COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*): Western North Atlantic Northern Migratory 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 comprises 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 U.S. East Coast. The Northern Migratory Coastal Stock is one such stock and one of only two (the other being the Southern Migratory Coastal Stock) thought to make broad-scale, seasonal migrations in coastal waters of the wNA.

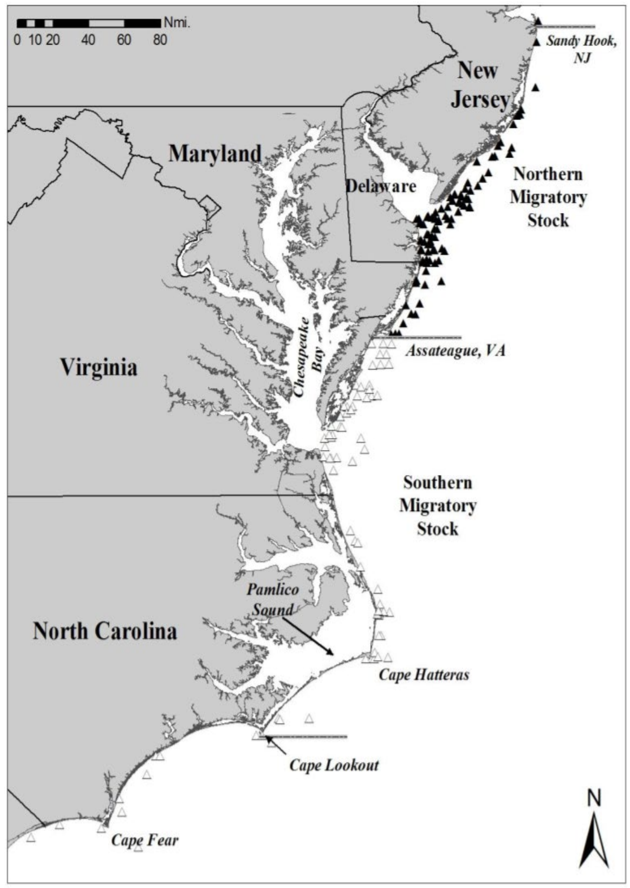

Figure 1. The distribution of common bottlenose dolphin sightings in coastal waters from North Carolina to New Jersey during July–August 2002, 2004, 2010, 2011, and 2016. Sighting locations from aerial surveys are plotted as triangle symbols. Sightings ascribed to the Northern Migratory Coastal Stock are shown as filled symbols; those from the Southern Migratory Coastal Stock as open symbols. Horizontal lines intersecting the coast denote the southern boundary for each stock in warm water months.

This stock exhibits spatiotemporal overlap with multiple common bottlenose stocks in the wNA. The stock is best defined by its distribution during warm water months (best described by July and August) when it overlaps with the fewest stocks. During warm water months, this stock occupies coastal waters from the shoreline to approximately the 20-m isobath between Assateague, Virginia, and Long Island, New York (Figure 1; Garrison *et al.* 2017b). The stock migrates in late summer and fall and, during cold water months (best described by January and February), occupies coastal waters from approximately Cape Lookout, North Carolina, to the North Carolina/Virginia border (Garrison *et al.* 2017b). Four common bottlenose dolphins tagged during 2003 and 2004 off the coast of New Jersey in late summer moved south to North Carolina and inhabited waters near and just south of Cape Hatteras during cold water months. These animals then returned to coastal waters of New Jersey in the following warm water months (Garrison *et al.* 2017b). Similarly, a dolphin tagged in late September 1998 off Virginia Beach, Virginia, moved south to waters between Cape Hatteras and Cape Lookout during cold water months (Garrison *et al.* 2017b). Photo-ID data also support that central North Carolina is the southern limit for this stock in winter (Urian *et al.* 1999). There are no matches from long-term photo-ID studies between sites in New Jersey and those south of Cape Lookout (Urian *et al.* 1999). Historically, common bottlenose dolphins have been rarely observed during cold water months in coastal waters north of the North Carolina/Virginia border, and their northern distribution in winter appears to be limited by water temperatures <9.5ºC (Garrison *et al.* 2016). During aerial and ship surveys off the New Jersey coast in 2008 and 2009, no sightings of common bottlenose dolphins were made during November–February; bottlenose dolphins were sighted from early March to mid-October and were most abundant during May–August (Whitt *et al.* 2015). Seasonal variation in the densities of animals observed off Virginia Beach, Virginia, supports the seasonal migration of dolphins northward during warm water months and then south during cold water months (Barco and Swingle 1996). Genetic analyses using mitochondrial and nuclear microsatellite data also indicated significant differentiation between common bottlenose dolphins occupying coastal waters north of the North Carolina/Virginia border to New Jersey during warm water months and those in southern North Carolina and further south (Rosel *et al*. 2009). Toth *et al.* (2012) suggested the Northern Migratory Coastal stock may be further partitioned in waters off of New Jersey. Two clusters of visual sightings that differed in the presence of a commensal soft-stalked barnacle, *Xenobalanus globicipitis*, in avoidance behavior, and in "base coloration" were identified. One cluster inhabited waters 0–1.9 km from shore while the other cluster inhabited waters 1.9–6 km from shore (Toth *et al.* 2012). Additional studies are needed to determine whether the two clusters should be considered demographically independent.

