



## 2018 - Coastal Carolina University

### Presentation Abstracts

#### **Preliminary examination of sexual dimorphism in Northeast Florida bottlenose dolphins (*Tursiops truncatus*)**

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Despite extensive morphometric analyses along the central east Florida coast, little has been done to examine sexual dimorphism in northeast Florida (NEFL) dolphins. To bridge this gap, this study investigates absolute sexual dimorphism in total body length of stranded dolphins along the Florida northeast coast (Nassau to Volusia County) from Mar. 2011-Oct. 2017. During necropsy, standard morphometric and photographic data were collected. Total body length (TL) was measured to the nearest centimeter in a straight line from rostrum tip to fluke notch. Only individuals classified as adults were used; this excluded specimens that were potentially undergoing ontogenetic variation. Individuals without stranding coordinates, photographs, measurements, or age classification were excluded. To determine if there was a difference between estuarine dolphins within the St. Johns River (SJR), and potential coastal ecotypes in this region, dorsal fins were compared to the UNF SJR catalog. Individuals sighted 10+ times were categorized as SJR residents (male=13, female=6), while coastal dolphins (male=26, female=12) were categorized as unidentified dolphins that stranded outside of the SJR. To determine sexual dimorphism, TL was compared between sexes and ecotypes using independent t-tests (SPSS Statistics v.22). When examining all dolphins stranded within NEFL, there was no statistically significant sexual dimorphism (male=46,  $\bar{x}$ =258.27±2.22; female=20,  $\bar{x}$ =251.20±3.84,  $t(64)=1.681$ ,  $p>0.05$ ) with females 97.26% of male length. Additionally, there were no intrasexual differences between SJR and coastal ecotypes, respectively (male:  $\bar{x}$ =260.50±3.28, 257.19±3.08,  $t(37)=0.668$ ,  $p>0.50$ ; female:  $\bar{x}$ =251.17±6.07, 248.25±5.34,  $t(16)=0.334$ ,  $p=0.742$ ). Further analyses on proportional dimorphism is warranted to corroborate these findings.

#### ***Komarekiella delphikhthonos* sp. nov. (Cyanobacteria): an epidermal cyanobacterium implicated in an estuarine bottlenose dolphin (*Tursiops truncatus*) fatality**

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The St. Johns River (SJR, Jacksonville, FL) is a large, brackish, estuarine system affected by anthropogenic pollution, recurrent HABs, and diverse toxin-producing cyanobacterial taxa. The SJR also provides critical habitat for a genetically and behaviorally distinct estuarine community of bottlenose dolphins (*Tursiops truncatus*). Behavioral and stranding data suggest population health decline, characterized by widespread dermatitis and routinely utilizing and stranding in oligohaline and mesohaline areas of the river. On January 15, 2015, a stranded adult male dolphin (identified "MKNA" from the University of North Florida (UNF) photo-identification catalog) was recovered from oligohaline habitat in Green Cove Springs, FL (N 30.029086, W -81.696062) with a thick mat present on the left and right flank and fluke consisting of fungi, bacteria, and cyanobacteria. MKNA was last seen with extensive skin lesions 5 months prior to stranding. Preliminary toxin analyses (ELISA and the MMPB technique) confirmed trace concentrations of microcystins/nodularins (MCs/NODs) in the epidermal mat. Due to small size of sample, additional analyses will be run on the cyanobacteria cultured from the original sample. A total evidence approach of molecular, genetic (16S rDNA and 16-23S ITS), and ecological analyses suggest the toxin producer as a new species of cyanobacteria (proposed *K. delphikhthonos*). To the author's knowledge, this is the first time MCs/NODs analyses have been conducted on an epidermal mat found on a bottlenose dolphin. This discovery warrants an area of further investigation as toxic, epiphytic cyanobacteria may be new source of health decline and mortality in bottlenose dolphins utilizing low salinity habitats.

### **Survival of male Weddell seals in Erebus Bay, Antarctica**

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Long-term survival estimates provide useful insights for understanding life history strategies, overall fitness, and ecological changes in marine mammals. Using long-term mark-recapture data for 7,516 male Weddell seals, we 1) evaluated how survival and detection rates vary with age, 2) compared survival rates with previous estimates for males and females in the population, and 3) interpreted our estimated survival rates in the context of populations of other pinniped species. We used a Bayesian approach to build hierarchical models using the R2JAGS package for R to estimate apparent survival and detection rates of male Weddell seals in Erebus Bay, Antarctica from 1980-2015. Our preliminary estimates of male survival vary strongly with age, provide evidence of actuarial senescence not previously detected for male Weddell seals, and are lower than recently developed estimates for females in the population. Our survival estimates are similar to male survival rates in other polygynous populations of pinniped species, which demonstrate decreased survival with increasing degrees of polygyny. Detection probabilities were modest for adult males of all ages, which suggests several interesting possible hypotheses regarding why male rates are lower than those for females and remain low throughout adulthood. Possible explanations relate to male reproductive behavior and the importance of defending underwater territories, which makes males more difficult to re-encounter each year compared to females, even late in life, which could relate to terminal investment by older males.

### **Pilot whale depredation in the Atlantic pelagic longline fishery: an interdisciplinary approach**

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Short-finned pilot whales (*Globicephala macrorhynchus*) predate on bait and catch in the pelagic longline tuna fishery of North Carolina, causing economic loss in the fishery and putting individual animals at risk of becoming hooked or entangled during these interactions. We are an interdisciplinary team of Duke University undergraduate and graduate students, professional scientists, and full-time academics researching the history and dynamics of this interaction using multiple, complementary approaches. We are currently conducting fishermen interviews to investigate how their behavior has adapted in response to conflict with the whales, what mitigation strategies they have attempted, and their perceptions of these interactions. We are also analyzing fisheries-dependent catch and depredation data to characterize the spatial and temporal occurrence of depredation, its impact on target fish catch, and its importance as an alternative food source for pilot whales. Our goal is to synthesize these sources of information to create a clearer picture of the current state of the interaction and provide potential recommendations for future mitigation efforts.

### **Fiber-type profiles and enzyme activities of the vocal muscles of long-beaked common dolphins (*Delphinus capensis*) and killer whales (*Orcinus orca*)**

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Cetaceans move air in their nasal passages past their sound generators, the monkey lips dorsal bursae complex, in order to produce sound. The anatomy of the muscles that act on the nasal passages has been described, and the fiber-type profiles of these muscles have been characterized in the bottlenose dolphin (*Tursiops truncatus*) and harbor porpoise (*Phocoena phocoena*). However, to better understand the contraction abilities of cetacean vocal muscles and the roles these muscles play in their sound production, we undertook a study of the fiber-type profiles of the vocal muscles of long-beaked common dolphins and killer whales. In addition, we investigated the oxidative [citrate synthase (CS)] and glycolytic [lactate dehydrogenase (LDH)] enzyme activities in these muscles, as well as those of *Tursiops* and *Phocoena*. The left and right nasal musculature of the killer whale and common dolphin, and the genioglossus complex and palatopharyngeal sphincter of *Delphinus*, were serially sectioned in a cryostat and stained for their acidic myosin ATPase activities. Images of these sections were then utilized to determine the percentages of fast- and slow-twitch fibers in the muscles, as well as the sizes of the fibers. Enzyme kinetic techniques were used to measure the CS and LDH activities in the killer whale, common and bottlenose dolphin, and porpoise vocal muscles. The fiber-type profiles, fiber sizes, and enzyme activities of the vocal muscles of all four cetacean species will be evaluated in order to determine how they fit with the sound production abilities of these animals.

