

BOTTLENOSE DOLPHIN (*Tursiops truncatus*) Southern North Carolina Estuarine System Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The coastal morphotype of bottlenose dolphin is continuously distributed along the Atlantic coast south of Long Island, New York, to the Florida peninsula, including inshore waters of the bays, sounds and estuaries. Several lines of evidence support a distinction between dolphins inhabiting primarily coastal waters near the shore and those present primarily 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 (e.g., Caldwell 2001; Gubbins 2002; Zolman 2002; Gubbins *et al.* 2003; Mazzoil *et al.* 2005; Litz 2007), and similar patterns have been observed in bays and estuaries along the Gulf of Mexico coast (e.g., 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between animals biopsied along the coast and those biopsied within the estuarine systems at the same latitude (NMFS unpublished data). Similar results have been found off the west coast of Florida (Sellas *et al.* 2005).

The Southern North Carolina Estuarine System (SNCES) stock is bounded in the south by the border between North Carolina and South Carolina and in the north by the Beaufort Inlet, and encompasses all estuarine waters in between, including but not limited to the Intracoastal Waterway, the Cape Fear River and tributaries, Bogue Sound and tributaries, and the White Oak and New Rivers. The borders are based primarily on a photo-ID study area (Read *et al.* 2003) and are subject to change upon further study of dolphin residency patterns in estuarine waters of North Carolina and northern South

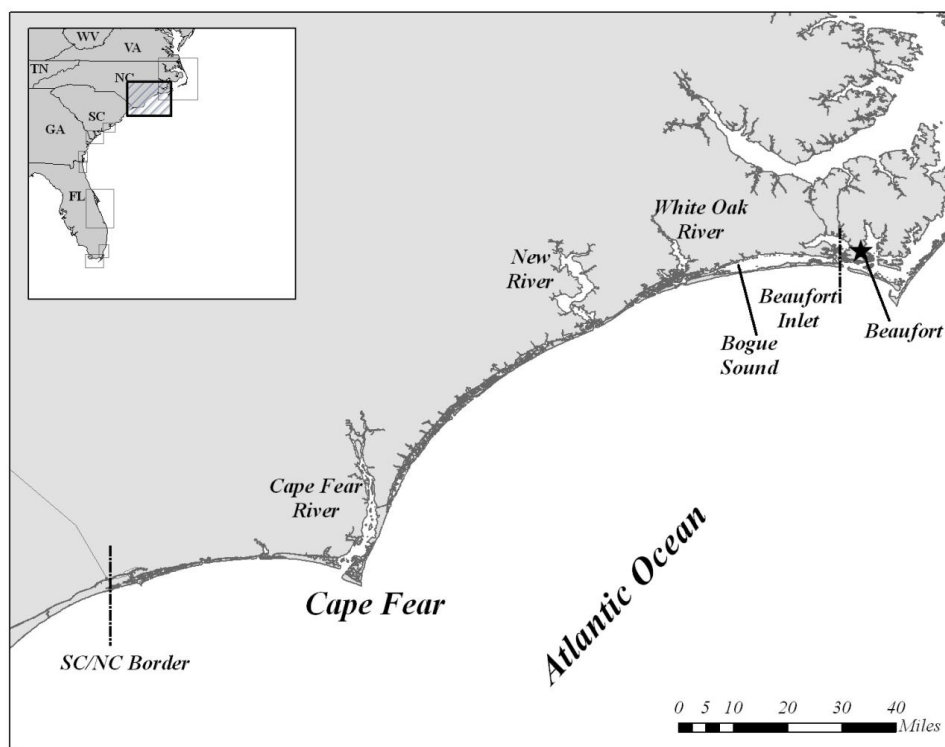


Figure 1. Geographic extent of the Southern North Carolina Estuarine System (SNCES) stock, located on the coast of North Carolina. The borders are denoted by dashed lines.