The distribution of the Northern Migratory Coastal Stock overlaps in certain seasons with several other common bottlenose dolphin stocks. Overlap with the Southern Migratory Coastal Stock in coastal waters of northern North Carolina and Virginia is possible during spring and fall migratory periods, but the degree of overlap is unknown and it may vary depending on annual water temperature (Garrison *et al.* 2016). When the stock has migrated in cold water months to coastal waters from just north of Cape Hatteras, North Carolina, to just south of Cape Lookout, North Carolina, it overlaps spatially with the Northern North Carolina Estuarine System (NNCES) Stock (Garrison *et al.* 2017b). Depending on the timing of the northward migration in the spring, it may overlap with the NNCES stock in coastal waters (<1 km from shore) as far north as Virginia Beach, Virginia, and the mouth of the Chesapeake Bay. It may also overlap with the Southern North Carolina Estuarine System Stock (Garrison *et al.* 2017b) in nearshore coastal waters south of Cape Hatteras in winter, although the degree of overlap with the latter stock is not well defined. This stock may also overlap to some degree with the wNA Offshore Stock of common bottlenose dolphins. A combined genetic and logistic regression analysis that incorporated depth, latitude, and distance from shore was used to model the probability that a particular common bottlenose dolphin group seen in coastal waters was of the coastal morphotype (Garrison *et al.* 2017a). North of Cape Hatteras during summer months, there is strong separation between the coastal and offshore morphotype (Kenney 1990, Garrison *et al.* 2017a), and the coastal morphotype is nearly completely absent in waters >20 m depth. South of Cape Hatteras, the regression analysis indicated that the coastal morphotype occurs at lower densities over the continental shelf, in waters >20 m deep where it overlaps to some degree with the offshore morphotype. For the purposes of defining stock boundaries and identifying bycaught dolphins, the offshore boundary of the Northern Migratory Coastal Stock is defined as the 20-m isobath in summer north of Cape Hatteras and the 200-m isobath in winter between Cape Hatteras and Cape Lookout.

POPULATION SIZE

The best available abundance estimate for the Northern Migratory Coastal Stock of common bottlenose dolphins in the western North Atlantic is 6,639 (CV=0.41; Table 1; Garrison *et al.* 2017a). This estimate was derived from aerial surveys conducted during the summer of 2016 covering coastal and shelf waters from Assateague, Virginia to Sandy Hook, New Jersey.

Background

Estimating the abundance of the Northern Migratory Coastal Stock is complicated by the spatiotemporal overlap the stock has with other coastal and estuarine common bottlenose dolphins as described above. Summer surveys are best for estimating the abundance for the Northern Migratory Coastal Stock because it overlaps least with other coastal, estuarine, and offshore stocks of common bottlenose dolphins during warm water months. Abundance for the Northern Migratory Coastal Stock is estimated using summer sightings made in the 0–20 m depth stratum during summer aerial surveys north of Assateague, Virginia (37.9°N) to Sandy Hook, New Jersey (40.3°N). The definition of the southern summer boundary and inter-annual variation in stock distribution are significant unquantified sources of uncertainty.

Earlier Abundance Estimates (>8 years old)

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions.

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 summer of 2016 (see Garrison *et al.* 2017a for survey design). The survey was conducted along tracklines oriented perpendicular to the shoreline and spaced latitudinally at 20-km intervals, and covered waters from the shoreline to the continental shelf break (Garrison *et al.* 2017a). The survey also included more closely spaced "fine-scale" tracklines in waters offshore of New Jersey and Virginia within areas being evaluated for the placement of offshore energy installations (Garrison *et al.* 2017a).

As with previous surveys, the 2016 survey was 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 the 2016 and two previous surveys indicated a decreased probability of detection near the trackline. The sighting data were therefore "left-truncated" by analyzing only sightings occurring greater than 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). The resulting abundance estimate is 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 (Klatsky *et al.* 2007) and the large group sizes, it is likely that this bias is small (Garrison *et al.* 2017a).

