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BOTTLENOSE DOLPHIN (*Tursiops truncatus*)
Southern Georgia 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. Except for animals residing within the Southern North Carolina and Northern North Carolina Estuarine Systems (e.g., Waring *et al.* 2008), estuarine dolphins along the U.S. east coast have not previously been included in stock assessment reports. 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 inshore areas of the southeastern United States (Caldwell 2001; Gubbins 2002; Zolman 2002; Mazzoil *et al.* 2005; Litz 2007), 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animals biopsied along the Atlantic coast and those biopsied within the estuarine systems at the same latitude (NMFS unpublished data).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 Georgia Estuarine System stock (SGES) is bounded in the south by the Georgia/Florida border at the Cumberland River and in the north by the Altamaha River inclusive and encompasses all estuarine waters in between, including but not limited to the Intracoastal Waterway, St. Andrew and Jekyll Sounds and their tributaries, St. Simon Sound and tributaries, and the Turtle/Brunswick River Estuary (TBRE) system (Figure 1). The southern boundary abuts the northern boundary of the Jacksonville stock, previously defined based on a photo-ID project (Caldwell 2001). The northern border is defined based on continuity of estuarine habitat, and a significantly high and unique contaminant burden found in dolphins from this area (Pulster and Maruya 2008). These boundaries are subject to change upon further study of dolphin residency patterns in estuarine waters of central and northern Georgia.

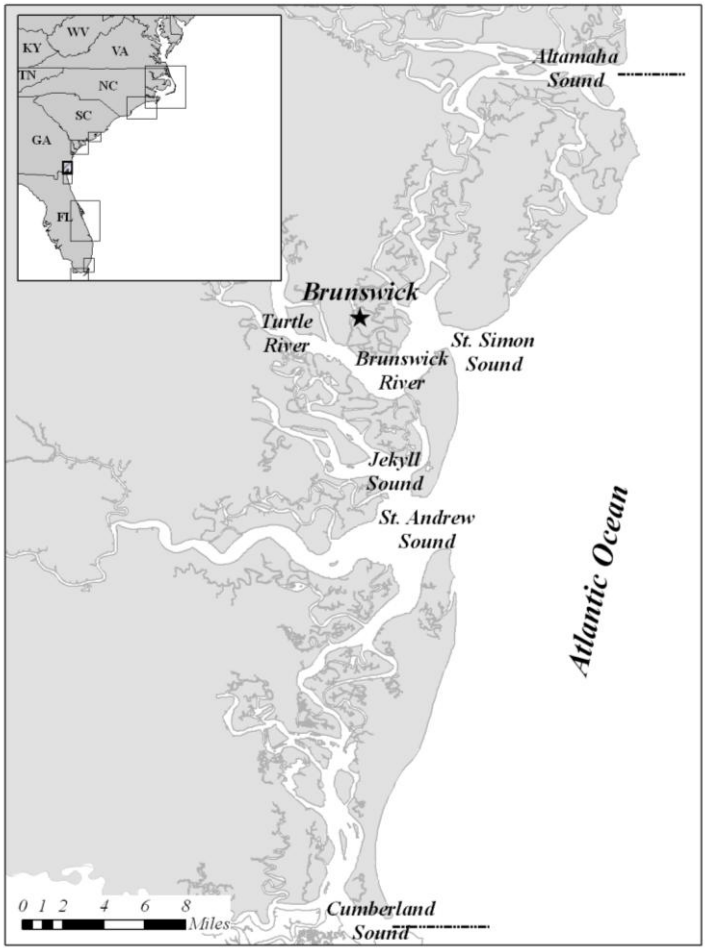

Figure 1. *Geographic extent of the Southern Georgia Estuarine System (SGES) stock. The borders are denoted by dashed lines.*

Genetic analysis of mitochondrial DNA control region sequences and microsatellite markers of dolphins biopsied in the SGES showed significant differentiation from animals biopsied in northern Georgia and southern South Carolina estuaries as well as from animals biopsied in coastal waters >1 km from shore at the same latitude (NMFS unpublished data). In addition, bottlenose dolphins in the TBRE exhibit contaminant burdens consistent with long-term fidelity to the TBRE (Pulster and Maruya 2008).

