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

STOCK DEFINITION AND GEOGRAPHIC RANGE

Geographic Range and Coastal Morphotype Habitat

The coastal morphotype of bottlenose dolphin is continuously distributed along the Atlantic coast south of Long Island, New York, around the Florida peninsula and along the Gulf of Mexico coast. Based on differences in mitochondrial DNA haplotype frequencies, nearshore animals in the northern Gulf of Mexico and the western North Atlantic represent separate stocks (Duffield and Wells 2002; Rosel *et al.* 2009). On the Atlantic coast, Scott *et al.* (1988) hypothesized a single coastal migratory stock ranging seasonally from as far north as Long Island, to as far south as central Florida, citing stranding patterns during a high mortality event in 1987-1988 and observed density patterns. More recent studies demonstrate that the single coastal migratory stock hypothesis is incorrect, and there is instead a complex mosaic of stocks (McLellan *et al.* 2003; Rosel *et al.* 2009).

The coastal morphotype is morphologically and genetically distinct from the larger, more robust morphotype primarily occupying habitats further offshore (Mead and Potter 1995; Hoelzel *et al.* 1998; Rosel *et al.* 2009). Aerial surveys conducted between 1978 and 1982 (CETAP 1982) north of Cape Hatteras, North Carolina, identified two concentrations of bottlenose dolphins, one inshore of the 25-m isobath and the other offshore of the 50-m isobath. The lowest density of bottlenose dolphins was observed over the continental shelf, with higher densities along the coast and near the continental shelf edge. 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 summer months in more recent aerial surveys (Garrison and Yeung 2001; Garrison *et al.* 2003). However, south of Cape Hatteras during both winter and summer months, there was no clear longitudinal discontinuity in bottlenose dolphin sightings (Garrison and Yeung 2001; Garrison *et al.* 2003).

To address the question of distribution of coastal and offshore morphotypes in waters south of Cape Hatteras, tissue samples were collected during large vessel surveys during the summers of 1998 and 1999, during systematic biopsy sampling efforts in nearshore waters from New Jersey to central Florida conducted in the summers of 2001 and 2002, and during winter biopsy collection efforts in 2002 and 2003, in nearshore continental shelf waters of North Carolina and Georgia. Additional biopsy samples were collected in deeper continental shelf waters south of Cape Hatteras during winter 2002. 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 summer months, all biopsy samples collected from nearshore 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).

Winter samples were collected primarily from nearshore waters in North Carolina and Georgia. The vast majority of samples collected in nearshore waters of North Carolina during winter 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 distance 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 extends from Florida to New Jersey during summer months and in waters less than 20 m deep, including estuarine and inshore waters. South of Cape Lookout, the coastal morphotype occurs in lower densities over the continental shelf (waters between 20 m and 100 m depth) 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 bottlenose dolphin also inhabits inshore estuarine waters along the U.S. east coast and Gulf of Mexico (Wells *et al.* 1987; Scott *et al.* 1990; Wells *et al.* 1996; 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 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 2007). A long-term photo-ID study in the Indian River Lagoon system in central Florida has also 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 nearshore coastal waters 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). In addition, stable isotope ratios of ^{18}O relative to ^{16}O (referred to as depleted ^{18}O or depleted oxygen) in animals sampled along the Outer Banks of North Carolina between Cape Hatteras and Bogue Inlet during February and March were very low (Cortese 2000). One explanation for this depleted oxygen signature is that a resident group of dolphins in Pamlico Sound moves into nearby nearshore areas in the winter.

Despite evidence for genetic differentiation between estuarine and nearshore 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. However, for the purposes of this analysis, bottlenose dolphins inhabiting primarily estuarine habitats are considered distinct from those inhabiting coastal habitats. Bottlenose dolphin stocks inhabiting coastal waters are the focus of this report.

Definition of the Northern Florida Coastal Stock

Initially, a single stock of coastal morphotype bottlenose dolphins was thought to migrate seasonally between New Jersey (summer months) and central Florida based on seasonal patterns in 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 (NMFS unpublished data) data demonstrate a complex mosaic of coastal bottlenose dolphin stocks. Integrated analysis of these multiple lines of evidence suggests that there are five coastal stocks of bottlenose dolphins: the Northern Migratory and Southern Migratory stocks, a South Carolina/Georgia Coastal stock, a Northern Florida Coastal stock and a Central Florida Coastal stock.

The spatial extent of these stocks, their potential seasonal movements, and their relationships with estuarine stocks are poorly understood. Migratory movement and spatial distribution of the Northern Migratory stock is best understood based on tag-telemetry, photo-ID and aerial survey data and migrates seasonally between coastal waters of central North Carolina and New Jersey. It is not thought to overlap with the South Carolina/Georgia Coastal Stock in any season. The Southern Migratory stock is defined primarily on satellite tag telemetry studies and is thought to migrate south from waters of southern Virginia and north central North Carolina in the summer to waters south of Cape Fear and as far south as coastal Florida during winter months. While it is possible that this stock overlaps during winter with the northern range of the Northern Florida Coastal stock, more data are needed to confirm this overlap.

