COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*) Central Georgia 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 inshore areas of the southeastern United States (Caldwell 2001; Gubbins 2002; Zolman 2002; Mazzoil *et al.* 2005; Rosel *et al.* 2009; Litz *et al.* 2012), and similar patterns have been observed in bays and estuaries along the Gulf of Mexico coast (Wells *et al.* 1987; Sellas *et al.* 2005; Balmer *et al.* 2008; Rosel *et al.* 2017).

Coastal central and northern Georgia contains an extensive estuarine tidal marsh system in which common bottlenose dolphins are documented. The primary river drainages in this region are the Altamaha in central Georgia and the Savannah River at the Georgia-South Carolina border. Much of the coastal marsh and islands in the area has been privately owned since the early 19th century and has therefore experienced little development, and the marshes and coastal region are relatively undisturbed. The Sapelo Island National Estuarine Research Reserve, part of NOAA's Estuarine Reserve System, lies in this section of the Georgia coast and includes 4,000 acres of tidal salt marsh.

Figure 1. ***Geographic extent of the Central Georgia Estuarine System (CGES) Stock. Dashed lines denote the boundaries.***

The Central Georgia Estuarine System Stock (CGES) is delineated in the estuarine waters of central Georgia (Figure 1). It extends from the northern extent of Ossabaw Sound, where it meets the border with the Northern Georgia/Southern South Carolina Estuarine System Stock, south to the Altamaha River, which provides the border between the CGES and the Southern Georgia Estuarine System Stock. Nearshore (≤ 1 km from shore) coastal waters are also included in the CGES Stock boundaries.

The boundaries of this stock are supported by photo-ID data. Balmer *et al.* (2011) conducted photo-ID studies between 2004 and 2009 in the Turtle/Brunswick River estuary (TBRE) in southern Georgia and in estuarine habitats from Altamaha Sound north to Sapelo Sound. Photo-ID data revealed strong site fidelity to the two regions and supported Altamaha Sound as an appropriate boundary between the two stocks as 85.4% of animals identified did not cross Altamaha Sound (Balmer *et al.* 2013). Just over half the animals that did range across Altamaha Sound had low site fidelity and were believed to be members of the South Carolina/Georgia Coastal Stock. In addition, common bottlenose dolphins sampled within the Sapelo Island area exhibited contaminant burdens significantly lower than those sampled to the south in the TBRE (Balmer *et al.* 2011; Kucklick *et al.* 2011), consistent with long-term fidelity to these separate areas. Analyses to determine whether multiple demographically independent populations exist within this stock have not been performed to date.

POPULATION SIZE

The current total number of common bottlenose dolphins residing within the CGES Stock is unknown because previous estimates are more than 8 years old (Table 1; NMFS 2016).

Earlier abundance estimates (>8 years old)

During 2008–2009, seasonal, mark-recapture photo-ID surveys were conducted to estimate abundance in a portion of the CGES area from Altamaha Sound north to Sapelo Sound. Estimates from winter were chosen as the best representation of the resident estuarine stock in the area surveyed, and a Markovian emigration model was chosen as the best fit based on the lowest Akaike's Information Criterion value. The estimated average abundance, based on winter 2008 and winter 2009 surveys, was 192 (CV=0.04; Balmer *et al.* 2013). Estimates were adjusted to include the 'unmarked' (not distinctive) as well as 'marked' (distinctive) portion of the population for each winter survey. It is important to note this estimate covered approximately half of the entire range of the CGES Stock, and therefore, the abundance estimate is negatively biased.

Minimum Population Estimate

No current information on abundance is available to calculate a minimum population estimate for the CGES Stock of common bottlenose dolphins.

Current Population Trend

There are insufficient data to determine the population trends for this stock because only one estimate of population size is available.

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 CGES Stock of common bottlenose dolphins 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 for the CGES Stock of common bottlenose dolphins is undetermined (Table 1).

Table 1. Best and minimum abundance estimates (Nest and Nmin) for the Central Georgia Estuarine System Stock of common bottlenose dolphins with Maximum Productivity Rate (Rmax), Recovery Factor (Fr) and PBR.

