May 2016

COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*) Northern North Carolina Estuarine System Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

In the western North Atlantic, the coastal morphotype of common bottlenose dolphins is continuously distributed in nearshore coastal and estuarine waters along the U.S. Atlantic coast south of Long Island, New York, around the Florida peninsula and into the Gulf of Mexico. Several lines of evidence support a distinction between dolphins inhabiting coastal waters near the shore and those present primarily in the inshore waters of the bays, sounds and estuaries. Photo-identification (photo-ID) and genetic studies support the existence of resident estuarine animals in several areas (Caldwell 2001; Gubbins 2002; Zolman 2002; Gubbins *et al.* 2003; Mazzoil *et al.* 2005; Litz *et al.* 2012), and similar patterns have been observed in bays and estuaries along the Gulf of Mexico coast (Wells *et al.* 1987; Balmer *et al.* 2008). Recent genetic analyses using both mitochondrial DNA and nuclear microsatellite markers found significant differentiation between animals biopsied in coastal and estuarine areas along the Atlantic coast (Rosel *et al.* 2009), and between those biopsied in coastal and estuarine waters at the same latitude (NMFS unpublished data). Similar results have been found off the west coast of Florida (Sellas *et al.* 2005; Balmer *et al.* 2008).

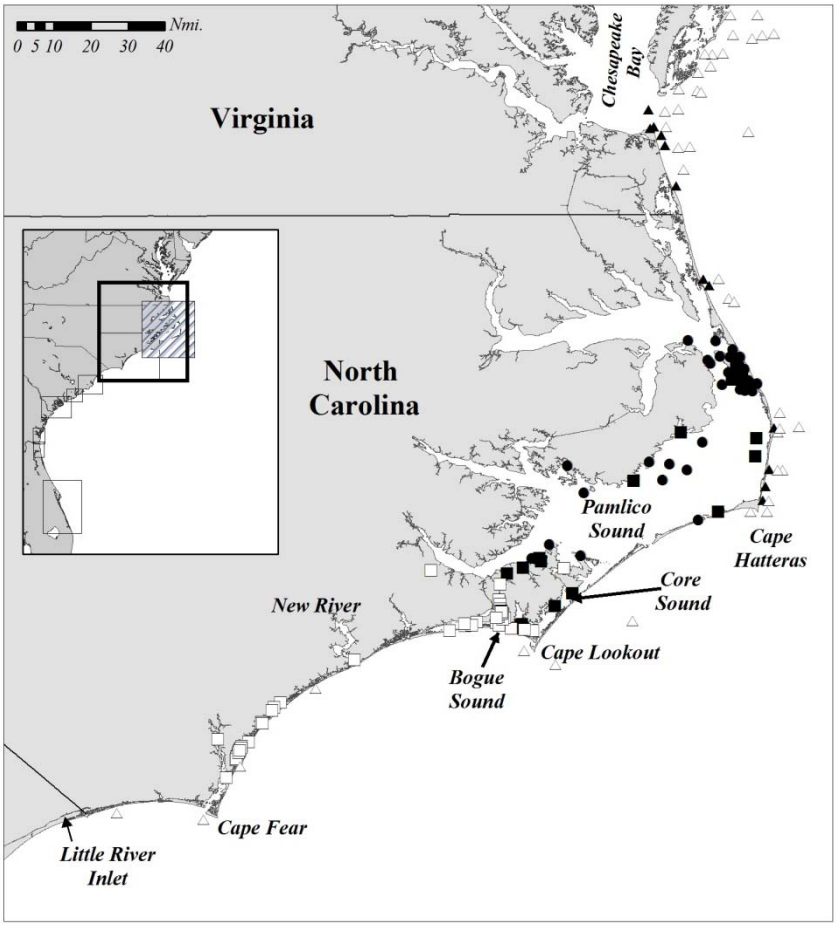

Figure 1. *The distribution of bottlenose dolphins occupying coastal and estuarine waters in North Carolina and Virginia during July-August. Locations are shown from aerial surveys (triangles), satellite-linked telemetry (circles), and photo-identification studies (squares). Sightings assigned to the 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 estuarine waters of Pamlico Sound during warm water months (July-August). Members of this stock are also thought to make use of coastal waters (<1 km from shore) of North Carolina from Beaufort north to southern Virginia and the lower Chesapeake Bay during this time period. Most of these animals move out of Pamlico Sound during colder water months and occupy coastal waters (< 3km from shore) between the New River and Cape Hatteras. However, some animals continue to be present in Pamlico Sound during cold water months (Goodman *et al*. 2013).