Dolphins residing in the estuaries north of this stock between Altamaha Sound, Georgia, and Wassaw Sound, Georgia, are not currently covered in any stock assessment report. There are insufficient data to determine whether

animals in this region exhibit affiliation to the SGES stock or to the stock to the north, the Northern Georgia/Southern South Carolina Estuarine System stock or should be delineated as their own stock. Further research is needed to establish affinities of dolphins in this region. It should be noted, however, that in this intervening region during 2003-2007, 7 dead stranded dolphins were reported but it could not be determined if there was evidence of human interactions for 6 of these stranded animals and for 1 animal no evidence of human interactions was detected.

POPULATION SIZE

The total number of bottlenose dolphins residing within the Southern Georgia Estuarine System stock is unknown. The Georgia Dolphin Project conducted quarterly boat-based surveys from 1992 to 2003 to photograph and count dolphins, but no abundance estimate has been published from this work. Gubbins *et al.* (2003), using photo-ID methods to identify individual dolphins, provided an estimate of 525 dolphins (CI: 399, 728) for a portion of the area covered by the SGES stock. However, these data were collected during May - October 1997 and hence are considered expired. In 2008, new efforts to estimate abundance in a portion of the SGES from St. Simons Sound to the Altamaha River were initiated (Balmer, pers. comm.). Mark-recapture, photo-ID surveys are planned for every season for 2 years and were started in February 2008 (Balmer, pers. comm.). This research should yield an abundance estimate for a large portion of this stock's range.

Minimum Population Estimate

Present data are insufficient to calculate a minimum population estimate for the Southern Georgia Estuarine System stock of bottlenose dolphins.

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 SGES 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 unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury of the SGES bottlenose dolphin stock during 2003-2007 is unknown.

Fishery Information

Crab Pots

Between 2003 and 2007, there were 2 documented reports of fishery-related interactions for this stock: 1 attributed to commercial blue crab pot gear; the second involved gear consistent with the crab pot fishery (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 10 November 2008). One of the 2 animals was disentangled and released alive (condition unknown) and the second was seen towing ~2-3 m of white line with a buoy on the end. Disentanglement efforts failed. In addition, there was a documented crab pot entanglement in 2001 in which the animal was released alive. Since there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab pots. However, bottlenose dolphin interactions with and entanglement in crab pot gear are well documented and mortalities have occurred in estuarine areas similar to the estuarine waters of southern Georgia (Burdett and McFee 2004). Thus, the potential for crab pot fishery gear to cause mortalities of bottlenose dolphins in the SGES should not be discounted.

Other Mortality

From 2003 to 2007, 15 additional bottlenose dolphins were reported stranded within the SGES (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 10 November 2008). It was not possible to make any determination of possible human interaction for 14 of these strandings. For the remaining dolphin, no evidence of human interactions was detected. 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 fishery interactions 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.

A portion of the stock's range is highly industrialized, and the Environmental Protection Agency has included 4 sites within the Brunswick area on its National Priority List (NPL) of hazardous waste sites (EPA 2008). Specifically, the LCP Chemicals Site contaminated soils, groundwater and adjacent marsh with mercury and polychlorinated biphenyls (PCBs). Mean total polychlorinated biphenyl (PCB) concentrations from dolphins biopsied in the Turtle/Brunswick River Estuary (Pulster and Maruya 2008; Sanger *et al.* 2008) were significantly higher than dolphins sampled in other areas of the world including other inshore estuarine waters along the Southeast coast of the United States (Schwacke *et al.* 2002; Hansen *et al.* 2004; Litz 2007). PCB congeners measured in tissues of dolphins biopsied in the TBRE system were enriched in highly chlorinated homologs consistent with Aroclor 1268 (Pulster and Maruya 2008; Sanger *et al.* 2008). The TBRE area is known to be contaminated with this specific PCB mixture in soil and sediments, and the transport of these contaminants into the food web through invertebrate and vertebrate fauna has been documented (Kannan *et al.* 1997; Kannan *et al.* 1998; Maruya and Lee 1998).