During summer months when the Southern Migratory stock is found in waters north of Cape Fear, North Carolina, bottlenose dolphins are still seen in coastal waters of South Carolina, Georgia and Florida, indicating the presence of additional stocks of coastal animals. Speakman *et al.* (2006) using photo-ID studies documented dolphins in coastal waters off Charleston, South Carolina, that are not known resident members of the estuarine stock. Genetic analyses of samples from northern Florida, Georgia and central South Carolina (primarily the estuaries around Charleston), using both mitochondrial DNA and nuclear microsatellite markers, indicate significant genetic differences between these areas (NMFS 2001; Rosel *et al.* 2009). This stock assessment report addresses the Northern Florida Coastal Stock, which is present in coastal Atlantic waters from the Georgia/Florida border south to 29.4°N (Figure 1). There is no obvious boundary defining the offshore extent of this stock. The combined genetic and logistic regression analysis (Garrison *et al.* 2003) indicated that in waters less than 10 m depth, 70% of the bottlenose dolphins were of the coastal morphotype. Between 10 and 20 m depth, the percentage of animals of the coastal morphotype dropped precipitously and at depths >40 m nearly all (>90%) animals were of the offshore morphotype. However, in winter months, the Southern Migratory stock (also of the coastal morphotype) moves into this region in waters 10-30 m depth complicating the ability to define ocean-side boundaries for the Northern Florida Coastal stock.

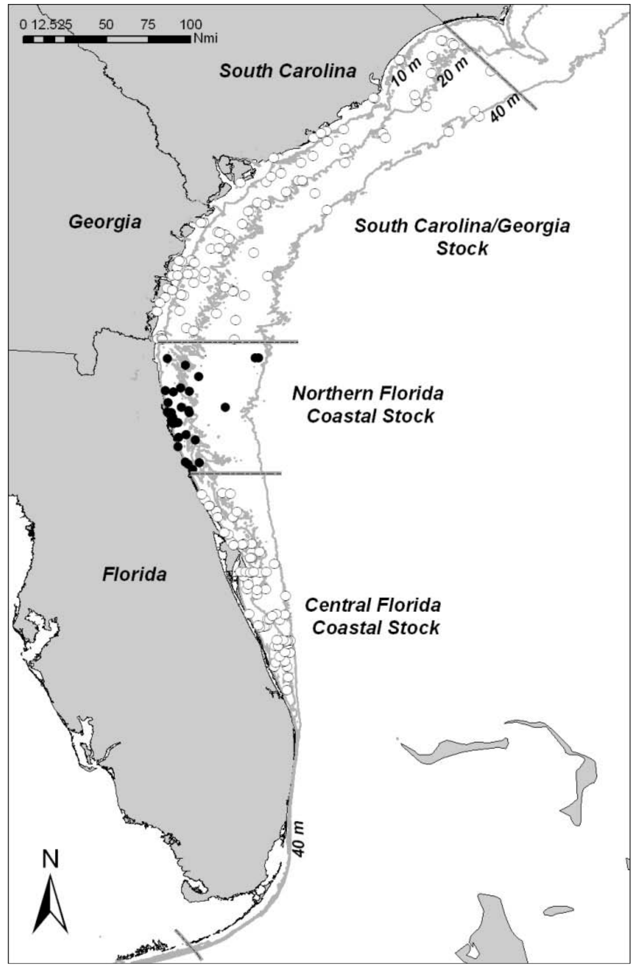

Figure 1. *The Northern Florida Coastal stock of bottlenose dolphins (Georgia/Florida border to 29.4°N). Circles represent all sightings of bottlenose dolphin groups from NMFS 2002 and 2004 aerial surveys; dark circles- groups within the boundaries of this stock. In waters > 20m, sightings may include the offshore morphotype of bottlenose dolphins.*

POPULATION SIZE

Aerial surveys to estimate the abundance of coastal bottlenose dolphins in the Atlantic were conducted during winter (January-February) and summer (July-August) of 2002. Survey tracklines were set perpendicular to the shoreline and included coastal waters to depths of 40 m. The surveys employed a stratified design so that most effort was expended in waters shallower than 20 m deep where a high proportion of observed bottlenose dolphins were expected to be of the coastal morphotype. Survey effort was also stratified to optimize coverage in seasonal management units. The surveys employed two observer teams operating independently on the same aircraft to estimate visibility bias.