Nest	CV Nest	Nmin	Fr	Rmax	PBR
Unknown	-	Unknown	0.5	0.04	Undetermined

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury for the CGES Stock during 2016–2020 is unknown. The mean annual fishery-related mortality and serious injury during 2016–2020 based on strandings and at-sea observations identified as fishery-related was 0.2. Additional mean annual mortality and serious injury during 2016–2020 due to other human-caused sources (vessel strike) was 0.2. The minimum total mean annual human-caused mortality and serious injury for this stock during 2016–2020 was therefore 0.4 (Table 2). This is considered a minimum because 1) not all fisheries that could interact with this stock are observed and/or observer coverage is very low, 2) stranding data are used as an indicator of fishery-related interactions and not all dead animals are recovered by the stranding network (Peltier *et al.* 2012; Wells *et al.* 2015; Carretta *et al.* 2016), 3) cause of death is not (or cannot be) routinely determined for stranded carcasses, and 4) the estimate of fishery-related interactions includes an actual count of verified fishery-caused deaths and serious injuries and should be considered a minimum (NMFS 2016).

Fishery Information

The commercial fishery that interacts, or has the potential to interact, with this stock is the Category II Atlantic blue crab trap/pot fishery. Detailed fishery information is presented in Appendix III.

Note: Animals reported in the sections to follow were ascribed to a stock or stocks of origin following methods described in Maze-Foley et al. (2019). These include strandings, observed takes (through an observer program), fisherman self-reported takes (through the Marine Mammal Authorization Program), research takes, and opportunistic at-sea observations.

Trap/Pot

During 2016–2020 there was one documented entanglement interaction of a common bottlenose dolphin in the CGES Stock area in commercial blue crab trap/pot gear. The interaction was a mortality occurring in 2019, and is included in the annual human-caused mortality and serious injury total for this stock (Table 2), and also documented within the stranding database (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021).

Since there is no observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab trap/pot fisheries. The documented interaction in this gear represents a minimum known count of interactions in the last five years.

Other Mortality

During 2016–2020 within the CGES area, two common bottlenose dolphins were documented with evidence of vessel strikes. In 2019, a mortality was documented with well-healed vessel strike wounds and it was considered improbable the wounds contributed to the mortality. In 2020, another mortality was documented and it was determined the mortality was due to the vessel strike impact. Both of these mortalities were included within the stranding database (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021). The 2020 vessel strike mortality was included in the annual human-caused mortality and serious injury total for this stock (Table 2).

All mortalities and serious injuries from known sources for the CGES Stock are summarized in Table 2.

Table 2. Summary of the incidental mortality and serious injury of common bottlenose dolphins (*Tursiops truncatus*) of the Central Georgia Estuarine System Stock. The fisheries do not have an ongoing, federal observer program, so counts of mortality and serious injury were based on stranding data, at-sea observations, or fisherman self-reported takes via the Marine Mammal Authorization Program (MMAP). For strandings, at-sea counts, and fisherman self-reported takes, the number reported is a minimum because not all strandings, at-sea cases, or gear interactions are detected. See the Annual Human-Caused Mortality and Serious Injury section for biases and limitations of mortality estimates, and the Strandings section for limitations of stranding data. NA = not applicable.

Fishery	Years	Data Type	Mean Annual Estimated Mortality and Serious Injury Based on Observer Data	5-year Minimum Count Based on Stranding, At-Sea, and/or MMAP Data
Commercial Blue Crab Trap/Pot	2016–2020	Stranding Data and At-Sea Observations	NA	1
Mean Annual Mortality due to commercial fisheries (2016–2020)			**0.2**	

Mean Annual Mortality due to other takes (2016–2020) (vessel strike)	**0.2**
Minimum Total Mean Annual Human-Caused Mortality and Serious Injury (2016–2020)	**0.4**

Strandings

During 2016–2020, 24 common bottlenose dolphins were reported stranded within the CGES Stock area (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021). There was evidence of human interaction for four of the strandings. No evidence of human interaction was detected for one stranding, and for the remaining 19 strandings it could not be determined if there was evidence of human interaction. Human interactions included an entanglement with commercial blue crab trap/pot gear and evidence of vessel strikes. It should be noted that evidence of human interaction does not necessarily mean the interaction caused the animal's stranding or death. However, for any case for which it could be determined that a human interaction contributed to an animal's stranding, serious injury, or death, the case was included in the counts of mortality and serious injury in Table 2.

