COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*) Southern 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 from 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 southern Georgia contains an extensive estuarine tidal marsh system, punctuated with several river drainages. There is moderate development throughout the region, along with the largest industrialized area around Brunswick, Georgia. The Environmental Protection Agency has included four sites within the Brunswick area among the Superfund hazardous waste sites.

Balmer *et al.* (2011) conducted photo-ID studies from 2004 to 2009 in two field sites in south-central Georgia, one in the Turtle/Brunswick River estuary (TBRE) and the second north of the Altamaha River/Sound including the Sapelo Island National Estuarine Research Reserve and extending 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 sites 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, bottlenose dolphins in the TBRE exhibit contaminant burdens consistent with long-term fidelity to the TBRE (Pulster and Maruya 2008; Balmer *et al.* 2011; Kucklick *et al*. 2011). Analyses to determine whether multiple demographically independent populations exist within this stock have not been performed.

Figure 1. ***Geographic extent of the Southern Georgia Estuarine System (SGES) stock. Dashed lines denote the boundaries.***

The Southern Georgia Estuarine System Stock (SGES) is bounded in the south by the Georgia/Florida border at the Cumberland River through Cumberland Sound and in the north by the Altamaha River through Altamaha Sound

inclusive, and encompasses all estuarine waters in between, including but not limited to the Intracoastal Waterway, Hampton River, St. Andrew and Jekyll Sounds and their tributaries, St. Simons Sound and tributaries, and the TBRE system (Figure 1). Although the majority of photo-ID survey effort by Balmer *et al.* (2013) was conducted within the estuaries, opportunistic surveys extending along the coast and satellite-linked telemetry of three individuals suggested that animals within the SGES had ranging patterns that extended into the coastal waters of the TBRE. Thus, the nearshore (≤ 1km from shore) coastal waters from Altamaha Sound to Cumberland Sound are included in the SGES Stock boundaries. The southern boundary abuts the northern boundary of the Jacksonville Estuarine System Stock, previously defined based on photo-ID and genetic data (Caldwell 2001). The northern boundary abuts the southern boundary of the Central Georgia Estuarine System Stock, and is defined based on continuity of estuarine habitat, evidence for significantly lower contaminant levels in dolphins from the Sapelo Island area (Balmer *et al.* 2011) and a genetic discontinuity between dolphins sampled in southern Georgia and those sampled in Charleston, South Carolina (Rosel *et al.* 2009). These boundaries are subject to change upon further study of dolphin residency patterns in estuarine waters of central and northern Georgia.

POPULATION SIZE

The current total number of common bottlenose dolphins residing within the SGES 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 by Balmer *et al.* (2013) to estimate abundance in a portion of the SGES including St. Simons Sound north to and inclusive of Altamaha Sound. Estimates from winter were chosen as the best representation of the portion of resident estuarine stock in the area surveyed, and a random emigration model was chosen as the best fit based on the lowest Akaike's Information Criterion value. The estimated average abundance estimate, based on winter 2008 and winter 2009 surveys, was 194 (CV=0.05; Balmer *et al.* 2013). It is important to note this estimate covered less than half of the entire range of the SGES 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 SGES 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 SGES 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 this stock of common bottlenose dolphins is undetermined (Table 1).

Table 1. Best and minimum abundance estimates (Nest and Nmin) for the Southern 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 SGES 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 0.1. No additional mortality or serious injury was documented from other human-caused sources. The minimum total mean annual human-caused mortality and serious injury for this stock during 2016–2020 was therefore 0.1 (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 commercial 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 SGES Stock area in commercial blue crab trap/pot gear. The interaction occurred during 2016 and the animal was released alive, but it could not be determined (CBD) whether the animal was seriously injured following mitigation efforts (the initial determination was seriously injured; Maze-Foley and Garrison 2022). The CBD case was prorated based on previous assignable injury events (NMFS 2012; Maze-Foley and Garrison 2022) and was included in the annual human-caused mortality and serious injury total for this stock (see 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 SGES area, there were two documented entanglements of common bottlenose dolphins in other gear types. In 2016, an animal was released alive following entanglement in a research seine, and this animal was considered not seriously injured (Maze-Foley and Garrison 2022). In 2017 an animal was released alive following entanglement in marine debris (Balmer *et al.* 2019), and it was considered not seriously injured following mitigation efforts (the initial determination was seriously injured; Maze-Foley and Garrison 2022). Both of these entanglements of live animals were included within the stranding database (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021).

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

Table 2. Summary of the incidental mortality and serious injury of common bottlenose dolphins (Tursiops truncatus) of the Southern 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. *Indicates the count would have been higher had it not been for mitigation efforts (see text for that specific fishery for further details).

