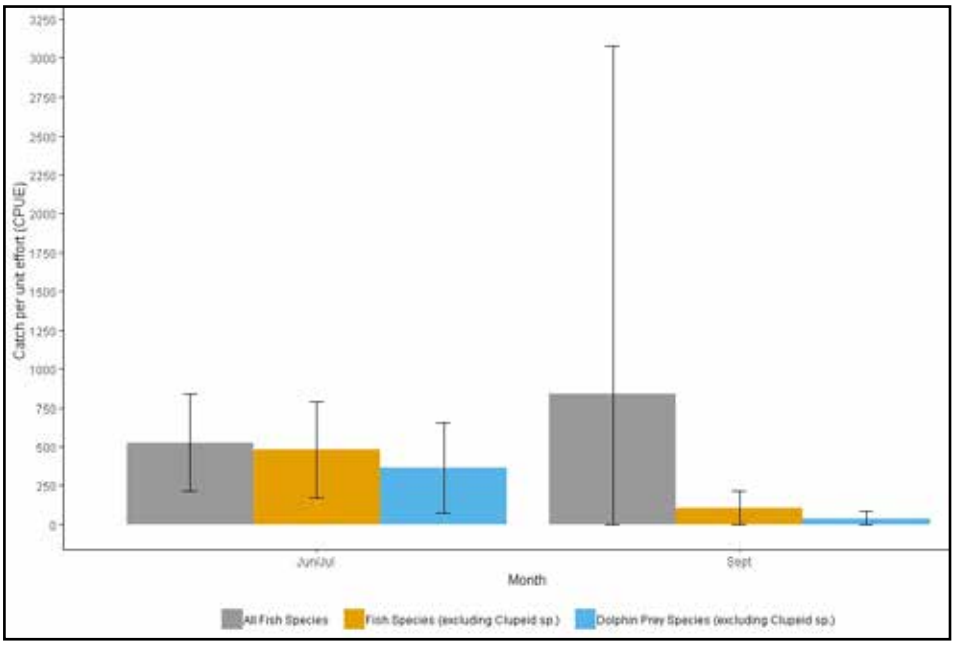
Severe red tide in Sarasota Bay: Prey monitoring update

Elizabeth Berens McCabe, Chicago Zoological Society

The Sarasota Dolphin Research Program explores the relationship between wild dolphins and their prey by conducting seasonal multispecies fish surveys to monitor fish abundance, distribution, and body condition in Sarasota Bay, Florida. Data from this project enable 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 across the bay. Since 2004, this project has also facilitated a variety of novel research and new collaborations; most recently the development and testing of a new low cost, portable electronic monitoring platform (described on pg. 6). Based on our 2018 fish survey data and *K. brevis* cell concentrations, the current severe red tide event in Sarasota Bay appears to be having a very significant effect on the bay's fish community!

Beginning in June 2018 and continuing to the present, a persistent red tide bloom has been present in Sarasota Bay and surrounding waters. Red tide cell concentrations taken by SDRP and Mote Marine Laboratory's Phytoplankton Ecology Lab exceeded 100,000 cells per liter, the concentration threshold typically required for fish kills and respiratory irritation in humans, from June 7-21, then dropped down to background levels throughout July in Sarasota Bay. On Aug. 1st, cell concentrations spiked to over 3 million cells per liter, with maximum concentrations of up to 90 million cells per liter on Aug. 13th. Between Aug. 24 and Oct. 15, concentrations fluctuated, with counts as low as zero and as high as 34.6 million cells per liter. Red tide can affect fish through 1) exposure to brevetoxins (the neurotoxins produced by the red tide organism) in the water, 2) consuming food that is tainted by brevetoxins, or 3) exposure to hypoxic water (water with unusually low concentrations of dissolved oxygen), which often accompanies severe red tides. Both brevetoxins and hypoxia can kill fish.

After an average winter season, overall catch rates of fish this summer (Jun-Sept.) were low, with only 522 fish caught per seine set, but comparable to previous summer catch rates from 2009-2014. Following the Aug. 1st spike in *K. brevis* cell concentrations, monthly catch rates of fish declined by 60% from June/July to Aug. Cell concentrations remained high in Sept., however a couple very large catches of schooling fish (Clupeidae sp.) resulted in a 76% increase in overall catch rates between Aug. and Sept. With clupeids excluded, monthly catch rates of all other species declined by 79% from June/July to Sept. Declines in the abundance of fish species typically eaten by dolphins (ladyfish, pinfish, pigfish, sheepshead, mullet, spotted seatrout, spot, and



Catch per unit effort (CPUE) of fish caught during 2018 June/July and September purse-seine surveys in Sarasota Bay, FL. Error bars represent the standard deviation of the mean, a common measure of data variability.

Gulf toadfish) were even more dramatic. Common dolphin prey species declined by 91% between June/July and Sept. These sudden and dramatic declines in fish abundance in Sarasota Bay are similar to the declines seen during Sarasota Bay's last severe red tide summer in 2005/2006. Further analysis of fish collected during our summer fish survey will quantify the levels of brevetoxins in various tissues of individual prey species. Ongoing survey efforts will monitor the recovery of the fish community from this ecological perturbation post-bloom.

We thank the many interns and dedicated volunteers who have worked on this project. The work would not be possible without you! Funding for this project was provided by the Barancik Foundation, FlyWire Cameras, 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. Supplemental fish surveys between standard seasonal sampling is being supported by Mote Scientific Foundation. This research was authorized by the Florida Fish and Wildlife Conservation Commission (16-0809-SR, Special Activity License) and by Mote Marine Laboratory's Institutional Animal Care and Use Committee (17-10-RW2).

Fish kill in August during red tide event.

The case of the mystery freezebrand uncovered by the Gulf of Mexico Dolphin Identification System

Carolyn Cush and Shauna McBride, Chicago Zoological Society

Now in its sixth year and with continued support from the National Fish and Wildlife Foundation (NFWF), the Gulf of Mexico Dolphin Identification System (GoMDIS) is well-established and serves as a standardized and centralized repository for bottlenose dolphin catalogs from our collaborators Gulf-wide, including Cuba and Mexico. GoMDIS is frequently updated, currently including 30 catalogs, with 19,192 dolphins and 32,855 images, and will yield more than 1,000 matches between projects (current and archived) once all matches have been verified. We expect GoMDIS to grow and evolve as a conservation decision-making tool. As part of that growth and as time marches on, it is ever-important to ensure that archival data are preserved. Bottlenose dolphin studies intensified in the Gulf in the 1970's, including both capture-release and photographic identification (photo-ID) efforts. As our collaborations broaden, more interesting life stories of dolphins are discovered.

One interesting story is an animal named "Tahoe" who was documented in 2006 in the John's Pass, FL area by one of our collaborators, Ann Weaver. The photo of this animal showed a unique scarring pattern on the left side of its dorsal fin. It was included in the repository when the GoMDIS initiative began in 2012, but we could not confirm that the markings were anything other than unique scarring. In the summer of 2018, the GoMDIS curator was contacted by Clearwater Marine Aquarium staff with sightings of an animal with a possible freezebrand in an area approximately ten miles north of John's Pass. SDRP staff determined this to be the same animal, "Tahoe," seen previously in the John's Pass area. Along with the new images came more evidence- the unique markings appeared on both sides of the fin and the body and therefore must be a freezebrand which appeared to be the number "86". The hunt was on to determine the identity of this animal. However, searches of all the possible likely suspects did not yield an answer. How could this be? The animal must have been handled to have the freezebrand applied, yet we could not easily determine where it came from. The search was even expanded to include animals captured and released in Mississippi Sound and the Indian River Lagoon on the east coast of Florida. Fortunately, after months of sleuthing, it was determined this animal had been captured and released under permit in Tarpon Springs, FL (ten miles north of Clearwater) in 1980 by SeaWorld. We have learned from this information that she is a female and is now roughly 40 years old. She is one of four animals captured and released that year and we hope to include them in GoMDIS to be archived so this information can be easily found in the future.

"Tahoe" is one example that demonstrates the value of our collaborative effort and the importance of preserving archival data. We have been able to extend her sighting history to 38 years and she has remained in the same approximate area. This information gives researchers insight into long-term movements and site fidelity of individual dolphins within the Gulf of Mexico, which can be helpful for population management and conservation efforts.

Tahoe's sighting history from 1980 to 2018 pieced together through multiple photo-ID and capture-release projects.

Advances in automated dorsal fin matching

Reny Tyson Moore and Jason Allen, Chicago Zoological Society

Photo-ID methods, which rely on obtaining a photograph of a dolphin's natural markings (for example, nicks, notches, and/or scars found along the dorsal fin or peduncle), have been widely used in the study of bottlenose dolphins for more than 40 years to identify individuals and track them over time. This process often involves taking thousands of pictures in the field, which must later be processed in the lab to identify each individual and compare it to a catalog of known individuals. As you can imagine, this process can take hundreds of hours and can be even more time consuming for large catalogs and/or infrequently surveyed populations. Thus, this effort represents a significant component of the photo-ID process that has the potential to be streamlined through computer vision processes.

In recent years, SDRP staff members have been working with colleagues at Wild Me (www.WildMe.org), the

Rensselaer Polytechnic Institute, Duke University, Cascadia Research Collective, and Massey University to develop an automated fin-matching program to accelerate the photo-ID process. Last year, a PhD student from Rensselaer Polytechnic Institute developed an algorithm for this purpose that can account for variations in fin angle, side, and distance from frame. This algorithm, called CurvRank, finds the fin in the image and uses an integral curvature measure to represent the identifying pattern of nicks and notches along the trailing edge of the dorsal fin. This representation is then compared to a catalog of known individuals to generate a ranking based on dorsal fin similarity. Currently, CurvRank is able to find the correct identification in the top ten of the ranked list 97% of the time, and as the first match 95% of the time!

