COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*)
Jacksonville Estuarine System Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

In the western North Atlantic, the coastal morphotype of common bottlenose dolphins is continuously distributed in nearshore coastal and estuarine waters along the U.S. Atlantic coast south of Long Island, New York, to the Florida peninsula. Several lines of evidence support a distinction between dolphins inhabiting coastal waters near the shore and those present in the inshore waters of the bays, sounds and estuaries. Photo-identification (photo-ID) and genetic studies support the existence of resident estuarine animals in several areas (Caldwell 2001; Gubbins 2002; Zolman 2002; Gubbins *et al.* 2003; Mazzoil *et al.* 2005; Litz *et al.* 2012), and similar patterns have been observed in bays and estuaries along the Gulf of Mexico coast (Wells *et al.* 1987; Balmer *et al.* 2008). Recent genetic analyses using both mitochondrial DNA and nuclear microsatellite markers found significant differentiation between animals biopsied in coastal and estuarine areas along the Atlantic coast (Rosel *et al.* 2009), and between those biopsied in coastal and estuarine waters at the same latitude (NMFS unpublished data). Similar results have been found off the west coast of Florida (Sellas *et al.* 2005).

The estuarine habitat around Jacksonville, Florida, is composed of several large brackish rivers, including St. Mary's, Amelia, Nassau, Fort George and St. Johns River (Figure 1). The St. Johns River is a deep, swift moving river with heavy boat and shipping activity (Caldwell 2001). The remainder of the area is made up of tidal marshes and riverine systems averaging 2m in depth over sand, mud or oyster beds, and is bisected by the Intracoastal Waterway.

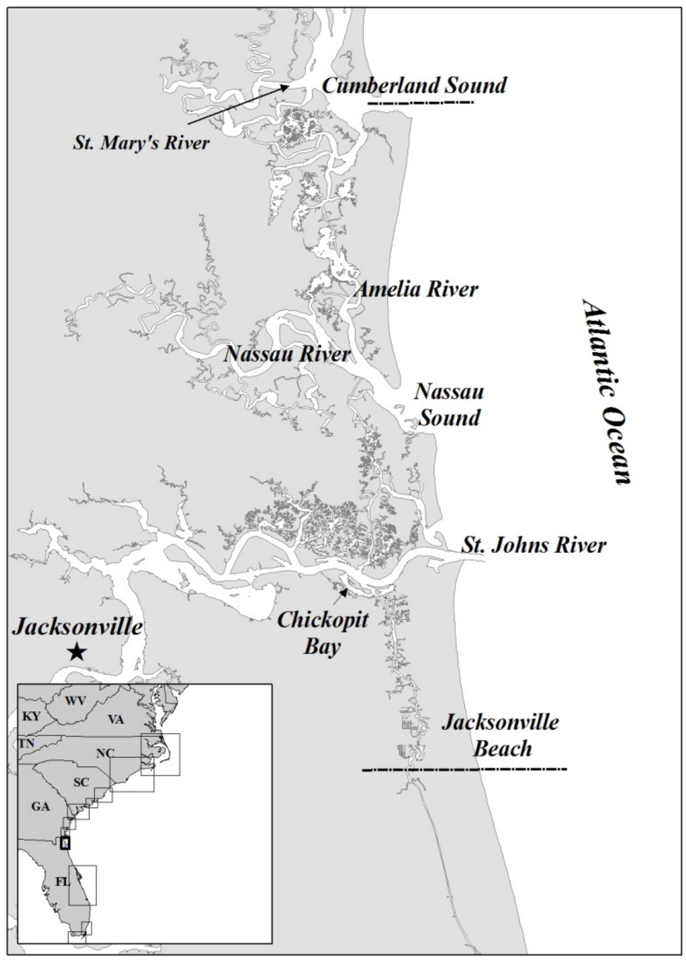

Figure 1. *Geographic extent of the Jacksonville Estuarine System (JES) Stock. The borders are denoted by dashed lines.*

