COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*) Biscayne Bay Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The coastal morphotype of common bottlenose dolphins is continuously distributed along the Atlantic coast south of Long Island, New York, to the Florida peninsula, including inshore waters of the bays, sounds and estuaries. Several lines of evidence support a distinction between dolphins inhabiting 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).

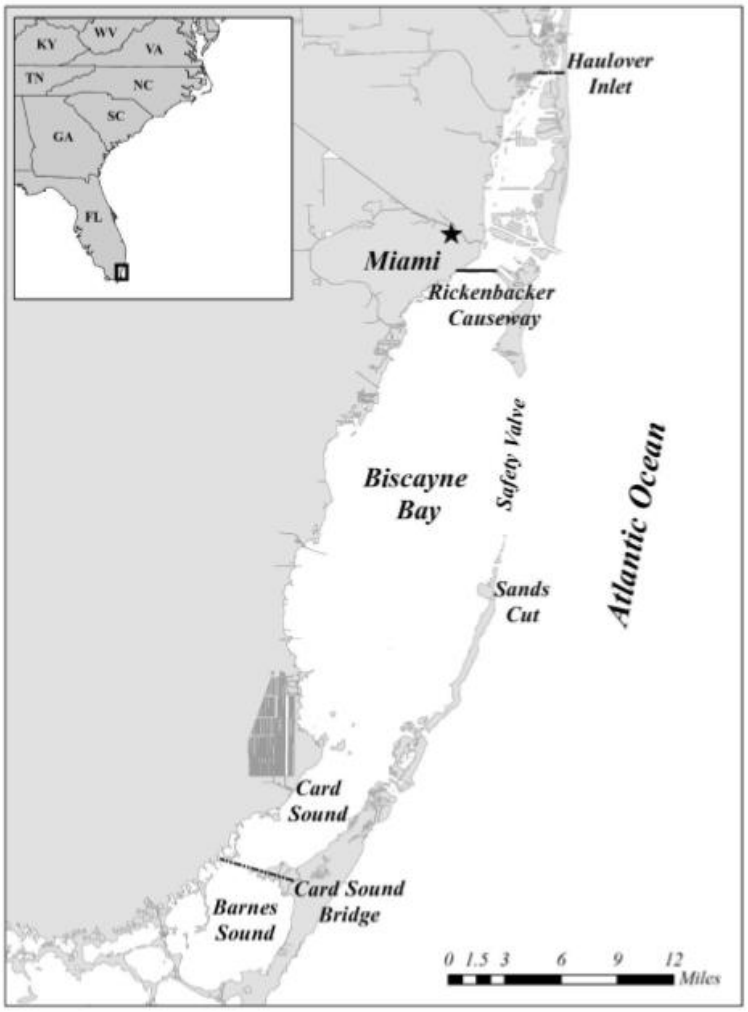

Figure 1. ***Geographic extent of the Biscayne Bay Stock. Dashed lines at Haulover Inlet and Card Sound Bridge denote the boundaries.***

Biscayne Bay is a shallow estuarine system located along the southeast coast of Florida in Miami-Dade County. The Bay is generally shallow (depths <5 m) and includes a diverse range of benthic communities including seagrass beds, soft coral and sponge communities, and mud flats. The northern portion of the Bay (Figure 1) is surrounded by the cities of Miami and Miami Beach and is therefore heavily influenced by industrial and municipal pollution sources. Furthermore, tidal flushing in this portion of the Bay is severely limited by the presence of dredged islands (Bialczak *et al.* 2001). In contrast, the central and southern portions of the Bay are less influenced by development and are better flushed. Water exchange with the Atlantic Ocean occurs through a broad area of grass flats and tidal channels termed the Safety Valve near the center of the Bay.

The Biscayne Bay Stock of common bottlenose dolphins has been the subject of an ongoing photo-ID study conducted by the NMFS Southeast Fisheries Science Center (SEFSC) since 1990. From 1990 to 1991, preliminary information was collected focusing on the central portion of the Bay. The survey was re-initiated in 1994, and it was expanded to include the northern portion of the Bay and south to the Card Sound Bridge in 1995 (Litz 2007). Photo-ID surveys were expanded further south through Barnes Sound to the Barnes Sound Bridge in 2008, and as of 2021, the photo-ID catalog contains more than 400 marked individuals. Many of these individuals are long-term residents with multiple sightings over the course of the study (Litz *et al.* 2012). Litz (2007) documented two social groups that differentially utilize habitats within Biscayne Bay; one group was sighted primarily

in the northern half of the Bay while the other was sighted primarily in the southern half. Members of these two groups exhibited significant differences in contaminant loads (Litz *et al.* 2007). Evidence of weak but significant genetic differentiation was found between these two social groups using microsatellite data but not mitochondrial DNA (mtDNA) data (Litz *et al.* 2012). The lack of differentiation at mtDNA coupled with field observations indicating overlapping home ranges for these two groups suggests ongoing, though perhaps low, levels of interbreeding and the two groups have not been split into separate stocks at this time. However, significant genetic differentiation was found between Biscayne Bay and Florida Bay dolphins at both marker types (Litz *et al.* 2012). The observed genetic differences between resident animals in Biscayne Bay and those in an adjacent estuary combined with the high levels of site fidelity observed, demonstrate that the resident Biscayne Bay common bottlenose dolphins are a demographically independent population. Further work is needed to evaluate the degree of demographic independence between the two groups that utilize different habitats within the bay, given the evidence for a measurable level of nuclear genetic differentiation between them (Litz *et al.* 2012).

