

COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*): Western North Atlantic South Carolina/Georgia Coastal Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Common bottlenose dolphins are found in estuarine, coastal, continental shelf, and oceanic waters of the western North Atlantic (wNA). Distinct morphological forms have been identified in offshore and coastal waters of the wNA off the U. S. East Coast: a smaller morphotype present in estuarine, coastal, and shelf waters from Florida to approximately Long Island, New York, and a larger more robust morphotype present further offshore in deeper waters of the continental shelf and slope from Florida to Canada (Mead and Potter 1995). The two morphotypes also differ in parasite load and prey preferences (Mead and Potter 1995), and show significant genetic divergence at both mitochondrial and nuclear DNA markers (Hoelzel *et al.* 1998; Kingston and Rosel 2004; Kingston *et al.* 2009; Rosel *et al.* 2009). The level of genetic divergence is greater than that seen between some other dolphin species (Kingston and Rosel 2004; Kingston *et al.* 2009) suggesting the two morphotypes in the wNA may represent different subspecies or species. The larger morphotype makes up the wNA Offshore Stock of common bottlenose dolphins. Spatial distribution data (Kenney 1990; Garrison *et al.* 2017a), tag-telemetry studies (Garrison *et al.* 2017b), photo-identification (photo-ID) studies (e.g., Zolman 2002; Speakman *et al.* 2006; Stolen *et al.* 2007; Mazzoil *et al.* 2008), and genetic studies (Caldwell 2001; Rosel *et al.* 2009; Litz *et al.* 2012) indicate that the coastal morphotype comprises multiple stocks distributed in coastal and estuarine waters of the wNA. The South Carolina/Georgia Coastal Stock is one such stock.

Common bottlenose dolphins are found in coastal waters south of Cape Hatteras, North Carolina, year-round (Blaylock and Hoggard 1994; Garrison and Yeung 2001; Garrison *et al.* 2016; Caldwell 2016). Significant genetic differentiation was observed between animals sampled in coastal waters of Georgia and those sampled in coastal waters of Virginia north to New Jersey (Rosel *et al.* 2009) indicative of demographic independence between animals sampled in these two regions. Speakman *et al.* (2006), using

