COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*)
Northern North Carolina Estuarine System 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 (Mead and Potter 1995) from Florida to Canada. 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, demographically independent stocks distributed in coastal and estuarine waters of the wNA. The Northern North Carolina Estuarine System Stock is one such stock.

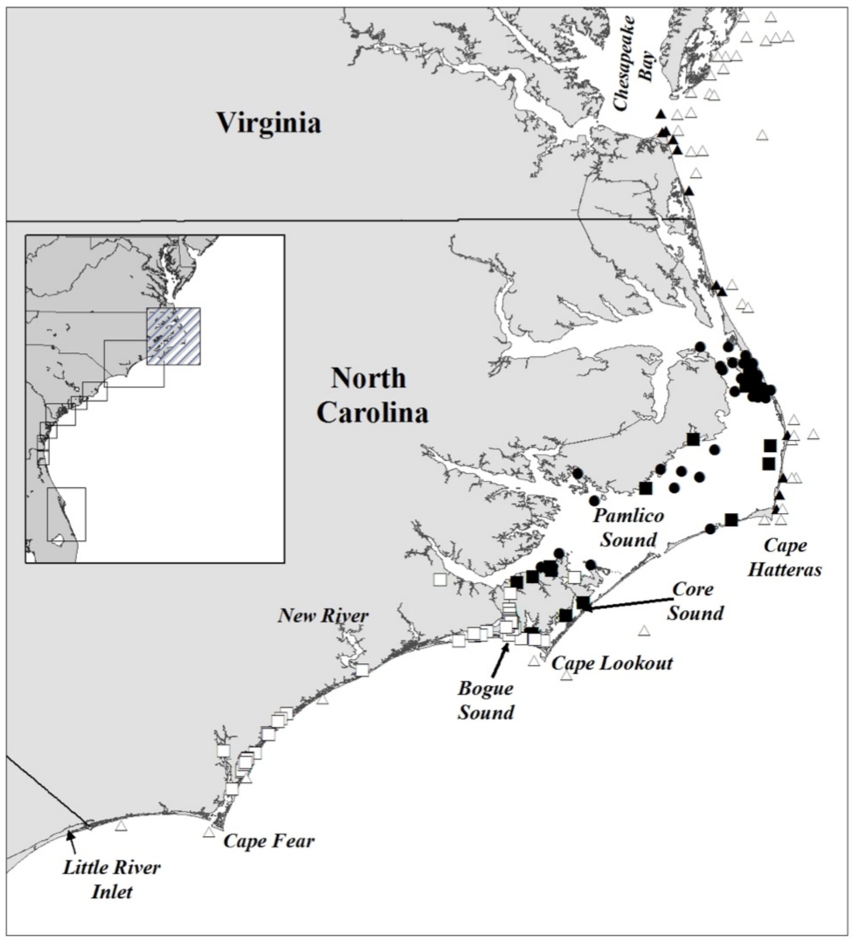

Figure 1. *The distribution of common bottlenose dolphins occupying coastal and estuarine waters in North Carolina and Virginia during July–August. Locations are shown from aerial surveys (triangles), satellite-linked telemetry (circles), and photo-identification studies (squares). Sightings assigned to the Northern North Carolina Estuarine System stock are shown with filled symbols (all fall within hatched box in inset map). Photo-identification data are courtesy of Duke University and the University of North Carolina at Wilmington.*

