Highlights: Bottlenose Dolphin (*Tursiops truncatus*) Inhabitance of the St. Johns River

Figure H-1. Bottlenose dolphins leaping in the St. Johns River (SJR), downtown Jacksonville. This species utilizes extensive habitat within the SJR, from its mouth through some 35 miles upriver. Photo: University of North Florida – NOAA Fisheries Permit 18182.

H1. Introduction

Common bottlenose dolphins (*Tursiops truncatus*) inhabit offshore, coastal and estuarine waters of temperate and tropical oceans around the globe (**Reynolds, et al. 2000**) and regularly utilize the St. Johns River (SJR) (Figure H-1). This species belongs to the family Delphinidae, and is one of several species of odontocetes (toothed whales) that have the word "dolphin" as part of their common name (**Wursig 2009**). In this report, the terms "dolphin" and "bottlenose dolphin" refer to the common bottlenose dolphin. Unlike dolphins in some other areas of Florida (**Wells and Scott 2009**; **Mazzoil, et al. 2005**), SJR dolphins have not been regularly studied until recently. This section of the 2017 SJR report provides natural history information on bottlenose dolphins and highlights recent events, current research, and concerns involving dolphins in the river.

H2. Laws Related to Bottlenose Dolphins

In addition to the ecological roles that bottlenose dolphins play in the SJR, the opportunity to view these charismatic social animals enhances public enjoyment of the river. Although not listed as an endangered or threatened species at this time, dolphins are federally protected by the Marine Mammal Protection Act (MMPA) of 1972 (**Congress 1972b**). Dolphins inhabiting the St. Johns River are considered part of the Jacksonville Estuarine System Stock (JES), further described below. Under the MMPA, the JES is classified as a strategic stock, as given its presumed small size, this population unit cannot likely withstand a significant number of mortalities (**NOAA 2016c**).

The MMPA provides the legal framework for monitoring populations of wild dolphins and prohibits harmful human activities toward these animals, such as feeding, harassing, capturing, killing, hunting, collecting, or attempting these activities. Additionally, an addendum to the MMPA established the Marine Mammal Health and Stranding Response Program (MMHSRP) (**Congress 1992**), and requires monitoring, response, and investigation of marine mammal strandings. The University of North Florida (UNF), Jacksonville University (JU), and other scientific organizations, in conjunction with the Jacksonville branch of the Florida Fish and Wildlife Conservation Commission (FWC), plus the National Oceanographic and Atmospheric Association (NOAA), collaborate to study SJR dolphins and respond to incidents of injury or illness involving these animals.

Figure H-2. Bottlenose dolphins (Tursiops truncatus) are characterized by a prominent rostrum (beak-like mouth) that is well defined from the melon (fat-filled expanded region of forehead), and a curved (falcate) dorsal fin. The gray coloration of their bodies fades to light pigmentation ventrally. Photo: University of North Florida - NOAA GA LOC 14157.

H3. Description and Natural History

Two distinct ecotypes of bottlenose dolphins are recognized, an offshore (deep water) form and a coastal (shallow water) form, that are distinguished anatomically and physiologically (**Hersh and Duffield 1990**; **Mead and Potter 1995**; **NOAA 2017c**). Depending on geographic location, dolphins may vary in size and coloration. In general, these animals have robust body form, reach lengths of some 2-4 meters, and are gray to nearly charcoal in body coloration, with lighter pigmentation ventrally (Figure H-2) (**NOAA 2017b**; **Read, et al. 1993**). The dorsal fin of bottlenose dolphins is curved (falcate), and there is sharp definition between the rostrum and melon (Figure H-2) (**Wells and Scott 2009**). These anatomic features plus dental characteristics help biologists distinguish *Tursiops truncatus* from other delphinid species that occur in NE Florida and may enter the SJR, such as Atlantic spotted dolphin (*Stenella frontalis*) (**FWC 2015**).

Bottlenose dolphins attain sexual maturity at approximately 5 to 13 years (females), and 9 to 14 years (males) (**Wells and Scott 2009**). Females typically give birth to a single calf that may wean at some 18 to 20 months of age (**NOAA 2017b**). However, maternal investment is often considerably longer as calves may continue to intermittently nurse and interact with their mothers for additional years (**Wells and Scott 2009**). Determination of reproductive parameters for SJR dolphins is an important component of current research and is further detailed below (**Gibson and Daigle 2015**). Dolphins can live for well over 50 years in the wild (**Wells 2009**), and birth of a calf to a 48-yr old dolphin has been reported (**Wells and Scott 2009**). The social structure of this species is complex (**Connor, et al. 2000**), may vary with habitat, and includes long term bonds between individuals (**Wells 2003**). Current research of SJR dolphins focuses particularly on alliances between male dolphins (**Ermak, et al. 2017**).