Biscayne Bay extends south through Card Sound and Barnes Sound, and connects through smaller inlets to Florida Bay (Figure 1). The Biscayne Bay Stock of common bottlenose dolphins is bounded by Haulover Inlet to the north and Card Sound bridge to the south. This range corresponds to the extent of confirmed home ranges of common bottlenose dolphins observed residing in Biscayne Bay by a long-term photo-ID study(Litz 2007) and probably represents the core range of this stock. Preliminary comparisons of the Biscayne Bay catalog with catalogs from Florida Bay indicate there is spatial overlap of these two genetically distinct stocks near the stock boundary and/or within Barnes Sound. Thus, Biscayne Bay dolphins may utilize habitats outside these boundaries, including Barnes Sound, and so this southern boundary is subject to change upon further study. NMFS SEFSC has entered its catalog into the Gulf of Mexico Dolphin Identification System (GoMDIS; https://sarasotadolphin.org/gomdis/) to further investigate this possibility.

Dolphins residing within estuaries north of this stock to Jupiter Inlet are currently not included in any Stock Assessment Report. There are insufficient data to determine whether animals in this region exhibit affiliation to the Biscayne Bay Stock, the estuarine stock further to the north in the Indian River Lagoon Estuarine System (IRLES), or are simply transient animals associated with coastal stocks. There is relatively limited estuarine habitat along this coastline; however, the Intracoastal Waterway extends north along the coast to the IRLES. It should be noted that during 2016–2020, there was one stranded common bottlenose dolphin in unassigned estuarine habitat north of the Biscayne Bay Stock. There was evidence of human interaction for this stranding in the form of healed fishery interaction marks.

POPULATION SIZE

The total number of common bottlenose dolphins residing within the Biscayne Bay Stock is unknown (Table 1).

Earlier abundance estimates (>8 years old)

An initial evaluation of the abundance of common bottlenose dolphins in Biscayne Bay was conducted with aerial surveys in 1974–1975 covering predominantly the central portion of the Bay from Rickenbacker Causeway to the northern end of Card Sound. Common bottlenose dolphins were observed in the Bay on seven of 22 aerial surveys with the sightings totaling 67 individuals. Only one group was seen on each survey. This led the authors to conclude that there was likely one herd of approximately 13 animals occupying the Bay (Odell 1979).

Between 1994 and 2007, 394 small boat surveys of Biscayne Bay were conducted for a common bottlenose dolphin photo-ID study. A day's survey effort covered either the northern (Haulover Inlet to Rickenbacker Causeway), central (Rickenbacker Causeway to Sands Cut) or southern (Sands Cut to Card Sound Bridge) region of the Bay. Each area was surveyed 8–12 times per year on a monthly basis from 1994 to 2003. From 2003 to 2007, the number of surveys was lower and ranged between four and eight per year, and the lowest amount of effort was expended in the southern portion of the Bay. Using standard methods (Litz 2007), there were 157 unique individuals identified by the photo-ID surveys between 2003 and 2007. However, this catalog size does not represent a valid estimate of population size because the residency patterns of dolphins in Biscayne Bay are not fully understood. Research is currently underway to estimate the abundance of the Biscayne Bay Stock using a photographic mark-recapture method.

Minimum Population Estimate

No current information on abundance is available to calculate a minimum population estimate for the Biscayne Bay Stock of common 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 Biscayne Bay Stock of common 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 the Biscayne Bay Stock of common bottlenose dolphins is unknown (Table 1).

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

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

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury for the Biscayne Bay 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 0.6. Additional mean annual mortality and serious injury during 2016–2020 due to other human-caused sources was 0.2 (vessel strike). The minimum total mean annual human-caused mortality and serious injury for this stock during 2016–2020 was therefore 0.8 (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, 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), and 5) a stranding with evidence of fishery-related interactions occurred in waters north of the Biscayne Bay Stock boundary that is not included within any stock, and the stranding could have been part of this stock (see Stock Definition and Geographic Range section).

Fishery Information

There are four commercial fisheries that interact, or that potentially could interact, with this stock. These include two Category II fisheries (Southeastern U.S. Atlantic, Gulf of Mexico stone crab trap/pot and Atlantic blue crab trap/pot) and two Category III fisheries (Florida spiny lobster trap/pot; and Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line)). 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 were two documented entanglement interactions of common bottlenose dolphins in Biscayne Bay with trap/pot fisheries. In 2020, one animal was disentangled from commercial blue crab trap/pot gear and released alive. Also in 2020, another animal was disentangled from unidentified trap/pot gear and released alive. For both cases, the animals were considered to be seriously injured following mitigation efforts (Maze-Foley and Garrison 2022). These live entanglements are included in the annual human-caused mortality and serious injury total for this stock (Table 2), and were also documented within the stranding database (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 18 November 2021).