Stranding data 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; Carretta *et al.* 2016). 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.

The CGES Stock has been affected by one unusual mortality event (UME) during the past 15 years. A UME occurred during 2013–2015 along the Atlantic coast of the U.S. and was attributed to morbillivirus (Morris *et al.* 2015). The total number of stranded common bottlenose dolphins from New York through North Florida (Brevard County) during the 2013–2015 UME was 1,614 (https://www.fisheries.noaa.gov/national/marine-life-distress/2013-2015-bottlenose-dolphin-unusual-mortality-event-mid-atlantic, accessed 13 November 2019). Most strandings and morbillivirus positive animals were recovered from the ocean side beaches rather than from within the estuaries, suggesting that coastal stocks may have been more impacted by this UME than estuarine stocks (Morris *et al.* 2015).

Table 3. Common bottlenose dolphin strandings occurring in the Central Georgia Estuarine System Stock area from 2016 to 2020, including the number of strandings for which evidence of human interaction (HI) was detected and number of strandings for which it could not be determined (CBD) if there was evidence of HI. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 15 June 2021). Please note HI does not necessarily mean the interaction caused the animal's death.

Stock	Category	2016	2017	2018	2019	2020	Total
Central Georgia Estuarine System Stock	Total Stranded	7	3	4	3	7	24
	HI--Yes	0	1	0	2a	1b	4
	HI--No	0	0	0	0	1	1
	HI--CBD	7	2	4	1	5	19

a. Includes 1 animal with evidence of a vessel strike and 1 fisheries interaction, an entanglement interaction with commercial blue crab trap/pot gear (mortality).

b. Includes 1 animal with evidence of a vessel strike.

HABITAT ISSUES

This stock is found in relatively pristine estuarine waters of central Georgia. Much of the area has been privately owned since the end of the 19th century and has remained undeveloped, leaving the marshes relatively undisturbed. This stock's area includes the Sapelo Island National Estuarine Research Reserve, which is part of NOAA's National Estuarine Research Reserve system, and several National Wildlife Refuges. Just to the south of this stock's range, however, the estuarine environment around Brunswick, Georgia, is highly industrialized and the Environmental Protection Agency has included four sites within the Brunswick area as Superfund hazardous waste sites. This region is known to be contaminated with a specific PCB mixture, Aroclor 1268, 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). Balmer *et al.* (2013) measured PCB concentrations in dolphins sampled near Sapelo Island and found concentrations, including detection of Aroclor 1268, lower than those found in dolphins from the Brunswick, Georgia area, but still high when compared to other common bottlenose dolphin stocks along the eastern seaboard. Given little evidence for movement of dolphins between these two areas (Balmer *et al.* 2011, 2013), the dolphins near Sapelo Island in the CGES Stock may be obtaining the high contaminant loads through eating contaminated prey (Balmer *et al.* 2011). Further work is necessary to examine contaminant and movement patterns of dolphin prey species in this region.

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). PCB-related health effects on common bottlenose dolphins along the Georgia coast were examined through a capture-release health assessment conducted during 2009 in the Brunswick area and in waters near Sapelo Island (Schwacke *et al.* 2012). Results from hematology and serum chemistry indicated abnormalities, most notably that 26% of sampled dolphins were anemic. The dolphins also showed low levels of thyroid hormone, and thyroid hormones negatively correlated with PCB concentration measured in blubber. In addition, a reduction in innate and acquired immune response was found. T-lymphocyte proliferation and indices of innate immunity decreased with PCB concentration measured in blubber, indicating increased vulnerability to infectious disease. The high levels of PCBs recorded in dolphins from this stock, despite their relatively pristine environment, along with demonstrated PCB-related health effects, raise concern for the long-term health and viability of the stock.