Caldwell (2001) investigated the social structure of bottlenose dolphins inhabiting the estuarine waters between the St. Mary's River and Jacksonville Beach, Florida, using photo-ID and behavioral data obtained from December 1994 through December 1997. Three behaviorally different communities were identified during this study, namely the estuarine waters north of St. Johns River (termed the Northern area), the estuarine waters south of St. Johns River (the Southern area) and the coastal area, all of which differed in density, habitat fidelity and social affiliation patterns. Caldwell (2001) found that dolphins inhabiting the Northern area were the most isolated, with 96% of the groups observed containing dolphins that had been photographically identified only in this area, demonstrating strong year-round site fidelity. Cluster analyses suggested that dolphins using the Northern area did not socialize with those using the Southern area. In the Southern area, 78% of the groups were photographed only in this region (Caldwell 2001). However, these dolphins migrated into and out of the Jacksonville area each year, returning to the area during 3 consecutive summers, suggesting the Southern area dolphins may show summer site fidelity as opposed to the year-round fidelity demonstrated in the Northern area. Caldwell (2001) found that dolphins found in the coastal areas were highly mobile, had fluid social affiliations, were not sighted more than 8 times over the entire study and showed no long-term (>4 months) site fidelity. Three of these dolphins were also sighted off South Carolina, behind shrimp boats. These coastal dolphins are thus considered to be members of the coastal morphotype stocks.

Caldwell (2001) also examined genetic differentiation among the Northern, Southern and coastal areas of the study site using mitochondrial DNA sequences and microsatellite data. Both mitochondrial DNA haplotype and microsatellite allele frequencies differed significantly between the Northern and Southern sampling areas. Differentiation between the Southern sampling area and the coast was lower, but still significant. These genetic data are in line with the behavioral analyses. However, sample sizes were small for these estuarine regions (n≤25) and genetic analyses did not account for the high number of closely related individuals within the dataset. Further analyses are necessary to confirm the results.

Gubbins *et al.* (2003) identified oscillating abundance year round for dolphins within the estuarine waters of this area, with low numbers reported in January and December. There was a positive correlation between dolphin abundance and water temperature, with peak numbers seen when water temperatures rose above 16°C.

The Jacksonville Estuarine System (JES) Stock has been defined as a separate estuarine stock primarily by the results of these photo-ID and genetic studies. It is bounded in the north by the Florida/Georgia border at Cumberland Sound, abutting the southern border of the Southern Georgia Estuarine System Stock, and extends south to Jacksonville Beach, Florida. Despite the strong fidelity to the Northern and Southern areas observed by Caldwell (2001), some dolphins were photographed outside their preferred areas, supporting the proposal to include both these areas within the boundaries of the JES Stock. Future analyses may provide additional information on the importance of the Southern area to the resident stock, and thus the inclusion of both areas in this stock boundary may be modified with additional data or further analyses.

Dolphins residing within estuaries south of this stock down to the northern boundary of the Indian River Lagoon Estuarine System Stock are currently not included in any Stock Assessment Report. There are insufficient data to determine whether animals south of the JES Stock exhibit affiliation to the JES Stock, the IRLES Stock to the south or are simply transient animals associated with coastal stocks. Further research is needed to establish affinities of dolphins in this region. It should be noted that during 2009–2013, there were 32 stranded bottlenose dolphins in this region in estuarine waters, including 3 interactions with hook and line fishing gear (1 mortality, 1 serious injury, 1 live release without serious injury) and 2 entanglements in blue crab trap/pot gear (1 mortality and 1 live release without serious injury) (Maze-Foley and Garrison in prep a,b). In addition to animals included in the stranding database, in estuarine waters south of JES there were 3 at-sea observations of dolphins entangled in hook and line gear, crab trap/pot gear and thick line. All 3 dolphins were considered not seriously injured (Maze-Foley and Garrison in prep a,b).

POPULATION SIZE

The total number of common bottlenose dolphins residing within the JES Stock is unknown because previous estimates are greater than 8 years old. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates greater than 8 years old are deemed unreliable to determine the current PBR. Data collected by Caldwell (2001) were incorporated into a larger study that used mark-recapture analyses to calculate abundance in 4 estuarine areas along the eastern U.S. coast (Gubbins *et al.* 2003). Sighting records collected only from May through October were used, as this limited time period was determined to reduce the possibility of violating the mark-recapture model's assumption of geographic closure and mark retention. Based on photo-ID data from 1994 to 1997, 334 individually identified dolphins were observed (Gubbins *et al.* 2003), which included an unspecified number of seasonal residents and transients. Mark-recapture analyses included all the 334 individually identifiable dolphins, and the population size for the JES Stock was calculated to be 412 residents (CV=0.06; Gubbins *et al.* 2003). This was an overestimate of the stock abundance in the area covered by the study because it included non-resident and seasonally resident dolphins. Caldwell (2001) indicated that 122 dolphins were resighted at least 10 times in the JES, with 33 individuals observed primarily in the Northern area, and 89 individuals reported to use the Southern area.