With generous support from the Harbor Branch Oceanographic Institution, SDRP staff recently worked with engineers at WildMe, a non-profit organization specializing in open-source data management platforms for wildlife research, to integrate CurvRank into FlukeBook (www.FlukeBook.org), a freely available cloud-based photo-ID tool for marine animal research. Flukebook, originally developed to perform photo-ID of cetacean flukes with computer vision techniques, has proven to be a successful photo-ID matching platform as evidenced by more than 1,200 identified animals, 52,000 encounters and 58 contributors in their system. In the upcoming year, we will use our extensive database of known bottlenose dolphins to test the performance of CurvRank and FlukeBook and to make refinements as necessary to improve its accuracy, usability, and reliability within the Flukebook platform. The integration of the dorsal fin algorithm into Flukebook, where it will be available to dolphin researchers at no cost, could save significant time for small cetacean research worldwide, greatly expanding the efficiency, capacity and usefulness of photo-ID methods in conservation and biological efforts.

Above: Two dolphins playing in a wave near Marco Island, FL. Right: Distinctive animals with damaged fins sighted near Marco Island, Florida.

Bottlenose dolphins in Southwest Florida: Ecology and conservation

Reny Tyson Moore and Christina Toms, Chicago Zoological Society

The coastal and inshore waters near Naples and Marco Island, Florida are home to a stock of bottlenose dolphins for which little is known, specifically with regards to their abundance, distribution, and behavior. This region is of interest because it represents the ecological interface between the highly developed and populated Naples/Marco Island area and the sparsely populated environments of the Everglades and the Rookery Bay National Estuarine Reserve (RBNERR). In addition, potentially harmful dolphin-human interactions have occurred in this region, evidenced by the presence of three entangled dolphins in these waters in recent years, including Skipper, a young female dolphin that the SDRP team disentangled in September 2014. Therefore, this region provides a unique environment to study how dolphins select and use habitat, particularly in relation to human activities.

The first step in studying a new population is often that of obtaining information regarding the population's abundance and distribution. This year our team, with the support of the Batchelor Foundation and in partnership with RBNERR, initiated a photographic-identification (photo-ID) study in this region to estimate the population size of bottlenose dolphins there and to build a photo-ID catalog of identifiable individuals, which will be included in our Gulf-wide catalog, GoMDIS. In May, 2018 we completed six photo-ID surveys for this purpose and observed 58 unique groups of dolphins. Information on the dolphins observed during these surveys will be used to estimate dolphin abundance in this region after completion and analysis of data from two more field seasons (October 2018 and spring 2019). During the May surveys, several dolphins were seen with unusual skin conditions or markings that may be related to disease and/or prolonged exposure to freshwater. Evidence of harmful interactions with humans was also observed, including several damaged fins and entanglement scars; several dolphin groups were also observed approaching and swimming near boats. The information collected during this and future studies can be used to monitor the health of the dolphins as well as the local ecosystem, and to better assess the effect of persistent threats (boat strikes, entanglements, etc.) and catastrophic events (oil spills, red tides, etc.) on these animals if/when such events occur. We are very excited to have this study up-and-running and hope that these efforts will form the basis of a long-term dolphin monitoring and outreach program in this region.

Bottlenose dolphin population structure in the Florida Panhandle

Christina Toms, Chicago Zoological Society and University of Central Florida

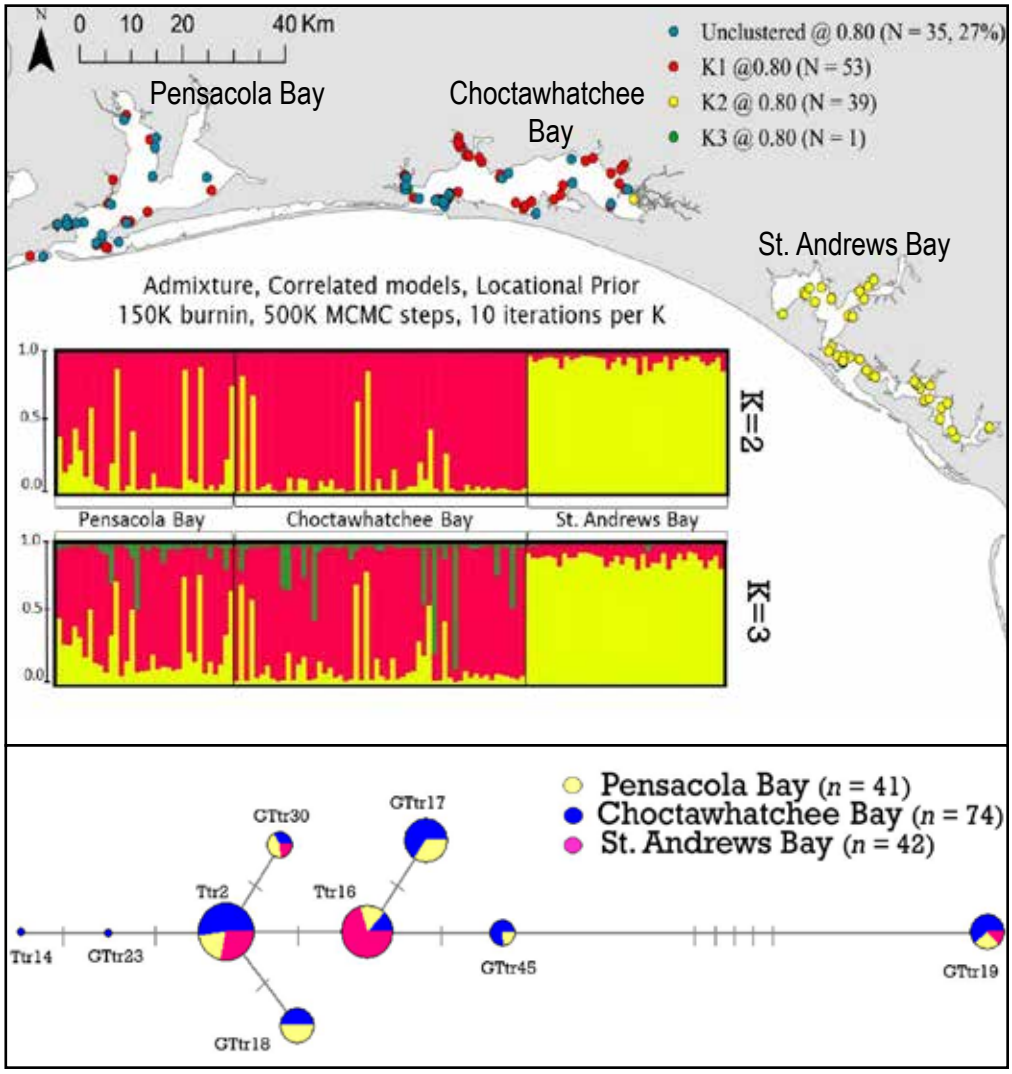
One of the goals of my dissertation research is to provide a better understanding of bottlenose dolphin population connectivity in the Florida Panhandle. Over the past few years I've been working with collaborators from the NOAA Fisheries SEFSC, the University of West Florida, and the Florida Institute of Technology, to test for fine-scale population structure of bottlenose dolphins inhabiting inshore waters of the Florida Panhandle.

We tested the hypothesis that Pensacola, Choctawhatchee, and St. Andrews Bays (in the Florida Panhandle) are home to three distinct genetic populations of bottlenose dolphins. Skin samples (168 samples) were collected during 2015 and 2016. We used two different types of genetic information for our analyses (mitochondrial DNA and microsatellite loci) since they provide information at different time scales, are passed on through generations differently, and can be used to answer different evolutionary questions. A 353-bp section of the mitochondrial DNA (mtDNA) control region was used to sequence each sample and individuals were genotyped at 19 microsatellite loci.

Results show a strong genetic distinction between St. Andrews Bay and the other two systems to the west (Pensacola and Choctawhatchee Bays). The results from a Bayesian clustering analyses are shown on the right. Each bar in the plot is an individual that was sampled and the colors/shades represent the probability of assignment to one population versus another. If the bar is mostly one color, it indicates a strong probability of assignment of that individual to that colored cluster. By comparing the plot to the map, one can see that all of the dolphins from St. Andrews have a very strong probability of assignment to the "yellow group". In contrast, the samples from Pensacola and Choctawhatchee Bays represent individuals from more than one group and include many individuals that could not be assigned with acceptable certainty.

Results from pairwise comparisons, using an analysis of molecular variance, were congruent; St. Andrews Bay significantly differed from Pensacola and Choctawhatchee Bays across all markers tested. Furthermore, genetic diversity was lower, across indices, for St. Andrews compared to Pensacola and Choctawhatchee Bays. The figure below shows that most haplotypes from mtDNA are shared between Choctawhatchee and Pensacola Bays, with only two haplotypes unique to Choctawhatchee Bay alone. Overall, results indicate high levels of gene flow between Choctawhatchee and Pensacola Bays and very little gene flow with either system into St. Andrews Bay. These three systems are currently each managed as separate units. Results indicate that two units may be more appropriate; in which case, management boundaries may need to be re-evaluated.

This research has been funded in part by University of West Florida (UWF) Office for Undergraduate Research Scholarships and the Naval Sea System Command, Naval Undersea Warfare Center Division, Newport. Thank you to the numerous interns, volunteers, and colleagues who have helped to make this happen over the past few years.



Top: Map of genetic sampling locations in the Florida Panhandle, color coded by cluster assignments from program STRUCTURE. Bottom: Median-joining haplotype network showing the relationship between nine bottlenose dolphin haplotypes. The size of each circle relates to the frequency of the haplotype in the total sample. Each hash mark represents one mutational event.

Predator risk mitigation by bottlenose dolphins in Sarasota Bay: Insights into group size, habitat use, and movements by young calves

Krystan Wilkinson, Chicago Zoological Society and University of Florida

Predator-prey dynamics between sharks and dolphins have been suggested to influence dolphin habitat use and group dynamics. While many predator-prey studies have focused on understanding how such aspects of prey behavior are influenced by predation risk, few have examined how prey species respond directly to failed predation attempts. For my dissertation research, I examined if and how previous interactions with predatory sharks, resulting in a wound, influence bottlenose dolphin behavior in Sarasota Bay, Florida. My objectives were to determine if dolphins changed their group size, ranging behavior or habitat use and selection following a shark bite. My results suggest that these aspects of dolphin lives, with the exception of ranging behavior, do not change after receiving a shark bite. I found that dolphin calves significantly shifted their center of activity southward following a shark bite, and bitten adults significantly shifted their center of activity eastward. This suggests that geographic location and proximity to potentially more dangerous areas may be important factors influencing dolphin movements in Sarasota Bay.