Illegal feeding or provisioning of wild common bottlenose dolphins has been documented in Georgia, particularly near Brunswick and Savannah (Wu 2013; Kovacs and Cox 2014; Perrtree *et al.* 2014), which are just south and north of the CGES Stock area, respectively. Feeding wild dolphins is defined under the MMPA as a form of 'take' because it can alter the behavior and increase the risk of injury or death to wild dolphins. Dolphins in estuarine waters near Savannah recently showed the highest rate of begging behavior reported from any study site worldwide (Perrtree *et al.* 2014). There are links between provisioning wild dolphins, dolphin depredation of recreational fishing gear, begging behavior, and associated entanglement and ingestion of gear (Powell and Wells 2011; Christiansen *et al.* 2016; Hazelkorn *et al.* 2016; Powell *et al.* 2018).

STATUS OF STOCK

Common bottlenose dolphins in the western North Atlantic are not listed as threatened or endangered under the Endangered Species Act. However, this stock is considered strategic under the MMPA because the documented mortalities and serious injuries are incomplete and biased low, and likely exceed PBR when corrected for unrecovered carcasses. While the abundance of the CGES Stock is currently unknown, based on the previous abundance estimate (Waring *et al*. 2015), it is likely small and therefore relatively few mortalities and serious injuries would exceed PBR. The documented mean annual human-caused mortality for this stock for 2016–2020 was 0.4. However, it is likely the estimate of annual human-caused, including fishery-caused, mortality and serious injury is biased low as indicated above (see Annual Human-Caused Mortality and Serious Injury section). Wells *et al.* (2015) estimated that the proportion of common bottlenose dolphin carcasses recovered in Sarasota Bay, a relatively open and more urbanized estuarine environment, was 0.33, indicating significantly more mortalities occur than are recovered. For a less developed area consisting of a more complex salt marsh habitat, the Barataria Bay Estuarine System, the estimated proportion of common bottlenose dolphin carcasses recovered was 0.16 (DWH MMIQT 2015). The Barataria Bay recovery rate may be most appropriate for this stock given that much of the habitat consists of tidal salt marshes. When annual human-caused mortality and serious injury is corrected for unrecovered carcasses using the 0.16 recovery rate (n=2.5), it exceeds the previous PBR for this stock based on a minimum abundance of 185. Total fishery-related mortality and serious injury for this stock is unknown, but at a minimum is greater than 10% of the previously calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate. The status of this stock relative to optimum sustainable population is unknown. There are insufficient data to determine 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

Balmer, B.C., L.H. Schwacke, R.S. Wells, R.C. George, J. Hoguet, J.R. Kucklick, S.M. Lane, A. Martinez, W.A. McLellan, P.E. Rosel, T.K. Rowles, K. Sparks, T. Speakman, E.S. Zolman and D.A. Pabst. 2011. Relationship between persistent organic pollutants (POPs) and ranging patterns in common bottlenose dolphins (*Tursiops truncatus*) from coastal Georgia, USA. Sci. Total Environ. 409:2094–2101.

Balmer, B.C., L.H. Schwacke, R.S. Wells, J.D. Adams, R.C. George, S.M. Lane, W.A. McLellan, P.E. Rosel, K. Sparks, T. Speakman, E.S. Zolman and D.A. Pabst. 2013. Comparison of abundance and habitat usage for common bottlenose dolphins between sites exposed to differential anthropogenic stressors within the estuaries of southern Georgia, U.S.A. Mar. Mamm. Sci. 29:E114–135.

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 Tech. Memo. NMFS-OPR-6. 73 pp.

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. from the University of Miami. 143 pp.