The Northern North Carolina Estuarine System (NNCES) Stock is best defined as animals that occupy primarily waters of the Pamlico Sound estuarine system (which also includes Core, Roanoke, and Albemarle sounds, and the Neuse River) during warm water months (July–August) (Figure 1). Members of this stock also use coastal waters (≤1 km from shore) of North Carolina from Beaufort north to Virginia Beach, Virginia, including the lower Chesapeake Bay during this time period (Garrison *et al.* 2017a). Many of these animals move out of the estuaries during colder water months and occupy coastal waters (≤3 km from shore) between the New River and Oregon Inlet, North Carolina (Garrison *et al.* 2017a). However, others continue to be present in the Pamlico Sound estuarine system during cold water months (Goodman Hall *et al*. 2013). These movements and the range of this stock have been inferred from a combination of photo-ID, satellite telemetry (Garrison *et al*. 2017a; 2017b) and stable isotope (Cortese 2000) data. Eighteen animals captured and released near Beaufort, North Carolina, between 1995 and 2006 were fitted with satellite-linked transmitters and or freeze-branded and were subsequently documented, through photo-ID surveys, in waters of Pamlico Sound in warm water months (Garrison *et al.* 2017b). Satellite telemetry data from one animal tagged near Virginia Beach in September 1998 indicated that this animal moved south into waters of Pamlico Sound during October (Garrison *et al.* 2017b). This dolphin was also observed in Pamlico Sound in July 2006, providing evidence that at least some members of this stock may move into nearshore coastal waters along the northern coast of North Carolina and into coastal waters of Virginia and perhaps into Chesapeake Bay during warm water months (Garrison *et al.* 2017b). Analysis of photo-ID and satellite telemetry data indicate that a portion of the stock moves out of Pamlico Sound into coastal waters south of Cape Hatteras during cold water months (Garrison *et al.* 2017b). Telemetry records show that NNCES animals move as far south as the New River during January and February (Garrison *et al*. 2017b). In addition, stable isotope analysis of animals sampled along the beaches of North Carolina between Cape Hatteras and Bogue Inlet during February and March showed very low stable isotope ratios of ^{18}O relative to ^{16}O (referred to as "depleted oxygen", Cortese 2000). One explanation for the depleted oxygen signature is a resident group of dolphins in Pamlico Sound that move into nearby coastal waters in the winter (NMFS 2001).

The distribution of the NNCES Stock overlaps in certain seasons with up to three other common bottlenose dolphin stocks. During warm water months (best defined as July and August), this stock overlaps with the Southern North Carolina Estuarine System (SNCES) Stock in estuarine waters near Beaufort, North Carolina, and in southern Pamlico Sound (Garrison *et al.* 2017b). However, SNCES Stock animals were not observed to move north of Cape Lookout in coastal waters nor into the main portion of Pamlico Sound during warm water months (Garrison *et al.* 2017b) thereby limiting the amount of overlap between the two stocks. Because the NNCES Stock also utilizes nearshore coastal waters of North Carolina north to Virginia Beach and the mouth of Chesapeake Bay, it likely overlaps with the Southern Migratory Coastal Stock in warm water months. During cold water months, the NNCES Stock overlaps in coastal waters with the Northern Migratory Coastal Stock, particularly between Cape Lookout and Cape Hatteras and may overlap with the Southern Migratory Coastal Stock between the New River and Beaufort Inlet. The timing of the seasonal movements into and out of Pamlico Sound and north along the coast likely occurs with some inter-annual variability related to seasonal changes in water temperatures and/or prey availability. Given the relatively small range of this stock and its seasonal movement in and out of the Pamlico Sound habitat, it is unlikely the stock contains multiple demographically independent populations. However, stocks of common bottlenose dolphins in other large estuaries show evidence of habitat partitioning that could suggest stock structure (Urian *et al*. 2009; Wells *et al*. 2017). To date, stock structure within this stock has not been investigated.

POPULATION SIZE

The best available abundance estimate for the NNCES Stock is 823 animals (CV=0.06) based upon photo-ID mark-recapture surveys in summer 2013 (Gorgone *et al*. 2014). This estimate may be negatively biased as the survey did not cover all of the stock's range (i.e., coastal waters).

Earlier abundance estimates (>8 years old)

Read *et al.* (2003) provided the first abundance estimate of common bottlenose dolphins that occur within the estuarine portion of the NNCES Stock range. This estimate, 919 (CV=0.13, 95% CI: 730–1,190), was based on a July 2000 photo-ID mark-recapture survey of a portion of North Carolina waters inshore of the barrier islands. However, the portion of the stock that may have occurred in coastal waters (≤1 km from shore) was not accounted for in this survey. Aerial survey data from 2002 (Garrison *et al.* 2016) were therefore used to account for this portion of the stock in coastal waters. The abundance estimate for the NNCES Stock during 2000–2002 was the combined abundance from estuarine and coastal waters. This combined estimate was 1,387 (CV=0.17). Because the survey did not sample all of the estuarine waters where dolphins are known to occur, the estimate of abundance may be negatively biased. Positive bias may have been introduced through the aerial survey data because Southern Migratory Coastal Stock dolphins may have been present in the coastal strip.