## **Social phenotypes in the Indo-Pacific bottlenose dolphin (*Tursiops aduncus*)**

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Interest in stable behavioral phenotypes has shaped modern studies of both human and non-human animal behavior. In the animal literature, two critically important areas have been neglected. First, the stability of behavioral phenotypes, essential by definition, has rarely been measured over time. Second, social phenotypes have received little attention. Social phenotypes impact fitness, but can also impact population dynamics through, for example, disease spread and information transfer. Long-lived, highly social species, such as elephants, primates, and cetaceans, are expected to be good candidates for inter-individual social variation. Here, we investigate the presence and temporal stability of social phenotypes in the Indo-Pacific bottlenose dolphin (*Tursiops aduncus*). Repeatability estimates were calculated across life history stages from infancy to adulthood for time spent socializing and time spent in different group sizes (alone, small, and large) using both surveys (N=31 females, 17 males) and focal animal sampling (N=11 females). Time spent socializing and in small groups showed low repeatability ( $r=0.35$ ,  $r=0.13$ ), but time spent alone and time spent in large groups showed high repeatability ( $r=0.74$ ,  $r=0.76$ ). This suggests broad measurements of social activity are only marginally repeatable across life history stages. Social behavior rates may be instead related to developmental contexts, emphasizing the importance of ontogeny for understanding phenotype stability. The high repeatability of the two extreme group categories indicates that certain facets of sociality exhibit a stable behavioral phenotype. The lack of repeatable individual differences for time spent in small groups suggests that some level of gregariousness is favored regardless of social phenotype.

## **Lethal Great White Shark (*Carcharodon carcharias*) Attack on a Bottlenose Dolphin (*Tursiops truncatus*) off the coast of North Carolina**

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Shark attacks on delphinids occur globally, but have been notably rare within North Carolina. On 13 December 2016, a freshly dead adult (2.52m), female bottlenose dolphin (RJM 021), stranded on Topsail Island, North Carolina. Both gross and histopathological exams identified the cause of mortality as exsanguination (and ensuing hypovolemic shock) due to shark attack. A large, gaping wound was located on the animal's ventral surface, with several other bite marks on the left lateral flank. Forensic analysis (based upon Lowry et al., 2009) was applied to determine both the size and species of shark, by examining the wound, teeth bite marks and interdental distances (IDD). Information from the literature on shark behaviour and distribution were used to support the forensic findings. Two digital photographs, taken before necropsy, were used to measure IDD: one with the carcass hanging vertically by its flukes and the other with the carcass positioned prone (to estimate maximum and minimum distances, resulting from varying blubber tension with each position). Three independent judges decided on which lacerations to use as part of the bite arc, and only when in unanimous agreement were the bite marks used. Resulting IDDs yielded an estimated shark length between 6.65-7.15m, identifying the species as a white shark (*Carcharodon carcharias*). Publicly available shark tracking data (OCEARCH.org) demonstrated that there were multiple white sharks off the North Carolina coast in December 2016. Intriguingly, the attacking shark did not consume RJM 021, potentially implying a more complex interaction than just predation.

## **Does primary production drive the migration patterns of coastal stocks of Atlantic Bottlenose Dolphins (*Tursiops truncatus*)?**

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Of the five coastal stocks of bottlenose dolphins (*Tursiops truncatus*) along the US Atlantic coast, only two are classified as migratory: the Northern Migratory (NM) and the Southern Migratory (SM) Coastal Stocks. The other three (the South Carolina/Georgia, Northern Florida and Central Florida Coastal Stocks) are classified as non-migratory, though potential small-scale seasonal movements have not been investigated. Management-related research efforts have largely focused on estimating stock range and abundance, but little attention has been given to the ecological foundations that select for distinct migratory and non-migratory stocks in the first place. The purpose of this study was to describe seasonal patterns of coastal primary production along the central and southern US Atlantic coast and to explore potential connections between primary production patterns and the distribution and movements of coastal bottlenose dolphin stocks. We analyzed satellite data of a chlorophyll-a proxy from Aqua-MODIS Climatology reports, compiling monthly averages for four months each year (January, April, July, October) from 2002 to 2017. Using SeaDAS, transects were drawn from regularly spaced locations along the US east coast to quantify changes in seasonal chlorophyll-a concentrations from 0-12 km offshore. Based on these patterns, we explore various questions regarding dolphin migratory patterns, including: (1) why the SM coastal stock migrates (it is likely not due to temperature), (2) why incursions by the SM coastal stock do

not displace neighboring stocks to the south, (3) where SM dolphins go during their southern, winter migrations, and (4) why the non-migratory coastal stocks form separate stocks.

### **HOW FAR DOES A WHISTLE TRAVEL? THE ESTIMATED ACTIVE SPACE OF THE HARMONICS OF BOTTLENOSE DOLPHIN (*Tursiops truncatus*) WHISTLES IN SARASOTA BAY, FLORIDA**

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The Sarasota Bay bottlenose dolphins are part of the world's longest running study of a wild dolphin population, including the medical and behavioral history of each animal. Dolphins communicate with whistles which contain frequency modulated strands called harmonics. Harmonics have been thought to aid in the signaler's orientation to other conspecifics, in which useful information is provided for group orientation and movement. Harmonics are also highly directional, the higher in frequency the harmonic (from the fundamental harmonic) the more directional it will be from the producer. For communication to be successful, the whistle component must be received. The propagation of sound is highly influenced by the environment and the physical characteristics of sound. Whistle transmission across both sand and seagrass dominated substrates in Sarasota Bay, FL, will be analyzed for harmonic transmission. The dolphin whistles (10-30 kHz) are played at three different depths through an underwater transducer to hydrophones stationed at different angles and distances to measure received levels in each of these different contexts. Seagrass is expected to absorb more sound, thus preventing the harmonics from traveling as far. Sand is expected to absorb less sound, allowing the harmonics to travel further. The received signal strength will be analyzed on Adobe Audition and Avisoft. Because harmonics are highly directional, they will likely attenuate differentially at different angles and across different substrates in Sarasota Bay. This is important in understanding how harmonics travel, which can be applied to cohesion studies of the dolphins in Sarasota Bay.