A variety of fish including mugilids, sciaenids, and scombrids, plus some invertebrates, particularly squid, are understood to comprise the dolphin diet (**Wells and Scott 2009**). Clupeid species have also been documented in stomach contents of deceased stranded dolphins (**Thayer, et al. 2017**). Dolphin preference for sound-producing (soniferous) fish species has been noted (**Barros and Wells 1998**) and likely complements the echolocation and listening strategies that dolphins utilize while hunting (**Gannon, et al. 2005**).

Specialization among dolphins is known to occur in how these animals capture prey and the specifics of their diet type (**Gazda, et al. 2005**; **Mann, et al. 2008**; **Torres and Read 2009**) In the SJR, dolphins may be seen herding mullet and tossing fish, yet comprehensive details of their diet and feeding strategies are not well known.

H4. Natural Mortality and Anthropogenic Impacts

Natural predators of dolphins include sharks, as well as orcas in some parts of the world (**Wells and Scott 2009**). Additionally, dolphins are sometimes fatally injured by encounters with sting rays (**Walsh, et al. 1988**). Dolphins can suffer lethal injury from human interactions, including entanglement in or ingestion of fishing gear, such as crab pots, and

marine debris, as well as boat collisions, feeding and harassment activities (**Christiansen, et al. 2016; NOAA 2016c**; **Stolen, et al. 2013**; **Burdett and McFee 2004**; **Vail 2016**; **NMFS 1994**). Such injuries/fatalities have been documented on several occasions for SJR dolphins (**FWC 2017a**).

a.

Figure H-3. A young bottlenose dolphin captured in the St. Johns River, 2013, to remove an Aerobie disc that encircled its neck and was injuring its pectoral flippers. The dolphin was successfully released. Photo: NOAA.

Entanglement with rope, fishing line, or other debris poses risks of drowning or serious harm to dolphins such as severing of pectoral flippers or flukes (Figure H-3). Proper disposal of fishing line and debris is essential in order to decrease risk of harm to dolphins and other wildlife.

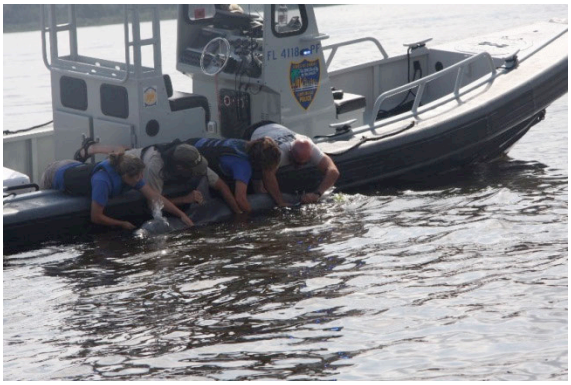

Figure H-4. a. Successful rescue and release of SJR dolphin entangled in crab fishery gear in 2012. b. An SJR dolphin immobilized by crab fishery gear wrapped around its body and pectoral flippers, was successfully disentangled in 2017. Crab fishery entanglements have resulted in SJR dolphin fatalities. See text for steps to reduce crab gear interactions with dolphins. Photos: FWC – Jacksonville.

Crab trap/line interactions are particularly dangerous to dolphins and are of significant concern for SJR dolphins (Figures H-4a and b). Risk of dolphin entanglement in crab gear may be reduced by the following practices (**Federal Register 2006; FWC 2017f**):

a) Use inverted baitwells or other bait door mechanisms aimed at reducing or eliminating "pot-tipping" by dolphins
b) Use only the length of line needed for the depth of a particular location. This practice reduces excess line and slack, which may contribute to entanglement.
c) Ensure a smooth line from buoy to trap without additional knots, splices, loops, etc.
d) Use a sinking or negatively buoyant line, such as nylon or polyester, to minimize excess line floating at the surface
e) Remove derelict or unused traps and associated buoy lines during authorized clean-ups.

Boat collisions may prove fatal to dolphins due to propeller strike or blunt force trauma injuries. However, dolphins may also be disturbed or harassed by the presence of boats or jet skis without occurrence of direct interaction (**Bechdel, et al. 2009; Mattson, et al., 2005**). Harassment occurs when an animal's behavior is disrupted or they are injured from human

impacts. Harassment is prohibited under the MMPA, except as allowed by federal permit. Closely approaching dolphins in a boat may result in harassment of dolphins. Guidelines for safe viewing of wild dolphins are provided by NOAA and include the following practices (**NOAA 2016a; NOAA 2016b**):

a) Observe wild dolphins from safe distances of at least 50 yards (150 feet) by land or sea and at least 333 yards (1000 feet) by air.

b) Avoid loud abrupt movements or loud noises around dolphins.

c) Avoid circling or entrapping dolphins between watercraft or watercraft and shore.

d) Avoid separating mother/calf pairs.

e) Limit overall viewing time to no more than 30 minutes.

f) Move away cautiously if behaviors are observed that indicate the dolphin is stressed.

g) Avoid feeding, touching or swimming with wild dolphins, even if they approach you.

h) Take a precautionary approach and do not fly unmanned aircraft (drones, model airplanes) in the vicinity of dolphins.