The abundance estimate for the 2016 summer aerial survey was 6,639 (CV=0.41; Table 1; Garrison *et al.* 2017a). Uncertainties in the abundance estimate arise primarily from annual, and unquantified, variation in stock distribution.

Table 1. Abundance estimate for the western North Atlantic Northern Migratory Coastal Stock of common bottlenose dolphins. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{est}) and coefficient of variation (CV).

Month/Year	Area	N_{est}	CV
July–August 2016	Assateague, Virginia (37.9°N) to Sandy Hook, New Jersey (40.3°N)	6,639	0.41

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. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate for the Northern Migratory Coastal Stock of common bottlenose dolphins is 6,639 (CV=0.41). The resulting minimum population size estimate is 4,759 (Table 2).

Current Population Trend

Available surveys allow an 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 Northern Migratory Coastal Stock, the resulting mean abundance estimate for 2002–2004 was 8,597 (CV=0.53), and that for 2010–2011 was 15,232 (CV=0.35). There was no significant difference between these estimates and the estimate of 6,639 (CV=0.41) 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).

An analysis of coast-wide (New Jersey to Florida) trends in abundance for common bottlenose dolphins was conducted. 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 (see Strandings section).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for the Northern Migratory Coastal Stock. 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 Northern Migratory Coastal Stock of common bottlenose dolphins is 4,759. 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 48 (Table 2).

Table 2. Best and minimum abundance estimates for the western North Atlantic Northern Migratory Coastal Stock of common bottlenose dolphins with Maximum Productivity Rate (R_{max}), Recovery Factor (F_r) and PBR.

N_{est}	CV	N_{min}	F_r	R_{max}	PBR
6,639	0.41	4,759	0.5	0.04	48

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury for the Northern Migratory Coastal Stock during 2014–2018 is unknown. The mean annual fishery-related mortality and serious injury for observed fisheries and strandings identified as fishery-related ranged between 12.2 and 21.5. No additional mortality and serious injury was documented from other human-caused sources (e.g., fishery research) and therefore, the minimum total mean annual human-caused mortality and serious injury for this stock during 2014–2018 ranged between 12.2 and 21.5 (Tables 3a, 3b and 3c). This range reflects several sources of uncertainty and is a minimum due to the following five factors: 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 detected and 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 in North Carolina and Virginia introduces uncertainty in assignment of mortalities to stock. In the sections below, dolphin mortalities and serious injuries were ascribed to a stock or stocks by comparing the season and geographic location of the take/stranding to the stock boundaries and geographic range delimited for each stock (Lyssikatos and Garrison 2018).

Fishery Information

There are eight commercial fisheries that interact, or that potentially could interact, with this stock. These include both the Category I mid-Atlantic gillnet and northeast sink gillnet fisheries, five Category II fisheries (Chesapeake Bay inshore gillnet, Virginia pound net, mid-Atlantic menhaden purse seine, Atlantic blue crab trap/pot, and mid-Atlantic haul/beach seine), and the Category III Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line) 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.*

Mid-Atlantic Gillnet

The mid-Atlantic gillnet fishery operates along the coast from North Carolina through New York (2016 List of Fisheries) and overlaps with the Northern Migratory Coastal Stock throughout its range. North Carolina is the largest component of the mid-Atlantic gillnet fishery in terms of fishing effort and observed marine mammal takes (Palka and Rossman 2001, Lyssikatos and Garrison 2018). This fishery is currently observed by the Northeast Fisheries Observer Program, and previously was observed by both the Northeast and Southeast Fisheries Observer Programs (through 2016). The Bottlenose Dolphin Take Reduction Team was convened in October 2001, in part, to reduce bycatch in gillnet gear. The Bottlenose Dolphin Take Reduction Plan (BDTRP) was implemented in May 2006 and resulted in changes to gillnet gear configurations and fishing practices (50 CFR 24776, 26 April 2006, Available from: https://www.federalregister.gov/documents/2006/04/26/06-3909/taking-of-marine-mammals-incidental-to-commercial-fishing-operations-bottlenose-dolphin-take). In addition, two amendments to the BDTRP were implemented in 2008 and 2012 regarding gear restrictions for medium-mesh gillnets in North Carolina waters (https://www.fisheries.noaa.gov/national/marine-mammal-protection/bottlenose-dolphin-take-reduction-plan). Mortality estimates for the period 2002–2006 (immediately prior to implementation of the BDTRP) and 2007–2011 are available in the 2015 stock assessment report for the Northern Migratory Coastal Stock (Waring *et al.* 2016). The current report covers the most recent available five-year estimate (NMFS 2016) for 2014–2018.