1652, the YoY who lived, was bitten by a shark during its first days of life

While all dolphin life stages are vulnerable to shark predation, calves are commonly assumed to be the most vulnerable due to their limited physical swimming abilities and undeveloped defenses. Therefore, in addition to understanding changes in behavior following a shark bite, I also assessed whether dolphin mothers with young-of-the-year calves (YoY; < 1 year of age) limit their ranging behavior. This may impact where and how far calves can range to avoid predation. I found that calves, with their mothers, showed variability in their movements, but a consistent increase in range size with age was not observed. Following graduation from the University of Florida I will continue with the Sarasota Dolphin Research Program (SDRP) as a post-doctoral scientist. This dissertation research was made possible from funds graciously provided by an anonymous donor to the Chicago Zoological Society, and the University of Florida.

As an extension of my dissertation, my future studies will address movement patterns of dolphin predators, primarily bull sharks, in Sarasota Bay. Information regarding habitat use of large bull sharks is extremely limited in nearshore habitats. By integrating information of dolphin habitat use with information gathered from shark tagging and tracking, I hope to provide a better understanding of habitat-associated predation risk within the estuary and its impact on the dolphin community. In 2015, we initiated a collaborative study using active and passive underwater acoustic recording systems to monitor the movements of multiple marine species, including dolphins and large bull sharks, in Sarasota Bay. In April 2017, five bull sharks were tagged with passive acoustic tags along Florida's Gulf coast. One of the sharks, nicknamed "Miss Lillie," was additionally fitted with a satellite-linked tag and spent April – July 2017 travelling extensively along Florida's Gulf coast. We have not heard from Miss Lillie's satellite-linked tag since July 2017, but last summer and fall, Miss Lillie and another tagged female bull shark were detected on the Sarasota Coast Acoustic Network (SCAN) – both were detected at one of our offshore acoustic stations and the other female was also detected in our Anna Maria Sound station. During this period, both sharks were also detected in nearby Charlotte Harbor, just south of Sarasota, by multiple collaborators' acoustic networks. Shark tagging efforts will be continuing. To date, funding for the shark tagging project has been provided by The Guy Harvey Ocean Foundation, Mote Scientific Foundation, and Dr. Jorge Brenner with The Nature Conservancy.

F275, a 6-yr-old female, was examined for the first time in June 2018 during a health assessment project, providing a close-up look at the healed shark bites on her peduncle (photos show left and right side of peduncle). F275 received the shark bites in 2013 and they appear to have healed well.

Dolphin Rescues, Releases, and Follow-up Monitoring

Updates on previously rescued dolphins

Aaron Barleycorn, Chicago Zoological Society

Because of our extensive experience with capture-release of dolphins for health assessments, the Sarasota Dolphin Research Program is called upon by NOAA to lead rescue efforts involving entangled dolphins along the west coast of Florida. Follow-up monitoring of these intervention cases helps rescuers to learn what approaches work well, and help NOAA to better understand the value of each successful intervention in terms of leveraging additional recruits to increase the population when rescued females produce calves that would not have been possible without the intervention. Here we report on six cases of disentanglements since 2006.

Scrappy: In July 2006, Scrappy, a juvenile male was observed entangled in a man's Speedo bathing suit. He had managed to put his head through the waist and one of the leg holes, and the suit had worked its way back to the point where it was cutting into the insertions of his pectoral fins. On 3 August 2006, Scrappy was temporarily captured, and the suit was removed. Now 20 years old, he and C835 have formed a male alliance. They were most recently seen together on 6 August 2018, swimming in the nude.

Ginger: In December 2008, Ginger, a recently independent juvenile female dolphin stranded on Siesta Beach. She was taken to Mote's dolphin hospital, treated for complications from the stranding, and released two months later. The SDRP radio-tagged her and closely monitored her for two months post-release, until the tag transmissions ceased. She has since been regularly seen during our monthly population monitoring surveys. Ginger's story inspired an SDRP volunteer to write a children's book about her time at Mote called "No Dead Fish for Ginger." She was most recently seen on 31 October 2018, swimming with another rescued dolphin, Nellie, and their 1-year-old calves.

Nellie: In February 2010, the newest calf of resident dolphin FB25 was seen with plastic twine and a metal hook tightly wrapped around her head, with the line becoming embedded in her skin as she grew. She was temporarily captured with her mother and her brother, Bill (who would himself be rescued from entanglement in 2016), disentangled and released on 1 March 2010. She was named Nellie in honor of Dr. Nelio Barros, a great friend and colleague, who had recently passed away. She was seen as recently as 31 October 2018, swimming with another rescued dolphin, Ginger, and their 1-year-old calves.

Nellie and Ginger surface together with their 1-year-old calves.

Lizzie with her newborn seventh calf and her previous calf, F273, from 2016.

Lizzie: One of our Sarasota residents, Lizzie, had an eventful 2012. She was given a temporary satellite-linked tag during our health assessments in May, and she and her 3-year-old calf were regularly followed to compare their behavior with and without the tag. During one of these follows SDRP staff noticed that Lizzie had become entangled with monofilament line around one of her flukes. Shortly after, her calf was struck by a boat propeller that left a large gash on his dorsal fin. Lizzie and her calf were temporarily captured on 20 July 2012 to remove the fishing line and the tag – and it was determined via ultrasound that she had become pregnant with her fourth calf since the May health assessment. Lizzie was seen as recently as 30 October 2018 with a newborn calf, her seventh!

Skipper: In August 2014, a dolphin calf was reported with fishing gear entangled tightly around its tail near Marco Island, Florida. The SDRP was asked to organize a rescue, and on 4 September 2014 the rescue team was able to temporarily catch and disentangle the calf from line and wire leader. She was named Skipper (her brother, Seymour, was rescued in the same area previously). The SDRP has been conducting population surveys in the area near her rescue site, and often see Skipper (now a juvenile) during these efforts. She was seen most recently on 15 October 2018 during one of those surveys.

Bill: On 1 March 2016 we received a report of a dolphin that was entangled in a crab trap line off Nokomis Beach, Florida. We went to the dolphin's last reported location from the night before, and found 10-year-old resident dolphin Bill (brother of disentangled dolphin Nellie) with his blowhole just above the water. He had managed to get his tail wrapped in the float line of a crab trap, and was weighed down by the trap to the point where he was unable to move and barely able to keep his head above water. We used a boathook to grab a bit of line floating next to Bill and pulled up line until we got to the entanglement. We were able to remove the line without cutting it. Bill was moving his tail strongly and appeared to have full motion of his fluke. There were some superficial lacerations where the line had wrapped. Once he was fully disentangled, we released him and watched him swim away. He is often seen during our monthly photo-ID surveys, most recently on 24 October 2018.

Halifax River, Florida "disentanglement"

Jason Allen, Chicago Zoological Society

Because of our extensive experience with rescues and capture-release health assessments, we are frequently asked to participate in rescues elsewhere in the southeast U.S. On the morning of 9 August 2018, a Hubbs SeaWorld Research Institute (HSWRI) photo-ID team observed an entangled three-month-old calf of a well-known dolphin. The entanglement appeared to be recent and consist of one piece of rope around the dolphin a few inches behind the eyes and another through the mouth, much like the bridle of a horse. I was asked by NOAA to be part of a team that was pulled together very quickly and a rescue was planned for the next morning.

A HSWRI photo-ID team left at first light on 10 August to find the mother and entangled calf. Once found, it was quickly determined that the calf had shed the entanglement overnight. The rescue team stood by briefly while the photo-ID team acquired photographic confirmation. The calf was indeed free of all entanglements!

Follow-up monitoring of intervention cases through satellite-linked tracking

Randall Wells, Chicago Zoological Society

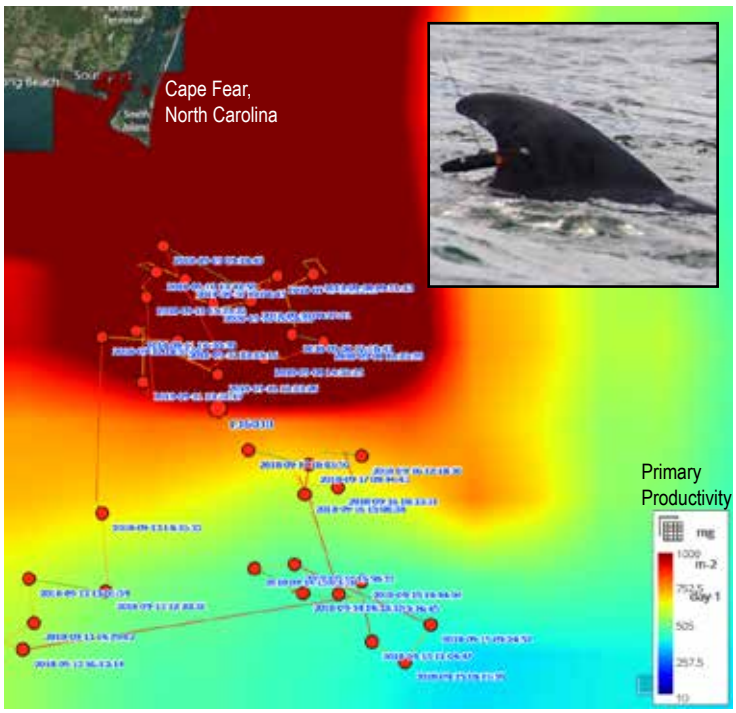
We provided tags and tracking services for three cases over the past year, with the two U.S. cases supported through two grants from the NOAA John H. Prescott Marine Mammal Rescue Assistance Grant Program. On 14 December 2017, a melon-headed whale rehabilitated by the Institute for Marine Mammal Studies in Mississippi was released offshore of Louisiana. Following two signals very close together in space and time, the tag ceased transmissions; it is not known if this was due to tag/attachment failure or death of the animal.

