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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*): Western North Atlantic Northern Migratory Coastal Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Geographic Range and Coastal Morphotype Habitat

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. Based on differences in mitochondrial DNA haplotype frequencies, coastal animals in the northern Gulf of Mexico and the western North Atlantic represent separate stocks (Rosel *et al.* 2009; Duffield and Wells 2002).

The coastal morphotype is morphologically and genetically distinct from the larger, more robust morphotype that occupies habitats further offshore in the western North Atlantic and Gulf of Mexico (Hoelzel *et al.* 1998; Mead and Potter 1995; Rosel *et al.* 2009; Vollmer 2011). Aerial surveys conducted between 1978 and 1982 (Kenney 1990) north of Cape Hatteras, North Carolina, identified two concentrations of bottlenose dolphins, one near the coast within the 25-m isobath and the other further offshore concentrated at the continental shelf edge. The lowest density of bottlenose dolphins was observed over the continental shelf. It was suggested, therefore, that north of Cape Hatteras, North Carolina, the coastal morphotype is restricted to waters < 25 m deep (Kenney 1990). Similar patterns were observed during warm-water months in more recent aerial surveys (Garrison and Yeung 2001; Garrison *et al.* 2003). However, south of Cape Hatteras during both cold water and warm water months, there was no clear longitudinal discontinuity in bottlenose dolphin sightings (Garrison and Yeung 2001; Garrison *et al.* 2003).

To address the question of the distribution of coastal and offshore morphotypes in coastal and continental shelf waters along the Atlantic coast, tissue samples were collected in coastal, shelf and slope waters from New England to Florida between 1997 and 2006. Genetic analyses using mitochondrial DNA sequences of these biopsies identified individual animals to the coastal or offshore morphotype. Using the genetic results from all surveys combined, a logistic regression was used to model the probability that a particular bottlenose dolphin group was of the coastal morphotype as a function of environmental variables including depth, sea surface temperature, and distance from shore. These models were used to partition the bottlenose dolphin groups observed during aerial surveys between the two morphotypes (Garrison *et al.* 2003).

The genetic results and spatial patterns observed in aerial surveys indicate both regional and seasonal differences in the longitudinal distribution of the two morphotypes in coastal Atlantic waters. During warm water months, all biopsy samples collected from coastal waters north of Cape Lookout, North Carolina (< 20 m deep), were of the coastal morphotype, and all samples collected in deeper waters (> 40 m deep) were of the offshore morphotype. South of Cape Lookout, the probability of an observed bottlenose dolphin group being of the coastal morphotype declined with increasing depth. In intermediate depth waters, there was spatial overlap between the two morphotypes. Offshore morphotype bottlenose dolphins were observed at depths as shallow as 13 m, and coastal morphotype dolphins were observed at depths of 31 m and 75 km from shore (Garrison *et al*. 2003).

Cold water month samples were collected primarily from coastal waters in North Carolina and Georgia and the vast majority of them were of the coastal morphotype; however, one offshore morphotype group was sampled during November just south of Cape Lookout only 7.3 km from shore. Coastal morphotype samples were also collected farther away from shore at 33 m depth and 39 km from shore. The logistic regression model for this region indicated a decline in the probability of a coastal morphotype group with increasing distance from shore; however, the model predictions were highly uncertain due to limited sample sizes and spatial overlap between the two morphotypes. Samples collected in Georgia waters also indicated significant overlap between the two morphotypes with a declining probability of the coastal morphotype with increasing depth. A coastal morphotype sample was collected 112 km from shore at a depth of 38 m. An offshore sample was collected in 22 m depth at 40 km from shore. As with the North Carolina model, the Georgia logistic regression predictions are uncertain due to limited sample size and high overlap between the two morphotypes (Garrison *et al.* 2003).

In summary, the primary habitat of the coastal morphotype of bottlenose dolphin in the western North Atlantic extends from Florida to Long Island, New York, during warm water months and in waters less than 20 m deep, including estuarine and inshore waters. South of Cape Lookout, the coastal morphotype also occurs in lower densities over the continental shelf and overlaps spatially with the offshore morphotype.