### **Analyzing the Strength of Male Bottlenose Dolphin (*Tursiops Truncatus*) Associations at Adjacent North Carolina Study Sites**

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Bottlenose dolphins (*Tursiops truncatus*) live in fission-fusion societies, although males may form stable associations with one or two individuals for easier access to mates. The objectives of this study were to quantify the social associations of male bottlenose dolphins occurring in the Roanoke Sound, NC, and examine the stability of these associations at an adjacent study site near Beaufort, NC. From 2007--2014, opportunistic (N = 93) and dedicated (N = 62) photo-identification surveys were conducted in Roanoke Sound. Dorsal fin photos were graded for quality and matched to the OBXCDR catalog. We calculated the half-weight coefficient of association (COA) for 19 males to determine the stability of their associations. In the Roanoke Sound, COA values ranged from 0.3-0.9, where more than 50% of the pairs were loosely associated (COA = 0.3 – 0.39). When the COA values for four highly associated pairs (COA =  $\geq 0.7$ ) in Roanoke Sound were compared to their COAs at the Beaufort site, we found two pairs exhibited similar association indices while two pairs experienced substantial drops in their COAs. By studying male pair associations, we can determine the extent of mixing between populations and estimate the relative abundances of each for conservation purposes. Future studies should focus on more detailed observations of male pairs by using focal follows, increasing the sighting dataset size to better quantify association patterns, and further examine the presence of social networks within known populations.

### **Analysis of Vessel Interaction Rates with Bottlenose Dolphins (*Tursiops truncatus*) in the St. Johns River, Jacksonville, FL**

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Vessel traffic and associated engine noise are a documented source of anthropogenic disturbance for cetaceans. A recent soundscape study of the St. Johns River (SJR), in Jacksonville, Florida, concluded that sound levels were significantly higher than those from other documented rivers. This finding is concerning because the SJR provides critical habitat for a resident population of bottlenose dolphins. The sound sources within the SJR have not yet been examined. Thus, this study aimed to determine if vessel traffic may be a source of disturbance for SJR dolphins by quantifying dolphin-vessel interaction rates. Since 2011, weekly dolphin surveys have been conducted along a fixed transect from the river's mouth to 40 km upriver (downtown Jacksonville). Using data from March 2011 to December 2016 (233 surveys) we quantified the number of vessels per minute along the survey route and within 50 m of a dolphin group. The SJR was divided into the same 71 quadrants (800m x 800m) used in the soundscape study. Mean dolphin-vessel interaction rates were calculated for each quadrant and ranged from zero vessels per minute (11 quadrants) to a maximum (mean $\pm$ SE) of 0.22 $\pm$ 0.08 vessels per minute. Overall, interaction rates were higher among the quadrants from the river

mouth to ~20 km upriver (0.07±0.01 vessels per min.), compared to the upriver portion of the survey route (0.03±0.01 vessels per min.). These data will be compared to the soundscape study to determine if there is a correlation between high sound levels and vessel interaction rates.

### **Examining stock structure of common bottlenose dolphins (*Tursiops truncatus*) through photo-identification and genetic analyses**

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Common bottlenose dolphins (*Tursiops truncatus*) in the southeastern United States exhibit varying degrees of residency within coastal populations including small-localized bay, sound, and estuary (BSE) populations. Evidence of resident estuarine animals along the U.S. Atlantic coastline is supported through photo-identification and genetic studies. The purpose of this project was to couple long-term photo-identification data, spatial data, and genetics to examine stock structure of the common bottlenose dolphins in the estuarine waters of Savannah, Georgia. Remote biopsy sampling was conducted in September 2015 and February and March 2017 between the Savannah River and northern Ossabaw Sound in the southern range of the Northern Georgia/Southern South Carolina Estuarine System stock of common bottlenose dolphins. Genomic DNA was extracted from skin samples and sequenced to determine haplotype. Dolphins with 10 or more sightings between 2009 and 2013 were mapped in ArcMap 10.2 (N = 45). The study area was split into three regions: north, buffer, and south. Population differentiation (Fst and Φst) were calculated between regions. Five haplotypes were identified within the sample population. Haplotype frequency (Fst) was found to be significantly different between the northern region and buffer region (p = 0.0137) but not between the northern and southern region or buffer and southern region. All pairwise Φst comparisons revealed no significant difference. It is possible that dolphins outside of the estuary traveled into the Wilmington River and non-BSE animals were sampled. The inclusion of spatial data with genetics may provide a more accurate representation of stock structure.

### **Pseudorca crassidens Mass Stranding Event in Southwest Florida: Significant Findings, Challenges, and Recommendations**

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On 14 January 2017, 99 false killer whales (*Pseudorca crassidens*) mass stranded in Everglades National Park, Monroe County, Florida. There have been only 7 other documented mass strandings of this species in Florida, with only one other event being of similar magnitude in 1970. To date, this is also the largest mass stranding of this species documented on the west coast of Florida. A multi-agency response was coordinated over the span of three days for this regionally extensive and rare mass stranding event. Early video-documentation of pre-stranding behavior showed erratic, active swimming, clustering, and logging close to shore. Stranded individuals were marked for identification. Attempts were made to redirect selected free-swimming animals offshore, however most animals eventually re-stranded. Drugs were administered to euthanize 10 of the whales. Level A Data, dorsal fin photographs, and blubber/skin samples were collected on 84 carcasses, full necropsies were performed for 12 cases, and blood was collected on nine live animals. Gross examinations, virology, histopathology, and biotoxin analyses revealed no probable cause of stranding, although thin body condition and worm infections were noted and some results are still pending. Notable challenges associated with a large-scale field response in a remote, isolated, boat accessible only location included lack of roads for transport of personnel and equipment, communication limitations (VHF radios only due to remoteness), administration of euthanasia, lack of tagging equipment and other means of marking, and human safety concerns. We will present lessons learned from this unique event and recommendations for future mass strandings.

### **Marine Mammal Permitting: What's new, what's not, and what you need to know**

Carrie Hubard

NOAA Fisheries

Whether you're studying marine mammals in the field or their samples in the lab, you need to make sure your activities are covered by the appropriate Marine Mammal Protection Act, and if applicable, Endangered Species Act (ESA) permit. We'll dig into the red tape to discuss what the different permit types are, how to choose the best one for your research, and what the process involves. We'll discuss when to apply for a permit and how to make sure your application is complete. Recent developments like the de-listing of East Coast humpback whales and an interim ESA definition of "harass," have also changed permitting options for some researchers. Once you have a permit, you will be required to submit annual and final reports. Those reporting forms were revised

this February, so we'll discuss how they've changed. We'll explain how to make changes to your permit such as adding new methods or increasing take numbers, adding personnel, and getting permission to have a documentary film crew with you in the field. Most importantly, we want to make sure you know where you can go to find answers to your permitting questions.