Mortality estimation for this stock is difficult for three main reasons: 1) observed takes are statistically rare events, 2) the Northern Migratory Coastal, Southern Migratory Coastal, NNCES, and Southern North Carolina Estuarine System stocks of common bottlenose dolphin overlap in coastal waters of North Carolina and Virginia at different times of the year, and therefore it is not always possible to definitively assign every observed mortality, or extrapolated bycatch estimate, to a specific stock, and 3) the low levels of federal observer coverage in state waters are insufficient to consistently detect rare bycatch events (Lyssikatos and Garrison 2018). To help address the first problem, two different analytical approaches were used to estimate common bottlenose dolphin bycatch rates during the period 2014–2018: 1) a simple annual ratio estimator of catch per unit effort (CPUE = observed catch/observed effort) per year based directly upon the observed data, and 2) a pooled CPUE approach (where all observer data from the most recent five years were combined into one sample to estimate CPUE; Lyssikatos and Garrison 2018). In each case, the annual reported fishery effort (defined as a fishing trip) was multiplied by the estimated bycatch rate to develop annual estimates of fishery-related mortality. Next, the two model estimates (and the associated uncertainty) were averaged, in order to account for the uncertainty in the two approaches, to produce an estimate of the mean mortality of common bottlenose dolphins for this fishery (Lyssikatos and Garrison 2018). To help address the second problem, minimum and maximum mortality estimates were calculated per stock to indicate the range of uncertainty in assigning observed takes to stock (Lyssikatos and Garrison 2018). Uncertainties and potential biases are described in Lyssikatos and Garrison (2018).

During the most recent five-year time period, 2014–2018, the combined average Northeast (NEFOP) and Southeast (SEFOP) Fisheries Observer Program observer coverage (measured in trips) for this fishery was 5.16% in state waters (0–3 miles from shore) and 9.95% in federal waters (3–200 miles from shore; Lyssikatos 2021). During these trips, observers documented five entangled dolphins that may have been from the Northern Migratory Coastal Stock, two off of North Carolina, two off of New Jersey, and one off of Virginia. In April 2018, the NEFOP observed one mortality in medium-mesh gillnet gear off the coast of Virginia that was ascribed solely to the Northern Migratory Coastal Stock. Also in October 2017, the NEFOP observed one mortality in medium-mesh gillnet gear off the coast of New Jersey ascribed solely to the Northern Migratory Coastal Stock. In February 2017, the NEFOP documented a dolphin entangled in small-mesh gillnet gear off the coast of North Carolina that was released alive, and it could not be determined if the animal was seriously injured. The animal was ascribed to the Northern Migratory Coastal and NNCES stocks. In August 2015, the NEFOP observed one mortality in medium-mesh gillnet gear off the coast of New Jersey that was ascribed solely to the Northern Migratory Coastal Stock. In January 2015, one mortality was observed by the NEFOP off Hatteras, North Carolina, entangled in a medium-mesh gillnet gear. This dolphin was ascribed to the Northern Migratory Coastal and NNCES stocks (this animal was also self-reported by the fisherman per the Marine Mammal Authorization Program). The resultant five-year mean minimum and maximum mortality estimates (2014–2018) were 11.8 (CV=0.18) and 19.5 (CV=0.14) animals per year, respectively (Table 3a; Lyssikatos 2021).

Historical stranding data have documented multiple cases of dead, stranded dolphins recovered with gillnet gear attached (Byrd *et al.* 2014, Waring *et al.* 2016, Lyssikatos and Garrison 2018). Six mortalities and one live animal were documented entangled in gillnet gear during the current five-year period, 2014–2018, that may have been from the Northern Migratory Coastal Stock (two of these mortalities were also documented by the Marine Mammal Authorization Program). The live animal was disentangled and released alive but it could not be determined whether the animal was seriously injured (Maze-Foley and Garrison 2020). From 2014 to 2018, 12 dead, stranded dolphins were recovered with markings indicative of interaction with gillnet gear (Read and Murray 2000), but no gear was attached to the carcasses and it is unknown whether the interactions with the gear contributed to the death of these animals. Seven of the 12 cases were ascribed to the Northern Migratory Coastal Stock alone, two were ascribed to the Northern and Southern Migratory Coastal stocks, and three were ascribed to the Northern Migratory Coastal and NNCES stocks.