The movements and range of this stock have been inferred from a combination of photo-ID, tag telemetry, stable isotope and genetic data. Animals captured and released near Beaufort, North Carolina, were fitted with satellite-linked transmitters and or freeze-branded during July 1995 (30 animals) (Hansen and Wells 1996), November 1999 (3 animals), April 2000 (8 animals) and April 2006 (5 animals) (Hohn and Hansen, NMFS unpublished data). Long-term photo-ID studies conducted in waters of North Carolina include records of some of these animals and revealed that 18 occupied waters of Pamlico Sound during warm water months. For example, tag telemetry data from one animal that was tagged near Virginia Beach in September 1998 indicated that this animal moved south into waters of Pamlico Sound during October (NMFS unpublished data). During July 2006, the animal was observed during photo-ID surveys within the sound 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 (Urian, pers. comm.). In addition, there are photo-ID matches between inshore waters of Virginia Beach, Virginia, and Pamlico Sound (Urian, pers. comm.) that also demonstrate movements of NNCES animals between these areas during warm water months. There are fewer telemetry data for assigned NNCES animals during cold water months. Bottlenose dolphins have been observed in the Pamlico Sound area during cold water months (Goodman Hall *et al*. 2013), however, photo-ID studies, available tag data and stable isotope data indicate that a portion of the stock moves out of Pamlico Sound into coastal waters south of Cape Hatteras during cold water months. Telemetry records show that NNCES animals move as far south as the New River during January and February (NMFS unpublished data). 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 movements of animals from the NNCES Stock are distinct from those of the Southern North Carolina Estuarine System Stock (SNCES). Some of the animals tagged or freeze-branded near Beaufort moved south to Cape Fear and occupied nearshore coastal and estuarine waters during cold water months. During warm water months, these animals moved north and occupied inshore and nearshore coastal waters near Cape Lookout including Bogue Sound and Core Sound. It is probable that there is spatial overlap between these 2 estuarine stocks during this time in the waters near Beaufort. 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 (NMFS unpublished data; Duke University unpublished data; University of North Carolina at Wilmington unpublished data). These movement patterns are consistent with those seen in resightings of individual dolphins during a photo-ID study that sampled much of the estuarine waters of North Carolina (Read *et al.* 2003). Read *et al.* (2003) suggested that movement patterns, differences in group sizes, and habitats are consistent with 2 stocks of animals occupying estuarine waters of North Carolina. Finally, genetic analysis of samples from animals in waters of southern North Carolina (between Cape Lookout and the North Carolina/South Carolina border) demonstrate significant differentiation from animals occupying waters from Virginia and further north and waters of South Carolina (Rosel *et al.* 2009).

In summary, during warm water months, the NNCES Stock occupies primarily estuarine waters of central and northern North Carolina, particularly Pamlico Sound, as well as nearshore coastal waters (< 1 km from shore) up to Assateague, Virginia, including the lower Chesapeake Bay (Figure 1). It likely overlaps with animals from the Southern Migratory Coastal Stock in coastal waters during these months, and SNCES Stock animals at the northern end of their range. During cold water months, the NNCES Stock primarily moves out of estuarine waters and occupies nearshore coastal waters (< 3km from shore) between the New River and Oregon Inlet. It overlaps with the Northern Migratory Coastal Stock during this period, particularly between Cape Lookout and Cape Hatteras and may overlap with the Southern Migratory Coastal Stock in the smaller region 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.

In prior stock assessment reports, the animals within the estuarine waters of Pamlico Sound were included in the abundance estimates and stock assessment reports for the Northern Migratory Coastal Stock and the winter “mixed” North Carolina management unit of coastal bottlenose dolphins (Waring *et al.* 2007). However, they are now recognized as a distinct stock based upon these differences in seasonal ranging patterns and stable isotope signatures.

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).

Earlier abundance estimates

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. The 2006 survey also included coastal waters up to Cape Hatteras extending up to 1 km from shore, consistent with the current understanding of the distribution of this stock. In order to estimate the abundance for the NNCES alone, only sightings north of 34°46' N in central Core Sound were used. The resulting abundance estimate included a correction for the proportion of dolphins with non-distinct fins in the population. The abundance estimate for the NNCES Stock based upon photo-ID mark-recapture surveys in 2006 was 950 animals (CV=0.23, 95% Confidence Interval=516-1,384; 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.