Distinction Between Coastal and Estuarine Bottlenose Dolphins

In addition to inhabiting coastal nearshore waters, the coastal morphotype of common bottlenose dolphin also inhabits inshore estuarine waters along the U.S. east coast and Gulf of Mexico (Wells *et al.* 1987; Wells *et al.* 1996; Scott *et al.* 1990; Weller 1998; Zolman 2002; Speakman *et al.* 2006; Stolen *et al.* 2007; Balmer *et al.* 2008; Mazzoil *et al.* 2008). There are multiple lines of evidence supporting demographic separation between bottlenose dolphins residing within different estuaries along the Atlantic coast. For example, long-term photo-identification (photo-ID) studies in waters around Charleston, South Carolina, have identified communities of resident dolphins that are seen within relatively restricted home ranges year-round (Zolman 2002; Speakman *et al.* 2006). In Biscayne Bay, Florida, there is a similar community of bottlenose dolphins with evidence of year-round residents that are genetically distinct from animals residing in a nearby estuary in Florida Bay (Litz *et al.* 2012). The Indian River Lagoon system in central Florida also has a long-term photo-ID study, and this study identified year-round resident dolphins repeatedly observed across multiple years (Stolen *et al.* 2007; Mazzoil *et al.* 2008). A few published studies demonstrate that these resident animals are genetically distinct from animals in nearby coastal waters; a study conducted near Jacksonville, Florida, demonstrated significant genetic differences between animals in coastal and estuarine waters (Caldwell 2001; Rosel *et al.* 2009) and animals resident in the Charleston Estuarine System show significant genetic differentiation from animals biopsied in coastal waters of southern Georgia (Rosel *et al.* 2009).

Despite evidence for genetic differentiation between estuarine and coastal populations, the degree of spatial overlap between these populations remains unclear. Photo-ID studies within estuaries demonstrate seasonal immigration and emigration and the presence of transient animals (e.g., Speakman *et al.* 2006). In addition, the degree of movement of resident estuarine animals into coastal waters on seasonal or shorter time scales is poorly understood. Bottlenose dolphins inhabiting primarily estuarine habitats are considered distinct stocks from those inhabiting coastal habitats. Bottlenose dolphin stocks inhabiting coastal waters are the focus of this report.

Definition of the Northern Migratory Coastal Stock

Common bottlenose dolphins occur along the North Carolina coast and as far north as Long Island, New York, during summer months (Kenney 1990; Garrison *et al.* 2003). Initially, a single stock of coastal morphotype bottlenose dolphins was thought to migrate seasonally between New Jersey (warm water months) and central Florida based on seasonal patterns of strandings during a large scale mortality event occurring during 1987-1988 (Scott *et al.* 1988). However, re-analysis of stranding data (McLellan *et al.* 2003) and extensive analysis of genetic (Rosel *et al.* 2009), photo-ID (Zolman 2002), and satellite telemetry (Hohn and Hansen) data demonstrate a complex mosaic of coastal bottlenose dolphin stocks. Integrated analysis of these multiple lines of evidence suggests that there are 5 coastal stocks of bottlenose dolphins: Northern Migratory and Southern Migratory Coastal Stocks, a South Carolina/Georgia Coastal Stock, a Northern Florida Coastal Stock and a Central Florida Coastal Stock.

Among the coastal stocks, the migratory movements and spatial distribution of the Northern Migratory Stock are the best understood based on aerial survey data, tag-telemetry studies, photo-ID data and genetic studies.

Four dolphins tagged during 2003 and 2004 off the coast of New Jersey in late summer moved south to North Carolina and inhabited waters near and just south of Cape Hatteras during cold water months. These animals then moved north to New Jersey again during the following warm water months (Hohn and Hansen). Similarly, a dolphin tagged in late September 1998 off Virginia Beach, Virginia, occurred between Cape Hatteras and Cape Lookout during cold water months (NMFS 2001). There is no evidence suggesting that this animal moved farther south than Cape Lookout during cold water months (NMFS 2001). In addition, there are no matches from long-term photo-ID studies between sites in New Jersey and those south of Cape Hatteras (Urian *et al.* 1999; NMFS 2001). During cold water months, bottlenose dolphins are rarely observed in coastal waters north of the North Carolina/Virginia border, and their northern distribution appears to be limited by water temperatures < 9.5ºC (Garrison *et al.* 2003). Seasonal variation in the densities of animals observed off Virginia Beach, Virginia, also indicates the seasonal migration of dolphins northward during warm water months and then south during cold water months (Barco and Swingle 1996).

Genetic analyses using mitochondrial and nuclear microsatellite data also indicated significant differentiation between bottlenose dolphins occupying coastal waters from the North Carolina/Virginia border to New Jersey during warm water months and those in southern North Carolina and further south (Charleston, South Carolina, coastal Georgia and Jacksonville, Florida). One exception was the comparison using the microsatellite data of animals from Virginia and north to those in southern North Carolina (NMFS 2001; Rosel *et al.* 2009). This finding is thought to be a result of some degree of seasonal spatial overlap between the Northern Migratory Coastal Stock and other stocks occupying coastal waters of North Carolina (Rosel *et al.* 2009) because some of the samples were collected in southern North Carolina during cold water months when multiple stocks are thought to be present.