### **Grandmother effects in bottlenose dolphins**

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Due to its rarity in mammalian taxa, menopause has sparked much evolutionary debate. One potential mechanism provided by the "grandmother hypothesis" is that by provisioning kin, menopausal females increase the number and survival of grandoffspring more than they would by reproducing themselves. However, do non-menopausal females also provide similar benefits and would this undermine the grandmother hypothesis? We utilized a multigenerational demographic dataset of > 30 years to investigate grandmother effects in reproductively senescent bottlenose dolphins (*Tursiops aduncus*) in Shark Bay, Australia. We analyzed 36 maternal grandmother relationships and found that while living grandmothers do not affect grandoffspring infant survival, they decrease grandoffspring age at weaning ( $z = -2.07$ ,  $p < 0.05$ ). Of individuals with living grandmothers, those that associated with her directly also had earlier weaning ages than grandoffspring-grandmother pairs that did not ( $z = -2.09$ ,  $p < 0.05$ ). Finally, females with living mothers gave birth to their first offspring earlier than females whose mothers had died ( $z = -3.60$ ,  $p < 0.001$ ). As both initiating reproduction earlier in life and weaning offspring sooner can allow for more successful offspring over the course of a lifetime, these results indicate that the presence of senescent female kin may increase reproductive performance. Older females might benefit kin through socio-ecological knowledge of key foraging habitats, or through a protective effect against predators or conspecifics. Next we will parse kin-directed benefits from matrilineal effects. Comparisons between menopausal and closely related non-menopausal species are essential to understanding factors that shape a prolonged post-reproductive lifespan.

### **Seasonal presence of common bottlenose dolphins (*Tursiops truncatus*) in the waters around Savannah, Georgia**

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Seasonal movements are important to understanding species distribution and habitat use to manage species effectively. Common bottlenose dolphins (*Tursiops truncatus*) inhabiting waters near Savannah, GA are part of the Northern Georgia/Southern South Carolina Estuarine System (NGSSCES) stock. Dolphins from estuarine stocks are thought to include year-round residents, seasonal residents (migratory individuals) and rarely seen transients. Near Savannah, GA, abundance reduces by half in winter. The purpose of this study was to identify year-round resident individuals in estuarine waters near Savannah. Boat-based photo-identification surveys were conducted from 2009 to 2016 resulting in 535 distinct individuals. For each year, data were organized into a winter period (November to March) and a summer period (May to September). Dolphins sighted on  $\geq 10$  days were expected to be resident animals; all 223 (100%) individuals were observed in  $\geq 2$  summers and 201 (90.1%) in  $\geq 4$  summers. However, 57 (25.6%) individuals were never seen in winter, and only 22 (9.9%) individuals were seen in  $\geq 4$  winters. These trends indicate that the majority of individuals are summer seasonal residents, while very few of them are year-round residents. The NGSSCES stock has a surprisingly complex population structure; the low number of individuals present in multiple winters in estuarine waters near Savannah, GA suggests that these dolphins do not display the expected year-round residency.

### **LOCOMOTOR MUSCLE MORPHOLOGY OF THREE SPECIES OF PELAGIC DELPHINIDS**

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Investigating the locomotor muscle morphology of diving mammals has yielded functional insights into how they utilize their environment and partition resources. This study examined a primary locomotor muscle, the longissimus, in three closely related, similarly-sized pelagic delphinids ( $n = 7-9$  adults of each species) that exhibit different habitat and depth preferences. The Atlantic spotted dolphin (*Stenella frontalis*) is a relatively shallow diver, inhabiting predominantly continental shelf waters, while the striped (*S. coeruleoalba*) and short-beaked common (*Delphinus delphis*) dolphins are sympatric, deep water species that dive to different depths. Based upon comparative data from other diving mammals, it was hypothesized that the locomotor muscle of the deepest-diving striped dolphin would exhibit a higher percentage of slow oxidative fibers, larger fiber diameters, a higher myoglobin concentration [Mb], and a lower mitochondrial density than that of the shallow-diving spotted dolphin, and that the muscle of the common dolphin would display intermediate values for these features. As expected, the locomotor muscle of the striped dolphin exhibited a significantly higher proportion of slow ( $57.3 \pm 3.9\%$ ), oxidative ( $51.7 \pm 2.5\%$ ) fibers and higher [Mb] ( $8.2 \pm 0.7$  g/100 g

muscle) than that of the spotted dolphin ( $41.3 \pm 3.9\%$ ,  $31.0 \pm 3.2\%$ ,  $4.7 \pm 0.05$  g/100 g muscle, respectively). *D. delphis* displayed intermediate values for percent slow ( $53.3 \pm 3.3\%$ ), oxidative ( $42.7 \pm 2.1\%$ ) fibers and [Mb] ( $5.0 \pm 0.2$  g/100 g muscle), although these values were not always significantly different from those of the stenellids. In contrast, there were no differences in fiber size or mitochondrial density between these species. Thus, like other deep divers, *S. coeruleoalba* displayed features of its locomotor muscle that enhance oxygen storage capacity and its efficient use, but did not display features that limit aerobic capacity. These results suggest a novel muscle design for an active, small-bodied, and deep-diving cetacean.

### **Reproductive success of bottlenose dolphins (*Tursiops truncatus*) in the St. Johns River, Florida**

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Due to their slow reproductive strategy, determining the interbirth interval (IBI) in bottlenose dolphins is essential because IBIs correlate with environmental conditions, and are directly affected by calf mortality. In dolphins, IBIs generally fall between 3-5 years across populations, yet calf mortality is highly variable. These measurements are strong indicators of population status, but have only been assessed in a small number of populations. To increase our understanding of dolphin reproductive strategies, this study aims to examine reproductive success of dolphins within the St. Johns River (SJR; Jacksonville, FL). Photo-identification and behavioral surveys were conducted weekly from March 2011 – July 2017. IBIs were calculated as the number of years between two young of year (yoy) births to the same mother, while calf survival was determined as the percentage of calves first sighted as yoys that survived to years 1 (N=96) and 3 (N=70) of life. The SJR has a mean birth rate of 21.5 births/year with a mean IBI of 2.94 years (Md=3; N=47). Calf survival was found to be 79.16% in year 1 and 51.42% in year 3. A low IBI equates to a high output of calves, and coupled with the normal rate of calf survival could suggest population growth in the SJR despite the high levels of anthropogenic disturbance in this area. Thus, this study establishes a baseline of reproductive success prior to increasing urbanization within the SJR.

### **Age and sex-specific survivorship in a long-lived bisexually philopatric species**

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Comprehensive mortality data for both sexes of a long-lived mammal are extremely rare. Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) in Shark Bay, Australia, are bisexually philopatric, as both sexes remain in their natal territories after they reach sexual maturity. Utilizing a 35+ year longitudinal data set collected by the Shark Bay Dolphin Project on over 1600 individuals, we investigated patterns of age and sex-specific survivorship in bottlenose dolphins. For individuals born within the study period, birth dates were calculated based on physical traits and consecutive observations of the mother before and after she had a calf. For individuals whose births were not observed, age was estimated based on observations of size and degree of ventral and dorsal speckling. Calf mortality was based on observations of the mother with, and then without her calf. Juvenile and adult mortality was estimated after 3 or more consecutive years that the individual was not sighted. Calf mortality by age 3 was 33.6% (N=841 calves). Maximum lifespan is at least 47 years and median age of death was 11.7 years. Females show an increase in mortality at around 12 years of age, coincident with the age of first reproduction. Males show a slight increase in mortality at around 20 years of age, also coincident with first reproduction (paternity). These data suggest there are elevated costs at the onset of reproduction for both sexes. This dataset provides a unique opportunity to examine age and sex-specific survivorship and mortality in a long-lived wild cetacean.