Feeding wild dolphins is well known to lead to a variety of high risk situations that place both dolphins and people in danger (**Christiansen, et al. 2016; Donaldson, et al. 2010, Cunningham-Smith, et al. 2006; NMFS 1994**) and is also forbidden by law. Dolphins that have been fed by humans approach boats more readily, and dolphins that approach people and boats looking for handouts are at increased risk for boat strike or gear entanglement (**Christiansen, et al. 2016; Powell and Wells 2011; Bechdel, et al. 2009; Samuels and Bejder 2004).** Additionally, begging behaviors can also be passed through a dolphin population by social learning, thus increasing the prevalence of the problem over time (**Donoghue, et al. 2002; Wells RS 2003**). Some populations of bottlenose dolphins include a high number of individuals that have become accustomed to approaching boats in order to beg for or take fish (**Hazelkorn et al., 2016; Christiansen, et al. 2016; Samuels and Bejder, 2004**). Currently, illegal feeding of dolphins in the SJR is not known to be widespread and continuous as it is in other areas. Discarding unwanted bait fish into the water alongside boats may also inadvertently attract dolphins to vessels, resulting in their harm (**Durden 2005**), and underscores the need to otherwise dispose of unwanted bait or catch.

In addition to potential disturbance of dolphins due to vessels, anthropogenic sounds and activities related to construction, dredging, or other human endeavors are of further concern for dolphins (**Buckstaff, et al. 2013; Pirotta, et al. 2013**). These animals are very reliant on sound in order to obtain prey, communicate, navigate, and maintain social groupings that are essential for successful reproduction. Anthropogenic noise may interfere with important acoustic signaling between dolphins and their environment, and disturb the animals during needed periods of rest. An important ongoing research project investigates anthropogenic noise exposure to SJR dolphins (**King and Gibson, 2017**).

Harmful algal blooms (**Fire, et al. 2015**), exposure to anthropogenic chemical contaminants (**Schwacke, et al. 2002; Hansen, et al. 2004**) and environmental degradation may also directly or indirectly contribute to dolphin mortality. Dolphin fatalities have occurred after some of these animals choked on fish species that dolphins were not known to usually consume, and may have resulted from depletion of preferred prey species (**Stolen, et al. 2013b**). The well-being of SJR dolphins is inextricably linked to the health of SJR fish populations and their habitats. Additional specific information on prey species preferred by SJR dolphins would be helpful toward monitoring SJR dolphins and SJR fisheries.

The longevity of dolphins and their possession of a lipid rich layer of blubber for thermoregulation make them particularly suitable as sentinels of ocean and human health (**Bossart 2011**). Dolphins bioaccumulate lipid soluble chemicals such as polychlorinated biphenyls (PCBs), chlordanes, DDT, and polybrominated phenyl ethers (PBDEs) in their blubber (**Fair, et al. 2010**). Exposure to these persistant organic pollutants may place dolphins at risk for reproductive failure, endocrine disruption, and immunosuppression, suggesting health concerns for other species exposed to contaminated marine environments (**Litz, et al. 2007**). High levels of inorganic substances such as mercury may also occur in dolphins and have deleterious effects (**Schaefer, et al. 2011**). The SJR is subject to urban drainage and runoff, making it likely that its dolphins are exposed to contaminants that may affect their health, yet formal analysis of SJR dolphin exposure to such contaminants has not been done (**NOAA 2016c**).

Wild dolphin health assessments, studies in which the animals are briefly captured, examined under careful supervision by veterinarians, then released, have been conducted in multiple locations in the southeast United States to determine dolphin exposure to chemicals and disease agents, and to otherwise more fully understand dolphin health (**Schwacke, et al. 2002; Hansen, et al. 2004; Wells, et al. 2005. Reif, et al. 2008**). Such studies have not as yet specifically targeted SJR dolphins.

H5. Geographic Movements and Recognized Stocks

Bottlenose dolphins display wide variation in their patterns of movement and site fidelity. Some dolphins seasonally migrate, and/or make occasional long range excursions, while other dolphins remain residents of very specific areas year-round or periodically (**Wells and Scott 1999**). Several studies show that dolphins may be further genetically, physically, and behaviorally defined from one another depending on their preference for specific habitats (**Litz, et al. 2012**; **Toth, et al. 2011**; **Torres and Read 2009**; **Rosel, et al. 2009**). Characterization of SJR dolphins as regards their fidelity to the river and movement between other areas has been more intensively studied in recent years, as noted below.