A photo-ID mark-recapture study was conducted by Urian *et al.* (2013) in July 2006 using similar methods to those in Read *et al.* (2003) and included estuarine waters of North Carolina from, and including, the Little River Inlet estuary (near the North Carolina/South Carolina border) to, and including, Pamlico Sound. This survey also included coastal waters up to Cape Hatteras extending up to 1 km from shore. In order to estimate the abundance for the NNCES Stock, only sightings north of 34°46' N in central Core Sound were used (Urian *et al.* 2013). The resulting abundance estimate was 950 animals (CV=0.23, 95% CI: 516–1,384) and included a correction for the proportion of dolphins in the population with non-distinct fins (Urian *et al.* 2013). Because the survey did not include estuarine waters of Albemarle or Currituck Sounds or more northern estuarine and coastal waters, it is likely that some portion of the NNCES Stock was outside of the boundaries of the survey. Thus, the 2006 abundance estimate was most likely negatively biased.

Recent surveys and abundance estimates

Photo-ID mark-recapture surveys were conducted in Pamlico, Albemarle, and Core Sounds and their tributaries during June–July 2013 to provide an abundance estimate for the NNCES Stock (see Gorgone *et al.* 2014). The surveys excluded nearshore coastal waters and inshore waters at the southern extent of the NNCES range (i.e., Bogue Sound, North River, and the southernmost portion of Core Sound) to avoid potential overlap with the SNCES and Southern Migratory Coastal stocks. Estimates were obtained using closed capture-mark-recapture models and a method described by Eguchi (2014) to correct for dolphins with indistinctive fins. The resulting abundance estimate was 823 (CV=0.06; Gorgone *et al.* 2014) and is likely to be negatively biased as not all of the stock's range (i.e., coastal waters) was covered in the survey.

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 of abundance for the NNCES Stock is 823 (CV=0.06). The minimum population estimate for the NNCES Stock is 782.

Current Population Trend

A trend analysis has not been conducted for this stock. Gorgone *et al.* (2014) noted that the estimate from 2013 (823; CV=0.06) was similar to the previous two estimates from 2006 (950, CV=0.23) and 2000 (919, CV=0.13), but methodological differences among the estimates need to be evaluated to quantify trends.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this 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). The minimum population size of the NNCES Stock of common bottlenose dolphins is 782. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor is 0.5 because the stock's status relative to optimum sustainable population (OSP) is unknown (Wade and Angliss 1997). The resulting PBR for this stock is 7.8 animals.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury for the NNCES Stock during 2011–2015 is unknown. The mean annual fishery-related mortality and serious injury for observed fisheries, for strandings, and for at-sea observations identified as fishery-related ranged between 0.2 and 17.6. Additional mean annual mortality and serious injury due to other human-caused sources (fishery research, at-sea entanglements in unidentified gear) was 0.6. The minimum total mean annual human-caused mortality and serious injury for this stock during 2011–2015 therefore ranged between 0.8 and 18.2 (Tables 1a, 1b and 1c). This range reflects several sources of uncertainty and is 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 detected or 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 the NNCES 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 nine commercial fisheries that interact, or that potentially could interact, with this stock. These include the Category I mid-Atlantic gillnet fishery, six Category II fisheries (North Carolina inshore gillnet, North Carolina long haul seine, mid-Atlantic haul/beach seine, Virginia pound net, North Carolina roe mullet stop net, and Atlantic blue crab trap/pot fisheries), and two Category III fisheries (the U.S. mid-Atlantic mixed species stop seine/weir/pound net fishery, which includes the North Carolina pound net fishery, and the Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line) fishery). Detailed fishery information is presented in Appendix III.

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 NNCES Stock. 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 observed by the Northeast and Southeast Fisheries Observer Programs. 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, April 26, 2006, available at http://www.nmfs.noaa.gov/pr/pdfs/fr/fr71-24776.pdf). 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 NNCES Stock (Waring *et al.* 2015). The current report covers the most recent available five-year estimate (NMFS 2016) for 2011–2015.

Mortality estimation for this stock is difficult because 1) observed takes are rare events, 2) the NNCES, Northern Migratory Coastal, Southern Migratory Coastal, and SNCES common bottlenose dolphin stocks overlap in coastal waters of North Carolina 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 likely insufficient to consistently detect rare bycatch events. To help address the first problem, two different analytical approaches were used to estimate common bottlenose dolphin bycatch rates during the period 2011–2015: 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 5 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). It should be noted that effort for internal North Carolina waters (i.e., Pamlico Sound Estuary) was not included in these analyses. Federal observer sampling rates in internal waters are low and insufficient to pool with bycatch rates coming from samples collected primarily in coastal/offshore waters. Internal waters are important habitat to the NNCES so this could lead to a downward bias in bycatch mortality estimates (see North Carolina Inshore Gillnet section below).