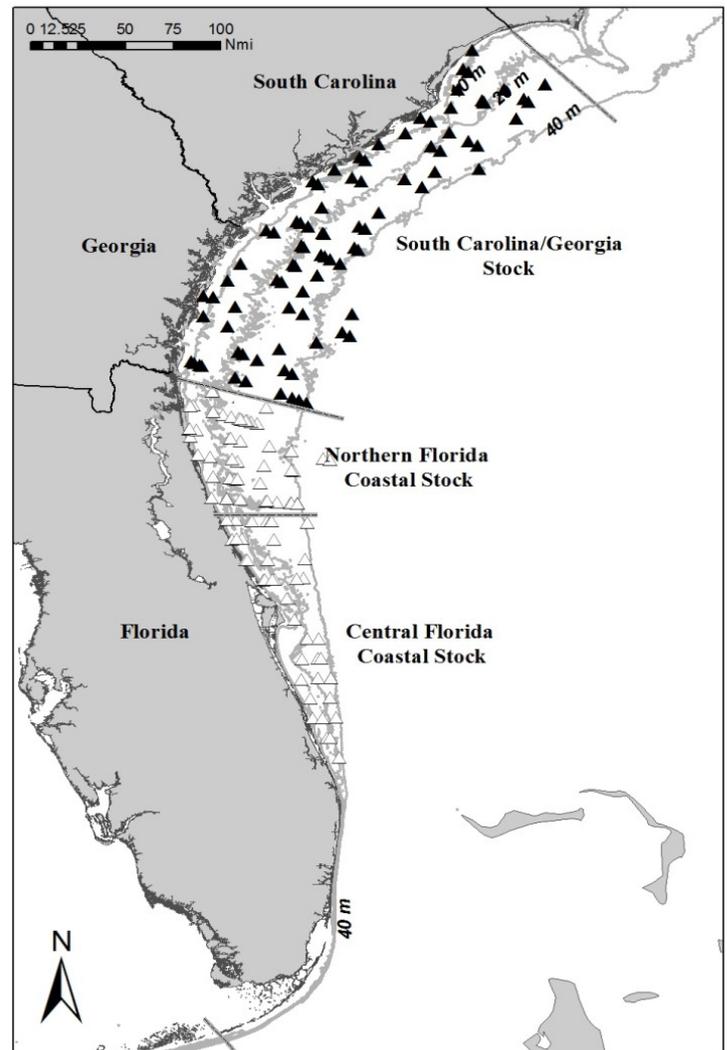


Figure 1. The South Carolina/Georgia Coastal Stock of common bottlenose dolphins (Little River Inlet, South Carolina to the Georgia/Florida border). Symbols represent all sightings of bottlenose dolphin groups from NMFS 2010, 2011, and 2016 aerial surveys; dark symbols - groups within the boundaries of this stock. In waters >20 m, sightings may include the offshore morphotype of bottlenose dolphins. Horizontal gray lines intersecting the coast denote the stock boundaries.

photo-ID studies, documented dolphins in coastal waters off Charleston, South Carolina, that are not known resident members of the local estuarine stock, revealing that the dolphins present in coastal waters are unlikely to be from the adjacent estuarine stocks. A coast-wide photo-ID catalog established across 15 sites from Cape May, New Jersey, to Cape Canaveral, Florida, found no matches between the northernmost and southernmost sites (Urian *et al.* 1999), and less movement was seen among southern sites than among northern sites (Urian *et al.* 1999), supporting the presence of stock structure in coastal waters of this region.

The South Carolina/Georgia Coastal Stock is best delimited as the dolphins of the coastal morphotype inhabiting coastal waters from the shoreline to approximately the 200-m isobath from the Little River Inlet, South Carolina (33.8°N), south to the Georgia/Florida border (30.7°N) (Figure 1). The northern and southern boundaries for this stock are provisional as the spatial extent of this stock is poorly understood. These boundaries were derived from the first delimitation of coastal stocks in 2002 (Waring *et al.* 2002) when the original single, coast-wide coastal stock suggested by Scott *et al.* (1988) was broken into seven management units (Waring *et al.* 2002). The offshore boundary was determined based on a combined genetic and logistic regression analysis that incorporated depth, latitude, and distance from shore to model the probability that a particular bottlenose dolphin group seen in coastal waters south of Cape Hatteras was of the coastal morphotype (Garrison *et al.* 2017a). Dolphins of the coastal morphotype were identified in waters out to 97 m depth. The logistic regression predicted that the majority of the coastal morphotype inhabits waters 0–20 m in depth and that the density of the coastal morphotype declines with increasing depth (Garrison *et al.* 2017a). South of Cape Hatteras in waters less than 20 m depth, 70% of the bottlenose dolphins were predicted to be of the coastal morphotype and fewer than 10% of the animals present beyond 35 m depth were predicted to be of the coastal morphotype (Garrison *et al.* 2017a).

During cold water months (best defined by January and February), this stock likely overlaps with the Southern Migratory Coastal Stock, which is thought to migrate south from waters of southern Virginia and north central North Carolina in the summer to waters south of Cape Fear, North Carolina, and as far south as coastal Florida during winter months (Garrison *et al.* 2017b). The spatiotemporal overlap of this stock with other stocks complicates the ability to definitively identify the offshore extension for the stock and the assignment of human-caused dolphin mortalities to stock at certain times of the year. While common bottlenose dolphins do exhibit significant site fidelity (e.g., Zolman 2002; Speakman *et al.* 2006), it is unlikely this stock contains multiple demographically independent populations as the area inhabited by the stock is relatively homogeneous, does not cross any known biogeographic breaks, nor cover multiple marine ecoregions (Spalding *et al.* 2007). However, to date, no analyses of stock structure within this stock have been performed.

It should be noted that dolphins in waters between 3 km from shore and the 200-m isobath from the Little River Inlet, South Carolina, to Cape Lookout, North Carolina, in summer are currently not contained with any delimited stock. These dolphins could be members of the South Carolina/Georgia Coastal Stock, but their affinities are currently unknown.

POPULATION SIZE

The best available abundance estimate for the South Carolina/Georgia Coastal Stock of common bottlenose dolphins in the western North Atlantic is 6,027 (CV=0.34; Table 1; Garrison *et al.* 2017a). This estimate is derived from aerial surveys conducted during the summer of 2016 covering coastal and shelf waters from Florida to New Jersey.