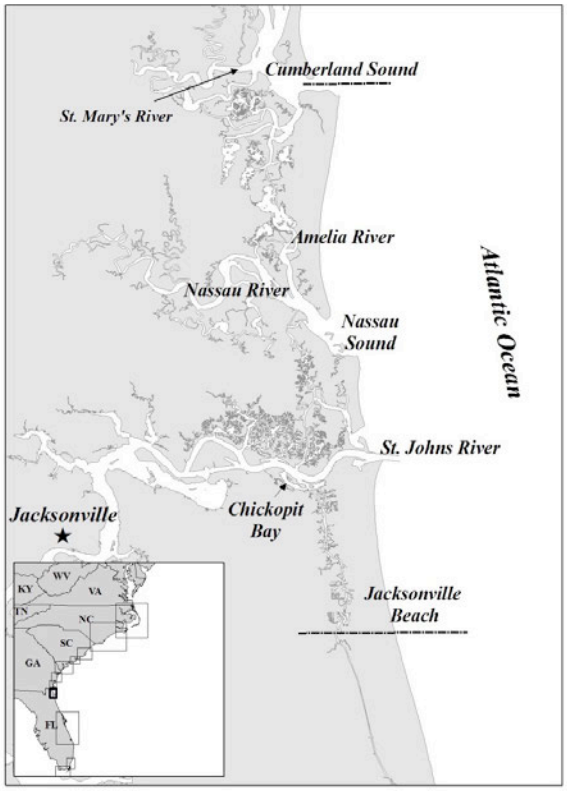

*Figure H-5. Geographic extent of Bottlenose Dolphin Jacksonville Estuarine System Stock (JES) recognized by NOAA. Borders are denoted with dashed lines (**NOAA 2016c**). Current research shows that dolphins sometimes utilize SJR areas further upriver than shown here (See Figure H-8).*

Along the U.S. Atlantic seaboard, NOAA recognizes several stocks of bottlenose dolphins, including offshore, coastal, and estuarine stocks (**NOAA 2016c**). A stock of marine mammals is a basic unit of population recognized by the MMPA that is important for management decisions. The term "population stock" or "stock" means a group of marine mammals of the same species or smaller taxa in a common spatial arrangement that interbreed when mature (**Congress 1972b**). The definition of a marine mammal stock has been further interpreted to distinguish demographically independent populations of marine mammals for which births and deaths within a population are more essential to the cohesiveness of the population than immigration and emigration (**Rosel, et al. 2011**). Dolphins that utilize the St. Johns River are part of the Jacksonville Estuarine System Stock (JES), which extends from the Florida/Georgia border to Jacksonville Beach (Figure H-5) (**NOAA 2016c**). Assessment of stock abundance is essential for conservation management of bottlenose dolphins, yet abundance estimates for some stocks, including the JES, have not been available for several years (**NOAA 2016c**). Current efforts to assess and monitor SJR dolphin abundance, described below, are of fundamental importance to establishing population trends of these animals (**Gibson, 2017**).

Previous Research Involving SJR Dolphins

Until recently, specific information regarding bottlenose dolphin utilization of the St. Johns River was limited. Historical information provides a point of reference for understanding current SJR dolphin abundance, distribution, and site fidelity, and is relevant to assessment of potential anthropogenic impacts and health concerns that may affect these animals (**Caldwell 2016a; Caldwell 2016b**). Research conducted via boat surveys in Jacksonville from Dec 1994 – Dec 1997 (**Caldwell 2001**; **Gubbins, et al. 2003**; **NOAA 2016c**) that involved genetic and photo-identification techniques provided insights into the abundance of JES dolphins at that time (**NOAA 2016c**). Many of these animals showed habitat preference and seasonal fidelity to specific areas of the Intracoastal Waterway and northeast SJR (**Caldwell 2001**). During the initial period of the study, occurrences of dolphins in regions of the SJR more distant that 14 km from the SJR mouth were infrequent and not further investigated (**Caldwell 2016b**). Some of the dolphins identified in this early study were resighted several years later, during photoidenitification surveys in late 2010 and 2011, providing a glimpse into site fidelity trends of these animals (**Caldwell 2016a**).

Dolphins were also routinely sighted in the SJR during numerous aerial surveys for manatees since the inception of those studies in 1994 (**Pinto 2007**). In addition to sightings of dolphins close to the SJR mouth and Intracoastal Waterway on those flights, dolphins were also seen in more interior SJR areas west of Blount Island and occasionally, south of downtown Jacksonville. These observations corroborated dolphin sightings from shore or vessel that sometimes occurred in upriver SJR areas. Interestingly, mention of dolphins swimming up the SJR to Palatka was made in older literature (**Caldwell and Caldwell 1972**).