### **Interactions between short-finned pilot whales (*Globicephala macrorhynchus*) and Pelagic Longline Fisheries in the Cape Hatteras Special Research Area (CHSRA)**

Roosevelt A. Mesa

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Short-finned pilot whales (*Globicephala macrorhynchus*) present a long history of interactions with Pelagic Longline (PLL) Fisheries along the East Coast of the United States. The species is known to feed mainly on the hooked bigeye tuna, representing a threat for both the PLL fisheries' economic interests and for the species itself. The establishment of the CHSRA was part of the measures enacted in the PLL Take Reduction Plan, responding to the constant presence of the whales in the Area. However, recent efforts have attempted

to remove it, arguing that the species no longer occurs in high numbers within it. We made use of ARGOS data from satellite tags deployed by the Duke Marine Lab on 57 pilot whales. Through geospatial analysis and modeling, this data was initially contrasted with oceanographic variables such as bathymetry, slope, and productivity. Results evidenced high use of the Area and significant fidelity of the tagged individuals to the shelf break, a potential consequence of the depth change and concentration of resources in these zones. The PLL fishing effort analysis demonstrated a high density of fishing activity also occurring along the shelf break and with important hotspots within the boundaries of the CHSRA. The combined analysis of both whales' and fisheries' densities evidenced high co-occurrence across the area of interest, depicting areas in which conflicts between both parts are very likely. This study constitutes a relevant initial approach to the negative interactions between fisheries and cetacean species in the region and serves as an updated and reliable source of information for stakeholders and policymakers to address this ongoing conflict.

### **Is There a Correlation Between Estuarine Habitat Complexity and Survey Density of Bottlenose Dolphins (*Tursiops truncatus*)?**

Riley Norman, Francesca Roselli, Daniela Silva, and Robert Young  
Coastal Carolina University

Estimates for the abundance and range of estuarine stocks of bottlenose dolphins are not always known in the Southeast US. This makes it difficult to assess the health and overall status of the stocks. In the absence of such information, changes in survey densities (relative abundance) can be used to monitor population trends over time. Even a single estimate can be instructive if expected survey densities are correlated with measures of habitat complexity. We investigated the hypothesis that seasonal dolphin survey density is correlated with habitat complexity in the salt marsh estuaries of South Carolina. Photo-identification surveys were conducted from May 16 to October 20, 2017 in estuarine waters from North Inlet/Winyah Bay to ACE Basin, SC. Surveys were broken into seven sub-locations, each of which could be completed in a single day. Each sub-location was surveyed on six separate occasions, yielding a total of 2,476 km of estuarine survey for comparison. The dendritic pattern of salt marsh creeks was quantified based on a modification of the fresh water stream order system, and a correlation between habitat complexity of the survey track and the number of dolphins sighted per survey will be reported.

### **A History of Antarctic Baleen Collected for the Smithsonian from Post-WWII Japan**

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Smithsonian Institution

In the aftermath of WWII, Japanese rice production was down by about 40%. Critical food shortages were severely disrupting the economy. The Supreme Command of the Allied Powers (SCAP), headed by General Douglas MacArthur, needed to find solutions to feed the population. Despite strong objections from Allies, in 1946 SCAP decided to authorize two Japanese whaling fleets to harvest mostly blue and fin whales in the Antarctic in order to feed the population. Allied and Japanese observers on the expeditions collected large amounts of shipboard as well as environmental data on the catch. Smithsonian curator Remington Kellogg requested that the largest baleen plates from each side of every harvested blue and fin whale be collected and shipped to the Smithsonian for an aging study. In 1948 plates from 1627 whales (two expeditions for two years) were shipped but the material proved inadequate for aging and was subsequently stored and neglected. The collection was stabilized and rehoused in 1996. Around 2010 marine mammals collections manager Charles Potter initiated an investigation to determine the origins of the baleen. Archival evidence linked the collection to the post-WWII Japan Antarctic whaling expeditions. In 2017 Robert Brownell procured the ship data from the Japanese, which was subsequently used to catalog the material and make it available for research. A number of research labs are now collaborating to analyze baleen samples for DNA, stable isotopes, hormones and toxins. The unique size of the collection allows for unprecedented research into the life history of these whales.

### **Field group size estimates: How close are we?**

Robin M. Perrtree, Amy K. Shook, and Tara M. Cox  
Savannah State University

Group size is an important variable for understanding abundance, social structure, and habitat usage. Final group size estimates are often based on field estimates and photo-identification data for common bottlenose dolphins (*Tursiops truncatus*). However, due to the time consuming nature of photo-identification, these final estimates may not be available for months to years. The purpose of this project was to analyze the accuracy and precision of field estimates by comparing to final estimates for each sighting after photo-identification analyses were completed. Photo-identification surveys of common bottlenose dolphins have been conducted in Savannah, Georgia since April 2009. Field and final group sizes were compared for 1495 sightings from April 2009 to July 2014. Field estimates of group size ranged from 1-40 dolphins, and final estimates were 1-77 dolphins. For most sightings (82.6%; 1235 of 1495)



the field estimate was identical to the final estimate. A total of 233 sightings (15.6%) had final estimates greater than the field estimate and just 27 sightings (1.8%) had final estimates fewer than the field estimate. Smaller groups had a large proportion of the sightings with equal field and final estimates and smaller differences between the two estimates. As group size increased the accuracy and precision of field estimates decreased. For group sizes of  $\leq 14$  dolphins, the mean difference between the field and final estimates was  $2.3 \pm 2.1$  dolphins. In contrast, groups  $> 14$  were more difficult to estimate in the field with mean differences of  $10.0 \pm 10.3$  dolphins, indicating photo-identification data are important.

### **Analyzing Potential Trends for the Occurrence of the Florida Manatee (*Trichechus manatus latirostris*) along the Coast of Georgia**

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<sup>1</sup>Savannah State University

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In the United States, the distribution of Florida manatees (*Trichechus manatus latirostris*) ranges from Texas to Florida and northward to North Carolina, but they have been observed as far north as Rhode Island. The migration patterns of the Florida manatee include the reliance on warm-water refugia and warm-water discharges at industrial sites. The purpose of this study was to evaluate potential drivers for manatee occurrence along the coast of Georgia from 1975 to 2017, during which the Georgia Department of Natural Resources has been collecting manatee sighting data through opportunistic and systematic surveys. Manatee sighting data were mapped and compared with dock and marina locations in Georgia, and facilities with the National Pollutant Discharge Elimination System (NPDES) permit. From a total of 403 sightings, 178 (44.2%) occurred in Chatham County, 159 (39.4%) were in Camden County, and 66 (16.4%) were in Glynn County. Most sightings from early in the study period (1975-2001) occurred in Camden County, which also had the lowest number of systematic observations (4 total, compared to 22 in Glynn and 55 in Chatham). Manatees were mainly observed around or at the discharges of NPDES-permitted facilities in all 3 counties. The results suggest the need for more systematic surveys, considering that the increase in effort through the years resulted in a higher number of sightings. The consistency of systematic surveys can contribute to the identification of potential drivers for manatee occurrence both in the present and in the future, and help predict hotspots based on the local environment.