Northeast Sink Gillnet

During 2014–2018, there were four documented mortalities self-reported through the Marine Mammal Authorization Program for the New England sink gillnet fishery that may have been from the Northern Migratory Coastal Stock. All four mortalities were ascribed to the Northern Migratory Coastal and Offshore Stocks, and included one case from August 2017 of two dolphins entangled in the same gillnet, and a separate case from November 2017 of two dolphins entangled in the same gillnet. This fishery is observed by the NEFOP and the Northeast Fisheries At-Sea Monitoring Program (ASM; see Orphanides and Hatch 2017), however, no observed takes have been assigned to the Northern Migratory Coastal Stock and there is no bycatch estimate for this stock. The four self-reported mortalities are included in the annual human-caused mortality and serious injury total for this stock (Table 3b).

Chesapeake Bay Inshore Gillnet

During 2014–2018, there was one documented stranding of a common bottlenose dolphin entangled in inshore gillnet gear in Chesapeake Bay. In 2015, in Virginia, a stranded animal was found entangled in gillnet gear (this animal was also self-reported by the fisherman per the Marine Mammal Authorization Program). This animal was ascribed to the Northern and Southern Migratory Coastal stocks, and is included in the annual human-caused mortality and serious injury total for this stock (Table 3b) as well as in the stranding database and stranding totals presented in Table 4 (Northeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 August 2019). There is no observer coverage of this fishery within Maryland waters of Chesapeake Bay; within Virginia waters of Chesapeake Bay, there is a low level of observer coverage (<1%). No estimate of bycatch mortality is available for this fishery, and the documented interaction in this commercial gear represents a minimum known count of interactions in the last five years. Six other dead, stranded common bottlenose dolphins were recovered within Chesapeake Bay with markings indicative of interaction with gillnet gear (Read and Murray 2000), but no gear was attached to the carcasses and it is unknown whether the interactions with the gear contributed to the death of these animals. Five of these animals were ascribed solely to the Northern Migratory Coastal Stock, and one was ascribed to the Northern and Southern Migratory Coastal and NNCES stocks.

Virginia Pound Net

During 2014–2018, there were no documented mortalities or serious injuries involving pound net gear in Virginia. However, one dead, stranded dolphin was recovered with twisted twine markings indicative of interactions with pound net gear, but it is unknown whether the interactions with the gear contributed to the death of this animal and this case is not included in the annual human-caused mortality and serious injury total for this stock. This stranding was ascribed solely to the Northern Migratory Coastal Stock, and it occurred inside estuarine waters near the mouth of the Chesapeake Bay in March 2016 (Northeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 August 2019). Because there is no systematic observer program for the Virginia pound net fishery, no estimate of bycatch mortality is available. An amendment to the BDTRP was implemented in 2015 requiring gear restrictions for VA pound nets in estuarine and coastal state waters of Virginia to reduce bycatch (https://www.fisheries.noaa.gov/national/marine-mammal-protection/bottlenose-dolphin-take-reduction-plan).

Mid-Atlantic Menhaden Purse Seine

During 2014–2018, there were no documented mortalities or serious injuries in mid-Atlantic menhaden purse seine gear of common bottlenose dolphins that could be ascribed to the Northern Migratory Coastal Stock. The mid-Atlantic menhaden purse seine fishery historically reported an annual incidental take of one to five common bottlenose dolphins (NMFS 1991, pp. 5–73). There has been very limited federal observer coverage since 2008. No observer coverage was allocated to this fishery during 2014–2018. Because there is no systematic observer program for this fishery, no estimate of bycatch mortality is available.

Atlantic Blue Crab Trap/Pot

During 2014–2018, stranding data documented four cases of common bottlenose dolphins entangled in trap/pot gear that could be ascribed to the Northern Migratory Coastal Stock. Two cases were serious injuries and for the remaining two cases, it could not be determined whether the animals were seriously injured. One serious injury occurred in 2017 in unidentified trap/pot gear and was ascribed solely to the Northern Migratory Coastal Stock. The second serious injury occurred in 2017 in commercial blue crab trap/pot gear and was ascribed to the Northern and Southern Migratory Coastal and NNCES stocks. The serious injuries are included in the annual human-caused mortality and serious injury total for this stock (Table 3b). Also in 2017, there was one entanglement in unidentified trap/pot gear ascribed to the Northern and Southern Migratory Coastal stocks. In 2018, there was an entanglement in unidentified trap/pot gear that was ascribed to the Northern and Southern Migratory Coastal and NNCES stocks. For both of these cases, it could not be determined whether the animals were seriously injured. All of the cases were included in the stranding database and in the stranding totals presented in Table 4 (Northeast Regional Marine Mammal Stranding Network; National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 August 2019). Details regarding the serious injury determinations can be found in Maze-Foley and Garrison (2020). 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. However, stranding data indicate that interactions with trap/pot gear occur at some unknown level in North Carolina (Byrd *et al*. 2014) and other regions of the southeast U.S. (Noke and Odell 2002, Burdett and McFee 2004).