On 28 June 2018, SeaWorld Orlando released a 241 cm female bottlenose dolphin, R-10, that had been undergoing rehabilitation since 27 February 2018, when it stranded at Ponte Vedra Beach, Florida. The dolphin was released with a satellite-linked location-only tag off St. Augustine, and she moved northward in offshore waters, spending much time in waters east and south of Cape Fear, NC, an area for which few data are available on dolphin movements. She remained in an area of high primary productivity through much of her track, except when she was apparently moved temporarily out of the region by surface currents associated with Hurricane Florence (see map). Signals ceased on 17 October 2018, after 110 days of tracking, apparently due to premature battery failure.

Ten-day plot of the movements of bottlenose dolphin R-10 off the coast of the Carolinas, including the period of passage of Hurricane Florence to her north. Initially she was in an area of high primary productivity (dark region extending out from shore, averaged over 8 days). She apparently was moved out of that area by strong hurricane-associated surface currents, and then she returned to the area of high primary productivity after the hurricane passed (Insert photo: R-10 shortly after release on 28 June 2018, with satellite-linked tag. Photo by SeaWorld Orlando.).

On 29 October 2018, a male, ~10-yr-old Atlantic spotted dolphin was released off Bimini, in the Bahamas. The dolphin, observed off Bimini since 2013, is known by the Wild Dolphin Project as "Lamda." He was reported to the Bahamas Marine Mammal Stranding Network/ Bahamas Marine Mammal Research Organisation as being in distress near Great Stirrup Cay on 24 August 2018, and after he was stabilized by Atlantis Animal Rescue Team, he left the bay on 25 August 2018. He stranded on Great Stirrup Cay on 26 August 2018 and was transported to Atlantis for rehabilitation. The dolphin was tagged with a satellite-linked location-only tag as it was transported by seaplane to Bimini, and initial days of tracking showed it moving along the edge of the Great Bahama Bank.

Atlantic spotted dolphin "Lamda" with satellite-linked tag.



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, Disney Worldwide Conservation Fund, and fishing guides and anglers to develop an educational card displaying ten tips intended to improve the experience of the angler or boater while enhancing protection for dolphins. The cards are available in English and Spanish as downloads through the SDRP website at: sarasotadolphin.org/sources-of-information/videos.

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 brief (2-8 min) educational videos we have produced about dolphin conservation and biology, are available through the SDRP website, at sarasotadolphin.org/sources-of-information/videos.

High school programs: King Conservation Science Scholars

Katie McHugh, Angela Sullivan, Luis Mendez, and Jason Allen, Chicago Zoological Society

Eight High Flying Scholars were chosen from the King Conservation Science Scholars program at Brookfield Zoo to take part in an intensive study of marine mammals which included dolphin identification, how to conduct behavior observations, conservation issues surrounding dolphins in Sarasota Bay, and more. In April, Randall Wells traveled to Chicago to meet with the teens and discuss his work on various research topics conducted since the 1970's. It was a unique opportunity for them to learn from a world-renowned dolphin expert. The program was led by the King Scholars staff at Brookfield Zoo and concluded with a capstone experience in June with the Sarasota Dolphin Research Program in Florida. The travel group consisted of the eight students and four CZS staff chaperones - Luis Mendez, Sandra Ortiz-Ortega, Jill Damato, Manager of NatureStart Programs, and Jason Theuman, Docent Program Coordinator.

Teens and chaperones went through an extensive training focusing on boat safety, appropriate data collection, and best practices for effective photography and identification of wild dolphins. The teens were exposed to real science methodology that could potentially be used in scientific papers. Then everyone got to practice research in action, spending two days on boats in Sarasota Bay contributing to our long-term photographic identification surveys and behavioral observations. The teens took pictures of the dorsal fins of different wild dolphins, and recorded salinity and environmental conditions during each encounter. During this time, SDRP staff shared career advice as well as personal anecdotes related to their experiences doing dolphin research. The teens also performed focal behavioral observations, following dolphins over the course of two hours and recording data on dolphin behavior, boat activity, distance from dolphins, and human interactions.

High Flying Scholars record data during a dolphin behavioral observation with SDRP Staff Scientist Katie McHugh.

High Flying Scholars learn about dolphin photo-identification with SDRP staff members Jason Allen and Randall Wells.

Back in the lab, the High Flying Scholars practiced photo-identification of dolphins using a catalog of known individuals within Sarasota Bay and learned how our sighting database is used to organize and query data to answer specific questions when publishing scientific papers. Onsite training was coordinated by Lab Manager Jason Allen, who made sure the students understood the importance of taking the necessary time to analyze data thoroughly, and that data analysis was just as important as data collection.

At the end of their week in Sarasota, the group toured Mote Marine Lab and Aquarium, talking to animal care and stranding investigations staff and interns about the work that they do, and getting a behind the scenes look at the "bone room" (the Ruth DeLynn Osteological Collection), necropsy room, and sea turtle rehabilitation hospital as well as observing an otter training session. After the trip, teen participants presented at a staff meeting to members of the Conservation Education and Training team. The feedback received was very positive, with all participants reaffirming their interest in a possible career in conservation after this experience. CZS staff made qualitative observations throughout the trip and reported that participants showed increased confidence, demonstrated teamwork, and expressed their individual talents during the experience.

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, the U.S. Marine Mammal Commission Committee of Scientific Advisors on Marine Mammals, the national Animal Telemetry Network, the Florida Marine Debris Reduction Guidance Plan Working Group, 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 and students 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. Over the past year, we had trainees, including interns and graduate students, from: Brazil, Canada, Denmark, Ireland, Italy, and Scotland.

Students:

As described throughout this newsletter, students from a variety of institutions, especially the University of California-Santa Cruz, 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, 42 doctoral dissertation and 37 master's thesis projects have benefited from association with our program, through field research opportunities or access to data, samples, or guidance. Over the past year ten doctoral students, one Master's student, and one undergraduate student have been making use of resources provided by the SDRP:

Doctoral Dissertations – Completed

Baker, Isabel. 2018. Life history, behaviour and social structure of bottlenose dolphins (*Tursiops truncatus*) in the Shannon Estuary, Ireland. Galway Mayo Institute of Technology.

Wilkinson, Krystan. 2018. Understanding risk mitigation by common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida through analysis of group size, habitat use, and perinatal movements. University of Florida.

Doctoral Dissertations – Underway

Allen, Austin. Developing an activity/energetics proxy for common bottlenose dolphins to estimate energetic costs of avoiding vessels. Duke University.

Beal, Andria. Epigenetic estimation of age in bottlenose dolphins (*Tursiops truncatus*) using DNA methylation. Florida International University.

Casoli, Marco. Mating strategies in bottlenose dolphins: Fine-scale behaviour and acoustic during male-male and male-female interactions. University of St. Andrews, Scotland.

Jones, Brittany. Communication accommodation theory: A dolphin perspective. University of St. Andrews, Scotland.

Powell, James. Bone density of bottlenose dolphins. Portland State University.

Tatom-Naecker, Theresa. In progress. Topic to be determined. University of California, Santa Cruz.

Toms, Christina. Bottlenose dolphin population dynamics, structure, and connectivity in the Florida Panhandle. University of Central Florida.

Doctoral Dissertations - Underway (continued)
Weideman, Hendrik. Contour-based instance recognition of animals. Rensselaer Polytechnic Institute.

Masters Theses - Underway
Ronje, Errol. Abundance and distribution of a common bottlenose dolphin metapopulation in North Texas. Fisheries and Aquatic Sciences, University of Florida.

Undergraduate Theses – Completed
Greenfield, M. R., D. I. Rubenstein, K. A. McHugh and R. S. Wells. 2018. Effect of anthropogenic injuries on the social associations of bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Princeton University.

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 undergraduate student interns who volunteer with our program for at least 2-3 months at a time (for more information on internships, please contact Katie McHugh, SDRP Intern Coordinator, at kmchugh@mote.org). During 2018, 17 interns and post-graduate trainees provided approximately 8,300 hours of assistance to the program.

Grad student – Where is he now?

Stable isotope research

Sam Rossman, Hubbs-SeaWorld Research Institute

Nearly a decade ago as I began my graduate education working with Dr. Peggy Ostrom at Michigan State University in collaboration with the SDRP to study the foraging ecology of bottlenose dolphins, I would learn that, much like life, graduate education rarely adheres to best laid plans. Luckily for me, the breadth of research at the SDRP provided a perfect setting to figure out what kind of scientist I wanted to be. Upon entering graduate school, I had dreams of the adventurous life of a field biologist, however, day-long surveys trying to spot dolphins for someone with mild ADHD is a fairly effective means of torture. So instead I turned my focus to the large sample archive of the SDRP and attempted to determine what the dolphins could tell us about how Sarasota Bay has changed. My work relied on harvesting small "tree-ring" like layers called growth layer groupings (GLG) from dolphin teeth and performing a technique known as stable isotope analysis to determine where dolphins were foraging. This turned out to be a very difficult process for a graduate student to tackle, however the SDRP's network of collaborators is extensive. I was able to call upon the expertise of Florida's resident GLG expert Megan Stolen (Hubbs-SeaWorld Research Institute) and together we developed a new extraction protocol for GLGs. This collaboration grew the following year when Megan's focal population of bottlenose dolphins in the Indian River Lagoon experienced their third unusual mortality event (UME) in less than two decades. The working hypothesis at the time was that UME resulted from the loss of habitat and prey fish. However, this was a question I could explore given my work using stable isotope analysis on dead, stranded dolphins from Sarasota Bay. Given the severity of the UME, Hubbs-SeaWorld Research Institute made a postdoc position available for me to join the team and at Hubbs-SeaWorld Research Institute I am, along with help from other SDRP alumni such as Dr. Spencer Fire, making progress in understanding the ecology of this threatened dolphin population using the skills and collaborations developed at the SDRP.

Grad student – Where is she now?

Spotted eagle ray research

Kim Bassos-Hull, Mote Marine Laboratory

I saw my first spotted eagle ray jump out of the water in Tampa Bay, Florida back in 1990 during my initial year with the Sarasota Dolphin Research Program. It was during SDRP's annual census surveys for bottlenose dolphins to provide abundance estimates for the National Marine Fisheries Service. I was a new graduate student with Randall Wells through the University of California at Santa Cruz, and learning the ropes about field surveys on the west coast of Florida. Fast forward to 2009 and a 19-year career with the SDRP, I was given the opportunity to take on a new research program with Mote Marine Lab under the direction of Bob Hueter with Mote's Center for Shark Research to

study these leaping rays. I credit the training I received with the SDRP to prepare me to be a good field biologist, outreach communicator, collaborator, write grant proposals, and initiate the Spotted Eagle Ray Conservation Research Program at Mote.