Mortality Events Involving SJR dolphins

Strong motivation for expanding scientific knowledge of bottlenose dolphin inhabitance of the SJR came in 2010, when SJR dolphins experienced a federally declared Unusual Mortality Event (UME) (**NOAA 2016c**; **NOAA 2017d**). A UME is declared by NOAA when specific criteria are met relative to historic stranding numbers, locations of strandings, age structure of stranded animals, etc. The impetus for request of a UME consultation in 2010 was a sudden spike in dolphin deaths that occurred over several weeks in the summer and appeared to be particularly affecting dolphins in areas of the SJR near downtown Jacksonville and points south (Figure H-6). Several of the dolphin carcasses that were ultimately included in the NOAA May – September 2010 SJR UME analysis were retrieved from upriver locations that were not previously recognized as bottlenose dolphin habitat (**NOAA 2016c**).

The 2010 SJR UME was co-associated with environmental events: an algal bloom and fish kill that extended along a 30-mile stretch of the SJR, from the Shands Bridge area of Green Cove Springs toward downtown Jacksonville, plus an extensive dredging project just north of downtown Jacksonville in the Talleyrand area (**Landsberg, et al. 2015**; **Borkowski and Landsberg 2012**). A bloom of *Aphanizomenon flos-aquae* was implicated in the fish kill. The dredging project spanned most of the SJR in a section of the river where dolphins, including mother-calf pairs, frequently travel between areas of lower and higher salinity. Any relationship between these events and the 2010 UME is not known. As with several UME investigations that have occurred since the inception of the UME program, the precise cause(s) of the 2010 SJR bottlenose dolphin UME could not be determined (**NOAA 2016c**; **Gulland 2006**). Following the 2010 UME, the Northeast Florida Bottlenose Dolphin Research Consortium was formed. Comprised of JU, UNF, plus several organizations along the Florida east coast, the consortium promotes scientific collaboration important for regional bottlenose dolphin conservation.

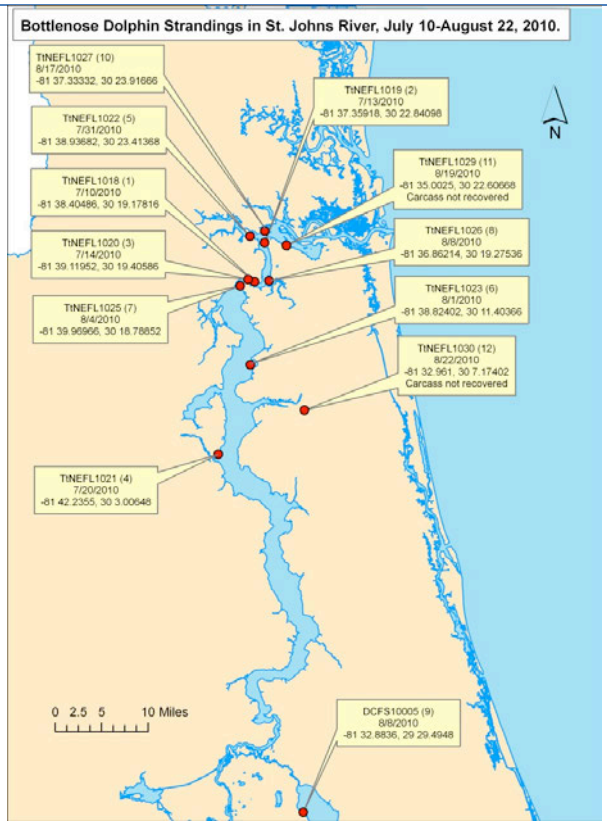

*Figure H-6. Bottlenose dolphin deaths in the St. Johns River during summer 2010 that provided impetus for request of an Unusual Mortality Event (UME) consultation with NOAA. The formal UME investigation included SJR dolphin deaths from May –Sept 2010. Cause of the UME was undetermined (**NOAA 2016c**). (Bottlenose dolphin carcass recovery and stranding data provided by FWC-Jacksonville (n =11) and Dolphin Conservation Field Station (n = 1). Map - G. Pinto, R. Borkowski, Jacksonville University.*

In contrast to the 2010 SJR UME, from July 2013 - Dec. 2015, a large-scale UME affected well over 1500 bottlenose dolphins along the eastern U.S. seaboard from New Jersey through Florida's east coast, including the St. Johns River, and was shown to be caused by morbillivirus infection (**Urian, et al. 2017**; **NOAA 2016c**). Morbillivirus is a well-documented marine mammal pathogen. The virus was implicated as a cause of the extensive 1987-88 Atlantic bottlenose dolphin die-off (**Lipscomb, et al. 1994**) and has since been recognized as a cause of several cetacean mortality events (**Van Bressem, et al. 2014**). In the years just prior to the 2013-2015 epizootic, health assessments of dolphin populations along the Atlantic seaboard showed renewed vulnerability to morbillivirus (**Rowles, et al. 2011**). Reemergence of the virus caused deaths among dolphins of all age classes. A relatively small number (n = 7) of SJR dolphins were confirmed to have been fatally affected by morbillivirus (**FWC 2017b**), as coastal dolphins were thought to experience the brunt of the epizootic (**NOAA 2016c**).