Background

Estimating the abundance of the South Carolina/Georgia Coastal Stock is complicated by the spatiotemporal overlap the stock has with the Southern Migratory Coastal Stock in cold water months and the potential for the presence, in nearshore coastal waters, of dolphins from estuarine common bottlenose dolphin stocks in South Carolina and Georgia. Summer surveys are best for estimating the abundance for this stock because it overlaps least with the Southern Migratory Coastal stock during warm water months. Using the logistic regression described above (Garrison *et al.* 2017a), abundance estimates for the South Carolina/Georgia Coastal Stock were made using sightings observed in the 0–200 m depth range during aerial summer surveys between the Little River Inlet, South Carolina (33.8°N), and the Georgia/Florida border (30.7°N). The regression model was used to estimate the probability that each sighting during the aerial survey is of the coastal (vs. offshore) morphotype. This probability and associated estimates of uncertainty were then incorporated into the abundance estimate for the coastal morphotype within the stock's range (Garrison *et al.* 2017a).

Earlier abundance estimates (>8 years old)

Aerial surveys were conducted during the summers of 2002 and 2004. Survey tracklines for the 2002 and 2004

surveys were set perpendicular to the shoreline and effort was stratified into 0–20 m and 20–40 m strata with the majority of effort in the shallow depth stratum (Garrison *et al.* 2017a). The 2002 surveys employed two observer teams operating independently on the same aircraft to estimate the probability of detection on the trackline. This estimate was also applied to the 2004 survey to reduce bias in the resulting abundance estimate. The resulting abundance estimates from the 2002 and 2004 summer aerial surveys for the South Carolina/Georgia Coastal Stock were 21,940 (CV=0.27) and 4,894 (CV=0.45), respectively (Garrison *et al.* 2017a). There were strong differences in spatial distribution between these two survey years, suggesting that the large difference in estimates was related to changes in distribution rather than population size of the stock (Garrison *et al.* 2017a). As recommended in the GAMMS II Workshop Report (Wade and Angliss 1997), these estimates are greater than eight years old and deemed unreliable and should not be used for PBR determinations. However, these estimates are included below in the assessment of trends for this stock.

Recent surveys and abundance estimates

The Southeast Fisheries Science Center conducted aerial surveys of continental shelf waters along the U.S. East Coast from southeastern Florida (26.9°N) to Sandy Hook, New Jersey (40.3°N), during the summers of 2010, 2011, and 2016 (see Garrison *et al.* 2017a for survey design). The surveys were conducted along tracklines spaced latitudinally at 20-km intervals and oriented perpendicular to the shoreline, and covered waters from the shoreline to the continental shelf break (Garrison *et al.* 2017a).

The recent surveys were conducted using a two-team approach to develop estimates of detection probabilities using the independent observer approach with Distance analysis (Laake and Borchers 2004). The detection functions from each survey indicated a decreased probability of detection near the trackline. The sighting data were therefore “left-truncated” by analyzing only sightings occurring greater than 80 m from the trackline during the 2010 survey, 70 m during the 2011 survey, and 100 m from the trackline during the 2016 survey (see Buckland *et al.* 2001 for left-truncation methodology). The independent observer method assuming point independence was used to estimate detection probability on the trackline. This estimate accounts for the probability of detecting a marine mammal group conditional on it being available to both survey teams. Covariates that may influence detection probabilities (e.g., sea state, glare, cloud cover, visibility) were incorporated into both the mark-recapture and distance function components of the detection models (Laake and Borchers 2004; Garrison *et al.* 2017a). In addition, the probability that an observed group was of the coastal morphotype was incorporated into the abundance estimates as noted above. The resulting abundance estimates are negatively biased due to the effects of animals spending some time underwater where they are not available to the survey teams. However, due to the relatively short dive times of bottlenose dolphins (Wells *et al.* 2013) and the large group sizes, it is likely that this bias is small (Garrison *et al.* 2017a).

The abundance estimates derived from the summer 2010, 2011, and 2016 surveys were 11,274 (CV=0.27), 7,406 (CV=0.53), and 6,027 (CV=0.34). The 2016 estimate was used as the best estimate of the current population size for the stock due to possible effects from the 2013–2015 unusual mortality event. Uncertainties in the abundance estimate arise primarily from annual, and unquantified, variation in stock distribution.