### **Epidemiological investigation of tattoo-like lesions among bottlenose dolphins in Shark Bay, Australia**

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Bottlenose dolphins are excellent bioindicators of ocean ecosystem health because they accumulate biotoxins and contaminants, routinely appear at the water's surface, and exhibit skin lesions associated with environmental degradation. Here, we analyzed tattoo-like lesions linked to poxvirus in a population of *Tursiops aduncus* studied for 30+ years in Shark Bay, Australia. Previous studies of tattoo skin disease (TSD) relied mostly on strandings, but we documented epidemiological patterns of TSD in a healthy population. Dolphins were classified with TSD by photographs. The average age of infection was 26.0 months (SE =  $\pm 3.9$  mos.) with the symptomatic period lasting  $137 \pm 29.8$  days. Prevalence of TSD was 19.4%, with yearlings (1-2 years) exhibiting TSD much more than younger and older calves ( $P < 0.001$ ). TSD was rare among juvenile and adult dolphins (N = 68 calves, 4 juveniles, and 3 adults). Lower prevalence in young-of-the-year might be due to maternal immunity, while older individuals ( $> 2$  years) have infection-acquired immunity. Some social network attributes were associated with TSD. Namely those that acquired TSD associated significantly more with symptomatic individuals in the year prior to onset ( $P < 0.0001$ ). Degree was not predictive of TSD infection status but we are investigating the relationship between TSD and other social attributes. Overall, the low prevalence of TSD in Shark Bay is consistent with other indicators of good health in this population such as high reproductive rate and survival. Thus, the prevalence of tattoo-like lesions should be monitored as a sentinel indicator of ecosystem health.

### **Assessing stock overlap of common bottlenose dolphins (*Tursiops truncatus*) in the northern Gulf of Mexico using a novel approach: semi-automated dorsal fin matching**

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The northern Gulf of Mexico (nGoMx) comprises 31 bay, sound, and estuary (BSE) stocks and three coastal stocks of common bottlenose dolphins (*Tursiops truncatus*). Although many of these BSE stocks have been studied extensively via photo-identification

(id), the overlap of individuals between stocks is largely unknown. Currently, there are also limited data on movement patterns of coastal stocks and interaction with BSE stocks. Photo-id of small cetacean dorsal fins is time consuming and labor intensive. Application of new technology is necessary to effectively and efficiently match individuals within and across study sites. FinfindR is a recently developed fin-matching software that aims to expedite the matching process and greatly reduce the constraints associated with manual photo-id comparisons. Using this new approach, we compared photo-id catalogs from two adjacent nGoMx BSE stocks: St. Andrew Bay, FL (SAB; N=389) and St. Joseph Bay, FL (SJB; N=726). Sighting records of individuals matched between sites will be used to evaluate site fidelity, temporary immigration, and stock structure. The results presented here will assist researchers and management agencies to evaluate movements of bottlenose dolphins in the nGoMx and provide insight into potential exposure from environmental and anthropogenic threats. In light of recent Unusual Mortality Events and disasters such as the *Deepwater Horizon* oil spill, comparing dolphin movement and interaction among stocks will be critical to inform future management and restoration decisions.

### **STRANDING RESPONSE AND SKELETAL REARTICULATION OF AN ATLANTIC SPOTTED DOLPHIN (*STENELLA FRONTALIS*)**

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A shark-bitten Atlantic spotted dolphin (*Stenella frontalis*) was discovered stranded dead on the ocean beach at Cape Hatteras National Seashore, Ocracoke Island, North Carolina on July 23, 2014. Stranding responders from NC Division of Marine Fisheries and the NC Maritime Museum transported the carcass to the NC State Center for Marine Sciences and Technology and froze it for later necropsy. The 213.6 cm, 120.7 kg adult male was necropsied on November 8, 2014. Post-necropsy, we wrapped the skeletal components in ½" mesh hardware cloth and buried them for two years in a shallow, sandy grave. Further bone treatment included a 2-week soak in a solution of Dawn dish soap and 10% household ammonia, then a five-day soak in 3.5% hydrogen peroxide. After drying, the bones were painted with 2 coats of diluted Jade 403 bookbinder glue. Bones were repaired and rearticulated with 16 gauge PVC coated annealed rebar tie wire and Alumilite casting resin mixed with bone dust. Vertebral centrums were drilled to accommodate a ¼" stainless steel support rod which extended into the cranium. The pectoral fin bones were mounted using 1/8" stainless steel rod, Plexiglas, E6000 adhesive, and stainless steel screws. Polyethylene foam was used to represent the intervertebral disks. Monofilament fishing line was used to support the mandibles, chevrons, and pelvic bones. The modular (seven sections) portable display weighed 5.54 kg, 91% of which is bone/teeth. Approximately 380 person hours were dedicated to this project. The cost of tools, materials, services, and supplies totaled approximately \$1,200.

### **Analyzing Stock Boundaries of the Common Bottlenose Dolphin (*Tursiops truncatus*) in the South Carolina Estuarine System Stocks**

Francesca M. Roselli, Dani Silva, and Robert F. Young  
Coastal Carolina University

The estuarine system stocks of bottlenose dolphins (*Tursiops truncatus*) in South Carolina occupy extensive salt marsh and estuarine systems that are nearly continuous from North Inlet/Winyah Bay, SC, to northern Georgia. The boundaries for these stocks were based primarily on the location and limits of previous survey efforts rather than a systematic investigation of stock ranges (Waring et al. 2016). It is imperative to identify the correct geographic boundaries of a stock before estimating population parameters to ensure correct abundance estimates and avoid potentially unsustainable management plans (Balmer et al. 2014). To investigate the validity of the boundaries, we conducted photo-identification surveys from May-October 2017, spanning from North Inlet, SC to South Edisto River, SC, and encompassing two published stock boundaries. Surveys followed the robust design with two primary periods, each with three secondary surveys. Over five months, we completed 37 survey days, including 221 hours and 2,476 km on effort, and sighted an estimated 1300 dolphins. Internal matches were made to compile individual capture histories, which were used to calculate transition and emigration rates (using Program MARK) between the primary periods to identify movement into and out of a survey area. Movements were not expected across stock boundaries, and by analyzing survey areas at various spatial scales, we could compare the likelihood of existing and alternative stock boundaries. Upon the conclusion of this project, the currently recognized stock boundaries will either be supported or rejected, the latter resulting in alternative recommendations for boundaries and/or stock management plans.

## **A review of methods used to calculate life history indices of female bottlenose, *Tursiops truncatus***

Jordan M. Rutland, Robin M. Perrtree, Tara M. Cox  
Savannah State University

Life history indices can indicate the status of a population that has no density estimates nor data on population trends. Using various methodologies to calculate these indices can produce different results for the same index. The purpose of this study was to analyze different photo-identification methods used to calculate life history indices and determine any variations in results based on the method that was used. Life history indices were calculated for the population of female common bottlenose dolphins, *Tursiops truncatus*, in waters near Savannah, GA. Calf survivorship is presented in multiple forms in published literature. For this study, calf survivorship was calculated by determining how many calves were seen the following year with their mother, which provided a survival rate of 0.6. Three methods were used to examine seasonality; all methods resulted in a similar trend, i.e. a unimodal peak from May-July. In contrast, interbirth interval had different results depending on the method that was used. The first two methods only included mothers that had surviving calves, calves older than 3 years, resulting in interbirth intervals of 5 (n= 3) and 6 years (n=4). However, the other method included all mothers seen frequently with all calves (n=12). Depending on the method used, these results could provide misleading information to researchers and managers. Methods chosen can dramatically affect biological conclusions and therefore need to be made carefully.