Toth *et al.* (2012) suggested the Northern Migratory Coastal Stock may be further partitioned in waters off of New Jersey. They identified two clusters of sightings that differed in the presence of a commensal soft-stalked barnacle, *Xenobalanus globicipitis*, in avoidance behavior and in "base coloration". One cluster inhabited waters 0-1.9 km from shore while the other cluster inhabited waters 1.9-6 km from shore. Additional studies are needed to determine whether this apparent partitioning has a genetic basis.

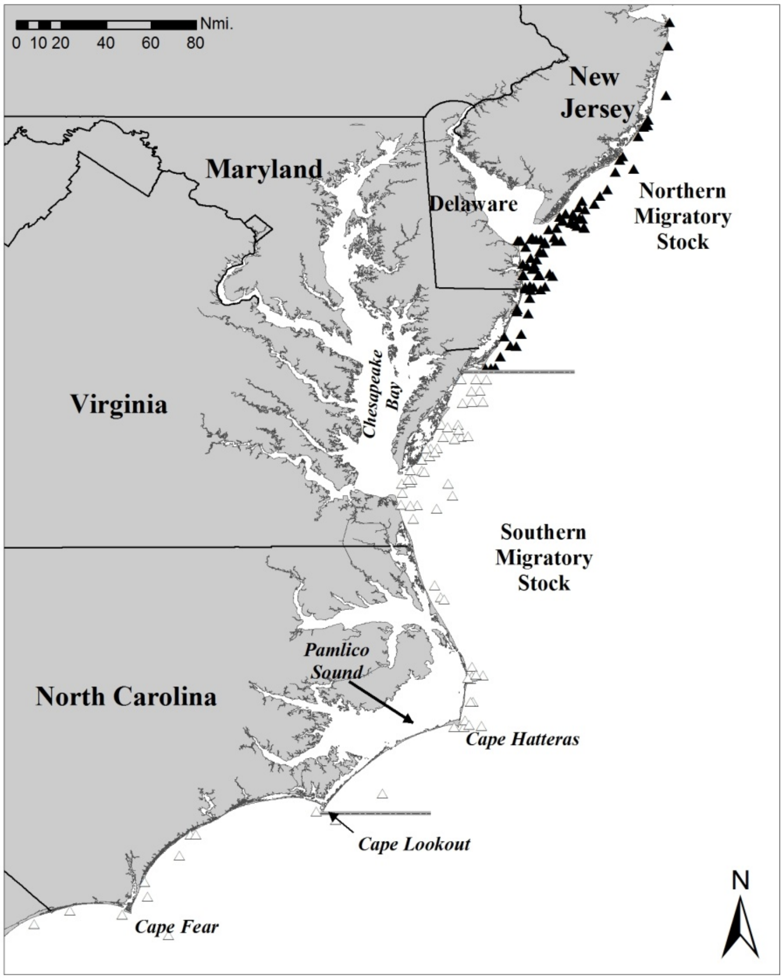

Figure 1. *The distribution of common bottlenose dolphin stocks occupying coastal waters from North Carolina to New Jersey during July-August 2002, 2004, 2010 and 2011. Sighting locations from aerial surveys are plotted as triangle symbols. Sightings assigned to the Northern Migratory Coastal Stock are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

Spatial and temporal overlap of the Northern Migratory Coastal Stock with other stocks is likely. During warm water months, overlap with the Southern Migratory Coastal Stock in coastal waters of northern North Carolina and Virginia is possible, but the degree of overlap is unknown. During cold water months, the Northern Migratory Coastal Stock moves southward to waters from Cape Lookout, North Carolina, to north of Cape Hatteras, North Carolina, based upon tag-telemetry studies. The stock overlaps spatially with the Northern North Carolina Estuarine System (NNCES) Stock during this period. These complex seasonal spatial movements and the overlap of coastal and estuarine stocks in the waters of North Carolina greatly limit the ability to fully assess the mortality of each of these stocks.

In summary, spatial distribution data, tag-telemetry studies, photo-ID studies and genetic studies demonstrate the existence of a distinct Northern Migratory Coastal Stock of coastal bottlenose dolphins. During warm water months, this stock occupies coastal waters from the shoreline to approximately the 25-m isobath between the Chesapeake Bay mouth and Long Island, New York (Figure 1). During cold water months, the stock occupies coastal waters from Cape Lookout, North Carolina, to the North Carolina/Virginia border.