Mid-Atlantic Haul/Beach Seine

During 2014–2018, one serious injury of a common bottlenose dolphin occurred associated with the mid-Atlantic haul/beach seine fishery that could be ascribed to the Northern Migratory Coastal Stock. During 2014, a common bottlenose dolphin was found within a haul seine net in Virginia and released alive seriously injured (Maze-Foley and Garrison 2020). The animal was ascribed to the Northern and Southern Migratory Coastal and NNCES stocks. This case was included in the stranding database and in the stranding totals presented in Table 4 (Northeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 August 2019) as well as in the annual human-caused mortality and serious injury total for this stock (Table 3b). The mid-Atlantic haul/beach seine fishery had limited observer coverage by the NEFOP in 2010–2011. No observer coverage was allocated to this fishery during 2014–2018. No estimate of bycatch mortality is available for this fishery, and the documented interaction in this commercial gear represents a minimum known count of interactions in the last five years.

Hook and Line (Rod and Reel)

During 2014–2018, stranding data identified four mortalities and one serious injury of common bottlenose dolphins that could be ascribed to the Northern Migratory Coastal Stock for which hook and line gear entanglement or ingestion were documented. For one mortality, available evidence suggested the hook and line gear interaction contributed to the cause of death (2018, Maryland). This animal was ascribed solely to the Northern Migratory Coastal Stock. For a second mortality that was also ascribed solely to the Northern Migratory Coastal Stock, the carcass was in a state of advanced decomposition and it could not be determined whether the hook and line gear interaction contributed to cause of death (2018, Delaware). For a third mortality, available evidence suggested the hook and line gear interaction did not contribute to the cause of death (2016, Virginia). This animal was ascribed to the Northern and Southern Migratory Coastal and NNCES stocks. The fourth mortality was in a state of advanced decomposition and it could not be determined whether the hook and line gear interaction contributed to cause of death (2014, Virginia; Maze-Foley *et al.* 2019). This mortality was ascribed solely to the Northern Migratory Coastal Stock. In addition, there was one live animal documented with an entanglement (2017, Virginia), and this animal was considered seriously injured (Maze-Foley and Garrison 2020). It was ascribed to the Northern and Southern Migratory Coastal stocks. All of these cases were included in the stranding database and in the stranding totals presented in Table 4

(Northeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 August 2019). The 2018 mortality for which evidence suggested the gear contributed to the cause of death and the 2017 serious injury are included in the annual human-caused mortality and serious injury total for this stock (Table 3b).

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., 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 in the last five years.

Other Mortality

Historically, there have been occasional mortalities of common bottlenose dolphins during activities including during directed live capture-release studies, turtle relocation trawls, and fisheries surveys (Waring *et al.* 2016); however, none were documented during 2014–2018 that could be ascribed to the Northern Migratory Coastal Stock. All mortalities and serious injuries from known human-caused sources for the Northern Migratory Coastal Stock are summarized in Tables 3a, 3b and 3c.

Table 3a. Summary of the incidental mortality and serious injury of common bottlenose dolphins of the Northern Migratory Coastal Stock for the commercial mid-Atlantic gillnet fishery, which has an ongoing, systematic federal observer program. The years sampled, the type of data used, the annual percentage observer coverage, the observed serious injuries and mortalities recorded by on-board observers, and the mean annual estimate of mortality and serious injury and its CV are provided. Minimum and maximum values are reported due to uncertainty in the assignment of mortalities to this particular stock because there is spatial overlap with other common bottlenose dolphin stocks in certain areas and seasons.

Fishery	Years	Data Type	Observer Coverage	Observed Serious Injury	Observed Mortality	Mean Annual Estimated Mortality and Serious Injury (CV) Based on Observer Data
Mid-Atlantic Gillnet	2014 2015 2016 2017 2018	Obs. Data Logbook	3.6 5.6 9.8 7.0 6.4	0 0 0 0 0	0 2 0 1 1	Min=11.8 (0.18) Max=19.5 (0.14)
Mean Annual Mortality due to the observed commercial mid-Atlantic gillnet fishery (2014–2018)						**Min=11.8 (0.18) Max=19.5 (0.14)**

Table 3b. Summary of the incidental mortality and serious injury of common bottlenose dolphins of the Northern Migratory Coastal Stock during 2014–2018 from commercial fisheries that do not have ongoing, systematic federal observer programs. Counts of mortality and serious injury based on stranding data 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 other common bottlenose dolphin stocks in certain areas and seasons.