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% Confidence Interval=730-1,190), was based on a photo-ID mark-recapture survey of a portion of North Carolina waters inshore of the barrier islands, conducted during July 2000. 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, In addition, the portion of the stock that may have occurred in coastal waters was not accounted for in this survey. Aerial survey data from 2002 (NMFS) 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).

Recent surveys and abundance estimates

Photo-ID 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).

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 20^{th} 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 2 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 was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of the 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 this stock is of unknown status. 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 2009–2013 is unknown because this stock is known to interact with unobserved fisheries (see below). The mean annual fishery-related mortality and serious injury for observed fisheries and for strandings and at-sea observations identified as fishery-caused ranged between 0.6 and 15.9. Additional mean annual mortality and serious injury due to other human-caused actions (fishery research) ranged from 0.4 to 0.8. The minimum total mean annual human-caused mortality and serious injury for this stock during 2009–2013 ranged between 1.0 and 16.7. This range reflects the uncertainty in assigning observed or reported mortalities to a particular stock.

Fishery Information

The commercial fisheries that interact, or that potentially could interact, with this stock are the Category I mid-Atlantic gillnet fishery; the Category II North Carolina long haul seine; North Carolina inshore gillnet; mid-Atlantic haul/beach seine; Virginia pound net; North Carolina roe mullet stop net; and Atlantic blue crab trap/pot fisheries; and the Category III 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. The magnitude of the interactions with each of these fisheries is unknown because of both uncertainty in the movement patterns of the stock and the spatial overlap between the NNCES Stock and other common bottlenose dolphin stocks in coastal waters. Observer coverage is also limited or non-existent for most of these fisheries, thus stranding data are used as an indicator of fishery-related interactions. There have been no documented interactions between common bottlenose dolphins of the NNCES Stock and the North Carolina long haul seine fishery or the U.S. mid-Atlantic mixed species stop seine/weir/pound net fishery during 2009–2013; however, it should be noted there is no observer coverage of these fisheries.

Mid-Atlantic Gillnet

Background

This fishery has the highest documented level of mortality of coastal morphotype common bottlenose dolphins, and the sink gillnet gear in North Carolina is its largest component in terms of fishing effort and observed takes. Because the Northern Migratory Coastal, Southern Migratory Coastal, NNCES and SNCES Stocks of bottlenose dolphins all occur in waters off of North Carolina, it is not possible to definitively assign every observed mortality, or extrapolated bycatch estimate, to a specific stock. Between 1995 and 2000 a total of 14 takes occurred, 13 mortalities and 1 live release: 1 in 1995 (mixed finfish), 1 in 1996 (spanish mackerel), 3 in 1998 (1 smooth dogfish, 1 spiny dogfish and 1 in beach-anchored gillnet targeting weakfish), 5 in 1999 (2 spiny dogfish, 1 striped bass, 1 shark, and 1 live release from gear targeting spanish mackerel), 4 in 2000 (1 kingfish, 1 spiny dogfish, 1 bluefish/smooth dogfish, and 1 in beach-anchored gillnet targeting striped bass). The observed takes occurred in gear off North Carolina (n=10), Virginia (n=2) and New Jersey (n=2).

The Bottlenose Dolphin Take Reduction Team was convened in October 2001, in part, to reduce bycatch in gillnet gear. While the Bottlenose Dolphin Take Reduction Plan (BDTRP) was being developed and implemented, there were 7 additional bottlenose dolphin mortalities observed in the mid-Atlantic gillnet fishery from 2001-2006. Three mortalities were observed in 2001 with 1 occurring off of northern North Carolina during April (monkfish fishery) and 2 occurring off of Virginia during November (striped bass fishery). Four additional mortalities were observed along the North Carolina coast near Cape Hatteras: 1 in May 2003 (Spanish mackerel), 1 in September 2005 (Spanish mackerel), 1 in September 2006 (Spanish mackerel), and 1 in October 2006 (king mackerel). The BDTRP was implemented in May 2006 and resulted in changes to gillnet gear configurations and fishing practices.

During 2007-2011 only 1 take was observed by the Southeast Fisheries Observer Program off the coast of northern North Carolina during the month of October. There were no observed takes by the Northeast Fisheries Observer Program (NEFOP) during 2007-2011.