Spotted eagle rays are considered near-threatened by the International Union for the Conservation of Nature (IUCN) due to targeted fisheries for them in places such as Mexico and Cuba and bycatch in several locations worldwide. They are a long-lived, late-maturing, low-fecund ray that only has 1-4 pups a year which is cause for concern if too many are taken in fisheries. At the same time spotted eagle rays are important for ecotourism as sighting one while diving or snorkeling is considered a special treat and visitors love to view them in aquariums. One of the goals of our program has been to shed more light on the biology and behavior of this ray in order to provide updated information to management in Florida, several foreign countries, and the IUCN. We have done this research through international collaborations with scientists from Mexico, Cuba, Bahamas, Brazil, other US academic institutions as well as collaborations with AZA public aquariums, such as Georgia Aquarium, that house spotted eagle rays. Together with these collaborators we have published several scientific and popular articles including one where citizen scientists have contributed important information. I can't thank the SDRP enough for giving me the conservation training that allowed me to initiate and grow this program where in 2018, nine years after inception, we have made significant strides providing important information about this previously understudied ray. For more information on our program please visit www.mote.org/eagleray.

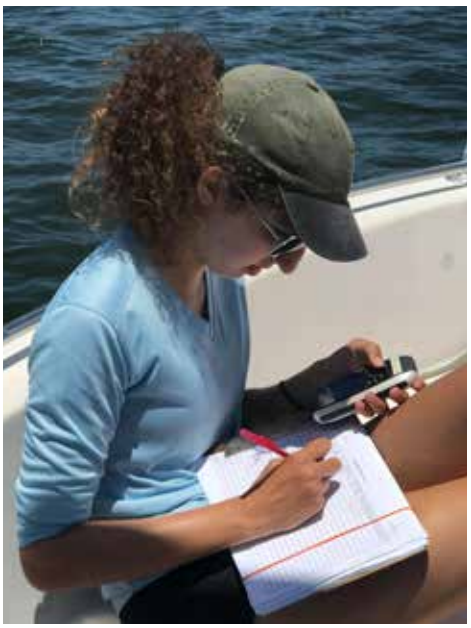
Kim Bassos-Hull and colleagues from Mexico examine a spotted eagle ray that was captured and released in Sarasota Bay.

Intern perspective - 2018

Mary Whiteacre

The first time I visited Mote Marine Lab, in the summer of 2016, I walked away with one thought in my mind: "I have to work here." When I sat down and looked at the internships available, I stumbled across the Sarasota Dolphin Research Program's internship and knew this was where I needed to be. Looking at the work the SDRP did, I couldn't help but feel it was almost too perfect. When I reached out to Katie McHugh for more information, every additional thing I learned reinforced the feeling. This internship was the perfect blend of what I wanted to do. It meshed together my two majors, wildlife biology and psychology, perfectly, and I couldn't help but be drawn to the chance to be a part of the world's longest running study of a wild dolphin population.

For a year and a half, I waited for the time to apply, and once I did my anticipation and excitement grew exponentially. I counted down the days to my start date, and once I arrived, knew right away it was going to be a great summer. There were some things I expected, including the chance to learn how to use new technology, the opportunity to get comfortable working on a boat, and of course the pleasure of getting to discover more about bottlenose dolphins. However, there were many more things I never could have anticipated. I realized early on that there was more to learn about every aspect of research than I had ever imagined. I never could have guessed how much I would love observing dolphins every day and learning about the species, individuals, and behaviors. If you had told me some of the most memorable days of the internship would be the ones where we were covered with fish scales before noon, I wouldn't have



believed you. There is no way I could have anticipated the priceless opportunities to network with biologists doing incredible work around the world.

These unexpected learning experiences left me with one major takeaway: this was the kind of work I could see myself doing for a long time. I enjoyed every minute of it, whether it was taking pictures in the field or adding numbers to a spreadsheet in the lab. By the end of the summer, I knew for certain that I wanted to attend graduate school to continue doing this sort of research after receiving my Bachelor's degree in May 2019. Even more importantly, this internship has prepared me to take this next step by providing the chance to develop the skills and gain the experience in research, data analysis, and networking required to be well-equipped for graduate work and, later, a career in this field.

Former intern perspective - Where is she now?

Still connected from the Land Down Under

By Katy Holmes

My passions for marine mammals and animal behavior have shaped my academic trajectory and work experience. As a high schooler I attended camps at the Dolphin Research Center in the Florida Keys to explore the career paths that most interested me: marine mammal training and research. I found the lure of learning more about the lives of wild cetaceans impossible to resist, so during my undergrad I began looking for opportunities to get field experience. My first taste of fieldwork was a hot summer in Mississippi, where I interned at the Institute for Marine Mammal Studies. Learning to survey bottlenose dolphins and do photo-ID was a dream come true, but I knew I still had a long way to go to satisfy my interests and make a place for myself. I was fortunate enough to intern with Sarasota Dolphin Research Program (SDRP) the next year. The SDRP exposed me to a variety of research projects, from population monitoring and human-interaction to passive acoustics, which enlightened me as to the broad and interdisciplinary nature of marine mammal science. I benefited greatly from the staff's openness, professionalism and depth of experience while honing the field skills I needed to grow professionally. Interning with SDRP has proved invaluable in helping me advance my career goals because of the valuable experience it provided and the strength of its record of excellence in research and training. Less than a year after graduating with a BS in Biology and completing my internship, I began the MRes in Marine Mammal Science degree program at University of St Andrews in Scotland, taught by members of the Sea Mammal Research Unit. Thanks to this reputable degree, my internships, and referees including Katie McHugh from SDRP, in 2016 I was selected for a volunteer research assistant position in the Shark Bay world heritage area in Western Australia for the Dolphin Alliance Project (DAP), the second-longest study on a wild bottlenose dolphin population after SDRP. I have now spent almost a year in this amazing place observing the fascinating social behavior of this population, first as an assistant and now running my own field season as a first-year PhD student.

Although my PhD began recently, I am already growing as a scientist with the guidance of my supervisors, who include DAP's primary investigators. I will build on DAP's long-term research on the alliances of adult males in the eastern gulf of Shark Bay. My research will delve into the lives of juvenile males, examining long-term fitness effects of their social networks and how they use communication and physical behavior to develop the alliance relationships that are crucial to their adult reproductive success. This is an exciting frontier; few studies have focused on juvenile cetacean behavior despite a reasonable expectation that this life history period has long-term effects on their ability to achieve reproductive success as adults. The generally less well-marked appearance of juveniles' dorsal fins compared to adults makes it more difficult to follow specific individuals in the field for focal observation. Happily, thanks to SDRP, IMMS and DAP, I am prepared for the challenge and am off to a great start with my first PhD field season.

It's funny how small and well-connected the marine mammal science community is. Only a couple years before Katie McHugh interviewed me for an SDRP internship she finished her PhD on the behavioral development of juveniles in the Sarasota Bay bottlenose dolphin population. Now I am on a similar journey and one of the talented people assisting me this field season (Beatriz Mattiuzzo) recently finished her own SDRP internship. Six years later, I still feel connected to SDRP and grateful for its role in helping me get to where I am.

Volunteer perspective

Ralph Piland, Salisbury Zoological Park and Dolphin Biology Research Institute

I was never the child in a grade school classroom who enthusiastically raised their hand and shouted "Pick me, pick me" when the teacher asked what we wanted to be when we grew up. Some might argue that was my reaction to most classroom questions, but truthfully I really didn't know the path I wanted to take or the thing that would bring meaning to my life. I enjoyed searching, taking the college classes I found stimulating rather than those dictated by a career choice (I confess to being a philosophy major). That searching, in a convoluted fashion, eventually gave me the opportunity to work at the Chicago Zoological Society's Brookfield Zoo. It was a wonderful environment, then under the direction of Dr. George Rabb, providing broad exposure to the issues of conservation. Brookfield presented opportunities and experiences, extensive learning opportunities, and more options that ultimately might resolve that still unanswered classroom question.

Growing up professionally at Brookfield Zoo included some outstanding life experiences. I traveled to the Amazon and to Australia. I helped with shark research in the Bahamas. But it was the accidental proximity of the Aquatic Bird House, where I began work at Brookfield, to the original Seven Seas Dolphinarium that proved to be a critical element. When extra hands and muscle were needed, I began helping my zoo neighbors with the semi-annual physical exams of the zoo's dolphins. An increasing focus on conservation issues lead the Chicago Zoological Society in 1989 to partner with the Sarasota Dolphin Research Program (SDRP). And in 1990 my experience lifting and carrying Brookfield's resident dolphins lead to a surprise invitation from Randall Wells to help assist in Sarasota.

My early days visiting Sarasota were a blur of new experiences, new people and an evolving understanding of the mission of SDRP. In those days the program was particularly dependent upon volunteer labor to assist both in the population surveys and in the periodic health assessments. I began to recognize that many of the volunteers were returning veterans, planning their summers and vacations so that they could gift their time and energy to helping perpetuate the work in Sarasota. Slowly those returning faces became more familiar, ultimately growing to feel like family. The summer work was important, but gathering in Sarasota was also an opportunity to check on the progress of student volunteers and interns as they moved through their graduate studies and began to apply the knowledge and skills cultivated in Sarasota to their areas of expertise. It was a chance to chat with established researchers and collaborators about their individual progress and their evolving areas of interest. The SDRP is recognized as conducting the world's longest running study of a wild dolphin population. But beyond the animals, there are multitudes of wonderful people absolutely committed to perpetuating the priceless work that SDRP represents.