Carolina. Estuarine animals residing within the SNCES were previously included in stock assessment reports for the Western North Atlantic Coastal Morphotype Stocks of bottlenose dolphins (e.g., Waring *et al.* 2009). Dolphins residing in the estuaries south of this stock between the North Carolina/South Carolina border and the northern boundary of the Charleston Estuarine System stock (CES) are not currently covered in any stock assessment report. There are insufficient data to determine whether animals in this region exhibit affiliation to the CES stock or to the SNCES stock, or if there are 1 or more estuarine stocks in this region. It should be noted, however, that in this intervening region during 2003-2007, there were 11 recorded bottlenose dolphin strandings, 2 of which were confirmed fishery interactions. One of these 2 was entangled in crab pot gear, disentangled and released alive. Of the remaining 9 stranded dolphins, evidence of human interaction could not be determined for 4 and 5 were determined

not to have had any human interaction.

The SNCES stock has been defined as an estuarine stock primarily by the results of photo-ID studies. Long-term photo-ID studies have identified numerous individuals that occur regularly both near and in the Cape Fear River, in the estuarine waters near Beaufort, and in estuarine waters and along ocean-front beaches between the Cape Fear River and Beaufort (Urian *et al.* 1999; Urian pers. comm.). Read *et al.* (2003) conducted a photo-ID study in the estuarine waters of North Carolina during July 2000 and suggested that, based on the patterns of resights, differences in group sizes, and habitat, there may be a northern stock and southern stock in North Carolina estuarine waters, with the stock boundary near Beaufort, North Carolina.

Limited telemetry data lend support to the boundary definition of the SNCES stock (Read *et al.* 1996; NMFS unpublished data). Four animals captured, fitted with satellite-linked telemetry, and released near Cape Fear, North Carolina, in November 2004 displayed 3 movement patterns: 1) 2 animals were clearly not of the estuarine stock, and occurred exclusively in coastal waters from Florida to Virginia (tag duration 221 and 251 days); 2) 1 animal occurred in estuarine and coastal waters from the Cape Fear River to Beaufort (tag duration 94 days), a pattern also evident in multi-year photo-ID data for this animal; and 3) 1 animal occurred primarily in the Cape Fear River and coastal waters near the Cape Fear River inlet (tag duration 322 days) (NMFS unpublished data). The information on these last 2 animals suggests 2 possible stock distribution patterns; 1 that encompasses estuarine and coastal waters between the Cape Fear River and Beaufort, and another that is restricted to estuarine waters of the Cape Fear River and nearby coastal waters. Radio-tracking of dolphins tagged in Bogue Sound, North Carolina, and in the vicinity of Beaufort, North Carolina, in 1995 showed movements consistent with photo-ID findings (Read *et al.* 1996).

Photo-ID studies have shown that some animals move between the estuaries in and around Beaufort south to the Cape Fear River and nearby waters, and some move from Beaufort north into Pamlico Sound and adjacent waters (Urian *et al.* 1999; Urian, pers. comm.; NMFS unpublished data), and telemetry data showed that animals moved between Beaufort and Pamlico Sound (NMFS unpublished data). This overlap near the Beaufort area could suggest that there is only 1 stock that includes estuarine waters from the North Carolina/South Carolina border to the North Carolina/Virginia border. However, the telemetry and photo-ID studies indicate that there is little, if any significant movement of animals from 1 area to the other, for instance, from Cape Fear to Pamlico Sound. The available information does not provide consistent, year-round coverage so it is possible that there may be seasonal variability in distribution patterns that may conflict with this stock definition.

The telemetry studies and the photo-ID studies show that while most locations where animals of the SNCES stock have been observed were in estuarine waters, at least some of the animals do occur in coastal waters. A variety of existing datasets with information on spatial distribution patterns of this stock may be useful for accurately quantifying its usage of coastal waters, and the integration and analyses of those data have been initiated. Information on use of coastal waters will be important when considering exposure to coastal fisheries as estuarine animals that make use of nearshore coastal waters would be at risk of entanglement in fishing gear while moving along the coast.