Pre-Take Reduction Plan Mortality Estimation (2002-2006)

All available data from 1995 to 2006 were used to estimate total mortality of common bottlenose dolphins in the mid-Atlantic gillnet fishery. Three alternative approaches were used to estimate a pre-BDTRP bycatch rate for the period 2002-April 2006. First, a generalized linear model (GLM) approach was used similar to that described in Palka and Rossman (2001). The dataset used in the GLM approach included all observed trips and mortalities from 1995 to April 2006 filtered to include only trips that reflected fishing practices in effect during the period from 2002 to April 2006. Second, a simple ratio estimator of catch per unit effort (CPUE = observed catch / observed effort) was used based directly upon the observed data collected from 2002 to April 2006. Finally, a ratio estimator pooled across years 2002-April 2006 was used to estimate different CPUE values for the pre-BDTRP period. In each case,

the annual reported fishery effort (represented as reported landings) was multiplied by the estimated bycatch rate to develop annual estimates of fishery-related mortality, again similar to the approach in Palka and Rossman (2001). To account for the uncertainty among the 3 alternative approaches, the average of the 3 model estimates (and the associated uncertainty) was used to estimate the mortality of bottlenose dolphins for this fishery (Table 2). It should be noted that the extrapolated estimates of total mortality include landings from inshore North Carolina waters (see North Carolina Inshore Gillnet section below) where the NNCES Stock is known to occur. The live release from 1999 and takes from beach anchored gillnets reported in the background text were not included in this analysis. Only years 2002-April 2006 are reported here as a new analytical approach is described below for the most recent 5-year mortality analysis covering calendar years 2007-2011.

Table 1. Summary of the 2002-2006 incidental mortality of common bottlenose dolphins in the Northern North Carolina Estuarine System Stock in the commercial mid-Atlantic coastal gillnet fisheries. The estimated annual and average mortality estimates are shown for the period prior to the implementation of the Bottlenose Dolphin Take Reduction Plan (pre-BDTRP) and after the implementation of the plan (post-BDTRP). Three alternative modeling approaches were used, and the average of the 3 was used to represent mortality estimates. The minimum and maximum estimates indicate the range of uncertainty in assigning observed bycatch to stock. Observer coverage is measured as a proportion of reported landings (tons of fish landed). Data are derived from the Northeast Observer program, NER dealer data, and NCDMF dealer data. Values in parentheses indicate the CV of the estimate. GLM = generalized linear model.

Period	Year	Observer Coverage	Min Annual Ratio	Min Pooled Ratio	Min GLM	Max Annual Ratio	Max Pooled Ratio	Max GLM
pre-BDTRP	2002	0.01	0	0	15.64 (0.63)	0	39.45 (0.92)	33.69 (0.38)
	2003	0.01	0	0	11.03 (0.58)	49.46 (0.94)	12.77 (0.92)	19.29 (0.36)
	2004	0.02	0	0	12.10 (0.62)	0	28.46 (0.92)	28.42 (0.34)
	2005	0.03	0	0	11.84 (0.60)	0	22.58 (0.92)	23.01 (0.37)
	Jan-Apr 2006	0.03	0	0	1.40 (0.50)	0	0	1.99 (0.37)
Annual Avg. pre-BDTRP			Minimum: 3.47 (CV=0.30)			Maximum: 19.79 (CV=0.11)		

During 2002-2006, there were 3 observed takes in the mid-Atlantic gillnet fishery that could potentially be assigned to the NNCES Stock. However, in each of these cases, the take also could potentially be assigned to the Southern Migratory Coastal Stock because they occurred in near-shore coastal waters of northern North Carolina. As stated previously, observed mortalities (and effort) cannot be definitively assigned to a particular stock within certain regions and times of year; therefore, the minimum and maximum possible mortality for the NNCES Stock are presented for comparison to PBR (Table 1).

Based upon these analyses, the minimum and maximum mean mortality estimates for the NNCES Stock for the pre-BDTRP period (2002-Apr 2006) were 3.47 (CV=0.30) and 19.79 (CV=0.11) animals per year, respectively (Table 1).