The popular Harry Potter stories include an early scene that asserts that "The wand chooses the wizard." Despite my inability to respond decisively to my teacher's question I had the good fortune to be drawn into something that resonated deeply for me. Like Harry I felt "chosen" by something both magical and meaningful. The SDRP has longevity and history, marking nearly 50 years of continuous scientific work. It has many key scientific discoveries. But it is more than just the sum of those discoveries and publications. It is a community of committed individuals that work to insure that meaningful science is conducted and communicated. It is a privilege to be associated with the Sarasota Dolphin Research Program, with the Dolphin Biology Research Institute, and with so many people willing to make this work a priority within their lives. While I look forward to continuing to assist in the physical work of SDRP I also hope that I can help others to be "chosen" by the opportunities SDRP represents and to experience its magic.

Top: Ralph Piland and long-time volunteer and Marine Mammal Commission staff member Dee Allen prepare to release F255 during a Sarasota Bay health assessment. Bottom: Ralph keeping track of Joker, a resident juvenile.

Products

Professional Activities Summary: November 2017 through October 2018

Published Peer-Reviewed Journal Articles, Book Chapters

Ardente, A. J., T. J. Garrett, J. Colee, B. J. Vagt, M. T. Walsh, R. S. Wells, C. R. Smith, E. D. Jensen, T. L. Schmitt and R. C. Hill. 2017. Differences in purine metabolite concentrations in the diet of managed and free-ranging common bottlenose dolphins, (*Tursiops truncatus*). Aquatic Mammals 43:618-628. DOI 10.1578/AM.43.6.2017.618.

Baker, I., J. O'Brien, K. McHugh, S. Ingram and S. Berrow. 2018. Bottlenose dolphin (*Tursiops truncatus*) social structure in the Shannon Estuary, Ireland, is distinguished by age- and area-related associations. Marine Mammal Science 34:458-487.

Baker, I., J. O'Brien, K. McHugh and S. Berrow. 2018. Female reproductive parameters and population demographics of bottlenose dolphins (*Tursiops truncatus*) in the Shannon Estuary, Ireland. Marine Biology 165:15.

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, P. Clarke, C. Cush, A. Honaker, K. McHugh, T. Speakman, R. Wells and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. J. Cet. Res. Management. 18:1-9.

Balmer, J. E., G. M. Ylitalo, T. K. Rowles, K. D. Mullin, R. S. Wells, F. I. Townsend, R. W. Pearce, J. L. Bolton, E. S. Zolman, B. C. Balmer and L. H. Schwacke. 2018. Persistent organic pollutants (POPs) in blood and blubber of common bottlenose dolphins (*Tursiops truncatus*) at three northern Gulf of Mexico sites following the Deepwater Horizon Oil Spill. Science of the Total Environment 621:130–137.

Cerutti-Pereyra, F., K. Bassos-Hull, X. Arvizu-Torres, K. A. Wilkinson, I. García-Carrillo, J. C. Perez-Jimenez and R. E. Hueter. 2018. Observations of spotted eagle rays (*Aetobatus narinari*) in the Mexican Caribbean using photo-ID. Environmental Biology of Fishes, 101:237-244.

Cheney, B., R. S. Wells, T. Barton and P. Thompson. 2017. Laser photogrammetry reveals variation in growth and early survival in free-ranging bottlenose dolphins. Animal Conservation. DOI:10.1111/acv.12384.

Desoubeaux, G., C. Le-Bert, V. Fravel, T. Clauss, A. J. Delaune, J. Soto, E. D. Jensen, J. E. Flower, R. S. Wells, G. D. Bossart and C. Cray. 2017. Evaluation of commercial Aspergillus Western blot IgG® kit and a genus-specific ELISA for the diagnosis of aspergillosis in common bottlenose dolphins (*Tursiops truncatus*). Medical Mycology 56:847-856. DOI:10.1093/mmy/myx114.

Fahlman, A., K. McHugh, J. Allen, A. Barleycorn, A. Allen, J. Sweeney, R. Stone, G. Bedford, M. J. Moore, F. Jensen and R. Wells. 2018. Resting metabolic rate and lung function in wild offshore common bottlenose dolphins, *Tursiops truncatus*, near Bermuda. Frontiers in Physiology 9:886. DOI:10.3389/fphys.2018.00886.

Fahlman, A., F. H. Jensen, P. L. Tyack and R. S. Wells. 2018. Modeling tissue and blood gas kinetics in coastal and offshore common bottlenose dolphins, *Tursiops truncatus*. Frontiers in Physiology 9:838. DOI:10.3389/fphys.2018.00838

Fahlman, A., M. Brodsky, R. Wells, K. McHugh, J. Allen, A. Barleycorn, J. C. Sweeney and D. Fauquier. 2018. Field energetics and lung function in wild bottlenose dolphins, *Tursiops truncatus*, in Sarasota Bay, Florida. Royal Society Open Science 5:171280. http://dx.doi.org/10.1098/rsos.171280.

Galligan, T. M., L. H. Schwacke, D. S. Houser, R. S. Wells, T. K. Rowles and A. S. P. Boggs. 2018. Characterization of circulating steroid hormone profiles in the bottlenose dolphin (*Tursiops truncatus*) by liquid chromatography-tandem mass spectrometry (LC-MS/MS). General and Comparative Endocrinology 263:80-91.

Hart, L. B., B. Beckingham, R. S. Wells, M. Alten Flagg, K. Wischusen, A. Moors, J. Kucklick, E. Pisarski and E. Wirth. 2018. Urinary phthalate metabolites in common bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, FL, USA. GeoHealth 2. https://doi.org/10.1029/2018GH000146.

Hart, L. B., K. Wischusen and R. S. Wells. 2017. Rapid assessment of bottlenose dolphin (*Tursiops truncatus*) body condition: There's an app for that. Aquatic Mammals 43(6):635-643. DOI:10.1578/AM.43.6.2017.635.

Le-Bert, C., C. R. Smith, J. Poindexter, A. Ardente, J. Meegan, R. S. Wells, S. Venn-Watson, E. D. Jensen and K. Sakhaee. 2018. Comparison of potential urinary risk factors for ammonium urate nephrolithiasis in two bottlenose dolphin (*Tursiops truncatus*) populations. American Journal of Physiology – Renal Physiology 315:F231-F237. DOI:10.1152/ajprenal.00606.2017.

O'Hara, T., M. Templeton, J. Castellini, R. Wells, K. Beckmen and J. Berner. 2018. Use of blood-soaked cellulose filter paper for measuring Carbon and Nitrogen stable isotopes. Journal of Wildife Diseases 54:375-379. DOI: 10.7589/2017-08-202.

Pirotta, E., C. Booth, D. Costa, E. Fleishman, S. Kraus, D. Lusseau, D. Moretti, L. F. New, R. Schick, L. Schwarz, S. Simmons, L. Thomas, P. Tyack, M. Weise, R. Wells and J. Harwood. 2018. Understanding the population consequences of disturbance. Ecology and Evolution, 2018: 1-13. DOI:10.1002/ece3.44

Pulis, E. E, R. S. Wells, G. S. Schorr, D. C. Douglas, M. M. Samuelson and M. Solangi. 2018. Movements and dive patterns of Pygmy Killer Whales (*Feresa attenuata*) released in the Gulf of Mexico following rehabilitation. Aquatic Mammals 44(5):555-567. DOI:10.1578/AM.44.5.2018.555.

Sequeira, A. M. M., J. P Rodríguez, V. Eguíluz, R. Harcourt, M. Hindell, D. W. Sims, C. M. Duarte, D. P. Costa, J. Fernandez-Gracia, L. C. Ferreira, G. Hays, M. Heupel, M. G. Meekan, A. Aven, F. Bailleul, A. Baylis, M. Berumen, C. Braun, M. J. Caley, R. Campbell, R. H. Carmichael, E. Clua, L. Einoder, S. D. Goldsworthy, C. Guinet, J. Gunn, D. Hammer, N. Hammerschlag, M. Hammill, L. A. Hückstädt, N. E. Humphries, I. Jonsen, G. Skomal, M.-A. Lea, A. Lowther, A. Mackay, E. McHuron, J. Mckenzie, L. McLeay, C. R. McMahon, K. Mengersen, M. Muelbert, A.M. Pagano, B. Page, N. Queiroz, P. Robinson, S. A. Shaffer, M. Shivji, S. Thorrold, S. Villegas-Amtmann, M. Weise, R. Wells, B. Wetherbee, A. Wiebkin, B. Wienecke, M. Thums. 2018. Convergence of movement patterns of marine megafauna in coastal and open oceans. Proceedings of the National Academy of Sciences. https://doi.org/10.1073/pnas.1716137115.

Serrano-Flores, F., J. C. Pérez-Jiménez, I. Méndez-Loeza, K. Bassos-Hull, and M. J. Ajemian. 2018. Comparison between the feeding habits of spotted eagle ray (*Aetobatus narinari*) and their potential prey in the southern Gulf of Mexico. Journal of the Marine Biological Association of the United Kingdom,1-12. DOI:10.1017/S0025315418000450.

Sprogis, K. R., F. Christiansen, H. C. Raudino, H. T. Kobryn, R. S. Wells and L. Bejder. 2018. Sex-specific differences in the seasonal habitat use of a coastal dolphin population. Biodiversity and Conservation, 27:3637-3656. DOI:10.1007/s10531-018-1618-7.

Weideman, H. J., Z. M. Jablons, J. Holmberg, K. Flynn, J. Calambokidis, R. B. Tyson, J. B. Allen, R. S. Wells, K. Hupman, K. Urian and C. V. Stewart. 2017. Integral curvature representation and matching algorithms for identification of dolphins and whales. IEEE International Conference on Computer Vision Workshops Proceedings, 2831-2839.

Wells, R. S. 2018. Identification methods. Pp. 503-509 In: B. Würsig, J. G. M. Thewissen, and K. Kovacs, eds., Encyclopedia of Marine Mammals. 3rd Edition. Academic press/Elsevier, San Diego, CA.

Wells, R. S. and M. D. Scott. 2018. Bottlenose dolphin: Common Bottlenose Dolphin (*Tursiops truncatus*). Pp. 118-125 In: B. Würsig, J. G. M. Thewissen, and K. Kovacs, eds., Encyclopedia of Marine Mammals. 3rd Edition. Academic press/Elsevier, San Diego, CA.