Studies have suggested an increased risk of detrimental effects on reproduction and endocrine and immune system function for marine mammals in relation to tissue concentrations of PCBs (De Swart *et al.* 1996; Kannan *et al.* 2000; Schwacke *et al.* 2002). Thus, the high levels of PCBs recorded in dolphins from this stock raise concern for the long-term health and viability of the stock. However, there are no estimates of indirect human-caused mortality from pollution or habitat degradation. Studies of the distribution and health of bottlenose dolphins in this area are ongoing (Sanger *et al.* 2008; Schwacke, pers. comm.).

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 SGES 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. The total human-caused mortality and serious injury for this stock is unknown 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. Entanglements in both commercial and recreational crab pot fisheries are documented, and detrimental impacts of high pollutant burdens may be a significant issue for this stock due to the high mean total polychlorinated biphenyl (PCB) concentrations found in the blubber of animals in this region. 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. Schwartz, T. C. Eagle and P. R. Wade. 1995. U. S. Marine Mammal Stock Assessments: Guidelines for Preparation, Background and Summary of the 1995 Assessments. NOAA Technical Memorandum 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 categorization. J. Cetacean Res. Manage. 6(3): 231-240.

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

De Swart, R. L., P. S. Ross, J. G. Vos and A. D. M. E. Osterhaus. 1996. Impaired immunity in harbour seals (*Phoca vitulina*) exposed to bioaccumulated environmental contaminants: Review of a long-term study. Environ. Health Perspect. 104: 823-828.

EPA. 2008. http://www.epa.gov/region4/waste/npl/index.htm.

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: 141-147.

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

Kannan, K., A. L. Blankenship, P. D. Jones and J. P. Giesy. 2000. Toxicity reference values for the toxic effects of polychlorinated biphenyls to aquatic mammals. Hum. Ecol. Risk Assess. 6: 181-201.

Kannan, K., K. A. Maruya and S. Tanabe. 1997. Distribution and characterization of polychlorinated biphenyl congeners in soil and sediments from a Superfund site contaminated with Aroclor 1268. Environ. Sci. Technol. 31: 1483-1488.

Kannan, K., H. Nakata, R. Stafford and G. R. Masson. 1998. Bioaccumulation and toxic potential of extremely hydrophobic polychlorinated biphenyl congeners in biota collected at a Superfund site contaminated with Aroclor 1268. Environ. Sci. Technol. 32: 1214-1221.

Litz, J. A. 2007. Social structure, genetic structure, and persistent organohalogen pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. Ph.D. dissertation from The University of Miami. 140 pp.

Maruya, K. A. and R. F. Lee. 1998. Aroclor 1268 and toxaphene in fish from a southeastern US estuary. Environ. Sci. Technol. 32: 1069-1075.

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: 217-226.

Pulster, E. L. and K. A. Maruya. 2008. Geographic specificity of Aroclor 1268 in bottlenose dolphins (*Tursiops truncatus*) frequenting the Turtle/Brunswick River estuary, Georgia (USA). Sci. Total Environ. 393: 367-375.

Sanger, D., A. Blair, G. DiDonato, T. Washburn, S. Jones, R. Chapman, D. Bergquist, G. Riekerk, E. Wirth, J. Stewart, D. White, L. Vandiver, S. White and D. Whitall. 2008. Support for integrated ecosystem assessments of NOAA's National Estuarine Research Reserves System (NERRS), Volume I: The impacts of coastal development on the ecology and human well-being of tidal creek ecosystems of the US Southeast. NOAA Tech. Memo., NOS-NCCOS-82, 76 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 the reproductive effects of polychlorinated biphenyls on bottlenose dolphins (*Tursiops truncatus*) from the southeast United States coast. Environ. Toxicol. Chem. 21: 2752-2764.

Scott, G. P., D. M. Burn and L. J. Hansen. 1988. The dolphin dieoff: Long-term effects and recovery of the population. Proceedings: Oceans '88, IEEE Cat. No. 88-CH2585-8, Vol. 3: 819-823.

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: 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, WA. NOAA Tech. Memo. NMFS-OPR-12, 93 pp.

Waring, G. T., E. Josephson, C. P. Fairfield-Walsh and K. Maze-Foley, eds. 2008. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments -- 2007. NOAA Tech. Memo. NMFS-NE-205, 415 pp.

Wells, R. S., M. D. Scott and A. B. Irvine. 1987. The social structure of free ranging bottlenose dolphins. pp. 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.