Post-Take Reduction Plan Mortality Estimation (2007-2011)

Different from the pre-BDTRP analytical approach, only 2 alternative approaches were used to estimate common bottlenose dolphin bycatch rates during the post-BDTRP period: 1) a simple annual ratio estimator of CPUE per year based directly upon the observed data from 2007-2011 and 2) a pooled CPUE (where all observer data from 2007-2011 were combined into one sample to estimate CPUE). 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. There were not enough observed take events in the post-BDTRP data set to run a GLM. Similar to the pre-BDTRP analytical approach, to account for the uncertainty in these 2 alternative approaches, the average of the 2 model estimates (and the associated uncertainty) were used to estimate the mean mortality of common bottlenose dolphins for this fishery (Table 2). It should be noted that unlike the analytical approach used in the pre-BDTRP analysis, effort from internal North Carolina waters (i.e., Pamlico Sound Estuary) was not included in the 2007-2011 post-TRP analysis. 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 2007-2011, 1 bottlenose dolphin take was observed (2009) by the Southeast Fishery Observer Program (SEFOP) off northern North Carolina that could potentially be assigned to the NNCES or Northern or Southern Migratory Coastal Stocks. The animal was observed within 1.1 km of shore in a region where it is possible the estuarine animals can overlap in time and space with coastal migratory bottlenose dolphins. There were no observed takes by the Northeast Fisheries Observer Program (NEFOP) during 2007-2011. The average percent federal observer coverage (measured in trips) for this fishery during 2007-2011 was 2.95% in state waters (0-3 miles) and 8.59% in federal waters (3-200 miles). The low level of coverage in state waters where the NNCES Stock largely resides is likely insufficient to detect bycatch events of common bottlenose dolphins in the coastal mid-Atlantic commercial gillnet fishery.

Based upon these analyses, the minimum and maximum mean mortality estimates for the NNCES Stock for the post-BDTRP period (2007-2011) were 0 and 16.23 (CV=0.30) animals per year, respectively (Table 2). However, based on documented serious injury and mortality in this fishery from both federal observer coverage and other data sources (see Table 3), mean annual mortality estimates are likely not zero. Incidental takes have been documented in research gillnet gear fished similarly to commercial gear (see Other Mortality section).

Table 2. Summary of 2007-2011 incidental mortality of common bottlenose dolphins in the Northern North Carolina Estuarine System Stock in the commercial mid-Atlantic coastal gillnet fisheries. An average from 2 alternative analytical approaches was used to estimate total bycatch mortality. The minimum and maximum estimates indicate the range of uncertainty in assigning observed bycatch to a stock. Observer coverage is reported on an annual basis for the entire mid-Atlantic coastal gillnet fishery (excluding internal waters) as a proportion of total trips sampled. Data sources include the Northeast and Southeast Fisheries Observer Programs, Greater Atlantic Regional Fisheries Office Vessel Trip Reports, Virginia Marine Resources Commission Fisheries Landings, and North Carolina Division of Marine Fisheries Trip Ticket Program. Values in parentheses indicate the CV of the estimate.

Year	Observer Coverage	Min Annual Ratio	Min Pooled Ratio	Max Annual Ratio	Max Pooled Ratio
2007	0.05	0.00	0.00	0.00	19.39 (0.95)
2008	0.04	0.00	0.00	0.00	16.16 (0.95)
2009	0.04	0.00	0.00	76.77 (0.98)	16.81 (0.95)
2010	0.04	0.00	0.00	0.00	13.92 (0.95)
2011	0.02	0.00	0.00	0.00	16.76 (0.95)
Mean	0.04	0.00	0.00	15.35 (0.98)	16.61 (0.43)
		Mean Minimum: 0.00		Mean Maximum[1]: 16.23 (0.30)	

[1]Mean weighted by inverse of CVs and CV equals inverse of sum of weights

North Carolina Inshore Gillnet

Information on interactions between common bottlenose dolphins and the North Carolina inshore gillnet fishery is based on stranding data. Historically, there was no systematic Federal observer coverage of this fishery. However,

from May 2010 through March 2012, the NMFS allocated sea days and observed this fishery for the first time. Average coverage from the NEFOP (measured in trips) was less than 1% and no bycatch was recorded by federal observers. 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.

Because of sea turtle bycatch in inshore gillnets, the North Carolina Division of Marine Fisheries (NCDMF) has operated systematic coverage of the fall (September-December) flounder gillnet fishery (> 5" mesh) in Pamlico Sound as a part of their Incidental Take Permit under the ESA (Byrd *et al.* 2011). In May 2010, NCDMF expanded the observer coverage to include gillnet effort using nets $\geq$ 4" mesh in most internal state waters and throughout the year, with a goal of 7-10% coverage. No bycatch of bottlenose dolphins has been recorded by state observers, although stranding data continue to indicate interactions with this fishery occur. During 2009–2013, 2 dead dolphin strandings that could have belonged to the NNCES Stock were recovered entangled in gillnet gear. One of them was found in 2010 in Albemarle Sound with medium-mesh gillnet gear wrapped around its mandible and tongue. The other stranded dolphin was recovered in Roanoke Sound in 2011 with medium-mesh gillnet gear entangled around its rostrum and flipper. The documented interactions in commercial gear represent a minimum known count of interactions with this fishery in the last five years. These animals were included in the stranding database and are included in Table 4.