During the most recent five-year time period, 2011–2015, the combined average Northeast (NEFOP) and Southeast (SEFOP) Fisheries Observer Program observer coverage (measured in trips) for this fishery was 2.67% in state waters (0–3 miles from shore) and 5.36% in federal waters (3–200 miles from shore) (Lyssikatos and Garrison 2018). During this timeframe, two mortalities and one non-serious injury were observed. In January 2015, one mortality was observed by the NEFOP off Hatteras, North Carolina, entangled in a medium-mesh gillnet within 0.23 km of shore and was ascribed to the NNCES and Northern Migratory Coastal stocks (Lyssikatos and Garrison 2018) (this animal was also self-reported by the fisherman per the Marine Mammal Authorization Program). The second mortality was observed by the SEFOP off the coast of northern North Carolina in September 2014, and this animal was ascribed to the NNCES and Southern Migratory Coastal stocks (Lyssikatos and Garrison 2018). The animal was observed entangled in a small-mesh gillnet. In February 2013, the NEFOP observed an animal entangled in a small-mesh gillnet off the coast of North Carolina that was released alive without serious injury, and, therefore, not included in the bycatch estimate (Wenzel *et al.* 2015). This animal was ascribed to the NNCES and Northern

Migratory Coastal stocks. The most recent five-year mean minimum and maximum mortality estimates (2011–2015) were 0 and 16.4 (CV=0.22) animals per year, respectively (Table 1a; Lyssikatos and Garrison 2018).

However, based on documented serious injury and mortality in this fishery from both federal observer coverage and other data sources, the mean annual minimum mortality is likely not zero. Historical stranding data have documented multiple cases of dead, stranded dolphins recovered with gillnet gear attached (Byrd *et al.* 2014; Waring *et al.* 2015). During 2011–2015, stranding data documented one mortality that was recovered in Roanoke Sound with medium-mesh gillnet gear entangled around its rostrum and flipper. The gear entangled around its flipper was attributed to the North Carolina inshore gillnet fishery and gear entangled around the rostrum was attributed to the mid-Atlantic gillnet fishery. This mortality is therefore reported in both fishery sections. The mortality is included within the annual human-caused mortality and serious injury total for the North Carolina inshore gillnet fishery (Table 1b). It may also be accounted for in the observer-based fishery bycatch estimate for the mid-Atlantic gillnet fishery. Four other dead, stranded common bottlenose dolphins were recovered with markings indicative of interaction with gillnet gear, 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. One of the four cases was ascribed to the NNCES Stock alone, one was ascribed to both the NNCES and Southern Migratory Coastal stocks, and two cases were ascribed to multiple stocks including the Northern and Southern Migratory Coastal stocks and NNCES Stock. Overall, the low level of observer coverage, rarity of observed takes, and the inability to definitively assign each observed take to stock are sources of uncertainty in the bycatch estimates for this fishery.

North Carolina Inshore Gillnet

During 2011–2015, one dead dolphin stranding, ascribed to the NNCES Stock, was recovered inshore with attached gillnet gear. This animal was recovered during 2011 in Roanoke Sound with two different types of medium-mesh gillnet gear entangled around its rostrum and flipper. The gear entangled around its flipper was attributed to the North Carolina inshore gillnet fishery, and gear entangled around the rostrum was attributed to the mid-Atlantic gillnet fishery. This mortality is therefore reported in both fishery sections. The mortality is included within the annual human-caused mortality and serious injury total for the North Carolina inshore gillnet fishery (Table 1b). It may also be accounted for in the observer-based fishery bycatch estimate for the mid-Atlantic gillnet fishery. This mortality was included in the stranding database and in the stranding totals presented in Table 2 (Northeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 6 June 2016). The documented interaction in commercial gear represents a minimum known count of interactions with this fishery in the last five years.