Fishery	**Years**	**Data Type**	**5-year Count Based on Stranding Data and the Marine Mammal Authorization Program**
Northeast Sink Gillnet	2014–2018	Federal Observer, and Marine Mammal Authorization Program	Min=0 Max=4
Chesapeake Bay Inshore Gillnet[a]	2014–2018	Limited Observer and Stranding Data	Min=0 Max=1
Virginia Pound Net[b]	2014–2018	Stranding Data	0
Mid-Atlantic Menhaden Purse Seine	2014–2018	Limited Observer and Stranding Data	0
Atlantic Blue Crab Trap/Pot	2014–2018	Stranding Data	Min=1 Max=2
Mid-Atlantic Haul/Beach Seine	2014–2018	Limited Observer and Stranding Data	Min=0 Max=1
Hook and Line[c]	2014–2018	Stranding Data	Min=1 Max=2
Mean Annual Mortality due to unobserved commercial fisheries (2014–2018)			**Min=0.4 Max=2.0**

a Chesapeake Bay inshore gillnet interactions are included if the animal was found entangled in gillnet gear. Strandings with markings indicative of interactions with gillnet gear are not included within the table. See "Chesapeake Bay Inshore Gillnet" text for more details.
b Pound net interactions are included if the animal was found entangled in pound net gear. Strandings with twisted twine markings indicative of interactions with pound net gear are not included within the table. See "Virginia Pound Net" text for more details.
c Hook and line interactions are counted here if the available evidence suggested the hook and line gear contributed to the cause of death per Maze-Foley *et al.* (2019). See "Hook and Line" text for more details.

Table 3c. Summary of the incidental mortality and serious injury of common bottlenose dolphins of the Northern Migratory Coastal Stock during 2014–2018 from all sources, including observed commercial fisheries, unobserved commercial fisheries, and research and other takes. See the Annual Human-Caused Mortality and Serious Injury section for biases and limitations of mortality estimates.

Mean Annual Mortality due to the observed commercial mid-Atlantic gillnet fishery (2014–2018) (Table 3a)	**Min=11.8 (0.18) Max=19.5 (0.14)**
Mean Annual Mortality due to unobserved commercial fisheries (2014–2018) (Table 3b)	**Min=0.4 Max=2.0**
Research Takes (5-year Min/Max Count)	0
Other takes (5-year Min/Max Count)	0
Mean Annual Mortality due to research and other takes (2014–2018)	**0**
Minimum Total Mean Annual Human-Caused Mortality and Serious Injury (2014–2018)	**Min=12.2 Max=21.5**

Strandings

Between 2014 and 2018, 692 common bottlenose dolphins that were ascribed to the Northern Migratory Coastal Stock stranded along the Atlantic coast between North Carolina and New York (Table 4; Northeast Regional (NER) Marine Mammal Stranding Network; Southeast Regional (SER) Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 May 2019 (SER) and 13 August 2019 (NER); Maze-Foley *et al.* 2019). There was evidence of human interaction for 80 of these strandings, of which 51 (64%) were fisheries interactions and 4 (5%) showed evidence of a boat strike. No evidence of human interaction was detected for 134 strandings, and for the remaining 478 strandings, it could not be determined if there was evidence of human interaction. It should be recognized that evidence of human interaction does not indicate cause of death, but rather only that there was evidence of interaction with a fishery (e.g., line marks, net marks) or evidence of a boat strike, gunshot wound, mutilation, etc., at some point. 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 to recognize signs of human interaction varies among stranding network personnel.

The assignment of animals to a single stock is impossible in some seasons and regions due to spatial and temporal overlap among several common bottlenose dolphin stocks (Maze-Foley *et al.* 2019). Of the 692 strandings ascribed to the Northern Migratory Coastal Stock, 297 were ascribed solely to this stock. Therefore, the counts in Table 4 likely include some animals from the Southern Migratory Coastal, NNCES, and Offshore stocks and, therefore, overestimate the number of strandings for the Northern Migratory Coastal Stock; those strandings that could not be ascribed to the Northern Migratory Coastal Stock alone are also included in the counts for these other stocks as appropriate. Stranded carcasses are not routinely identified to either the offshore or coastal morphotype of common bottlenose dolphin, therefore, it is possible that some of the reported strandings were of the offshore form though that number is likely to be low, especially for states south of New York (Byrd *et al.* 2014).