Mid-Atlantic Haul/Beach Seine

There were no reports of mortality or serious injury during 2009–2013 in the mid-Atlantic haul/beach seine fishery, and no estimate of bycatch mortality is available. The mid-Atlantic haul/beach seine fishery had limited observer coverage by the NEFOP in 2009-2011. No observer coverage was allocated to this fishery in 2012 or 2013. Recent evidence for bycatch risk in this gear is limited. The most recent documented interaction is from 2007 when 1 dolphin was killed in a multifilament beach seine during a research project performed by the North Carolina Division of Marine Fisheries. However, this animal likely belonged to either the Northern Migratory or Southern Migratory Coastal Stock.

Virginia and North Carolina Pound Nets

Historical and recent stranding network data report interactions between common bottlenose dolphins and pound nets in Virginia. During 2009–2013, 3 bottlenose dolphin strandings that could have belonged to the NNCES Stock were entangled in pound net gear in Virginia (Northeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 17 June 2014). An additional 11 dolphins that could have belonged to the NNCES Stock stranded with twisted twine markings indicative of interactions with pound net gear. These interactions occurred in estuarine waters near the mouth of the Chesapeake Bay and primarily in summer months. The overall impact of the Virginia Pound Net fishery on the Northern North Carolina Estuarine System Stock is unknown due to the limited information on the stock's movements, particularly the extent to which it occurs within waters inside the mouth of the Chesapeake Bay. It is also possible that observed interactions with the Virginia pound net fishery involve the Northern or Southern Migratory Coastal Stocks as well.

The pound net is a common fishing gear used in portions of North Carolina's estuarine waters. However, the level of interaction with bottlenose dolphins is unknown. Between 1997 and 2013, there has only been 1 documented mortality (2008) in North Carolina pound net gear, and this came from stranding data (Byrd *et al.* 2014). Also, between 1998 and 2013, NMFS researchers sampled 1,642 pound net trips in North Carolina and did not document an entangled bottlenose dolphin (NMFS unpublished data).

North Carolina Roe Mullet Stop Net

During 2009–2013, there was 1 reported mortality of an animal entangled in a stop net. This mortality occurred during November 2013 and the animal likely belonged to the NNCES or Southern Migratory Coastal Stock. This mortality was included in the stranding database and in the stranding totals presented in Table 4. 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 opportunistically observed historical takes of dolphins entangled in stop nets occurred in 1993 and 1999.

Atlantic Blue Crab Trap/Pot

During 2009–2013, there were no reported mortalities of common bottlenose dolphins in trap/pot gear that

could be assigned to the NNCES Stock. Since there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab trap/pot gear. However, stranding data indicate that interactions 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).

Hook and Line

During 2009–2013, 2 dolphins in the stranding database that could have belonged to the NNCES Stock were documented as interacting with hook and line gear. In 2012 in North Carolina, a dolphin that could have belonged to this stock or the Southern Migratory Coastal Stock was documented with ingested hook and line gear. In 2011 in Virginia, a dolphin that could have belonged to this stock or the Southern Migratory Coastal Stock was documented entangled in hook and line gear. These mortalities were included in the stranding database and are included in the stranding totals presented in Table 4. It should be noted that, in general, it cannot be determined if hook and line gear originated from a commercial (i.e., charter boat and headboat) or recreational angler because the gear type used by both sources is typically the same. Also, it is not possible to estimate the total number of interactions with hook and line gear because there is no systematic observer program.

Other Mortality

There have been occasional incidental takes of common bottlenose dolphins during research activities. Two incidental takes (mortalities) in research gillnet gear set in coastal waters were documented that could have belonged to the NNCES or Southern Migratory Coastal Stocks: (1) in 2009 during a small mesh gillnet research project targeting Spanish mackerel in North Carolina; and (2) in 2010 during a medium mesh gillnet research project targeting sharks in North Carolina. In addition, 2 incidental takes (1 mortality; 1 live release, could not be determined if seriously injured) in research gillnet gear were documented during 2012 that were attributed to the NNCES Stock. The 2 animals were captured in the same research sink gillnet targeting striped bass in estuarine waters. All research gillnet incidental takes were included in the stranding database and are included in Table 4. All known human-caused mortalities including both commercial fisheries and research related mortalities are summarized in Table 3.