Current information on interactions between common bottlenose dolphins and the North Carolina inshore gillnet fishery is based solely on stranding data as no bycatch has been observed by state and federal observer programs. There was limited federal observer coverage (0.28%) of this fishery from May 2010 through March 2012, when NMFS observed this fishery. No common bottlenose dolphin bycatch was recorded. However, the low level of federal observer coverage in internal waters where the NNCES Stock largely resides is likely insufficient to detect bycatch events of common bottlenose dolphins if they were to occur in the inshore commercial gillnet fishery. The North Carolina Division of Marine Fisheries (NCDMF) has operated their own observer program since 2000 due to sea turtle bycatch in inshore gillnets. The NCDMF applied for and obtained an Incidental Take Permit (ITP) in September 2013 that covers gillnet fisheries in all internal state waters. This ITP requires monitoring of gillnets statewide in internal waters with at least 7% observer coverage of large-mesh nets during spring, summer, and fall, and at least 1% observer coverage of small mesh nets during the same seasons (U.S. Dept. of Commerce 2013, Notice of permit issuance, Fed. Register 78: 57132–57133). No bycatch of common bottlenose dolphins has been recorded by state observers since they began monitoring in 2000.

North Carolina Long Haul Seine

There have been no documented interactions between common bottlenose dolphins of the SNCES Stock and the North Carolina long haul seine fishery during 2011–2015. The fishery includes fishing with long haul seine gear to target any species in waters off North Carolina, including estuarine waters in Pamlico and Core Sounds and their tributaries. There has not been federal observer coverage of this fishery.

Mid-Atlantic Haul/Beach Seine

During 2011–2015, stranding data documented one serious injury involving a common bottlenose dolphin and the mid-Atlantic haul/beach seine fishery in Virginia (Maze-Foley and Garrison 2017). The animal was ascribed to the Northern and Southern Migratory Coastal and NNCES stocks. The serious injury occurred during October 2014, and is included in the annual human-caused mortality and serious injury total for this stock (Table 1b) as well as in the stranding database and in the stranding totals presented in Table 2 (Northeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 6 June 2016). 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 2012–2015. 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.

Virginia Pound Net

During 2011–2015, there were no documented mortalities or serious injuries in pound net gear of common bottlenose dolphins that could be ascribed to the NNCES Stock (Northeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 6 June 2016). However, during 2011–2015, two dolphin carcasses stranded with twisted twine markings indicative of interactions with Virginia pound net gear, 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. These cases are not included in the annual human-caused mortality and serious injury total for this stock (Table 1b). Both strandings were ascribed to multiple stocks: the Northern and Southern Migratory Coastal and NNCES stocks. These two animals stranded inside estuarine waters near the mouth of the Chesapeake Bay in September and October of 2011. These mortalities were included in the stranding database and in the stranding totals presented in Table 2. Because there is no systematic observer program for the Virginia pound net fishery, no estimate of bycatch mortality is available. The overall impact of the Virginia Pound Net fishery on the NNCES Stock is unknown due to limited information on the extent to which the stock occurs within waters inside the mouth of the Chesapeake Bay.

North Carolina Roe Mullet Stop Net

During 2011–2015, stranding data documented one mortality in which a common bottlenose dolphin was found entangled and dead in a stop net (this animal was also self-reported by the fisherman per the Marine Mammal Authorization Program). This mortality occurred during November 2013, and the animal was ascribed to the NNCES and Southern Migratory Coastal stocks and is included in the annual human-caused mortality and serious injury total for this stock (Table 1b). In addition, in 2015 a dead dolphin with line markings indicative of interaction with stop net gear was recovered ~300 yards from a stop net, but it is unknown whether the interaction with gear contributed to the death of this animal, and this case is therefore not included in the annual human-caused mortality and serious injury total for this stock. This animal was ascribed to the NNCES, SNCES, and Southern Migratory Costal stocks. Both mortalities were included in the stranding database and in the stranding totals presented in Table 2 (Southeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 18 May 2016). No estimate of bycatch mortality is available for the stop net fishery, and the documented interaction in this commercial gear represents a minimum known count of interactions with this fishery in the last five years. This fishery has not had regular, ongoing federal or state observer coverage. However, the NMFS Beaufort laboratory observed this fishery in 2001–2002 (Byrd and Hohn 2010), and Duke University observed the fishery in 2005–2006 (Thayer *et al.* 2007). Entangled dolphins were not documented during these formal observations, but two mortalities of dolphins due to entanglement in stop nets occurred in 1993 and 1999, and were documented by the stranding network in North Carolina (Byrd and Hohn 2010).