POPULATION SIZE

Population size estimates for this stock are greater than 8 years old and therefore the current population size for the stock is considered unknown (Wade and Angliss 1997). Read *et al.* (2003) provided the first and only available comprehensive abundance estimate of bottlenose dolphins that occur within the proposed boundaries of the SNCES stock. This estimate is based on a photographic mark-recapture survey of North Carolina waters inshore of the barrier islands, conducted during July 2000. Read *et al.* (2003) estimated the number of animals in the inshore waters of North Carolina equivalent to that of the SNCES stock at 141 (95% CI 112 - 200, CV=0.15).

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). Because the only available abundance estimate for this stock was derived from data that are more than 8 years old, they may not be used to calculate the minimum population estimate, and as a result the minimum population estimate for the SNCES stock of bottlenose dolphins is unknown. A new estimate of abundance based on photo-ID capture-recapture studies will be forthcoming (Read, pers. comm.).

Current Population Trend

There are insufficient data to determine the population trends for this stock.

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 of the SNCES stock of bottlenose dolphins is unknown. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is of unknown status. PBR for this stock of bottlenose dolphins is undetermined.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury for this stock during 2003-2007 is unknown.

Fishery Information

The SNCES stock interacts with 3 Category II fisheries: the Atlantic blue crab trap/pot fishery, the North Carolina inshore gillnet fishery, and the North Carolina stop net fishery. There is no systematic observer coverage of these fisheries by the NMFS, although the North Carolina Division of Marine Fisheries operates systematic coverage of the fall flounder gillnet fishery in Pamlico Sound (Price 2008). As a result, information about interactions with North Carolina inshore fisheries is based solely on stranding data and it is not possible to estimate the annual number of interactions or mortalities in these fisheries. The SNCES stock may also interact with the mid-Atlantic gillnet fishery, but estimates of the potential for this interaction will not be known until the various datasets on spatial distribution mentioned above are integrated and analyzed.

From 2003 through 2007, 19 bottlenose dolphins were found stranded or entangled in gear within the SNCES area (Table 1; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 10 November 2008). Of these, it was possible to determine whether or not a human interaction (HI; e.g., gear and debris entanglement, mutilation, boat collision) had occurred for 10 (52.6%); for the remainder it was not possible to make that determination due primarily to decomposition. Three of the 10 strandings were categorized as 'yes' for evidence of human interactions, all of which were determined to have been involved in a fisheries interaction (FI) based on direct observation of entanglement or by entanglement lesions (Read and Murray 2000). One of them was seen alive and entangled in monofilament line. This animal was captured to remove the line, but it died during the capture. The condition of the entanglement and the necropsy afterwards indicated that the animal's health was severely complicated by the entanglement and that survival of the injuries without intervention was unlikely (NMFS unpublished data). Of the remaining 2 FI strandings, 1 had healed lesions that were unlikely to have contributed to its death. The other FI stranding had entanglement lesions consistent with entanglement in multifilament webbing. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals that die or are seriously injured in fisheries are discovered, reported, or investigated, nor will all of those that are found necessarily show signs of entanglement or other fishery interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interactions.

Table 1. Bottlenose dolphin strandings for the Southern North Carolina Estuarine System (SNCES) stock from 2003 to 2007, as well as number of strandings for which evidence of human interaction was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interaction. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (accessed 10 November 2008). Please note human interaction does not necessarily mean the interaction caused the animal's death.

Stock	Category	2003	2004	2005	2006	2007	Total
SNCES	Total Stranded	3	5	4	3	4	19
	Human Interaction						
	---Fishery Interaction	0	0	2	0	1	3
	---Other	0	0	0	0	0	0
	No Human Interaction	1	4	0	1	1	7
	CBD	2	1	2	2	2	9

Other Mortality

Three bottlenose dolphins that were captured, tagged with satellite-linked transmitters, and released near Beaufort, North Carolina, during April 2006 by the National Marine Fisheries Service (NMFS) as part of a long-term stock delineation research project were believed to have died shortly thereafter as a result of the capture or tagging (NMFS unpublished data). Two of the animals were recovered stranded but because of advanced decomposition of the carcasses cause of death could not be determined. One of these 2 animals was known from long-term photo-ID and was likely of the SNCES stock. The third animal has not been observed subsequent to release, but patterns in the data received from its satellite tag were similar to that of the other 2 and indicated the fates were similar. These last 2 animals were, based on satellite-derived locations, likely of the Northern North Carolina Estuarine System stock.