POPULATION SIZE

The best available estimate for the Northern Migratory Coastal Stock of common bottlenose dolphins in the western North Atlantic is 11,548 (CV=0.36; Table 1). This estimate is from aerial surveys conducted during the summers of 2010 and 2011 covering waters from Florida to New Jersey.

Earlier abundance estimates

Earlier abundance estimates for the Northern Migratory Coastal stock were derived from aerial surveys conducted during the summer of 2002. Survey tracklines were set perpendicular to the shoreline and included coastal waters to depths of 40 m. These surveys employed two observer teams operating independently on the same aircraft to estimate visibility bias. In summer 2004, an additional aerial survey between central Florida and New Jersey was conducted. As with the 2002 surveys, effort was stratified into 0-20 m and 20-40 m strata with the majority of effort in the shallow depth stratum. Observed common bottlenose dolphin groups from these were partitioned between the coastal and offshore morphotypes based upon analysis of available biopsy samples (Garrison *et al.* 2003). For the region north of Cape Hatteras, North Carolina, there was complete separation between the coastal and offshore morphotypes, with only coastal animals occupying waters < 20 m deep. Therefore, all animals observed in the 0-20 m depth stratum during surveys of this region were assigned to the coastal morphotype (Garrison *et al.* 2003).

Summer surveys are best for estimating the abundance for both the Northern and Southern Migratory Coastal Stocks because they overlap least with other stocks during summer months. An analysis of summer survey data from 1995, 2002 and 2004 demonstrated strong inter-annual variation in the spatial distribution of presumed Northern Migratory and Southern Migratory Coastal Stock animals. Two groups of dolphins in each survey year were identified using a multivariate cluster analysis of sightings based on water temperature, depth and latitude. One group ranged from Cape Lookout, North Carolina, to just north of the Chesapeake Bay mouth, and one ranged farther north along the eastern shore of Virginia to New Jersey. The southern group (i.e., the Southern Migratory Coastal Stock) was found in water temperatures between 26.5 and 28.0°C, and the northern group (i.e., the Northern Migratory Coastal Stock) occurred in cooler waters between 24.5 and 26.0°C. The spatial distribution of these groups was strongly correlated with water temperatures and varied between years. During the summer of 2004, water temperatures were significantly cooler than those during 2002, and animals from both groups were distributed farther south and overlapped spatially. Very few bottlenose dolphins were observed in waters north of Virginia during the summer 2004 survey. Therefore, it was not possible to develop an estimate of abundance for the Northern Migratory Coastal Stock from the summer 2004 survey and so the best abundance estimate for the Northern Migratory Coastal Stock came from the summer 2002 survey when there was little overlap and an apparent separation from the Southern Migratory Coastal Stock at approximately 37.5°N latitude. The resulting abundance estimate for the Northern Migratory Coastal Stock was 9,604 (CV=0.36).

Recent surveys and abundance estimates

The Southeast Fisheries Science Center conducted aerial surveys of continental shelf waters along the U.S. East Coast from southeastern Florida to Cape May, New Jersey, during the summers of 2010 and 2011. The surveys were conducted along tracklines oriented perpendicular to the shoreline that were latitudinally spaced 20 km apart and covered waters from the shoreline to the continental shelf break. The summer 2010 survey was conducted during 24 July–14 August 2010, and 7,944 km of on-effort tracklines completed. A total of 127 common bottlenose dolphin groups were observed including 1,541 animals. During the 2011 summer survey, 8,665 km of trackline were completed between Cape May, New Jersey and Ft. Pierce, Florida. The survey was conducted during 6 July–29 July 2011. The 2011 survey also included more closely spaced “fine-scale” tracklines in waters offshore of New Jersey and Virginia within areas being evaluated for the placement of offshore energy installations. A total of 112 bottlenose dolphin groups were observed including 1,339 animals.

Both the summer 2010 and 2011 surveys were conducted using a two-team approach to develop estimates of visibility bias using the independent observer approach with Distance analysis (Laake and Borchers 2004). However, the detection functions from both surveys indicated a decreased probability of detection near the trackline, which limited the effectiveness of the method for correcting for visibility bias due to a relatively small number of sightings made by both teams near the trackline. Abundance estimates were therefore derived by combining the sightings from both teams during a survey and “left-truncating” the data by analyzing only sightings occurring greater than 100 m from the trackline during the 2010 survey and 50 m during the 2011 survey (see Buckland *et al.* 2001 for left-truncation methodology). Detection functions were fit to these left-truncated data accounting for the effects of survey conditions (e.g., sea state, glare, water color) on the detection probabilities. A bootstrap resampling approach was used to estimate the variance of the estimates. The resulting abundance estimates assume that detection probability at the truncation distance is equal to 1. While the estimates could not be explicitly corrected for this assumption, analyses of the summer 2010 data suggest that this bias is likely small.