Fishery	Years	Data Type	Mean Annual Estimated Mortality and Serious Injury	5-year Minimum Count Based on Stranding, At-Sea,

			Based on Observer Data	and/or MMAP Data
Commercial Blue Crab Trap/Pot	2016–2020	Stranding Data and At-Sea Observations	NA	0.5*a
Mean Annual Mortality due to commercial fisheries (2016–2020)			**0.1**	
Mean Annual Mortality due to other takes (2016–2020)			**0***	
Minimum Total Mean Annual Human-Caused Mortality and Serious Injury (2016–2020)			**0.1**	

a. One non-calf entanglement in which the post-mitigation determination was CBD. The CBD was prorated as 0.46 (rounded to 0.5) serious injuries based on previous assignable injury events (NMFS 2012; Maze-Foley and Garrison 2022).

Strandings

During 2016–2020, 19 common bottlenose dolphins were reported stranded within the SGES 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 three of the strandings. No evidence of human interaction was detected for four strandings, and for the remaining 12 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, a research seine, and marine debris. 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 SGES Stock area has been affected by one unusual mortality event (UME) during the most recent 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). During 2015, Balmer *et al.* (2018) conducted a telemetry and health assessment study during which 19 common bottlenose dolphins were captured, satellite-linked tags were applied, and dolphins were tested for antibodies to dolphin morbillivirus (DMV). Using telemetry data, dolphins were classified into three ranging patterns referred to as estuary, sound and coastal. The findings of Balmer *et al.* (2018) supported those of Morris *et al.* (2015) and suggested that coastal animals, likely members of the South Carolina/Georgia Coastal Stock, were more exposed to DMV (based on DMV antibody titers) compared to animals from the SGES Stock (sound and estuary animals).

Table 3. Common bottlenose dolphin strandings occurring in the Southern 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
Southern Georgia Estuarine System Stock	Total Stranded	5	7	3	3	1	19
	HI--Yes	2a	1b	0	0	0	3
	HI--No	1	2	1	0	0	4
	HI--CBD	2	4	2	3	1	12

a. Includes 1 entanglement in a research seine (released alive, not seriously injured) and 1 fisheries interaction, an entanglement interaction with commercial blue crab trap/pot gear (released alive, CBD if seriously injured).

b. Includes 1 entanglement in marine debris (released alive, not seriously injured).

HABITAT ISSUES

A portion of the stock's range is highly industrialized, and the Environmental Protection Agency has included four sites within the Brunswick area as Superfund hazardous waste sites. 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 TBRE (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, including the Gulf of Mexico (Schwacke *et al.* 2002; Hansen *et al.* 2004; Litz 2007; Balmer *et al.* 2011; Kucklick *et al.* 2011). 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, Balmer *et al.* 2011; Kucklick *et al.* 2011). 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). PCB-related health effects on bottlenose dolphins along the Georgia coast were examined through a capture-release health assessment conducted during 2009 in the TBRE 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. Also, dolphins 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. Overall, the results plainly showed that bottlenose dolphins are susceptible to PCB-related health effects (Schwacke *et al.* 2012). Thus, the high levels of PCBs recorded in dolphins from this stock, along with demonstrated PCB-related health effects, raise concern for the long-term health and viability of the stock.

In 2017, a dolphin with long-term site fidelity to the SGES area that was entangled in marine debris was captured for disentanglement (Balmer *et al.* 2019). During the disentanglement capture event, samples were also collected to assess the animal's health. Health results showed the animal to have high levels of site-specific contaminants, PCBs and Aroclor 1268, and to suffer from anemia. Balmer *et al.* (2019) note the possibility the chronic entanglement and associated blood loss could have played a role in the anemia; however, it is likely the anemia was a result of chronic PCB exposure (see Schwacke *et al.* 2012).

Illegal feeding or provisioning of wild bottlenose dolphins has been documented in Georgia, particularly near Brunswick and Savannah (Wu 2013; Kovacs and Cox 2014; Perrtree *et al.* 2014). 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. 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 because of serious concerns regarding the health and reproduction of this stock. The documented mean annual human-caused mortality for the SGES Stock for 2016–2020 was 0.1. 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 more open and 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 applying the 0.16 recovery rate (n=0.6), it does not exceed the previous PBR for this stock based on a minimum abundance of 185. However, NMFS has concerns for this stock because of the high mean total PCB concentrations found in the blubber of animals in this region which are believed to be having detrimental effects on health and reproduction (see Habitat Issues section). 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 optimum sustainable population is unknown. There are insufficient data to determine population trends for this stock.

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