In addition to animals included in the stranding database, during 2009–2013, there was 1 at-sea observation in the NNCES Stock area of a live bottlenose dolphin entangled in unidentified fishing gear. This observation occurred during 2011 and the animal was considered seriously injured (Maze-Foley and Garrison in prep).

Table 3. Summary of annual reported and estimated mortality of common bottlenose dolphins from the Northern North Carolina Estuarine System Stock during 2009–2013 from observer data, stranding data and research takes. Where minimum and maximum values are reported in individual cells, there is uncertainty in the assignment of mortalities to this particular stock due to spatial overlap with other bottlenose dolphin stocks in certain areas and seasons. This is especially the case for strandings where the maximum number reported may truly be a minimum because not all strandings are detected. Therefore, to account for both scenarios, the maximum numbers under the total column are reported as the maximum greater than or equal to what was recovered.

Year	mid-Atlantic Gillnet		Virginia Pound Net (strandings and observed)	NC Inshore Gillnet (strandings)	NC Roe Mullet Stop Net (strandings)	Hook and Line (strandings)	Research (incidental takes)	Total [b]
	Min/Max estimate extrapolated from observer data (only through 2011)[a]	Interactions known from stranding data						
2009	Min = 0 Max = 55.19	0	Min = 0 Max = 3	0	0	0	Min = 0 Max = 1	Min = 0 Max ≥ 59.19
2010	Min = 0 Max = 6.96	0	0	1	0	0	Min = 0 Max = 1	Min = 1 Max ≥ 8.96

2011	Min = 0 Max = 8.38	0	0	1	0	Min = 0 Max = 1	0	Min = 1 Max ≥ 10.38
2012	No estimate[c]	0	0	0	0	Min = 0 Max = 1	2	Min = 2 Max ≥ 3
2013	No estimate[c]	0	0	0	Min = 0 Max = 1	0	0	Min = 0 Max ≥ 1
Annual Average Mortality (2009–2013)					Minimum Estimated = 0.8 Maximum Estimated ≥ 16.5			

[a] Where given, these numbers are the average of the 2 minimum and 2 maximum mortality estimates for that year from Table 2.
[b] In years with bycatch estimates for the mid-Atlantic gillnet fishery, stranded animals recovered with gillnet gear attached would be accounted for in the estimate for that year. Therefore, stranded animals with attached gear are only included in the Total column when no bycatch estimate has been calculated for that year.
[c] Mortality analyses that use observer data are updated every 3 years. The next update is scheduled for 2015 and will include mortality estimates for years 2012-2014.

Strandings

Between 2009 and 2013, 810 common bottlenose dolphins stranded along coastal and estuarine waters of North Carolina and Virginia that could be assigned to the NNCES Stock (Table 4; Northeast Regional Marine Mammal Stranding Network, Southeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 17 June 2014 and 11 June 2014). It could not be determined if there was evidence of human interaction (HI) for 569 of these strandings, and for 160 it was determined there was no evidence of human interaction. The remaining 81 showed evidence of human interactions (Table 4). Within estuarine waters of North Carolina, where the probability is very high that strandings are from the NNCES Stock, there were a total of 127 strandings in this 5-year period. In most cases, it was not possible to determine if a HI had occurred due to the decomposition state of the stranded animal. Of the 10 (of 127) estuarine strandings positive for HI, 4 (40%) of them exhibited evidence of fisheries entanglement (e.g., entanglement lesions, attached gear), and 2 were incidental takes from research gillnet gear. 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. Also, stranding data probably underestimate the extent of human and fishery-related mortality and serious injury because not all of the dolphins that die or are seriously injured in human interactions wash ashore, or, if they do, they are not all recovered (Peltier *et al*. 2012; Wells *et al*. 2015). Additionally, not all carcasses will show evidence of human interaction, entanglement or other fishery-related interaction due to decomposition, scavenger damage, etc. (Byrd *et al*. 2014). Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of human interaction.