Table 1. Summary of abundance estimates for the western North Atlantic South Carolina/Georgia Coastal Stock of common bottlenose dolphins. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).			
Month/Year	Area	N_{best}	CV
July-August 2002	Little River Inlet, South Carolina (33.8°N) to the Georgia/Florida border (30.7°N)	21,940	0.27
July-August 2004	Little River Inlet, South Carolina (33.8°N) to the Georgia/Florida border (30.7°N)	4,894	0.45

July-August 2010	Little River Inlet, South Carolina (33.8°N) to the Georgia/Florida border (30.7°N)	11,274	0.27
July-August 2011	Little River Inlet, South Carolina (33.8°N) to the Georgia/Florida border (30.7°N)	7,406	0.53
July-August 2016	Little River Inlet, South Carolina (33.8°N) to the Georgia/Florida border (30.7°N)	6,027	0.34

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. The best estimate for the South Carolina/Georgia Coastal Stock is 6,027 (CV=0.34). The resulting minimum population estimate is 4,569.

Current Population Trend

Available surveys allow a limited analysis of trend in population size for coastal stocks of common bottlenose dolphins. A standardized analytical approach accounting for variation in survey execution and environmental conditions was used to derive unbiased abundance estimates for each survey (Garrison *et al.* 2017a). A weighted generalized linear model was used to evaluate trends in population size by stock using abundance estimates from surveys conducted in the summers of 2002, 2004, 2010, 2011, and 2016. Abundance estimates were weighted by the inverse of their standard error, which reduces the influence of less certain estimates (Neter *et al.* 1983). Stock was treated as a fixed factor, and surveys were grouped into three periods to test for long term trends in population size: 2002–2004, 2010–2011, and 2016. Period was also included as a fixed factor in the model along with the interaction between stock and period. Contrasts were specified to test for differences in abundance between periods for each stock (Garrison *et al.* 2017a). For the South Carolina/Georgia Coastal Stock, the resulting mean abundance estimate for 2002–2004 was 9,434 (CV=0.41), and that for 2010–2011 was 9,567 (CV=0.42). There was no significant difference between these estimates and the estimate of 6,027 (CV=0.34) for 2016. There is limited power to detect a significant change given the high CV of the estimates, interannual variability in spatial distribution and stock abundance between 2002 and 2004, and the availability of only one recent survey (Garrison *et al.* 2017a). However, see the Strandings section for a discussion of coast-wide trends in population size.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for the western North Atlantic coastal morphotype. The maximum net productivity rate is assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations likely do 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; Wade 1998). The minimum population size of the South Carolina/Georgia Coastal Stock of common bottlenose dolphins is 4,569. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor is 0.5 because this stock is depleted. PBR for this stock of common bottlenose dolphins is 46.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total mean annual human-caused mortality and serious injury for the South Carolina/Georgia Coastal Stock during 2011–2015 is unknown. The mean annual fishery-related mortality and serious injury for observed fisheries and strandings identified as fishery-related ranged between 1.0 and 1.2. Additional mean annual mortality and serious injury due to other human-caused sources (fishery research, recreational fishing gear) was 0.4. The minimum total mean annual human-caused mortality and serious injury for this stock during 2011–2015 therefore ranged between 1.4 and 1.6 (Table 2). This range reflects several sources of uncertainty and is a minimum because 1) not all fisheries that could interact with this stock are observed, 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),

3) cause of death is not (or cannot be) routinely determined for stranded carcasses, 4) the estimate includes an actual count of verified human-caused deaths and serious injuries and should be considered a minimum (NMFS 2016), and 5) the spatiotemporal overlap between this stock and other common bottlenose dolphin stocks introduces uncertainty in assignment of mortalities to stock. In the sections below, dolphin mortalities were assigned to a stock or stocks by comparing the time and geographic location of the mortality to the stock boundaries and geographic range delimited for each stock.

Fishery Information

There are six commercial fisheries that interact, or that potentially could interact, with this stock. These include four Category II fisheries (Southeastern U.S. Atlantic shark gillnet, Southeast Atlantic gillnet, Southeastern U.S. Atlantic shrimp trawl, and Atlantic blue crab trap/pot fisheries) and two Category III fisheries (Georgia cannonball jellyfish trawl, and Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line) fisheries). Limited or no observer data are available for these fisheries that may interact with this stock. Detailed fishery information is presented in Appendix III.