It is to be remembered that the number of dolphin carcasses retrieved in a mortality event may greatly underestimate the actual number of animals that died (**Williams, et al. 2011; Carretta, et al. 2015**; **Wells, et al. 2015**; **Peltier, et al. 2012**). Additionally, infection with a virus or other disease agent may not lead to immediate death, yet cause chronic pathology that contributes to mortality at a later time (**Van Bressem, et al. 2014**).

A compilation of annual and monthly bottlenose dolphin mortality statistics from 2006-2016, (Figure H-7) (**FWC 2017e**), show dolphin deaths in the St. Johns River (Duval, St. Johns, Clay, Putnam counties) as well as coastal and nearshore NE FL (Nassau, Duval, and St. Johns counties). Elevated SJR and/or NE FL bottlenose dolphin mortalities are seen in years coinciding with UME events.

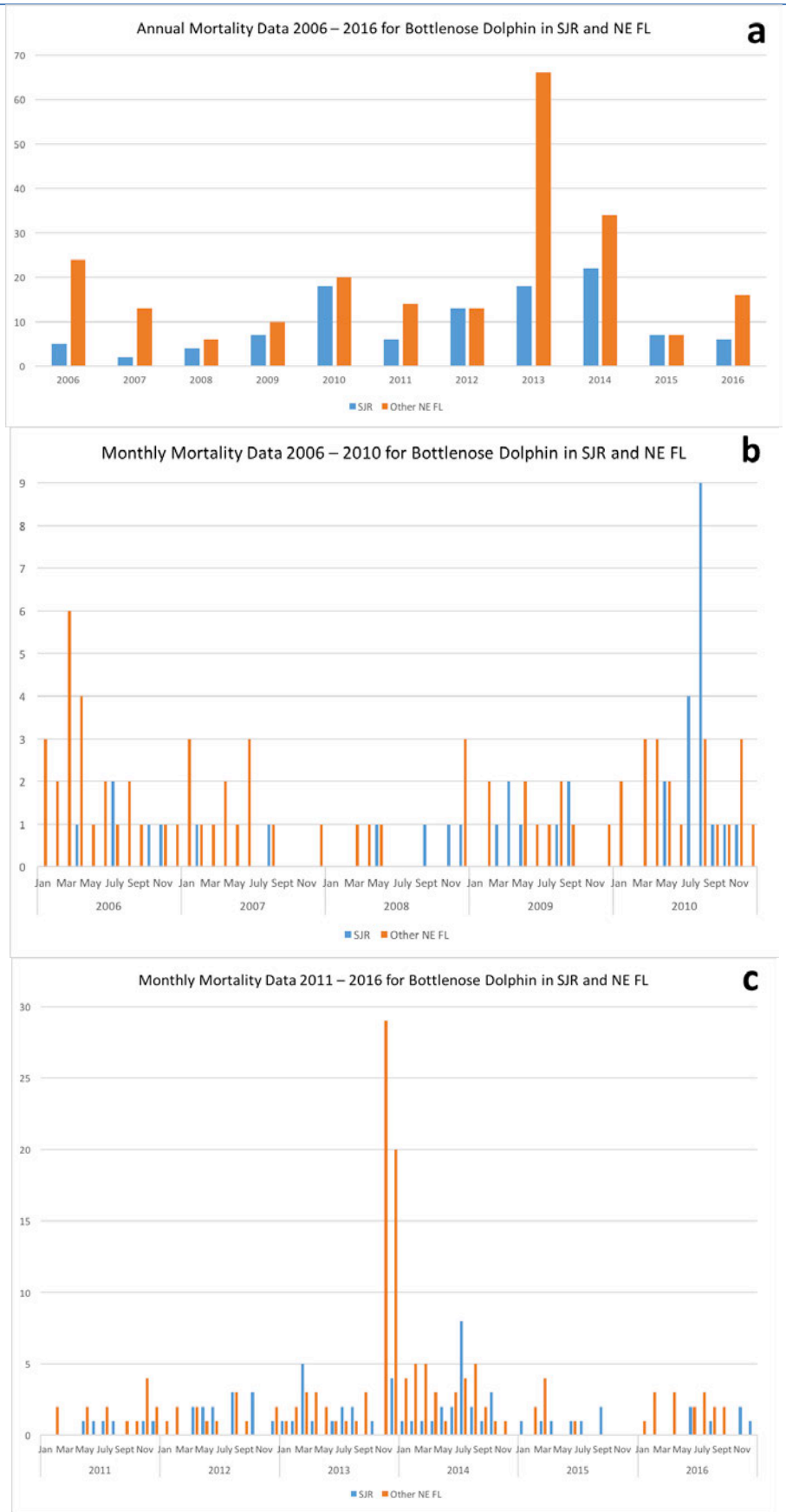

*Figure H-7. a. Annual 2006-2016, b. monthly 2006-2010, and c. monthly 2011-2016 mortality statistics for bottlenose dolphins (Tursiops truncatus) in the St. Johns River (Duval, St. Johns, Clay, Putnam counties) and other NE FL areas (Coastal/Nearshore Nassau, Duval, St. Johns counties) (**FWC 2017e**).*

In addition to dolphin deaths associated with UMEs, SJR dolphin mortality analysis underscores previously noted concerns with dolphin – human interactions (**NOAA 2016c**), particularly fisheries interactions (**FWC 2017a**). For the 5-year period, 2012-2016, some 7 SJR dolphin carcasses were recovered with crab gear or rope entangling the animals. For the same period, some 10 additional dolphins were successfully rescued from crab gear, rope or line entanglements, or managed to disentangle themselves, or were otherwise not known to have died. Additional SJR dolphin carcasses have shown evidence of hook/monofilament line entanglement or ingestion, or evidence of watercraft collision. The degree to which fisheries interactions affect the SJR population is not known but may be substantial given the likelihood that current statistics may underestimate such incidents, particularly since there is no formal observer program for crab fisheries (**NOAA 2016c**). Entanglement has been shown to impact dolphin populations in other similar ecosystems (**Burdett and McFee 2004**).

Such dolphin-fishery interaction data from within the SJR provide further support for concerns that dolphin – fisheries interactions within the JES stock may be increasing. The most recent Stock Assessment Report for the entire JES, inclusive of the SJR, shows that for the 2009-2013 period, 71 dolphins stranded in the JES, and 18 of those dolphins showed evidence of fisheries interaction such as with crab trap/pot gear, hook and line gear, or other debris (**NOAA 2016c**). Aligning SJR dolphin-fisheries interaction data with JES dolphin-fisheries interaction data is particularly important, given that stock assessment data is utilized to guide management plans, such as the Bottlenose Dolphin Take Reduction Plan (**NOAA 2017b**).