The abundance estimates for the Northern Migratory Coastal Stock were based upon tracklines and sightings occurring north of 37.5°N latitude and in waters from the shoreline to the 20-m isobath. Prior analyses suggested that this latitudinal boundary separates the Northern and Southern Migratory Coastal Stocks. The abundance estimate derived from the summer 2010 survey was 12,602 (CV=0.76), and the estimate from the summer 2011 survey was 11,044 (CV=0.36). The best estimate is a weighted average of these two with higher weighting given to the more precise estimate from 2011. The resulting best estimate is 11,548 (CV=0.36).

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

Month/Year	Area	N_{best}	CV
July-August 2002	Virginia to New Jersey	9,604	0.36
July-August 2010 and 2011	Virginia to New Jersey	11,548	0.36

Minimum Population Estimate

The minimum population size (Nmin) was calculated as the lower bound of the 60% confidence interval for a lognormally distributed mean (Wade and Angliss 1997). The best estimate for the Northern Migratory Coastal Stock of common bottlenose dolphins is 11,548 (CV=0.36). The resulting minimum population estimate is 8,620.

Current Population Trend

A trend analysis has not been conducted for this stock. There are 2 estimates from the 2002 (9,604; CV=0.36) and 2010/2011 (11,548; CV=0.36) surveys. Methodological differences between the estimates need to be evaluated to quantify trends.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for the Northern Migratory Coastal Stock. The maximum net productivity rate 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 Northern Migratory Coastal Stock of common bottlenose dolphins is 8,620. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factoris 0.5 because this stock is depleted. PBR for this stock of common bottlenose dolphins is 86.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury for the Northern Migratory Coastal 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 strandings identified as fishery-caused ranged between 1 and 7.5. No additional mortality and serious injury was documented from other human-caused actions. The minimum total mean annual human-caused mortality and serious injury for this stock during 2009–2013 ranged between 1 and 7.5. 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 Chesapeake Bay inshore gillnet; Virginia pound net; mid-Atlantic menhaden purse seine; Atlantic blue crab trap/pot; and mid-Atlantic haul/beach seine fisheries; and the Category III Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line) fishery. Detailed fishery information is presented in Appendix III.

The primary known source of estimated fishery mortality is the mid-Atlantic coastal gillnet fishery, which has the potential to affect the Northern Migratory Coastal, Southern Migratory Coastal, NNCES and Southern North

Carolina Estuarine System (SNCES) Stocks of common bottlenose dolphin. Additional fishery interactions have been reported in inshore gillnets, Virginia pound nets, blue crab or other pot gear, and Atlantic Ocean commercial passenger fishing vessel (hook and line) gear. However, these additional fisheries have limited or no systematic federal observer coverage, which prevents the estimation of total takes. In addition, at certain times of year, it is not possible to definitively assign mortalities to a specific stock because of the overlap amongst the 4 stocks around North Carolina.

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, Southern Migratory, NNCES and SNCES bottlenose dolphin stocks all occur in waters off North Carolina, it is not always 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-TRP 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-TRP 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). The live release from 1999 and 2 takes from beach anchored gillnets reported in the background text were not included in this analysis. Only years 2002-Apr 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 2. Summary of the 2002–2006 incidental mortality of common bottlenose dolphins in the Northern Migratory Coastal Stock in the commercial mid-Atlantic 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, VMRC landings 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	24.75 (0.34)	0	0	27.87 (0.33)
	2003	0.01	0	0	11.77 (0.36)	0	0	19.98 (0.30)
	2004	0.02	0	0	14.57 (0.35)	0	0	21.83 (0.33)
	2005	0.03	0	0	14.67 (0.39)	0	0	19.55 (0.32)
	Jan-Apr 2006	0.03	0	0	5.92 (0.37)	0	0	6.50 (0.37)
Annual Avg. pre-BDTRP			Minimum: 4.78 (CV=0.17)			Maximum: 6.38 (CV=0.15)		

During 2002–2006, there were no observed mortalities in the mid-Atlantic gillnet fishery that could potentially be assigned to the Northern Migratory Coastal Stock. Hence, both the annual and pooled ratio estimators of bycatch rate were equal to zero in the pre-BDTRP period. Because the GLM approach included information from prior to 2002, bycatch mortality for the Northern Migratory Coastal Stock was estimated from takes that could have possibly belonged to this stock (Table 2). 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 of the Northern Migratory Coastal Stock are presented for comparison to PBR (Table 2).