Southeastern U.S. Atlantic Shark Gillnet and Southeast Atlantic Gillnet

There have been no documented mortalities or serious injuries of common bottlenose dolphins associated with the Southeastern U.S. Atlantic Shark Gillnet or Southeast Atlantic Gillnet fisheries during 2011–2015 that could be ascribed to the South Carolina/Georgia Coastal Stock (Gulak *et al.* 2012; Mathers *et al.* 2013; 2014; 2015; 2016). These fisheries target sharks and finfish in waters between North Carolina and southern Florida. The majority of fishing effort occurs in federal waters because Florida, Georgia, and South Carolina, with limited exception, prohibit the use of gillnets in state waters. These fisheries use gillnets set in a sink (anchored), stab, set, strike, or drift fashion. The Southeast Gillnet Observer Program observes these fisheries year-round (e.g., Mathers *et al.* 2016).

Shrimp Trawl

During 2011–2015, one common bottlenose dolphin mortality occurred in association with the shrimp trawl fishery and was ascribed to the South Carolina/Georgia Coastal Stock. Through the Marine Mammal Authorization Program, a fisherman self-reported a mortality in 2013 off South Carolina in which a dolphin became entangled in his commercial shrimp trawl. This mortality was also included in the stranding database as well as in the annual human-caused mortality and serious injury total for this stock (Table 2). In addition, during 2015 off South Carolina, one common bottlenose dolphin was caught in the trawl net of a commercial shrimp trawl and released alive without serious injury (Maze-Foley and Garrison 2017). This animal was reported through the Marine Mammal Authorization Program. Prior to these interactions, the most recent documented interaction was another self-reported take in a commercial shrimp trawl in South Carolina during 2002. No other bottlenose dolphin mortality or serious injury has been reported to NMFS for the Atlantic shrimp trawl fishery. However, Greenman and McFee (2014) suggested shrimp trawl related mortality of bottlenose dolphins in South Carolina was underreported. There has been very little systematic observer coverage of this fishery during the last decade and the documented interactions in this commercial gear represents a minimum known count of interactions with this fishery.

Atlantic Blue Crab Trap/Pot

During 2011–2015, one mortality and one serious injury of common bottlenose dolphins were documented in association with commercial blue crab trap/pot gear. In 2011, one dolphin stranded dead with commercial blue crab pot trap/pot gear around its peduncle, and this animal was ascribed solely to the South Carolina/Georgia Coastal Stock. In addition, in 2015, a dolphin stranded alive entangled in commercial blue crab trap/pot gear. The animal was disentangled, released alive, and considered seriously injured (Maze-Foley and Garrison 2017). The dolphin was ascribed to the South Carolina/Georgia Coastal and Southern Migratory Coastal stocks. Both of these animals were included in the stranding database and in the stranding totals presented in Table 3 (Southeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 18 May 2016), and both were included in the annual human-caused mortality and serious injury total for this stock (Table 2). 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 and these documented interactions in this commercial gear represents a minimum known count of interactions with this fishery.

Georgia Cannonball Jellyfish Trawl

During 2011–2015, two common bottlenose dolphins ascribed to the South Carolina/Georgia Coastal Stock were observed incidentally killed by commercial fishing vessels trawling for cannonball jellyfish. These mortalities occurred in 2011 and 2012 off the Georgia coast and both were included in the annual human-caused mortality and

serious injury total for this stock (Table 2). Initially, this fishery was an experimental fishery but then became a bona fide commercial fishery in 2013 (Page 2015). The fishery operates from October–November to May–June, primarily in federal waters (3–200 nm) offshore of Georgia, with limited effort in Georgia's coastal state waters (Page 2015). Bycatch for this fishery was examined during December 2005–December 2012 by placing observers onboard commercial vessels operating in state and adjacent federal waters. The two bottlenose dolphin mortalities were observed during this study (Page 2015). The state of Georgia continued observer coverage until May 2014 and then ceased observing this fishery. There is no federal observer coverage of this fishery.

Hook and Line (Rod and Reel)

During 2011–2015, stranding data recorded one common bottlenose dolphin mortality for which hook and line gear ingestion was documented, but it could not be determined whether the interaction contributed to cause of death based on the available evidence so this mortality was not included in the annual human-caused mortality and serious injury total for this stock (Table 2). The dolphin was ascribed to the South Carolina/Georgia Coastal and Southern Migratory Coastal stocks. This mortality occurred in 2011 in South Carolina, and was included in the stranding database and in the stranding totals presented in Table 3 (Southeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 18 May 2016).