## **When Dolphins Break the Rules. An Estuarine Dolphin's Journey Across Two Stock Boundaries In South Carolina**

Dani Silva<sup>1</sup>, Adam Fox<sup>2</sup>, Jamie Brusa<sup>3</sup>, and Rob F. Young<sup>1</sup>

<sup>1</sup>Coastal Carolina University, <sup>2</sup>University of Georgia, <sup>3</sup>Montana State University

Bottlenose dolphins are managed as an array of stocks in the USA. In South Carolina, three bottlenose dolphin stocks are described in estuarine waters: The Northern South Carolina Estuarine System Stock (NSCESS), the Charleston Estuarine System Stock (CESS), and the Northern Georgia Southern South Carolina Estuarine System Stock (NGSCESS) (Waring et al. 2016). The boundaries for the CESS were defined based on evidence of dolphin movements via photo-identification efforts and satellite and radio tags. However, the boundaries for the two neighboring stocks to the north (NSCESS) and the south (NGSCESS) of the Charleston harbor are not well defined. Movements of individual dolphins may be inferred using catalog comparisons among research areas, especially with the advance of photo-identification methods and the relative ease of sharing dorsal fin images of marked individuals. Since 2013, dorsal fin catalogs created by several graduate students at Coastal Carolina University were compared and consolidated. These comparisons yielded an interesting find: one well-marked individual was found in Bluffton and in North Inlet, a 200 km journey across two defined stock boundaries. Movements across stock boundaries have been reported for transient individuals found in Hilton Head (Gubbins 2002) and Charleston (Speakman 2010), but those dolphins were sighted in coastal and estuarine water. This is the first East-Coast-record of long-distance movements for an individual that has only been sighted in estuarine waters. Movement of dolphins among stocks opens the possibility of genetic exchange. Extensive catalog comparisons may uncover other unusual matches, shedding light on stock boundaries and stock overlap.

## **Seasonal patterns of skin lesion prevalence and type in the St. Johns River, FL, bottlenose dolphins (*Tursiops truncatus*)**

Bailey J. Slater<sup>1</sup> and Quincy A. Gibson<sup>2</sup>

University of North Florida

Documentation of bottlenose dolphin skin lesions through photo-identification can provide a non-invasive measure of population health because lesions are often symptomatic of disease. The St. Johns River (SJR; Jacksonville, FL) is an estuarine habitat frequently impacted by anthropogenic activity, which may jeopardize SJR dolphin health. This study assessed the seasonality of skin lesion prevalence and type within SJR dolphins and compared these findings to published data for Sarasota Bay, FL, Sapelo Island, GA, and Charleston, SC populations. Data were collected between April 2011 and July 2016 during weekly photo-identification surveys and were confined to one representative month per season (Feb.–winter, Apr.–spring, Jul.–summer, and Oct.–autumn). Then, 3,452 high-quality photos of 370 individuals were examined for lesions on dorsal fins (body section observed across surveys). Overall lesion prevalence was higher in the SJR (0.67) relative to all comparison sites (N=249 individuals with lesions). Mean prevalence was highest in autumn (0.44±0.04) and decreased through winter (0.39±0.03), spring (0.32±0.037), and summer (0.31±0.05) across all years. Four of the eleven lesion types observed, pale (0.84), tattoo (0.35), spotted (0.17), and white-fringed (0.17), were major lesion types (observed on >0.15 of adults with lesions). Tattoo lesions were a major type in all comparison populations. Pale lesions (0.59±0.07) were a major type in all seasons, tattoo lesions (0.20±0.02) were major during spring and summer, and spotted lesions were major in autumn (0.15±0.02). This study began a surveillance of skin lesions within the SJR dolphin population of which the health status is largely unknown.

## **Residency and site fidelity of an estuarine dolphin population**

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University of North Florida

The St. Johns River (SJR) in Northeast Florida is an estuarine system inhabited by bottlenose dolphins (*Tursiops truncatus*). Individual dolphins vary in time spent within the river, and can therefore be grouped into different residency categories. Residency categories include year-round residents (YR) sighted in all four seasons, potential residents (PR) sighted in three seasons, seasonal residents (S) sighted in 1-2 seasons ( $\geq 3$  sightings in one season), and transients (T) sighted in 1-2 seasons ( $\leq 2$  sightings in one season). Study of residency in this dolphin population is important because the Jacksonville estuarine stock assessment report is currently based on data from the 1990's. Since then, dolphin utilization of the SJR has shifted, making updated data critical for the stock assessment report and management plans. For this study, weekly photo-identification surveys were conducted from October 2011 to September 2016 (n=197) from the mouth of the SJR to 40 km upriver, generating sighting histories for 419 non-calf individuals. Results suggest that 55% of dolphins utilize the river at least 3 seasons a year. Transients (32%) are the next largest category of dolphins in the river, followed by seasonal residents (13%). An assessment of residency over time determined that about 125 (30%) individuals have unstable residency categories. Further research will analyze spatial distribution of residency categories, using kernel density estimation to calculate dolphin home ranges and core areas. Ultimately, this study will better our understanding of dolphin residency in the SJR, and provide more recent information useful for management efforts.

## **Common bottlenose dolphin (*Tursiops truncatus*) strandings in Pamlico and Albemarle Sounds and adjacent rivers and tributaries, North Carolina, 2010-2017**

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We examined common bottlenose dolphin (*Tursiops truncatus*) strandings in the waters of Albemarle and Pamlico Sounds and adjacent rivers and tributaries from 2010 through 2017. One hundred and two bottlenose dolphins stranded in twelve counties during the eight-year period. Strandings occurred most frequently during summer months (June-August, n=40, 39%), and spring (March-May, n=37, 36%), and less frequently in winter (December-February, n=13, 13%) and fall (September-November, n=12, 12%). Sixty-six (65%) of the stranded dolphins were male, 26 (25%) were females, and 10 (10%) were of undetermined sex. Two dolphins (2%) were alive (Code 1), three (3%) of the dolphins were fresh dead (Code 2), most of the stranded dolphins were moderately decomposed (Code 3, n=78, 76%), 18 animals were in an advanced state of decomposition (Code 4, 18%), and one carcass (1%) was skeletal remains (Code 5). Evidence of human interaction could not be determined in 82 (80%) of the stranded animals. Of the 20 animals that could be evaluated for human interaction, two live dolphins were released from a gill net, nine showed evidence of fishing interaction, and nine showed no evidence of interaction. Thirteen animals (13%) were calves (<184 cm length), 15 (15%) were young adults (212-240 cm), 22 (22%) were older calves (184-211 cm), 48 (46%) of the animals were adults (>240 cm), and four animals' lengths could not be collected. Continued, expanded outreach in these remote areas may result in rapid reporting of stranded animals and allow us to collect higher quality data before carcasses decompose.