Wells, R. S., A. Natoli and G. Braulik. 2018. *Tursiops truncatus*. The IUCN Red List of Threatened Species. Version 3.1. <www.iucnredlist.org>.

Nellie's first calf leaping while socializing.

Products

Manuscripts In Press or Accepted for Publication

Desoubeaux, G., R. Peschke, C. LeBert, V. Fravel, J. Soto, E. Jensen, J. Flower, R. Wells, A. Joachim and C. Cray. 2018. Seroprevalence survey for microsporidia in common bottlenose dolphins (*Tursiops truncatus*): Example of a quantitative approach based on immunoblotting J. Wildlife Diseases 54:000-000. DOI:10.7589/2017-11-287.

Lauderdale, L. K., C. Messinger, R. S. Wells, K. A. Mitchell, D. Messinger, R. Stacey and L. J. Miller. Accepted. Advancing the use of morphometric data for estimating and managing common bottlenose dolphin (*Tursiops truncatus*) mass. Marine Mammal Science.

McBride-Kebert, S., J. S. Taylor, H. Lyn, F. R. Moore, D. F. Sacco, B. Kar and S. A. Kuczaj II. Accepted. Controlling for survey effort is worth the effort: Comparing bottlenose dolphin (*Tursiops truncatus*) habitat use between standardized and opportunistic photographic-identification surveys. Aquatic Mammals.

McHugh, K. Accepted. Odontocete social strategies along and in-shore. Pp. xxx-xxx In: B. Würsig, ed., Ethology and Behavioral Ecology of Toothed Whales and Dolphins, the Odontocetes. Springer International Publishing.

Wells, R. S. Accepted. Foraging patterns of common bottlenose dolphins: Behavioral solutions that incorporate habitat features and social associates. Pp. xxx-xxx In: B. Würsig, ed., Ethology and Behavioral Ecology of Toothed Whales and Dolphins, the Odontocetes. Springer International Publishing.

Contract and Other Reports

Wells, R. S. 2017. Post-release monitoring of injured or stranded cetaceans in the Southeastern U.S. Final Report: John H. Prescott Marine Mammal Rescue Assistance Grant Program, Award No. NA14NMF4390187. 14 pp.

Tyson, R. B., Pinaik, W. E. D., Domit, C., Nowacek, D. P., and M. P. B. Fuentes. 2018. Behavioural response of juvenile green sea turtles (*Chelonia mydas*) to the FaunaGuard Turtle Module. Prepared for VanOord, www.VanOord.com.

Popular and Semi-Popular Articles, Book Reviews, Educational Films and Videos

Honeyborne, J. and M. Brownlow. 2017. Blue Planet II. BBC Books (and television) – scientific advisor.

Presentations at Professional Meetings

Bassos-Hull, K., K. McHugh, K. Gaylord-Opalewski, and R. Ryan. 2018. Tracking debris hotspots in Southwest Florida USA with the help of student scientists. 6th International Marine Debris Conference, 12-16 March 2018, San Diego, CA.

Bassos-Hull, K., K. Wilkinson, and R. S. Wells (presenter). 2018. Sarasota Bay Acoustic Network: A collaborative effort to study movement of multiple species along the west coast of Florida. GCOOS Animal Telemetry Network Workshop, New Orleans, LA. 23 Jan 18.

Diaz, V. and K. McHugh. 2018. Acoustic monitoring of anthropogenic disturbance of bottlenose dolphins in Sarasota Bay. Mote Marine Laboratory NSF REU Poster Session, 02 August 2018, Sarasota, FL.

Greenfield, M. R., D. I. Rubenstein, K. A. McHugh and R. S. Wells. 2018. Effect of anthropogenic injuries on the social associations of bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Florida Marine Mammal Health Conference VI, 28-30 March 2018, Orlando, FL.

Hart, L.B. 2018. Canaries of the Coast: A study of phthalate exposure in bottlenose dolphins. Oceans '18 Conference. Charleston, SC, USA. 10/22/18-10/25/18.

Phillips, G., L. Thomas, R. S. Wells and D. P. Nowacek. 2018. Estimating animal abundance from passive acoustics: A real-world test using a bottlenose dolphin population of known size. International Statistical Ecology Conference, St Andrews, Scotland, 5 Jul 2018.

Toms, C. N., T. S., Daly-Engel, P. E., Rosel, L. A., Wilcox and A. J. Worthy. 2018. Fine-scale genetic population structure of common bottlenose dolphins (*Tursiops truncatus*) in the Florida Panhandle. Proceedings of the 2018 Annual Ecological Society of America Conference. New Orleans, LA.

Wells, R. S. 2018. Longitudinal bottlenose dolphin health assessment and population monitoring in Sarasota Bay, Florida. Florida Marine Mammal Health Conference VI, 28 Mar 2018, Orlando, FL.

Wells, R. S. 2018. Sarasota Dolphin Research Program involvement in small cetacean telemetry in the Gulf of Mexico. GCOOS Animal Telemetry Network Workshop, New Orleans, LA. 23 Jan 18.

Wells, R. S. and G. N. Lovewell. 2018. Long-term research and conservation programs – value and challenges. Florida Marine Mammal Health Conference VI, 30 Mar 2018, Orlando, FL.

Wells, R. S., K. A. McHugh and G. N. Lovewell. 2018. Long-term research and conservation programs – value and challenges. Clearwater Marine Aquarium Stranding Conference, Clearwater, FL. 27 Oct 18.

Wells, R. S. B. C. Balmer, L. E. Howle, M. D. Scott, D. A. Fauquier, A. A. Barleycorn, K. A. McHugh, J. B. Allen, A. B. Irvine, F. I. Townsend, J. C. Sweeney, K. Ng and A. J. Westgate. 2018. Finmount tag history of development and performance. Workshop to Discuss Future Directions for Cetacean Tag Attachment Development, 19-20 June 2018, Seattle, WA.

Invited Public, University, School Lectures

Bassos-Hull, K. 2017. Marine megafauna research in the Gulf of Mexico and Caribbean Sea - citizen scientists can help! Mote Marine Laboratory Teacher Workshop. 04 Nov 2017.

Bassos-Hull, K. 2017. Trash to treasure: Raysing awareness about marine debris. Youth Ocean Conservation Summit at Mote Marine Laboratory. 09 Dec 2017.

Bassos-Hull, K. 2018. Tackling conservation issues with the help of citizen science. Mote Marine Laboratory Teacher Workshop. 24 Feb 2018.

Bassos-Hull, K. 2018. Marine debris - more than what our eyes can see. Mote Science Café. Calusa Brewing, Sarasota, FL. 16 Apr 2018.

Bassos-Hull, K. 2018. Plastic pollution: Wildlife & habitat impacts. St. Petersburg College STEM Center, FL. 13 Jul 2018.

Bassos-Hull, K. 2018. Plastic pollution: Wildlife & habitat impacts. Marine Explorers Camp, Emerson Preserve, FL. 10 Aug 2018.

Bassos-Hull, K. 2018. Connecting for conservation: Research on dolphins and marine rays in Gulf of Mexico, Atlantic Ocean and Caribbean Sea. Dolphin Quest, Waikoloa, Hawaii. 04 Sep 2018.

McHugh, K. and K. Bassos-Hull. 2018. Plastic Pollution: Wildlife and Habitat Impacts. Science and Environment Council, Mote Marine Laboratory. 18 Jan 2018.

McHugh, K. 2018. Meet Your Dolphin Neighbors! Sarasota P.E.O. 28 Mar 2018.

McHugh, K., G. Lovewell, and R. Hazelkorn. 2018. Help Protect Our Wildlife. Sarasota County Sheriff Office Marine Unit Boating Roundtable. Venice Community Center. 01 Jun 2018.

McHugh, K. 2018. Integrating behavior and conservation of dolphins: The fun and frustration of studying charismatic megafauna. REU Brown Bag Seminar, Mote Marine Laboratory. 27 Jul 2018.

McHugh, K. 2018. Dolphins: Our Coastal Neighbors. Florida Maritime Museum, Cortez, FL. 24 Oct 2018.

Wells, R. S. 2017. Sustainable life with our aquatic neighbors – The dolphins of Sarasota Bay. Keynote Address. 12th Annual Sustainable Communities Workshop, Sarasota County, FL. 30 Nov 2017.

Wells, R. S. 2018. The world's longest-running study of a wild dolphin population: Lessons from 4 decades and 5 generations. St. Stephens Episcopal School – High School Assembly, Bradenton, FL. 24 Jan 2018.

Wells, R. S. 2018. The world's longest-running study of a dolphin population: Lessons from four decades and 5 generations. Mote Marine Laboratory Basic Marine Science Class. 12 Feb 2018.

Wells, R. S. 2018. The dolphins of Sarasota Bay – Lessons from 48 years and five generations. Oceanogràfic, Valencia, Spain. 08 Mar 2018.

Wells, R. S. 2018. Checking in on our finned neighbors: Sarasota dolphin update, and notes from our efforts around the world. Cosmos Club, Sarasota, FL. 20 Apr 2018.

Wells, R. S. 2018. Sarasota's bottlenose dolphins – Indicators of ecosystem health. Environmental Summit 2018, Sarasota, FL. 26 Apr 2018.

Wells, R. S. 2018. Sarasota dolphin conservation research. King Scholars High Flyers, Brookfield, IL. 28 Apr 2018.

Wells, R. S. 2018. The world's longest-running study of a wild dolphin population – Lessons from 48 years and five generations. Annual Night of Appreciation, Brevard Zoo, Melbourne, FL. 07 Sep 2018.

Wells, R. S. 2018. The world's longest-running study of a wild dolphin population – Lessons from 48 years and five generations. Wharton School Advanced Management Program Alumni Group, Sarasota, FL. 03 Oct 18.

Wells, R. S. 2018. The world's longest-running study of a wild dolphin population – Lessons from 48 years and five generations. Mote Volunteer General Meeting, Mote Marine Laboratory, Sarasota, FL. 11 Oct 2018.

Wilkinson, K. A. 2018. Dolphin behavioral shifts post shark interaction. Interdisciplinary Ecology Seminar. Gainesville, FL. 09 Apr 2018.

Program Operations

As the lab turns...