Atlantic Blue Crab Trap/Pot

During 2011–2015, stranding data documented one mortality and two serious injuries of common bottlenose dolphins entangled in trap/pot gear, all in Virginia. The mortality occurred during 2015 in commercial blue crab trap/pot gear. One serious injury occurred in 2014 in commercial blue crab trap/pot gear and one occurred in 2015 in unidentified trap/pot gear. All three cases were ascribed to the Southern Migratory Coastal and NNCES stocks, and all are included in the annual human-caused mortality and serious injury total for this stock (Table 1b). These animals were included in the stranding database and in the stranding totals presented in Table 2 (Northeast Regional Marine Mammal Stranding Network; Southeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 18 May 2016 (SER) and 6 June 2016 (NER)). Because there is no observer program, it is not possible to estimate the total number of 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).

North Carolina Pound Net

During 2011–2015, there were no documented mortalities or serious injuries in North Carolina pound net gear of common bottlenose dolphins that could be ascribed to the NNCES Stock (Northeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 6 June 2016). The North Carolina pound net fishery is included within the Category III U.S. mid-Atlantic mixed species stop seine/weir/pound net fishery. The pound net is a common fishing gear used in portions of North Carolina's estuarine waters. However, the level of interaction with common bottlenose dolphins is unknown. Between 1997 and 2015, there has only been one documented mortality (2008) in North Carolina pound net gear, and this came from stranding data (Byrd *et al*. 2014). Because there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with this commercial gear.

Hook and Line (Rod and Reel)

During 2011–2015, stranding data included two mortalities ascribed to the NNCES Stock for which hook and line gear entanglement or ingestion were documented. For one of the mortalities, the stranding data suggested the hook and line gear interaction was not a contributing factor to cause of death (2012, North Carolina). For one mortality, it could not be determined whether the hook and line gear interaction contributed to cause of death (2011, Virginia). Neither of these mortalities is included in the annual human-caused mortality and serious injury total for this stock (Table 1b).

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, so documented interactions in this gear represent a minimum known count of interactions in the last five years.

Other Mortality

There have been occasional incidental takes of common bottlenose dolphins during research activities. Two interactions with research gillnet gear were documented during 2011–2015 that were ascribed to the NNCES Stock: one mortality and one live release for which it could not be determined if the animal was seriously injured. The two animals were captured in 2012 in the same research sink gillnet targeting striped bass in North Carolina estuarine waters. Both research gillnet interactions were included in the stranding database and are included in Table 2. The mortality was included in the annual human-caused mortality and serious injury total for this stock (Table 1c).

In addition to animals included in the stranding database, during 2011–2015, there were at-sea observations in the NNCES Stock area of live common bottlenose dolphins entangled in unidentified line/fishing gear in two cases and one entangled in a sport toy flying ring (e.g., Aerobie or similar flying ring) in the third case. One observation occurred during 2011 and one during 2015, and both of these animals were considered seriously injured. Both were ascribed to the NNCES Stock alone and are included in the annual human-caused mortality and serious injury total for this stock (Table 1c). The remaining observation occurred during 2014 and it could not be determined if the animal was seriously injured (see Maze-Foley and Garrison 2017 for details on serious injury determinations). The 2014 observation was ascribed to the NNCES and SNCES stocks. All mortalities and serious injuries from known sources for the NNCES Stock are summarized in Tables 1a, 1b and 1c.

Table 1a. Summary of the incidental mortality and serious injury of common bottlenose dolphins of the Northern North Carolina Estuarine System Stock for the commercial mid-Atlantic gillnet fishery, which has an ongoing, systematic federal observer program. The years sampled (Years), the type of data used (Data Type), the annual percentage observer coverage (Observer Coverage), the observed serious injuries and mortalities recorded by on-board observers, and the mean annual estimate of mortality and serious injury (CV in parentheses) 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	2011–2015	Obs. Data Logbook	2.0, 2.6, 3.1, 3.6, 5.6	0, 0, 0, 0, 0	0, 0, 0, 1, 1	Min=0 Max=16.4 (0.22)
Mean Annual Mortality due to the observed mid-Atlantic gillnet commercial fishery (2011–2015)						**Min=0 Max=16.4 (0.22)**

Table 1b. Summary of the incidental mortality and serious injury of common bottlenose dolphins of the Northern North Carolina Estuarine System Stock during 2011–2015 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. In addition, mortality due to research and other non-commercial fishery takes are included, as well as a total mean annual human caused mortality and serious injury summed from all sources.