## **Distribution of coastal bottlenose dolphins, *Tursiops truncatus*, along the northern South Carolina coast in relation to tidal stage, season, and distance from inlets**

Rachel E. Unger, Daniela Silva, and Robert Young  
Coastal Carolina University

Fine-scale distribution patterns of coastal bottlenose dolphins (*Tursiops truncatus*) have not been previously examined along the northern South Carolina coast, but this is now possible based on sightings from two years of coastal survey effort by Coastal Carolina University researchers (Silva 2016, MS Thesis). The objective of this study was to identify predictive spatial and temporal patterns for the distribution of coastal dolphins. Specifically, we examined sighting location, distance from the nearest inlet, season, and tidal stage. Sightings occurred during shore-parallel photo-identification surveys centered on either Murrells Inlet (2013-2015) or Little River, SC (2014-2015). Collectively, these surveys covered approximately 100 km of the coast at two distances from shore, 0.5 and 1.5 km. Surveys followed the robust design with three secondary surveys per primary period and primary periods spaced approximately ten weeks apart. Preliminary analyses indicate that season, tidal stage, and distance from the nearest inlet all impact dolphin sighting patterns.

## **Determining seasonal home ranges and density distribution of common bottlenose dolphins *Tursiops truncatus***

Candice M. Vinson, Robin M. Perrtree, Tara M. Cox, Emily K. Griffin  
Savannah State University

Home range is a quantitative measurement of the spatial area an individual inhabits while sustaining its biological needs. The spatial density an organism occupies within its home range is its utilization distribution (UD). Home range area and spatial density distribution are essential for understanding population structure of a species. The purpose of this study was to determine seasonality of home range area and UD for individual common bottlenose dolphins (*Tursiops truncatus*) using minimum convex polygon (MCP) and kernel density estimation (KDE), respectively. Increasing sample sizes will be used to calculate non-seasonal MCP and KDE areas for each dolphin to determine if an asymptote exists, indicating a minimum number of sightings necessary to accurately define the individual's home range. Sightings were separated into two seasons, summer (May-September) and winter (November-March), based on average water temperatures. Data from 5 dolphins sighted on a minimum of 8 summer and 8 winter days between 2009 – 2017 were mapped in ArcMap 10.4. Average summer MCP ( $81.60 \pm 53.77$  km<sup>2</sup>) was not significantly different from average winter MCP ( $44.70 \pm 20.04$  km<sup>2</sup>; Wilcoxon signed-rank;  $p = 0.23$ ). Seasonal differences in MCP area were not detected, possibly indicating that more sightings are needed, or that males and females have different patterns. However, the locations of the home ranges that dolphins occupied did change between the seasons for 2 of the 5 dolphins, which will be examined further with KDE. Analyzing individual habitat use with regard to season and sex may reveal differences not detected here.

## **Trophic levels of oceanic and estuarine bottlenose dolphins in South Carolina from stable carbon and nitrogen isotopes**

Hannah G. Wareheim and Robert F. Young  
Coastal Carolina University

Estuarine and oceanic bottlenose dolphins occupy different ecological habitats and exhibit different foraging behaviors. If they feed on different prey species or at different trophic levels, their ecological role may also differ between habitats. We investigated the trophic levels of estuarine and coastal bottlenose dolphins using stable isotope ratios of nitrogen and carbon from archived muscle tissue of dolphins that stranded in South Carolina between 2009 and 2017. Stranded dolphins greater than 90 cm in length were classified as estuarine or coastal based on stranding location and season. Dolphins were classified as estuarine if strandings occurred in salt marsh creeks and waterways far from inlets, large bays, or sounds. They were classified as coastal if strandings occurred on the ocean beach at least 1.5 km from an inlet, from April through October (colder months were excluded because estuarine dolphins utilize coastal waters more in the winter). <sup>13</sup>C results will be used to support stock classifications, because a lower ratio is expected from estuarine systems. The <sup>15</sup>N analyses will be used to compare the trophic levels of the estuarine and coastal dolphins, with a higher ratio corresponding to a higher trophic level. In addition to the ecological implications, this study addresses whether stranded dolphins can reliably be assigned to an estuarine or coastal stock, potentially increasing the pool of individuals for genetic analysis.

## **Skin lesion prevalence on bottlenose dolphins (*Tursiops truncatus*) from coastal waters near Murrells Inlet, SC**

Hannah Weinberg, Daniela Silva, and Robert Young  
Coastal Carolina University

The prevalence of skin lesions on cetaceans, especially dolphins, can be an indication of the health of the population and the surrounding marine environment. As sentinels that frequent coastal areas, exposure to anthropogenic factors, such as pollution, and environmental factors, such as water temperature, can affect the dolphin's ability to combat disease and other lesion types. Skin lesions were investigated for bottlenose dolphins, *Tursiops truncatus*, in coastal waters near Murrells Inlet, SC, using photographs from year-round coastal surveys conducted between 2013 and 2015. Lesion types were categorized based on previous studies by Hart et al. (2012): black, pale, cloudy, lunar, dark-fringed, white-fringed, orange, tattoo-like, lacaziosis, and spotted. We hypothesized that dolphins will exhibit the highest prevalence of skin lesions during the spring season (March-May), with the most common type of skin lesion being dark-fringed. Results will be presented and will form a baseline for continued monitoring of dolphin health and water quality in the coastal waters of northern South Carolina.

## **Determining the northern range of the NNCES stock of bottlenose dolphins (*Tursiops truncatus*) through photo-identification**

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The Roanoke Sound is an important summer habitat for coastal Atlantic bottlenose dolphins, including members of the Northern North Carolina Estuarine System (NNCES) stock. However, our understanding of the northern range of this stock is limited. It has

been assumed that the stock occurs northward only as far as the NC/VA border, but there is considerable uncertainty in the location of this boundary. The objective of the present study was to better delineate this boundary by determining the northern range of individual dolphins sighted in Roanoke Sound. We matched individuals with high capture probabilities ( $n=59$ ) in Roanoke Sound (NC-OBXCDR catalog) with individuals sighted in Norfolk, Virginia (VA-HDR catalog), the Potomac (MD-PCDP catalog), and Cape May, NJ (NJ-CMWWRC catalog) through the MABDC. Five individuals, all likely females, were matched to VA-HDR, but none were matched to MD-PCP nor to NJ-CMWWRC. Four of the matched individuals were also sighted in the Pamlico Sound. The movements of these dolphins show some degree of seasonality, with sightings in the Roanoke Sound peaking in June but occurring from May to October, and in Virginia only in July and August. The results of our study indicate that the NC/VA border is not the northern boundary of the NNCES stock, but instead that the movement of these dolphins extends into the Chesapeake Bay. Thus, the management of this stock of dolphins should consider the threats, including by-catch, that may occur in this extended range.