Minimum Population Estimate

Present data are insufficient to calculate a minimum population estimate for the JES Stock of common bottlenose dolphins.

Current Population Trend

One abundance estimate is available for this stock, and therefore there are insufficient data to assess population trends.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for the JES Stock is unknown. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor is 0.5 because this stock is of unknown status. PBR is unknown for this stock.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury for the JES Stock during 2009–2013 is unknown because this stock is known to interact with unobserved fisheries (see below). The mean annual fishery-related mortality and serious injury for strandings and at-sea observations identified as fishery-caused was 1.2. No additional mortality or serious injury was documented from other human-caused actions. The minimum total mean annual human-caused mortality and serious injury for this stock during 2009–2013 was 1.2.

Fishery Information

The commercial fisheries that interact, or that potentially could interact, with this stock are the Category II Atlantic blue crab trap/pot; and Southeastern U.S. Atlantic, Gulf of Mexico stone crab trap/pot fisheries; and the Category III Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line) fishery (Appendix III).

Crab Trap/Pot

Between 2009 and 2013, 7 strandings within the JES area displayed evidence of interaction with a trap/pot fishery (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 11 June 2014). Three carcasses were entangled in crab trap gear (identified as commercial blue crab trap gear in 2 cases and unidentified trap/pot gear in the third), and 4 live animals were observed entangled in commercial blue crab trap line and buoys. One of the live animals was determined to be seriously injured and 3 were determined to be not seriously injured (Maze-Foley and Garrison in prep a,b,c). Because there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab traps/pots.

Hook and Line

During 2009–2013, 1 live animal was documented entangled in hook and line gear and debris within the JES area, and this animal was considered seriously injured (Maze-Foley and Garrison in prep b). This animal was included in the stranding database and in the stranding totals presented in Table 1. It should be noted that, in general, it cannot be determined if hook and line gear originated from a commercial (i.e., charter boat and headboat) or recreational angler because the gear type used by both sources is typically the same. Also, it is not possible to estimate the total number of interactions with hook and line gear because there is no systematic observer program.

Other Mortality

During 2009–2013, 71 strandings were documented within the JES area, including 18 strandings with evidence of a human interaction. Human interactions were from numerous sources, including the 7 crab trap/pot interactions and 1 hook and line gear interaction noted above, as well as entanglement in an Aerobie frisbee, and also evidence of 3 boat collisions (Table 1; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 11 June 2014). For 7 strandings, no evidence of human interactions was found, and for 46 strandings, it could not be determined if there was evidence of human interactions. Stranding data probably underestimate the extent of human and fishery-related mortality and serious injury because not all of the dolphins that die or are seriously injured in human interactions wash ashore, or, if they do, they are not all recovered (Peltier *et al.* 2012; Wells *et al.* 2015). Additionally, not all carcasses will show evidence of human interaction, entanglement or other fishery-related interaction due to decomposition, scavenger damage, etc. (Byrd *et al.* 2014). Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of human interaction.

In addition to animals included in the stranding database, in 2013 there was an at-sea observation in the JES area of a dolphin entangled in unidentified fishing gear, and this dolphin was determined to be seriously injured

(Maze-Foley and Garrison in prep c).