Shauna McBride, Chicago Zoological Society

We have had quite a few additions to our SDRP family over the past year! After welcoming Matthew Allen Cush, second child for Carolyn and Brian Cush, in October, we welcomed Harper Naia McHugh Barleycorn, first-born to Katie McHugh and Aaron Barleycorn, to the family on November 28th. Then, we started 2018 off with a bang by welcoming Sawyer Blue Moore, first-born to Reny Tyson Moore and Jason Moore, to our SDRP family on January 7th. We will have quite a crew of interns in the year 2036!

Future SDRP interns, Matthew Allen Cush, Sawyer Blue Moore, and Harper Naia McHugh Barleycorn pose for a photo in their SDRP onesies!!

Christina Toms photographing dolphins in Sarsota Bay

In mid-January, we welcomed Christina Toms to our team as a Research Associate. Christina joined us after conducting her dissertation research with the University of Central Florida. She conducted photo-ID and biopsy surveys to document dolphin population structure and dynamics in the Florida Panhandle. Her role at SDRP focuses on leading photo-ID surveys, assisting with fishing surveys, and coordinating sampling for health assessments amongst many other tasks. Christina is a valuable staff addition thanks to her years of experience (including as an SDRP intern in 2006) in photo-ID and her versatility.

Shauna McBride and Alan Kebert tying the knot on March 17, 2018.

In March, I celebrated St. Patrick's Day by tying the knot with Alan Kebert and eating green velvet wedding cake.

In other developments, congratulations to Christina, Reny, and Krystan Wilkinson for putting down roots and purchasing homes! Kim and Pete Hull celebrated their sons' big accomplishments – Ian and Dylan started graduate and undergraduate programs at the University of Washington in Seattle. Krystan defended her dissertation through the University of Florida at the beginning of November and she will be continuing with us as a Postdoctoral Scientist.

Program Operations

Chicago Zoological Society Staff

Jason Allen, BS, Lab Manager
Aaron Barleycorn, BS, Field Coordinator
Elizabeth Berens McCabe, MS, Research Associate
Carolyn Cush, BS, Research Assistant
Allison Honaker, MPS, Research Assistant
Shauna McBride, PhD, Research Assistant
Katie McHugh, PhD, Staff Scientist
Reny Tyson Moore, PhD, Staff Scientist
Christina Toms, MA, Research Associate
Randall Wells, PhD, Program Director
Krystan Wilkinson, PhD, Postdoctoral Scientist

Mote Marine Laboratory Staff

Kim Bassos-Hull, MS, Research Associate

Dolphin Biology Research Institute Officers

Ralph Piland, President
Blair Irvine, PhD, Vice President
Michael Scott, PhD, Secretary
Randall Wells, PhD, Treasurer

Doctoral Students (SDRP staff serve on committees)

Austin Allen, Duke University
Isabel Baker, Galway - Mayo Institute of Technology
Andria Beal, Florida International University
James Powell, Portland State University
Theresa Anne Tatom-Naecker, University of California, Santa Cruz
Christina Toms, University of Central Florida
Krystan Wilkinson, University of Florida

Master's Student (SDRP staff serve on committees)

Errol Ronje, University of Florida

Undergraduate Senior Thesis Student

Michelle Greenfield, Princeton University

Interns and Post-Graduate Trainees

Jacqueline Bucsa
Ashley Burke
Victoria Diaz - REU
Jenna Dilworth
Wendy Folfas
Lindsay Hooper
Renee LaGarenne
Beatriz Mattiuzzo (Brazil)
Kasey Pruett
Alex Salamone
Lucas Santos (Brazil)
Katie Swatkowski
Kara Watts
Mary Whiteacre
Erica Wirth

Interns Jenna Dilworth and Lindsay Hooper enthusiastically searching for dolphins during a photo-ID survey.

SDRP staff members Aaron Barleycorn and Randall Wells work with Michael Moore and Jay Sweeney to test the tag attachment device (TADpole).

Local and Returning Volunteers

Austin Allen
Dee Allen
Ralph Arden
Perfecto Barba
Ed Blair, Jr.
René Byrskov (Denmark)
Brianna Cahill
Ralph Corse
Heather Daszkiewicz
Michael Duranko
Amy Evers
Kristi Fazioli
Mark Fishman
Devon Francke
Ramsey Frangie
Charles Gates
John Hamilton
Aren Hendrickson
Chris Hessell
Jeff Hollway
Fran Johnson
Olvy Johnson
Renee Jones
Cathy Marine
Caryl Mason
Charlie Mericle
Fran Mericle
Cecilia Mould
Nigel Mould
Jim Ochiltree
Danielle Oplaski
Chip Phillips
Aya Robinson
Bryan Spaulding
Frank Szydlowski
Jeff Stover
Jessica Taing
James Thorson
Bill Tiffan
Martha Wells

Volunteer René Byrskov caught the tail end (literally) of a set with Noah during our Sarasota Bay dolphin health assessment project.

Opportunities for You to Help Dolphin Research and Conservation

Show Your Support for the Chicago Zoological Society's Sarasota Dolphin Research Program

Your gift to the Sarasota Dolphin Research Program will ensure the future of the important research and continued development of an unparalleled base of knowledge about wild dolphin populations. Each year, it costs approximately $1.0 million to fund our scientists and our internationally recognized research. Your donation will ensure that we can continue to learn about and help some of the world's most majestic creatures. For more information on how you can help, please contact Cindy Zeigler, Chief Advancement Officer, at (708) 688-8263.

Special Thanks

The Chicago Zoological Society is honored to recognize the following donors and funding organizations for their generous contributions from October 1, 2017 - October 31, 2018 to its Sarasota Dolphin Research Program through donations, research grants, and/or contracts.

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Nancy C. Tameling
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Mr. & Mrs. Thomas A. Tisbo
Barbara & George Trees
Cindy & Bill Zeigler

SDRP welcomes equipment donations in addition to funds

Donations, including boats, computers, cameras, and vehicles, greatly help with our efforts, and can be made to Dolphin Biology Research Institute (dba Sarasota Dolphin Research Program). DBRI is a Sarasota-based 501{c}3 not-for-profit organization, incorporated in 1982, and dedicated to research and conservation of dolphins and their habitat. For more information on how you can help, please contact Randall Wells at (941) 374-0449.

Dolphin Biology Research Institute would like to thank the following contributors for their donations of $500 or more over the past year, through October 2018:

Anonymous
Ronnie and John Enander
Eric Frick and Pam Salaway
John Hamilton
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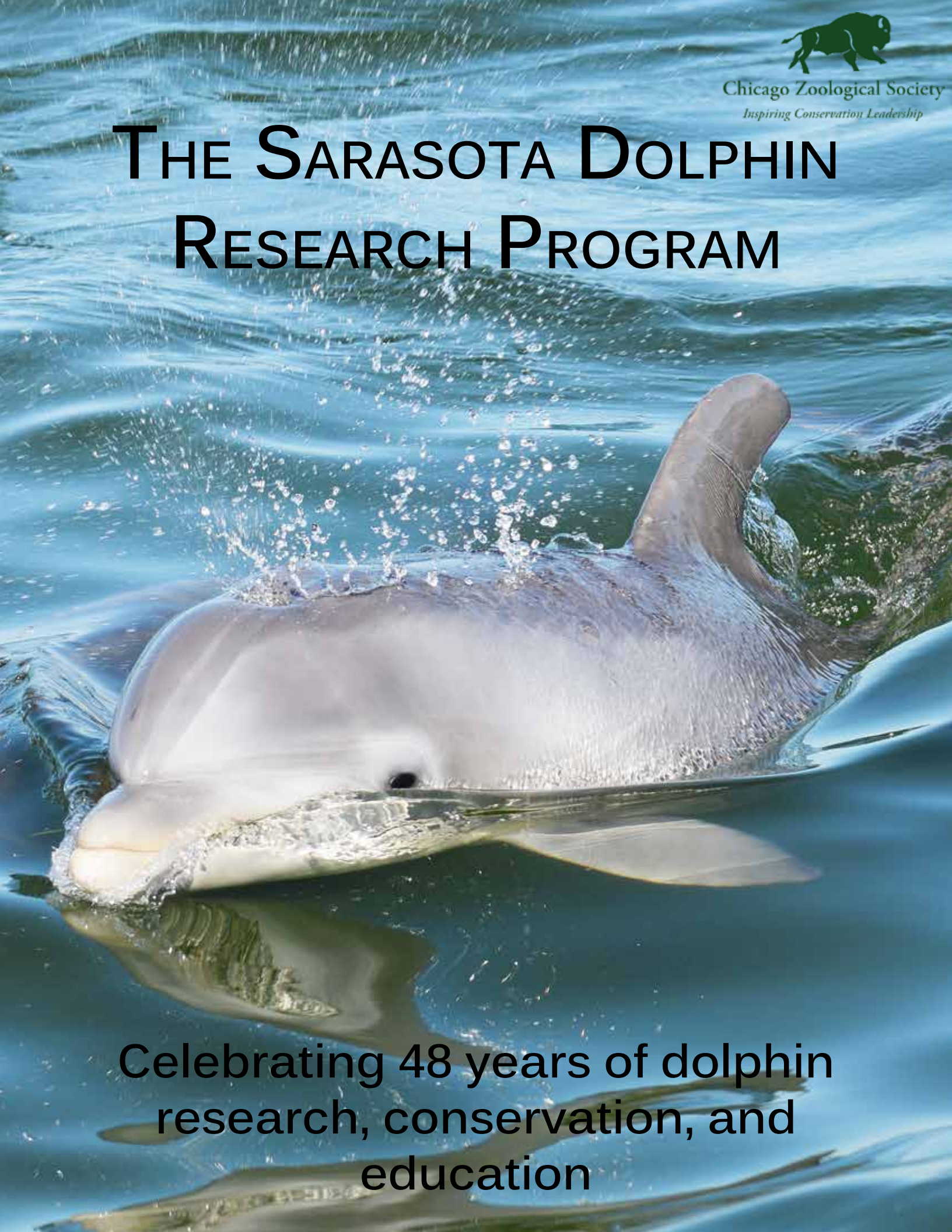

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