This stock inhabits areas with significant drainage from agricultural, industrial and urban sources, and as such is exposed to contaminants in runoff from those sources. The blubber of 47 bottlenose dolphins captured and released in waters around Beaufort contained contaminants of some level, and 7 had unusually high levels of the pesticide methoxychlor (Hansen *et al.* 2004). While there are no estimates of indirect human-caused mortality from pollution or habitat degradation, Schwacke *et al.* (2002) found that the levels of polychlorinated biphenyls (PCBs) observed in Beaufort female bottlenose dolphins would likely impair reproductive success, especially of primiparous females.

STATUS OF STOCK

From 1995 to 2001, NMFS recognized only a single migratory stock of coastal bottlenose dolphins in the western North Atlantic, and the entire stock was listed as depleted as a result of the 1987-1988 mortality event. Scott *et al.* (1988) suggested that dolphins residing in the bays, sounds and estuaries adjacent to these coastal waters were not affected by the mortality event and these animals were explicitly excluded from the depleted listing (Federal Register: 54(195), 41654-41657; 56(158), 40594-40596; 58(64), 17789-17791).

The status of the SNCES stock relative to OSP is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine population trends for this stock. Total human-caused mortality and serious injury for this stock is not known and there is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. However, considering the evidence from stranding data (Table 1), the total human-caused mortality and serious injury is likely not insignificant, and, therefore, the levels are likely not approaching zero mortality and serious injury rate. Because the stock size is currently unknown, but likely small and relatively few mortalities and serious injuries would exceed PBR, the NMFS considers this stock to be a strategic 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.
- 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. *Aquatic Mammals* 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. 2007. Social structure, genetic structure, and persistent organohalogen pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. Ph.D. thesis. University of Miami. 140 pp.
- 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. *Florida Scientist* 68(4): 217-226.
- Price, B. 2008. Sea turtle bycatch monitoring of the 2007 fall gillnet fisheries in southeastern Pamlico Sound, North Carolina. Completion report for activities under Endangered Species Act Section 10 Incidental Take Permit # 1528. NC Division of Marine Fisheries, Morehead City, NC 25 pp.
- Read, A.J. and K.T. Murray 2000. Gross evidence of human-induced mortality in small cetaceans. NOAA Tech. Memo. NMFS-OPR-15. 21 pp.
- Read, A.J., K.W. Urian, B. Wilson and D.M. Waples 2003. Abundance of bottlenose dolphins in the bays, sounds, and estuaries of North Carolina. *Mar. Mamm. Sci.* 19(1): 59-73.
- Read, A.J., A.J. Westgate, K.W. Urian, R.S. Wells, B.M. Allen and W.J. Carr 1996. Monitoring movements and health status of bottlenose dolphins in Beaufort, NC using radio telemetry. Final contract report to the National Marine Fisheries Service, Southeast Fisheries Science Center, Charleston, SC. Contract No. 40-GENF-500160 37 pp.
- 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. *Environ. Toxicol. Chem.* 21(12): 2752-2764.
- Scott, G.P., D.M. Burn and L.J. Hansen 1988. The dolphin dieoff: Long-term effects and recovery of the population. Conference proceedings, Oceans '88. IEEE Cat. No. 88-CH2585-8.
- 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.
- Urian, K.W., A.A. Hohn and L.J. Hansen 1999. Status of the photoidentification catalog of coastal bottlenose dolphins of the western North Atlantic: Report of a workshop of catalog contributors. NOAA Tech. Memo. NMFS-SEFSC-425. 24 pp.
- 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.
- Waring, G.T., E. Josephson, C.P. Fairfield-Walsh and K. Maze-Foley, eds. 2009. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments -- 2008. NOAA Tech Memo. NMFS NE 210. 440 pp.
- 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.