An Unusual Mortality Event (UME) was declared for the St. Johns River area during May-September 2010, including 14 strandings assigned to the JES Stock and 4 strandings within estuaries to the south not currently included in any stock assessment report. The cause of this UME is undetermined. A UME was declared in the summer of 2013 for the mid-Atlantic coast from New York to Brevard County, Florida. Beginning in July 2013, bottlenose dolphins have been stranding at elevated rates. The total number of stranded bottlenose dolphins from New York through North Florida (Brevard County) as of mid-October 2014 (1 July 2013 - 19 October 2014) was ~1546. Morbillivirus has been determined to be the cause of the event. Most strandings and morbillivirus positive animals have been recovered from the ocean side beaches rather than from within the estuaries, suggesting that at least so far coastal stocks have been more impacted by this UME than estuarine stocks. However, several confirmed morbillivirus positive animals have been recovered from within the JES Stock area. The UME is still ongoing as of December 2014 when this report was drafted, and work continues to determine the effect of this event on all bottlenose dolphin stocks in the Atlantic.

Table 1. Common bottlenose dolphin strandings occurring in the Jacksonville Estuarine System, South Carolina, from 2009 to 2013, as well as number of strandings for which evidence of human interactions (HI) was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interactions. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 11 June 2014). Please note human interaction does not necessarily mean the interaction caused the animal's death.

Stock	Category	2009	2010	2011	2012	2013	Total
Jacksonville Estuarine System	Total Stranded	7	17[a]	7	13	27	71
	Human Interaction						
	---Yes	3[b]	1[c]	2[d]	6[e]	6[f]	18
	---No	0	4	1	0	2	7
	---CBD	4	12	4	7	19	46

[a] 14 of these strandings were part of the St. Johns River UME during May-September 2010.
[b] This total includes 1 entanglement interaction with crab trap/pot gear (mortality).
[c] This HI was an entanglement interaction with crab trap/pot gear (released alive, not seriously injured).
[d] These HIs include 1 mortality from an entanglement in commercial blue crab trap/pot gear and 1 animal observed entangled in and trailing unknown material/gear that was seriously injured.
[e] This total includes 3 entanglement interactions with commercial blue crab trap/pot gear (1 mortality, 1 animal released alive seriously injured, and 1 animal released alive not seriously injured). Also included is 1 entanglement interaction with hook and line gear and debris (serious injury).
[f] This total includes 1 entanglement interaction with commercial blue crab trap/pot gear (not seriously injured). In addition, another live animal was considered not seriously injured after being disentangled from an Aerobie (frisbee).

HABITAT ISSUES

This stock inhabits areas with significant drainage from industrial and urban sources, and as such is exposed to contaminants in runoff from them. No contaminant analyses have yet been conducted in this area. In other estuarine areas where such analyses have been conducted, it has been suggested that exposure to anthropogenic contaminants could potentially result in adverse effects on health or reproductive rates (Schwacke *et al.* 2002; Hansen *et al.* 2004).

STATUS OF STOCK

Common bottlenose dolphins in the western North Atlantic are not listed as threatened or endangered under the Endangered Species Act. However, because the abundance of the JES Stock is currently unknown, but likely small, and relatively few mortalities and serious injuries would exceed PBR, NMFS considers this to be a strategic stock under the MMPA. The documented mean annual human-caused mortality for this stock for 2009 – 2013 was 1.2. However, there are commercial fisheries, including crab trap/pot fisheries, operating within this stock's boundaries and these fisheries have little to no observer coverage. The impact of crab trap/pot fisheries on estuarine bottlenose dolphins is currently unknown, but has been shown previously to be considerable in the similar Charleston Estuarine System Stock area (Burdett and McFee 2004). Therefore, the documented mortalities must be considered minimum estimates of total fishery-related mortality. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to OSP is unknown. There are insufficient data to determine the population trends for this stock.

REFERENCES CITED

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. J. Cetacean Res. Manage. 10(2): 157-167.

Barlow, J., S.L. Swartz, T.C. Eagle and P.R. Wade. 1995. U.S. marine mammal stock assessments: Guidelines for preparation, background, and a summary of the 1995 assessments. NOAA Tech. Memo. NMFS-OPR-6. 73 pp.

Burdett, L.G. and W.E. McFee. 2004. Bycatch of bottlenose dolphins in South Carolina, USA, and an evaluation of the Atlantic blue crab fishery categorisation. J. Cetacean Res. Manage. 6: 231-240.

Byrd, B.L., A.A. Hohn, G.N. Lovewell, K.M. Altman, S.G. Barco, A. Friedlaender, C.A. Harms, W.A. McLellan, K.T. Moore, P.E. Rosel and V.G. Thayer. 2014. Strandings illustrate marine mammal biodiversity and human impacts off the coast of North Carolina, USA. Fish. Bull. 112: 1-23.