Fishery	Years	Data Type	5-year Count Based on Stranding Data
North Carolina Inshore Gillnet	2011–2015	Limited Federal Observer and Stranding Data	1
North Carolina Long Haul Seine	2011–2015	Stranding Data	0
Mid-Atlantic Haul/Beach Seine	2011–2015	Limited Observer and Stranding Data	Min=0 Max=1
Virginia Pound Net[a]	2011–2015	Stranding Data	0
North Carolina Roe Mullet Stop Net[b]	2011–2015	Stranding Data	Min=0 Max=1
Atlantic Blue Crab Trap/Pot	2011–2015	Stranding Data	Min=0 Max=3
North Carolina Pound Net	2011–2015	Stranding Data	0
Hook and Line[c]	2011–2015	Stranding Data	0
Mean Annual Mortality due to unobserved commercial fisheries (2011–2015)			**Min=0.2 Max=1.2**

[a] 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.
[b] Stop Net interactions are included if the animal was found entangled in stop net gear. Stranding with line markings indicative of interaction with stop net gear are not included within the table. See "North Carolina Roe Mullet Stop 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. See "Hook and Line" text for more details.

Table 1c. Summary of the incidental mortality and serious injury of common bottlenose dolphins of the Northern North Carolina Estuarine System Stock during 2011–2015 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 (2011–2015) (Table 2a)	**Min=0 Max=16.4 (0.22)**

Mean Annual Mortality due to unobserved commercial fisheries (2011–2015) (Table 2b)	**Min=0.2 Max=1.2**
Research Takes (5-year Min/Max Count)	1
Other takes (5-year Min/Max Count)	2
Mean Annual Mortality due to research and other takes (2011–2015)	**0.6**
Minimum Total Mean Annual Human-Caused Mortality and Serious Injury (2011–2015)	**Min=0.8 Max=18.2**

Strandings

Between 2011 and 2015, 895 common bottlenose dolphins stranded along coastal and estuarine waters of North Carolina, Virginia, and Maryland that could be assigned to the NNCES Stock (Table 2; Northeast Regional Marine Mammal Stranding Network, Southeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 18 May 2016 (SER) and 6 June 2016 (NER)). It could not be determined if there was evidence of human interaction (HI) for 635 of these strandings, and for 187 it was determined there was no evidence of human interaction. The remaining 73 showed evidence of human interactions (Table 2). Wells *et al.* (2015) estimated only one-third of common bottlenose dolphin carcasses in estuarine environments are recovered. In most cases, it was not possible to determine if an HI had occurred due to the decomposed state of the stranded animal. Of the 12 (of 156) estuarine strandings positive for HI, seven (58%) of them exhibited evidence of fisheries entanglement (e.g., entanglement lesions, attached gear), and two were incidental takes from research gillnet gear (described above). 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 where stocks overlap, particularly in coastal waters of North Carolina and Virginia, and estuarine waters near Beaufort Inlet. Of the 895 strandings ascribed to the NNCES Stock, 156 were ascribed solely to this stock. It is likely, therefore, that the counts in Table 2 include some animals from the Southern Migratory Coastal, Northern Migratory Coastal, and SNCES stocks, and thereby overestimate the number of strandings for the NNCES Stock; those strandings that could not be definitively ascribed to the NNCES Stock were 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 (Byrd *et al*. 2014).

This stock has also been impacted by two 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 in spatiotemporal locations that apply to the NNCES 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) and it was estimated that 10 to 50% of the coast-wide stock died as a result of this UME (Scott *et al.* 1988; Eguchi 2002). Impacts to the NNCES Stock alone are not known. However, Scott *et al.* (1988) indicated that the observed mortalities from this event affected primarily coastal dolphins. The total number of stranded common bottlenose dolphins from New York through North Florida (Brevard County) during the 2013–2015 UME was ~1827 (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, again suggesting that coastal stocks may have been more impacted by this UME than estuarine stocks (Morris *et al.* 2015). However, the habitat of the NNCES stock includes more nearshore coastal waters (in winter) than many estuarine stocks and so it may have been more heavily impacted by this UME than other estuarine stocks. An assessment of the impacts of the 2013–2015 UME to common bottlenose dolphin stocks in the wNA is ongoing.

Table 2. Strandings of common bottlenose dolphins during 2011–2015 from North Carolina, Virginia, and Maryland that were ascribed to the Northern North Carolina Estuarine System (NNCES) 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. Strandings observed in North Carolina are separated into those occurring within the Pamlico Sound estuarine system (Estuary) vs. coastal waters. Assignments to stock were based upon the understanding of the seasonal movements of this stock. However, particularly in coastal waters, there is likely overlap between the NNCES Stock and other common bottlenose dolphin stocks. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 18 May 2016 (SER) and 6 June 2016 (GAR)). Please note HI does not necessarily mean the interaction caused the animal's death.