It should be noted that, in general, it cannot be determined if hook and line gear originated from a commercial (i.e., commercial fisherman charter boat, or 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. The documented interactions in this gear represent a minimum known count of interactions with this fishery.

Other Mortality

During 2011–2015, there were four additional human-caused interactions that were all ascribed solely to the South Carolina/Georgia Coastal Stock: two mortalities and two animals released alive, one without serious injury and one for which it could not be determined if the animal was seriously injured. In 2012, one common bottlenose dolphin mortality occurred incidental to a research trawl off South Carolina. One mortality occurred during 2013 in a small-mesh recreational gillnet in South Carolina. Because this was a recreational, not commercial net, it does not fall under the Southeast Atlantic gillnet fishery. These two mortalities were included in the stranding database and in the annual human-caused mortality and serious injury total for this stock (Table 2). In addition, one bottlenose dolphin was released alive without serious injury following an entanglement in research bottom trawl gear during 2012. There was also an at-sea report in 2013 of an animal entangled in unidentified line, and it could not be determined if this animal was seriously injured. The live release and at-sea sighting are described by Maze-Foley and Garrison (2018). All mortalities and serious injuries from known sources for the South Carolina/Georgia Coastal Stock are summarized in Table 2.

Table 2. Summary of the incidental mortality and serious injury of common bottlenose dolphins of the South Carolina/Georgia Coastal Stock. For fisheries with an ongoing, systematic, federal observer program, the years sampled (Years), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the observed mortality and serious injury recorded by on-board observers, and mean annual mortality and serious injury are provided. For fisheries that do not have an ongoing, systematic, federal observer program, counts of mortality and serious injury based on stranding data or fisherman self-reported takes via the Marine Mammal Authorization Program (MMAP) are given. Minimum and maximum values are reported in individual cells when there is uncertainty in the assignment of mortalities to this particular stock due to spatial overlap with the Southern Migratory Coastal Stock. See the Annual Human-Caused Mortality and Serious Injury section for biases and limitations of mortality estimates. NA = not applicable.

Fishery	Years	Data Type	Observer Coverage	Observed Mortality and Serious Injury	Mean Annual Mortality and Serious Injury Based on Observer Data	5-year Min/Max Count Based on Stranding and/or MMAP Data
Southeastern U.S. Atlantic Shark Gillnet	2011–2015	Obs. Data Logbook	NA due to uncertainty in reported effort	0,0,0,0,0	Not estimated	NA

Southeast Atlantic Gillnet	2011–2015	Obs. Data Logbook	NA due to uncertainty in reported effort	0,0,0,0,0	Not estimated	NA
Shrimp Trawl	2011–2015	Limited Observer and MMAP fisherman self-reported takes	NA	NA	NA	1
Atlantic Blue Crab Trap/Pot	2011–2015	Stranding Data	NA	NA	NA	min=1 max=2
Georgia Cannonball Jellyfish Trawl ^a	2011–2012	Obs. Data Logbook	<5%	1,1,0,0, NA	0.6 ^a	NA
Hook and Line ^b	2011–2015	Stranding Data	NA	NA	NA	0
Mean Annual Mortality due to commercial fisheries (2011–2015)					0.6	min=0.4 max=0.6
Research Takes (5-year Count)					1	
Other takes (recreational fishing gear; 5-year Count)					1	
Mean Annual Mortality due to research and other takes (2011–2015)					0.4	
Minimum Total Mean Annual Human-Caused Mortality and Serious Injury (2011–2015)					min=1.4 max=1.6	
^a Observer coverage for this fishery occurred during 3.5 years only, and 2 mortalities were observed during this time. The 2 observed mortalities were divided by 3.5 years to calculate mean annual mortality. ^b Hook and line interactions are counted here if the available evidence suggested the hook and line gear contributed to the cause of death. See "Hook and Line" text for more details.						