Based upon these analyses, the minimum and maximum mean mortality estimates for the Northern Migratory Coastal Stock for the pre-BDTRP period (2002-Apr 2006) were 4.78 (CV=0.17) and 6.38 (CV=0.15) animals per year, respectively (Table 2).

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 3). It should be noted that internal waters from New Jersey to Virginia (i.e., Delaware and Chesapeake Bays) may be important habitat to the Northern Migratory Coastal Stock and were included in the estimation of bycatch mortality during 2007–2011.

During 2007–2011, 1 bottlenose dolphin take was observed in 2009 by the Southeast Fishery Observer Program (SEFOP) off northern North Carolina that could potentially be assigned to the NNCES or the 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 takes observed by the Northeast Fisheries Observer Program (NEFOP) during 2007–2011. The combined NEFOP and SEFOP average 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 is likely insufficient to consistently detect rare bycatch events of common bottlenose dolphins in the commercial mid-Atlantic gillnet fishery.

Based upon these analyses, the minimum and maximum mean mortality estimates for the Northern Migratory Coastal Stock for the post-BDTRP period (2007-2011) were 0 and 6.77 (CV=0.32) animals per year, respectively (Table 3). However, based on documented serious injury and mortality in this fishery from both federal observer coverage and other data sources (see Table 4), mean annual mortality estimates are likely not zero. Stranding data also documented 2 dolphin mortalities during 2009–2013 recovered with gillnet gear attached: (1) in 2009 in Virginia, a dead dolphin was recovered entangled in gillnet gear; and (2) in 2010 in Delaware, a dead dolphin was recovered with its flukes entangled in monkfish gillnet gear. These 2 mortalities likely belonged to the Northern Migratory Coastal Stock and were included in the stranding database and the stranding totals presented in Table 5.

Table 3. Summary of 2007–2011 incidental mortality estimates of common bottlenose dolphins in the Northern Migratory Coastal Stock in the commercial mid-Atlantic coastal gillnet fisheries. An average from 2 alternative analytical approaches (annual and pooled) was used to estimate total annual 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	6.36 (1.08)
2008	0.04	0.00	0.00	0.00	6.10 (1.08)
2009	0.04	0.00	0.00	41.26 (0.95)	6.46 (1.08)
2010	0.04	0.00	0.00	0.00	5.23 (1.08)
2011	0.02	0.00	0.00	0.00	5.96 (1.08)
Mean	0.04	0.00	0.00	8.25 (0.95)	6.02 (0.48)
		Mean Minimum: 0.00		Mean Maximum[1]: 6.77 (0.32)	

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

Chesapeake Bay Inshore Gillnet

During 2009–2013, there was 1 documented interaction between common bottlenose dolphins and inshore gillnet gear in Chesapeake Bay. In 2013 in Maryland, a dead dolphin was recovered entangled in 9-inch stretched mesh gillnet gear. This animal likely belonged to either the Northern or Southern Migratory Coastal Stock, and was included in the stranding database and the stranding totals presented in Table 5 (Northeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 17 June 2014). There is no observer coverage of this fishery within Maryland waters of Chesapeake Bay; within Virginia waters of Chesapeake Bay, there is a low level of observer coverage (<1%).

Virginia Pound Net

Historical and recent stranding network data report interactions between common bottlenose dolphins and pound nets in Virginia. During 2009–2013, 3 bottlenose dolphin strandings (mortalities) which could have belonged to the Northern Migratory Coastal Stock were entangled in pound net gear in Virginia (2 in 2009, 1 in 2011; Northeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 17 June 2014). An additional 13 dolphins that could have belonged to the Northern Migratory Coastal Stock stranded with twisted twine markings indicative of interactions with pound net gear. These interactions occurred primarily inside estuarine waters near the mouth of the Chesapeake Bay and in summer months.

Mid-Atlantic Menhaden Purse Seine

The mid-Atlantic menhaden purse seine fishery historically reported an annual incidental take of 1 to 5 common bottlenose dolphins (NMFS 1991, pp. 5-73). This information has not been updated for some time. There has been very limited observer coverage since 2008, but no takes have been observed (see Appendix III).