Carretta, J.V., K. Danil, S.J. Chivers, D.W. Weller, D.S. Janiger, M. Berman-Kowalewski, K.M. Hernandez, J.T. Harvey, R.C. Dunkin, D.R. Casper, S. Stoudt, M. Flannery, K. Wilkinson, J. Huggins and D.M. Lambourn. 2016. Recovery rates of bottlenose dolphin (*Tursiops truncatus*) carcasses estimated from stranding and survival rate data. Mar. Mamm. Sci. 32(1):349–362.

Christiansen, F., K.A. McHugh, L. Bejder, E.M. Siegal, D. Lusseau, E.B. McCabe, G. Lovewell, R.S. Wells. 2016. Food provisioning increases the risk of injury in a long-lived marine top predator. R. Soc. open sci. 3: 160560.

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.

Hazelkorn, R.A., B.A. Schulte and T.M. Cox. 2016. Persistent effects of begging on common bottlenose dolphin (*Tursiops truncatus*) behavior in an estuarine population. Aquat. Mamm. 42(4):531–541.

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.

Kovacs, C. and T. Cox. 2014. Quantification of interactions between common bottlenose dolphins (*Tursiops truncatus*) and a commercial shrimp trawler near Savannah, Georgia. Aquat. Mamm. 40(1):81–94.

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and northern Gulf of Mexico. Environ. Sci. Technol. 45:4270–4277.

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.

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.

Maze-Foley, K., B.L. Byrd, S.C. Horstman and J.R. Powell. 2019. Analysis of stranding data to support estimates of mortality and serious injury in common bottlenose dolphin (*Tursiops truncatus truncatus*) stock assessments for the Atlantic Ocean and Gulf of Mexico. NOAA Tech. Memo. NMFS-SEFSC-742. 42 pp. Accessible at: https://repository.library.noaa.gov/view/noaa/23151

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.

Morris, S.E., J.L. Zelner, D.A. Fauquier, T.K. Rowles, P.E. Rosel, F. Gulland and B.T. Grenfell. 2015. Partially observed epidemics in wildlife hosts: Modelling an outbreak of dolphin morbillivirus in the northwestern Atlantic, June 2013–2014. J. R. Soc. Interface 12:20150676.

NMFS. 2016. Guidelines for preparing stock assessment reports pursuant to the 1994 amendments to the MMPA. NMFS Instruction 02-204-01, February 22, 2016. Accessible at: http://www.nmfs.noaa.gov/op/pds/index.html

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.

Perrtree, R.M., C.J. Kovacs and T.M. Cox. 2014. Standardization and application of metrics to quantify human-interaction behaviors by the bottlenose dolphin (*Tursiops* spp.). Mar. Mamm. Sci. 30(4):1320–1334.

Powell, J.R. and R.S. Wells. 2011. Recreational fishing depredation and associated behaviors involving common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Mar. Mamm. Sci. 27(1): 111-129.

Powell, J.R., A.F. Machernis, L.K. Engleby, N.A. Farmer and T.R. Spradlin. 2018. Sixteen years later: An updated evaluation of the impacts of chronic human interactions with bottlenose dolphins (*Tursiops truncatus*) in Panama City, Florida, USA. J. Cetacean Res. Manage. 19:79–93.

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.

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the *Deepwater Horizon* oil spill. Endang. Species Res. 33:221–234.

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.

Schwacke, L.H., E.S. Zolman, B.C. Balmer, S. De Guise, R.C. George, J. Hoguet, A.A. Hohn, J.R. Kucklick, S. Lamb, M. Levin, J.A. Litz, W.E. McFee, N.J. Place, F.I. Townsend, R.S. Wells and T.K. Rowles. 2012. Anaemia, hypothyroidism and immune suppression associated with polychlorinated biphenyl exposure in bottlenose dolphins (*Tursiops truncatus*). Proc. R. Soc. B. 279(1726):48–57.

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.

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.

Wu, C. 2013. Human and boat interactions with common bottlenose dolphins (*Tursiops truncatus*) in the waterways around Savannah, Georgia. M. Sc. thesis. Savannah State University, Savannah, Georgia. 101 pp.

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.