Strandings

There were 273 stranded common bottlenose dolphins documented between 2011 and 2015 in the range of the South Carolina/Georgia Coastal Stock (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 18 May 2016). It could not be determined whether there was evidence of human interaction for 173 of these strandings, and for 85 it was determined there was no evidence of human interaction. The remaining 15 showed evidence of human interaction, including eight fishery interactions (FIs). As mentioned above, two of the FIs were entanglements in commercial blue crab trap/pot gear, one consisted of ingested hook and line gear, and one was an entanglement in a commercial shrimp trawl. Two additional human interactions also mentioned above were an entanglement in recreational gillnet gear and an entanglement in a research trawl. 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.

It is worth noting that during winter months, the South Carolina/Georgia Coastal Stock overlaps with the Southern Migratory Coastal Stock and it is currently not possible to assign strandings to a single stock if they are recovered during the time of overlap. Therefore, the counts in Table 3 likely include some animals from the Southern Migratory Coastal Stock and overestimate the total number of strandings for the South Carolina/Georgia Coastal Stock. Of the 273 strandings ascribed to the South Carolina/Georgia Coastal Stock, 198 were ascribed solely to this stock.

This stock has been impacted by three unusual mortality events (UMEs). Two events, one in 1987–1988 and one in 2013–2015, have been attributed to morbillivirus epidemics (Lipscomb *et al.* 1994; Morris *et al.* 2015). Both UMEs included deaths of dolphins in spatiotemporal locations that apply to the South Carolina/Georgia Coastal Stock. When the impacts of the 1987–1988 UME were being assessed, only a single coastal stock of common bottlenose dolphin was thought to exist along the U.S. eastern seaboard from New York to Florida (Scott *et al.* 1988), so impacts to the South Carolina/Georgia Coastal Stock alone are not known. However, it was estimated that between 10 and 50% of the coast-wide stock died as a result of this UME (Scott *et al.* 1988; Eguchi 2002). The total number of stranded bottlenose dolphins from New York through North Florida (Brevard County) during the 2013–

2015 UME was 1827, including 305 from South Carolina and Georgia (<http://www.nmfs.noaa.gov/pr/health/mmume/midatldolphins2013.html>, accessed 8 November 2016). Most strandings and morbillivirus positive animals have been recovered from the ocean side beaches rather than from within the estuaries, suggesting that coastal stocks have been more impacted by this UME than estuarine stocks (Morris *et al.* 2015). Fourteen strandings considered to be part of the UME were assigned to the South Carolina/Georgia Coastal Stock. An analysis of trends in abundance for common bottlenose dolphins coast-wide (New Jersey to Florida) indicated a statistically significant decline in population size between 2011 and 2016 (Garrison *et al.* 2017a). A weighted generalized linear model was used to evaluate trends in coast-wide population size based on aerial surveys conducted between 2002 and 2016 (see Population Size above for survey descriptions). The model included a linear term for survey year and an interaction term to test for a difference in slope between 2002–2011 and 2011–2016. Estimates were weighted by the inverse of their standard error to reduce the influence of less certain estimates. There was no significant trend in population size between 2002 and 2011; however, there was a statistically significant ($p=0.0308$) change in slope between 2011 and 2016, indicating a decline in population size. The coast-wide inverse-variance weighted average estimate for coastal common bottlenose dolphins during 2011 was 41,456 (CV=0.30) while the estimate during 2016 was 19,470 (CV=0.23; Garrison *et al.* 2017a). It is possible that this apparent decline in common bottlenose dolphin abundance in coastal waters along the eastern seaboard is a result of the 2013–2015 UME. An assessment of the impacts of the 2013–2015 UME on common bottlenose dolphin stocks in the wNA is ongoing. Finally, a UME was declared in South Carolina during February–May 2011. The cause of this UME was undetermined.

Table 3. Strandings of common bottlenose dolphins during 2011–2015 that were ascribed to the South Carolina/Georgia Coastal Stock, 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. Assignments to stock were based upon the understanding of the seasonal movements of the coastal stocks. However, there is overlap between this stock and the Southern Migratory Coastal Stock during winter months, and it is currently not possible to distinguish between them. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 18 May 2016). Please note HI does not necessarily mean the interaction caused the animal’s death.

State	2011			2012			2013			2014			2015		
	HI Yes	HI No	CBD												
South Carolina	3 ^a	9	12	1 ^b	16	8	2 ^c	23	40	2 ^d	14	20	0	6	8
Georgia	4 ^e	2	14	0	3	8	1	8	37	0	2	15	2 ^f	2	11
Annual Total	44			36			111			53			29		

^a Includes 2 fishery interactions (FIs), 1 of which involved an animal that ingested hook and line gear (mortality).