Atlantic Blue Crab Trap/Pot

During 2009–2013, there were no reports of a common bottlenose dolphin from the Northern Migratory Coastal Stock entangled in trap/pot gear. Because there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab traps/pots. However, stranding data indicate that interactions with trap/pot gear occur at some unknown level in North Carolina (Byrd *et al*. 2014) and other regions of the southeast U.S. (Noke and Odell 2002; Burdett and McFee 2004).

Mid-Atlantic Haul/Beach Seine

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. This animal likely belonged to either the Northern Migratory or Southern Migratory Coastal Stock based on its location north of Oregon Inlet during June.

Hook and Line

During 2009–2013, 4 dolphin mortalities likely belonging to the Northern Migratory Coastal Stock were documented as interacting with hook and line gear. Three mortalities occurred during 2009 (2 in New Jersey, 1 in Virginia), and 1 occurred during 2012 (in Virginia). These mortalities were included in the stranding database and are included in the stranding totals presented in Table 5. 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

Historically, there have been occasional mortalities of bottlenose dolphins during research activities including both directed live capture studies, turtle relocation trawls, and fisheries surveys; however, none were documented during 2009–2013. All mortalities from known sources for the Northern Migratory Coastal Stock are summarized in Table 4.

Table 4. Summary of annual reported and estimated mortality of common bottlenose dolphins from the Northern Migratory Coastal Stock during 2009–2013 from observer and stranding data. 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 common 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		Chesapeake Bay Inshore Gillnet (strandings)	Virginia Pound Net (strandings and observed)	Hook and Line (strandings)	Total[b]
	Min/Max estimate extrapolated from observer data (only through 2011)[a]	Interactions known from stranding data				
2009	Min = 0 Max = 23.86	Min = 0 Max = 1	0	Min = 0 Max = 2	3	Min = 3 Max ≥ 28.86
2010	Min = 0 Max = 2.62	1	0	0	0	Min = 1 Max ≥2.62
2011	Min = 0 Max = 2.98	0	0	Min = 0 Max = 1	0	Min = 0 Max ≥ 3.98
2012	No estimate[c]	0	0	0	1	1
2013	No estimate[c]	0	Min = 0 Max = 1	0	0	Min = 0 Max ≥ 1
Annual Average Mortality (2009–2013)				Minimum Estimated = 1 Maximum Estimated ≥ 7.5		

[a] Where given, these numbers are the average of the 2 minimum and 2 maximum mortality estimates for that year from Table 3.
[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, 1013 common bottlenose dolphins that could be potentially assigned to the Northern Migratory Coastal Stock stranded along the Atlantic coast between North Carolina and New York (Table 5; Northeast Regional Marine Mammal Stranding Network; Southeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 11 June 2014 (SER) and 17 June 2014 (NER)). It could not be determined if there was evidence of human interaction (HI) for 670 of these strandings, and for 248 it was determined there was no evidence of HI. The remaining 95 showed evidence of HI, of which 71 (75%) were fisheries interactions (Table 5). It should be recognized that evidence of HI 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 North Carolina, Virginia and Maryland. Therefore, the counts in Table 5 likely include some animals from the Southern Migratory Coastal and NNCES Stocks and therefore overestimate the number of strandings for the Northern Migratory Coastal Stock; those strandings that could not be definitively assigned to the Northern Migratory Coastal Stock were also included in the counts for these other stocks as appropriate. In addition, 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).

A 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 5. Strandings of common bottlenose dolphins from North Carolina to New York during 2009 – 2013 that could have belonged to the Northern Migratory Coastal Stock. Assignments to stock were based upon the understanding of the seasonal movements of this stock. However, in waters of North Carolina and Virginia there is likely overlap with other stocks during particular times of year. 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[a]	1[b]	3	18	4[c]	9	14	6[d]	16	22	11[e]	14	16	2[f]	21	36
Virginia[g]	10[h]	5	51	7[i]	6	33	7[j]	3	36	11[k]	7	37	9[l]	17	130
Maryland	0	0	1	1[m]	3	2	2[n]	1	4	0	2	2	3[o]	16	37
Delaware	1	0	10	3[p]	1	6	2	2	6	1	3	11	3[q]	1	56
New Jersey	4[r]	11	2	0	11	2	1[s]	14	4	2	10	10	3	56	90
New York	0	0	2	0	1	0	0	1	2	1[t]	2	4	0	12	26