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

Hook and Line (Rod and Reel)

During 2016–2020 within the Biscayne Bay area, there was one documented interaction of a common bottlenose dolphin with ingested hook and line fishing gear. During 2018, there was one mortality where monofilament line was wrapped around the goosebeak and evidence suggested the hook and line gear contributed to the cause of death. This case was included in the annual human-caused mortality and serious injury total for this stock (Table 2), and it was included within the stranding database (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 18 November 2021).

It should be noted that, in general, it cannot be determined if rod and reel hook and line gear originated from a commercial (i.e., charter boat and 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 observer program. The documented interaction in this gear represents a minimum known count of interactions in the last five years.

Other Mortality

During 2018, there was one mortality documented with wounds consistent with a vessel strike, and it was determined the mortality was due to the vessel strike. This mortality was included within the annual human-caused mortality and serious injury total for this stock (Table 2) as well as the stranding database (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 18 November 2021).

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

Table 2. Summary of the incidental mortality and serious injury of common bottlenose dolphins (*Tursiops truncatus*) of the Biscayne Bay 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 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
Unidentified Trap/Pot	2016–2020	Stranding Data and At-Sea Observations	NA	1
Hook and Line	2016–2020	Stranding Data and At-Sea Observations	NA	1
Mean Annual Mortality due to commercial fisheries (2016–2020)			**0.6**	

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)	**0.8**

Strandings

During 2016–2020, nine common bottlenose dolphins were reported stranded within Biscayne Bay (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 18 November 2021). There was evidence of human interaction for four of the strandings. For the remaining five strandings, it could not be determined if there was evidence of human interaction. Human interactions were from entanglements with trap/pot gear, hook and line gear, and a vessel strike. 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.

Table 3. Common bottlenose dolphin strandings occurring in the Biscayne Bay 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
Biscayne Bay Stock	Total Stranded	2	1	2	1	3	9
	HI--Yes	0	0	2[a]	0	2[b]	4
	HI--No	0	0	0	0	0	0
	HI--CBD	2	1	0	1	1	5

a. Includes 1 entanglement interaction with hook and line gear (mortality) and 1 mortality with evidence of a vessel strike.

b. Includes 1 entanglement interaction with commercial blue crab trap/pot gear and 1 entanglement interaction with unidentified trap/pot gear (both animals released alive, seriously injured).

HABITAT ISSUES

The nearshore and estuarine habitats occupied by dolphins in Biscayne Bay are adjacent to areas of high human population and some are highly industrialized. Studies have examined persistent organic pollutant concentrations in common bottlenose dolphin tissues from several estuaries along the Atlantic coast and have likewise found evidence of high pollutant concentrations in blubber, particularly near Charleston, South Carolina, and Beaufort, North Carolina (Hansen *et al.* 2004). 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). A study of persistent organic pollutants in common bottlenose dolphins of Biscayne Bay demonstrated a strong geographic gradient in pollutant concentrations between dolphins with sighting histories primarily in the northern, more polluted areas compared to dolphins with ranges in the southern portion of the Bay (Litz *et al.* 2007). The

observed tissue concentrations of polychlorinated biphenyls (PCBs) for male animals from the northern Bay were five times higher than those in southern Biscayne Bay and were also higher than those of dolphins from other Atlantic estuaries including Beaufort, North Carolina, Charleston, South Carolina, Indian River Lagoon, Florida, and Florida Bay (Litz *et al.* 2007). These findings demonstrate differential exposure of common bottlenose dolphins to pollutants through the food chain on a very fine spatial scale within Biscayne Bay and between estuaries.

Eutrophication poses a threat to water quality throughout Biscayne Bay, especially in the northern portion of the bay. A twenty-year study (1995–2014) conducted within the bay found that concentrations of both chlorophyll a and phosphates increased throughout the bay, with concentrations increasing at a higher rate in northern Biscayne Bay (Millette *et al.* 2019). Their findings coupled with recent seagrass die-offs, fish kills due to low levels of dissolved oxygen, and harmful algal blooms, indicate water quality is declining (Millette *et al.* 2019).

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. The documented mean annual human-caused mortality for the Biscayne Bay Stock for 2016–2020 was 0.8. However, it is likely the estimate of annual 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 Sarasota Bay recovery rate may be most appropriate for this stock given that much of the habitat is urban and relatively open. When annual human-caused mortality and serious injury is corrected for unrecovered carcasses applying the 0.33 recovery rate (n=2.4), it exceeds the PBR for this stock based on an older minimum abundance of ~157 residents (Litz 2007). Total U.S. fishery-related mortality and serious injury for this stock is unknown, but at a minimum is greater than 10% of the PBR and, therefore, cannot be considered to be insignificant and approaching a zero mortality and serious injury rate. There is also uncertainty as to the level of demographic independence between two groups of dolphins that utilize different habitats within the bay. 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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