This stock has also been impacted by two large unusual mortality events (UMEs), one in 1987–1988 and one in 2013–2015, both of which have been attributed to morbillivirus epidemics (Lipscomb *et al.* 1994, Morris *et al.* 2015). Both UMEs included deaths of dolphins north of Assateague, Virginia, in summer, corresponding solely to the Northern Migratory Coastal Stock area. 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 Northern Migratory 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). For the 2013–2015 UME, a total of 1614 stranded common bottlenose dolphins were recovered in the UME area which stretched from New York to Brevard County, Florida. Of these, 348 stranded dolphins were recovered from the states of New York, New Jersey, Delaware, and Maryland (https://www.fisheries.noaa.gov/national/marine-life-distress/2013-2015-bottlenose-dolphin-unusual-mortality-event-mid-atlantic, accessed 13 November 2019). While some of these deaths may be attributable to the Offshore Stock, the majority likely came from the Northern Migratory Coastal Stock given their geographic location. This number is likely an underestimate of the total number of deaths for this stock, however, because it does not include animals that stranded in Virginia and North Carolina in cold water months that might have come from this stock, and not all dolphins that died during the UME would have been recovered.

Table 4. Strandings of common bottlenose dolphins during 2014–2018 from North Carolina to New York that were ascribed to the Northern Migratory 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 this stock. However, in waters of North Carolina and Virginia there is likely overlap with other stocks during particular times of year. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 21 May 2019 for SER and 13 August 2019 for NER). Please note HI does not necessarily mean the interaction caused the animal's death.

State	**2014**			**2015**			**2016**			**2017**			**2018**			**Total**
	HI Yes	HI No	CBD	HI Yes	HI No	CBD	HI Yes	HI No	CBD	HI Yes	HI No	CBD	HI Yes	HI No	CBD	**(2014–2018)**
North Carolina	3	15	23	3	10	23	3	6	21	5	7	13	2	20	12	166
Virginia	5	5	44	8	6	55	11	6	33	9	1	46	9	1	50	289
Maryland	0	1	6	0	2	8	2	1	9	2	2	6	1	0	7	47
Delaware	0	0	7	1	2	5	0	1	8	0	1	6	2	2	17	52
New Jersey	0	2	16	0	0	24	0	7	4	3	10	7	1	10	4	88
New York	1	1	8	0	2	2	0	3	3	5	5	5	4	5	6	50
Total	**137**			**151**			**118**			**133**			**153**			**692**

[a] Strandings for North Carolina include data for November–April north of Cape Lookout when Northern Migratory Coastal animals may be in coastal waters. The stock identity of these strandings is highly uncertain and likely also includes animals from the NNCES Stock.
[b] Strandings from Virginia were ascribed to stock based upon both location and time of year. Some of the strandings ascribed to the Northern Migratory Coastal Stock could possibly be ascribed to the Southern Migratory Coastal Stock or NNCES Stock.
[c] Strandings from New York are assigned to both the Northern Migratory Coastal Stock and the Offshore Stock regardless of the month or location (coastal or sound waters) of their recovery.

HABITAT ISSUES

The coastal habitat occupied by this stock is adjacent to areas of high human densities, some industrialized areas, and waters that are heavily utilized for commercial and recreational fishing, and boating activities. The blubber of stranded dolphins examined during the 1987–1988 mortality event contained very high concentrations of organic pollutants (Kuehl *et al*. 1991). Total DDT levels measured in common bottlenose dolphins sampled in Cape May, New Jersey, were higher than 12 other sites sampled in the wNA and northern Gulf of Mexico (of 14 sites examined in total; Kucklick *et al*. 2011). Values for total PCBs exceeded toxic thresholds proposed by Kannan *et al*. (2000) and Schwacke *et al*. (2002) and may result in adverse effects on health or reproductive rates (Schwacke *et al*. 2002, Hansen *et al*. 2004, Yordy *et al*. 2010). 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). Exposure to high PCB levels has been linked to anemia, hyperthyroidism, and immune suppression in common bottlenose dolphins in Georgia (Schwacke *et al*. 2012). The exposure to environmental pollutants and subsequent effects on population health is an area of concern.

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 Northern Migratory 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 common 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 Northern Migratory 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 Northern Migratory Coastal Stock is 48 and so the zero mortality rate goal, 10% of PBR, is 4.8. The documented mean annual human-caused mortality for this stock for 2014–2018 ranged between a minimum of 12.2 and a maximum of 21.5. However, these estimates are biased low for the following reasons: 1) the total U.S. human-caused mortality and serious injury for the Northern Migratory Coastal Stock cannot be directly estimated because of the spatial overlap among the stocks of common bottlenose dolphins that occupy waters of North Carolina and Virginia resulting in uncertainty in the stock assignment of some 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). The total fishery-related mortality and serious injury for this stock is not less than 10% of the calculated PBR and therefore, cannot be considered to be insignificant and approaching a zero mortality and serious injury rate. The impacts of two large UMEs on the status of this stock are unknown. Analysis of trends in abundance suggests a probable decline in stock size between 2010–2011 and 2016, concurrent with a large UME in the area; 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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