Annual Total	119	103	129	144	518

[a] Strandings for North Carolina include data for November-April north of Cape Lookout when Northern Migratory Coastal animals may be in coastal waters. The stock identity of these strandings is highly uncertain and likely also includes animals from the NNCES Stock.
[b] Includes 1 fisheries interaction (FI).
[c] Includes 4 FIs.
[d] Includes 5 FIs.
[e] Includes 10 FIs, 2 of which had markings indicative of interactions with gillnet gear (mortalities).
[f] Includes 2 FIs, 1 of which had markings indicative of interactions with gillnet gear (mortality).
[g] Strandings from Virginia were assigned to stock based upon both location and time of year. Some of the strandings assigned to the Northern Migratory Coastal Stock could possibly be assigned to the Southern Migratory Coastal Stock or NNCES Stock.
[h] Includes 9 FIs. Two FIs were entanglement interactions in Virginia pound nets (mortalities); 4 FIs were mortalities with twisted twine markings indicative of interactions with Virginia pound net gear; 1 FI was an entanglement interaction with hook and line gear (mortality).
[i] Includes 7 FIs. Five FIs were mortalities with twisted twine markings indicative of interactions with Virginia pound
[j] Includes 6 FIs. One FI was an entanglement interaction in a Virginia pound net (mortality) and 2 FIs were mortalities with twisted twine markings indicative of interactions with Virginia pound net gear.
[k] Includes 7 FIs. One FI was an entanglement interaction with hook and line gear (mortality) and 1 FI was a mortality with twisted twine markings indicative of interactions with Virginia pound net gear.
[l] Includes 6 FIs, 1 of which was a mortality with twisted twine markings indicative of interactions with Virginia pound net gear.
[m] Includes 1 FI.
[n] Includes 1 FI.
[o] Includes 3 FIs, 1 of which was an entanglement interaction with gillnet gear (mortality, Chesapeake Bay inshore gillnet fishery).
[p] Includes 2 FIs, 1 of which was an entanglement interaction with gillnet gear (mortality, mid-Atlantic gillnet fishery).
[q] Includes 2 FIs.
[r] Includes 3 FIs, 2 of which were interactions with hook and line gear (mortalities).
[s] Includes 1 FI.
[t] Includes 1 FI.

HABITAT ISSUES

The coastal and estuarine habitats occupied by the coastal morphotype are adjacent to areas of high human population and some are highly industrialized. The blubber of stranded dolphins examined during the 1987-1988 mortality event contained very high concentrations of organic pollutants (Kuehl *et al.* 1991). More recent studies have examined persistent organic pollutant concentrations in common bottlenose dolphin tissues from several estuaries along the Atlantic coast and have likewise found evidence of high blubber concentrations particularly in estuaries near Charleston, South Carolina, and Beaufort, North Carolina (Hansen *et al.* 2004), and in portions of Biscayne Bay, Florida (Litz *et al.* 2007). The concentrations found in male dolphins from both of these sites exceeded toxic threshold values that may result in adverse effects on health or reproductive rates (Schwacke *et al.* 2002; Hansen *et al.* 2004). Studies of contaminant concentrations relative to life history parameters showed higher levels of mortality in first-born offspring and higher contaminant concentrations in these calves and in primiparous females (Wells *et al.* 2005). The exposure to environmental pollutants and subsequent effects on population health is an area of concern and active research.

STATUS OF STOCK

Common bottlenose dolphins are not listed as threatened or endangered under the Endangered Species Act, but the Northern Migratory Coastal Stock is a strategic stock due to the depleted listing under the MMPA. From 1995 to 2001, NMFS recognized only a single stock of coastal bottlenose dolphins in the WNA, and the entire stock was listed as depleted. This stock structure was revised in 2002 to recognize both multiple stocks and seasonal management units and again in 2008 and 2009 to recognize resident estuarine stocks and migratory and resident coastal stocks. This stock retains the depleted designation as a result of its origins from the original western North Atlantic Coastal Stock. PBR for the Northern Migratory Coastal Stock is 86 and so the zero mortality rate goal, 10% of PBR, is 8.6. The documented mean annual human-caused mortality for this stock for 2009–2013 ranged between a minimum of 1 and a maximum of 7.5. However, these estimates are biased low for the following reasons: 1) the total U.S. human-caused mortality and serious injury for the Northern Migratory Coastal Stock cannot be directly estimated because of the spatial overlap among the stocks of bottlenose dolphins that occupy waters of North Carolina and Virginia; 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 that have little to no observer coverage. Therefore, the documented mortalities must be considered minimum estimates of total fishery-related mortality. There is insufficient information available to determine whether the total fishery-related mortality and serious injury is 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 population trends for this stock.

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