Caldwell, M. 2001. Social and genetic structure of bottlenose dolphin (*Tursiops truncatus*) in Jacksonville, Florida. Ph.D. thesis. University of Miami. 143 pp.

Gubbins, C. 2002. Association patterns of resident bottlenose dolphins (*Tursiops truncatus*) in a South Carolina estuary. Aquat. Mamm. 28: 24-31.

Gubbins, C.M., M. Caldwell, S.G. Barco, K. Rittmaster, N. Bowles and V. Thayer. 2003. Abundance and sighting patterns of bottlenose dolphins (*Tursiops truncatus*) at four northwest Atlantic coastal sites. J. Cetacean Res. Manage. 5(2): 141-147.

Hansen, L.J., L.H. Schwacke, G.B. Mitchum, A.A. Hohn, R.S. Wells, E.S. Zolman and P.A. Fair. 2004. Geographic variation in polychlorinated biphenyl and organochlorine pesticide concentrations in the blubber of bottlenose dolphins from the U.S. Atlantic coast. Sci. Total Environ. 319: 147-172.

Litz, J.A., C.R. Hughes, L.P. Garrison, L.A. Fieber and P.E. Rosel. 2012. Genetic structure of common bottlenose dolphins (*Tursiops truncatus*) inhabiting adjacent South Florida estuaries - Biscayne Bay and Florida Bay. J. Cetacean Res. Manage. 12(1): 107-117.

Maze-Foley, K. and L.P. Garrison. in prep a. Preliminary serious injury determinations for small cetaceans off the southeast U.S. coast, 2007-2011.

Maze-Foley, K. and L.P. Garrison. in prep b. Preliminary serious injury determinations for small cetaceans off the southeast U.S. coast, 2012.

Maze-Foley, K. and L.P. Garrison. in prep c. Preliminary serious injury determinations for small cetaceans off the southeast U.S. coast, 2013.

Mazzoil, M., S.D. McCulloch and R.H. Defran. 2005. Observations on the site fidelity of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Fla. Sci. 68(4): 217-226.

Peltier, H., W. Dabin, P. Daniel, O. Van Canneyt, G. Dorémus, M. Huon and V. Ridoux. 2012. The significance of stranding data as indicators of cetacean populations at sea: modelling the drift of cetacean carcasses. Ecol. Indicators 18: 278–290.

Rosel, P.E., L. Hansen and A.A. Hohn. 2009. Restricted dispersal in a continuously distributed marine species: common bottlenose dolphins *Tursiops truncatus* in coastal waters of the western North Atlantic. Molec. Ecol. 18: 5030–5045.

Schwacke, L.H., E.O. Voit, L.J. Hansen, R.S. Wells, G.B. Mitchum, A.A. Hohn and P.A. Fair. 2002. Probabilistic risk assessment of reproductive effects of polychlorinated biphenyls on bottlenose dolphins (*Tursiops truncatus*) from the southeast United States coast. Env. Toxic. Chem. 21(12): 2752-2764.

Sellas, A.B., R.S. Wells and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conserv. Genet. 6(5): 715-728.

Wade, P.R. and R.P. Angliss. 1997. Guidelines for assessing marine mammal stocks: Report of the GAMMS Workshop April 3-5, 1996, Seattle, Washington. NOAA Tech. Memo. NMFS-OPR-12. 93 pp.

Wells, R.S., J.B. Allen, G. Lovewell, J. Gorzelany, R.E. Delynn, D.A. Fauquier and N.B. Barros. 2015. Carcass-recovery rates for resident bottlenose dolphins in Sarasota Bay, Florida. Mar. Mamm. Sci. 31(1): 355-368.

Wells, R.S., M.D. Scott and A.B. Irvine. 1987. The social structure of free ranging bottlenose dolphins. Pages 247-305 *in*: H. Genoways, (ed.) Current Mammalogy, Vol. 1. Plenum Press, New York.

Zolman, E.S. 2002. Residence patterns of bottlenose dolphins (*Tursiops truncatus*) in the Stono River estuary, Charleston County, South Carolina, U.S.A. Mar. Mamm. Sci. 18: 879-892.