State	**2011**			**2012**			**2013**			**2014**			**2015**		
Type	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
North Carolina - Estuary	1[a]	3	8	3[b]	1	15	3[c]	13	45	2[d]	3	35	3[e]	3	18
North Carolina - Coastal	7[f]	20	25	12[g]	15	19	7[h]	46	69	2[i]	22	27	7[j]	15	25
Virginia[k]	5[l]	2	13	1[m]	2	12	12[n]	35	275	5[o]	3	16	3[p]	3	22
Maryland[k]	0	0	1	0	0	0	0	1	6	0	0	4	0	0	0
Annual Total	85			80			512			119			99		

[a] Includes 1 FI, an entanglement interaction with commercial gillnet gear (mortality, North Carolina inshore gillnet fishery).
[b] Includes 2 entanglement interactions in research sink gillnet gear (1 mortality; 1 released alive, could not be determined if seriously injured) and 1 FI.
[c] Includes 2 FIs.
[d] Includes 1 FI.
[e] Includes 2 FIs, 1 of which had markings indicative of interactions with gillnet gear (mortality).
[f] Includes 4 FIs.
[g] Includes 9 FIs, 1 of which involved ingestion of hook and line gear (mortality), and 3 of which had markings indicative of interactions with gillnet gear (mortalities).
[h] Includes 4 FIs, 1 of which was an entanglement in a stop net (mortality, North Carolina roe mullet stop net fishery). Also includes 2 mortalities with evidence of a boat strike.
[i] Includes 2 FIs, 1 of which had markings indicative of interactions with gillnet gear (mortality).
[j] Includes 6 FIs, 1 of which had markings indicative of an entanglement in a stop net (mortality, North Carolina roe mullet stop net fishery).

[k] Strandings from Virginia and Maryland include primarily waters inside Chesapeake Bay during late summer through fall. It is likely that the NNCES Stock overlaps with the Southern Migratory Coastal Stock in this area.
[l] Includes 5 FIs, 1 of which was an entanglement in hook and line gear (mortality). Two FIs were mortalities with twisted twine markings indicative of interaction with Virginia pound net gear.
[m] A mortality with evidence of a boat strike.
[n] Includes 7 FIs.
[o] Includes 3 FIs. One animal was released alive seriously injured following entanglement in commercial crab trap/pot gear. Another animal was released alive seriously injured following capture in a haul seine. Also includes 1 mortality with evidence of a boat strike.
[p] Includes 2 FIs. One FI was an entanglement in commercial blue crab trap/pot gear (mortality), and the other was an entanglement in unidentified trap/pot gear (released alive seriously injured).

HABITAT ISSUES

This stock inhabits areas with significant drainage from agricultural, industrial and urban sources (Lindsey *et al.* 2014), and as such is exposed to contaminants in runoff from those sources. The blubber of 47 common bottlenose dolphins captured and released near Beaufort, North Carolina, contained levels of organochlorine contaminants, including DDT and PCBs, sufficiently high to warrant concern for the health of dolphins, and seven had unusually high levels of the pesticide methoxychlor (Hansen *et al.* 2004). Schwacke *et al.* (2002) found that the levels of polychlorinated biphenyls (PCBs) observed in female common bottlenose dolphins near Beaufort, North Carolina, would likely impair reproductive success, especially of primiparous females. In addition, 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. However, this stock is considered strategic under the MMPA. PBR for the NNCES Stock is 7.8 and so the zero mortality rate goal, 10% of PBR, is 0.8. The documented mean annual human-caused mortality for this stock for 2011–2015 ranged between a minimum of 0.8 and a maximum of 18.2. However, these estimates are biased low for the following reasons: 1) the total U.S. human-caused mortality and serious injury for this stock cannot be directly estimated because of the spatial overlap of several stocks of common bottlenose dolphins in 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). Given these uncertainties, and the fact that the maximum mean annual human-caused mortality and serious injury exceeds PBR, NMFS considers this stock strategic under the MMPA. 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 impact of the 2013–2015 UME on the status of this stock is unknown. The status of this stock relative to OSP is unknown. There are insufficient data to determine the population trends for this stock.

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