H6. Current Research Involving SJR Dolphins

Particularly in light of recent mortality events, a need for expanded fundamental information regarding SJR dolphins has existed. Current information regarding abundance and reproductive success of SJR dolphins has been needed to establish baseline information such that potential impacts of disease outbreaks and anthropogenic activities on these animals can be assessed. UNF scientists recently completed a 3-year study of bottlenose dolphin abundance specifically within the SJR community (**Gibson 2017**). This research involved photo-identification surveys of dolphins each summer, autumn, winter, and spring in years 2011-2013, and enabled documentation of 226 distinct individuals (non-calves). Abundance estimates of dolphins during the study ranged from 74 (95% CI = 61-95) individuals in winter 2014 to 203 (95% CI = 178-237) individuals in both summer 2011 and summer 2013. UNF research has also shown that some 50% of the SJR dolphin population utilizes the river year-round.

UNF scientists have also investigated reproductive success of SJR dolphins for years 2011-2015 (**Gibson and Daigle 2015**). This research showed that, on average, 21 calves were born during each year of the study. Reproductive success of female SJR dolphins appeared to be relatively high, as most calves survived their first year. However, survival of calves to weaning and juvenile survival have not yet been determined.

Female bottlenose dolphins supporting calves were also shown to prefer particular areas of the SJR, such as Mill Cove and Chicopit Bay (**Ward and Gibson 2017**). These animals may be impacted by the current Mile Point river deepening/port expansion project. Utilization of Chicopit Bay by female dolphins and their calves was also noted in the 1994-1997 study of SJR dolphins (**Caldwell 2016b**), and may suggest long-term importance of this area as a dolphin nursery.

Dolphin utilization of upriver, low salinity areas (0-10 ppt) of the SJR has been a primary research focus of JU investigators. Consistent occurrences of bottlenose dolphins in areas of the SJR not previously recognized as habitat of Jacksonville estuarine dolphins, including oligohaline and low mesohaline waters, have been documented via boat surveys since 2011 (**Borkowski, et al. 2015**). Groups of dolphins have been occasionally but consistently sighted in the SJR well south of downtown Jacksonville, from the San Marco and Riverside areas through the Ortega, Naval Air Station Jacksonville, Mandarin, and Doctors Lake areas, some 35 miles from the SJR mouth (Figure H-8).