^b Includes 1 entanglement interaction in research trawl gear (mortality).

^c Includes 2 FIs. One FI was an entanglement interaction with recreational gillnet gear (mortality), and 1 was an entanglement interaction with commercial shrimp trawl gear (mortality).

^d Includes 2 FIs.

^e Includes 1 FI, which was an entanglement interaction with commercial blue crab trap/pot gear (mortality).

^f Includes 1 FI, which was an entanglement interaction with commercial blue crab trap/pot gear (released alive, seriously injured).

HABITAT ISSUES

The nearshore and estuarine habitats occupied by the coastal morphotype are adjacent to areas of high human population and some are highly industrialized. Studies have examined persistent organic pollutant concentrations in bottlenose dolphins inhabiting estuaries along the Atlantic coast and have found evidence of high blubber concentrations particularly near Brunswick, Georgia, Charleston, South Carolina, and Beaufort, North Carolina (Hansen *et al.* 2004; Balmer *et al.* 2011; Kucklick *et al.* 2011). The concentrations found in male dolphins from both of these sites exceeded toxic threshold values that may result in adverse effects on health or reproductive rates (Schwacke *et al.* 2002; Hansen *et al.* 2004; Balmer *et al.* 2011). Studies of contaminant concentrations relative to life history parameters showed higher levels of mortality in first-born offspring and higher contaminant concentrations in these calves and in primiparous females (Wells *et al.* 2005). Balmer *et al.* (2011) reported extremely high levels of total PCBs in dolphins sampled in estuarine waters near Brunswick, Georgia, where there is a point source Superfund site. Dolphins that have been sighted exclusively in estuarine waters 40 km north of Brunswick, near Sapelo Island, Georgia, also exhibit elevated PCB levels (Balmer *et al.* 2011). Movement of contaminated prey may be the source of exposure for the dolphins in Sapelo Island (Balmer *et al.* 2011), and, if those prey enter the coastal environment, the South Carolina/Georgia Coastal Stock could also be exposed to these unusually high contaminant levels. The exposure to environmental pollutants and subsequent effects on population health is an area of concern and active research.

STATUS OF STOCK

Common bottlenose dolphins in the western North Atlantic are not listed as threatened or endangered under the Endangered Species Act, but the South Carolina/Georgia Coastal Stock is a strategic stock due to its designation as depleted under the MMPA. From 1995 to 2001, NMFS recognized only the western North Atlantic Coastal Stock of bottlenose dolphins in the western North Atlantic, and this stock was listed as depleted as a result of a UME in 1988–1989 (64 FR 17789, April 6, 1993). The stock structure was revised in 2008, 2009, and 2010, to recognize resident estuarine stocks and migratory and resident coastal stocks. The South Carolina/Georgia Coastal Stock retains the depleted designation as a result of its origin from the western North Atlantic Coastal Stock. This stock is presumed to be below OSP due to its designation as depleted. PBR for the South Carolina/Georgia Coastal Stock is 46 and so the zero mortality rate goal, 10% of PBR, is 4.6. The documented total mean annual human-caused mortality for this stock for 2011–2015 ranged between 1.4 and 1.6. However, these estimates are biased low for the following reasons: 1) the total U.S. human-caused mortality and serious injury for the South Carolina/Georgia Coastal Stock cannot be directly estimated because of the spatial overlap among the stocks of bottlenose dolphins that occupy waters of South Carolina and Georgia resulting in uncertainty in the stock assignment of takes, 2) there are several commercial fisheries operating within this stock's boundaries that have little to no observer coverage, and 3) this mortality estimate incorporates a count of verified human-caused deaths and serious injuries and should be considered a minimum (NMFS 2016). Given these biases and uncertainties, there is insufficient information to determine whether or not the total fishery-related mortality and serious injury is approaching a zero mortality and serious injury rate. The stock may have been negatively impacted by the large 2013–2015 UME and the 2011 UME,

and some dolphins in the stock could contain high levels of PCBs from a Superfund site in Georgia. These factors could influence the recovery of this stock. Analysis of trends in abundance suggest a possible decline in stock abundance between 2002–2004 and 2016; however, there is limited power to evaluate trends given uncertainty in stock distribution, lack of precision in abundance estimates, and a limited number of surveys.

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