The assignment of animals to a particular stock is impossible in some seasons and regions, particularly in coastal waters of North Carolina and Virginia, and estuarine waters near Beaufort Inlet. Therefore, it is likely that the counts in Table 4 include some animals from the Southern Migratory Coastal, Northern Migratory Coastal and Southern North Carolina Estuarine System Stocks, and therefore overestimate the number of strandings for the NNCES Stock; those strandings that could not be definitively assigned 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 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).

An Unusual Mortality Event (UME) was declared in the summer of 2013 for the mid-Atlantic coast from New York to Brevard County, Florida. Beginning in July 2013, bottlenose dolphins have been stranding at elevated rates. The total number of stranded bottlenose dolphins from New York through North Florida (Brevard County) as of mid-October 2014 (1 July 2013 - 19 October 2014) was ~1546. Morbillivirus has been determined to be the cause of the event. Most strandings and morbillivirus positive animals have been recovered from the ocean side beaches rather than from within the estuaries, suggesting that at least so far coastal stocks have been more impacted by this

UME than estuarine stocks. However, the UME is still ongoing as of December 2014 when this report was drafted, and work continues to determine the effect of this event on all bottlenose dolphin stocks in the Atlantic.

Table 4. Strandings of common bottlenose dolphins from North Carolina and Virginia that can possibly be assigned to the Northern North Carolina Estuarine System (NNCES) Stock. Strandings observed in North Carolina are separated into those occurring within Pamlico Sound and other estuaries (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 bottlenose dolphin stocks. HI = Evidence of Human Interaction, CBD = Cannot Be Determined whether an HI occurred or not. NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 11 June 2014 (SER) and 17 June 2014 (NER).

State	**2009**			**2010**			**2011**			**2012**			**2013**		
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	2	0	9	2[a]	2	21	1[b]	3	8	3[c]	1	15	2[d]	13	45
North Carolina - Coastal	6[e]	3	18	4[f]	18	18	7[g]	20	25	12[h]	15	19	8[i]	46	69
Virginia[j]	12[k]	2	12	4[l]	2	16	5[m]	2	14	1	2	12	12[n]	31	268
Annual Total	64			87			85			80			494		

[a] Includes 2 fisheries interactions (FIs), 1 of which was an entanglement interaction with commercial gillnet gear (mortality, North Carolina inshore gillnet fishery).
[b] An entanglement interaction with commercial gillnet gear (mortality, North Carolina inshore gillnet fishery).
[c] Includes 2 entanglement interactions in research sink gillnet gear (1 mortality; 1 released alive, could not be determined if seriously injured) and 1 FI.
[d] Includes 1 FI.
[e] Includes 5 FIs and 1 incidental take in research gillnet gear.
[f] Includes 3 FIs and 1 incidental take in research experimental gillnet gear targeting shark.
[g] Includes 4 FIs.
[h] 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).
[i] Includes 5 FIs, 1 of which was an entanglement in a stop net (mortality, North Carolina roe mullet stop net fishery).
[j] Strandings from Virginia 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.
[k] Includes 12 FIs, 3 of which were mortalities entangled in Virginia pound nets and 8 were mortalities with twisted twine markings indicative of interactions with Virginia pound net gear.
[l] Includes 2 FIs, 1 of which was a mortality with twisted twine markings indicative of interaction with Virginia pound net gear.
[m] 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.
[n] Includes 7 FIs.

HABITAT ISSUES

This stock inhabits areas with significant drainage from agricultural, industrial and urban sources, and as such is exposed to contaminants in runoff from those sources. The blubber of 47 bottlenose dolphins captured and released in and around Beaufort contained detectable environmental contaminants, and 7 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 bottlenose dolphins near Beaufort, North Carolina, would likely impair reproductive success, especially of primiparous females.

STATUS OF STOCK

Common bottlenose dolphins in the western North Atlantic are not listed as threatened or endangered under the Endangered Species Act. However, because the total human-caused mortality and serious injury is equal to or greater than 10% of PBR and may exceed PBR, NMFS considers the NNCES Stock to be a strategic stock under the Marine Mammal Protection Act. 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 2009 – 2013 ranged between a minimum of 1.0 and a maximum of 16.7. 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 bottlenose dolphins in this area; 2) the mean annual fishery-related mortality from the mid-Atlantic gillnet fishery does not include estimates from the observer component for years 2012-2013; and 3) there are several commercial fisheries operating within this stock's boundaries and these fisheries have little to no observer coverage. Therefore, the documented mortalities must be considered minimum estimates of total fishery-related mortality. The total fishery-related mortality and serious injury for this stock is likely 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 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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