Figure H-8. Dolphins surfacing in low salinity (1.7 ppt) water near Mandarin and Doctors Lake, some 35 miles from the SJR mouth, in August 2016. Photo: Jacksonville University – NOAA Permit 18182.

The degree to which dolphins normally travel in the SJR further upriver than the aforementioned areas is not currently known. Dolphin carcasses have occasionally been retrieved from upriver areas quite distant from the SJR mouth, such as Putnam County. A live female dolphin was reported in Lake Monroe, over 140 miles from the SJR mouth, in 2009 (Figure H-9). However, the animal may have been ill and was not known to have survived following its relocation and release in coastal Brevard county, where it was believed to have originated (**Stolen 2010**).

*Figure H-9. A female bottlenose dolphin was reported in Lake Monroe, 2009, more than 140 miles from the SJR mouth. The animal may have been ill and was not known to have survived following its relocation and release (**Stolen 2010**). Photo: Hubbs-SeaWorld Research Institute.*

Dolphins inhabiting upriver, lower salinity habitats within the SJR must be able to regularly return from such areas to locations closer to the SJR mouth where salinity is higher. Dolphins may experience pathophysiological effects and risk of mortality if exposed to low salinity environments for an extended time (**Ewing, et al. 2017**). Skin lesions, secondary infections, and metabolic compromise can result from prolonged exposure to freshwater (**Mullin, et al. 2015**; **Mase-Guthrie, et al. 2005**; **Wilson, et al. 1999**). Dolphins may inhabit lower salinity water for prolonged periods due to illness, injury, anthropogenic or environmental disturbance. For example, in 2008, a severely injured SJR dolphin that had evidence of entanglement was also confirmed to have freshwater (low salinity) overexposure (Figure H-10). Such overexposure likely occurred due to its markedly compromised swimming ability. Dolphins utilizing low salinity areas may also be at risk for disease-causing microbes, algal or anthropogenic toxins that can occur in these environments (**Carmichael, et al. 2012**).

Figure H-10. A dolphin severely injured in the SJR, 2008, with skin lesions due to confirmed freshwater (low salinity) overexposure. The dolphin had also suffered fisheries gear entanglement of its tail (not shown) and was unable to swim normally. It did not survive. Photo Courtesy of FWC

Understanding the degree to which SJR dolphins move about in local waters along the eastern seaboard and interact with dolphins in other areas is important relative to management decisions and health concerns. Important collaborative research enabled a recent study into the home ranges of individual SJR dolphins (**Gibson 2017**). Scientists combined photo-identification data from six study areas including the SJR plus adjacent nearshore waterways from Jacksonville to the southern end of the Mosquito Lagoon in the Indian River Lagoon Estuarine System. Analysis of this data will enable a better understanding of the degree to which individual dolphins utilize the SJR in combination with other areas.

Greater understanding of the dynamics of the SJR bottlenose dolphin population relative to other areas of Florida has been fortified by semi-annual abundance surveys that were conducted concurrently, 2011-2016, by organizations comprising the Northeast Florida Bottlenose Dolphin Research Consortium. These surveys included waters from the Florida/Georgia border to the Indian River Lagoon and included the SJR from its mouth to Green Cove Springs. Analysis of these data will provide insights into seasonal dolphin abundance in the SJR relative to historic abundance levels (1994-97) as well as contemporary regional site fidelity.

H7. Protecting SJR Dolphins

Bottlenose dolphin inhabitance of the St. Johns River is a distinctive feature of this waterway. Recent mortality events affecting these animals as well as mortality events affecting dolphins in the Indian River Lagoon and elsewhere, are reminders that the presence of these intriguing animals is not guaranteed. Preservation of water quality and habitat throughout the extensive areas of the SJR that are utilized by dolphins is essential for their survival. Urban drainage and runoff into the SJR may be deleterious to dolphins. These animals may be vulnerable to the effects of contaminants, including persistent organic pollutants, that are of concern for dolphins in other ecoystyems (**NOAA 2016c**). Additional research into contaminant exposure and anthropogenic impacts on SJR dolphin warrants consideration. The potential association of dolphin strandings with the presence of cyanotoxins (**Brown, et al. 2017**) and investigation of other disease conditions that may affect SJR dolphins are important topics for future investigation. Diligent efforts to reduce interactions of dolphins with boats, fishing and crab gear, plus discarded debris, are continually needed in order to keep SJR dolphins safe from serious or fatal injury. Additionally, further research to understand bottlenose dolphin abundance and stock structure is crucial to conservations efforts, as information resulting from such studies is necessary to determine sustainable levels of mortality and to inform management plans.