The winter 2002 survey included the region from the Georgia/Florida state line to the southern edge of Delaware Bay. A total of 6,411km of trackline was completed during the survey, and 185 bottlenose dolphin groups were sighted including 2,114 individual animals. No bottlenose dolphins were sighted north of Chesapeake Bay where water temperatures were <9.5ºC. During the summer survey, 6,734 km of trackline were completed between Sandy Hook, New Jersey, and Ft. Pierce, Florida. All tracklines in the 0-20 m stratum were completed throughout the survey range while offshore lines were completed only as far south as the Georgia/Florida state line. A total of 185 bottlenose dolphin groups was sighted during summer including 2,544 individual animals.

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. The survey was conducted between 16 July and 31 August and covered 7,189 km of trackline. There were 140 sightings of bottlenose dolphins including 3,093 individual animals. A winter survey was conducted between 30 January and 9 March 2005 covering waters from the mouth of Chesapeake Bay through central Florida. The survey covered 5,457 km of trackline and observed 135 bottlenose dolphin groups accounting for 957 individual animals.

Abundance estimates for bottlenose dolphins in each stock were calculated using line-transect methods and distance analysis (Buckland *et al.* 2001). The 2002 surveys included two teams of observers to derive a correction for visibility bias. The independent and joint estimates from the two survey teams were used to quantify the probability that animals available to the survey on the trackline were missed by the observer teams, or perception bias, using the direct-duplicate estimator (Palka 1995). The resulting estimate of the probability of seeing animals on the trackline was applied to abundance estimates for the summer 2004 and winter 2005 surveys. Observed bottlenose dolphin groups were also partitioned between the coastal and offshore morphotypes based upon analysis of available biopsy samples (Garrison *et al.* 2003).

For the Northern Florida Coastal stock, the mean of the summer 2002 and 2004 abundance estimates provided the best estimate of abundance. During winter months, this stock overlaps spatially with the Southern Migratory stock, and hence winter survey data are inappropriate for estimating abundance. There is strong inter-annual variation in the abundance estimates and observed spatial distribution of bottlenose dolphins in this region that may indicate movements of animals in response to environmental variability. The abundance estimate for this stock from the summer 2002 survey was 737 (CV=0.47) and that from summer 2004 was 5,391 (CV=0.27). The best abundance estimate is the unweighted average of these 2 surveys and is 3,064 (CV=0.24). It is unknown why the abundance estimates from 2002 and 2004 differ by nearly an order of magnitude. Survey methodologies did not differ significantly between the years, although a larger amount of survey effort was expended in the Northern Florida and Central Florida strata during 2004 than in 2002. The disparity most likely represents variability in dolphin spatial distribution between those 2 years. Because the 2 abundance estimates differ so dramatically, using an inverse-variance weighted mean when combining the estimates would heavily weight the smaller of the 2 estimates, and therefore would likely introduce negative bias into the estimate of stock size. Therefore, an unweighted mean of the 2002 and 2004 abundance estimates was calculated and used as the best estimate of stock abundance.

Minimum Population Estimate

The minimum population size (Nmin) for the stock was calculated as the lower bound of the 60% confidence interval for a log-normally distributed mean (Wade and Angliss 1997). The best estimate for the Northern Florida Coastal stock is 3,064 (CV=0.24). The resulting minimum population estimate is 2,511.

Current Population Trend

There are insufficient data to determine the population trends for this stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for the western North Atlantic coastal morphotype. 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 Florida Coastal stock of bottlenose dolphins is 2,502. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is depleted. PBR for this stock of bottlenose dolphins is 25.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

Three Category II fisheries have the potential to interact with the Northern Florida Coastal stock of bottlenose dolphins – the Southeastern U.S. Atlantic shark gillnet fishery, the Southeast Atlantic gillnet fishery and the Atlantic blue crab/trap pot fishery. In addition, the Southeastern U.S. Atlantic shrimp trawl fishery (Category III) may interact with this stock. Only limited observer data are available for these and other fisheries that may interact with this stock. Therefore, the total average annual mortality estimate is a lower bound of the actual annual human-caused mortality for each stock. Detailed fishery information is presented in Appendix III.

Southeastern U.S. Atlantic Shark Gillnet Fishery and Southeast Atlantic Gillnet Fishery

Gillnet fisheries targeting finfish and sharks operate in southeast waters between North Carolina and southern Florida. Historically, a drift net fishery targeting coastal sharks operated in waters including within the Northern Florida Coastal stock boundaries during winter months. Bottlenose dolphin takes (n=2) in the drift net fisheries were documented in 2002 and 2003 just south of the range of the Northern Florida Coastal stock (Garrison 2007). Currently, gillnet fisheries include a number of different fishing methods and gear types including drift nets, "strike" fishing, and anchored ("sink") gillnets. The majority of this fishing is reported from waters of North Carolina and central Florida. Gillnet trips (average 211 annually from 2004-2008) are reported within the bounds of the Northern Florida Coastal stock. There have been no observed bottlenose dolphin takes within the stock boundaries, but there was no observer coverage in 2008, so it was not possible to observe any takes (Table 1).

Table 1. Summary of the 2004-2008 incidental mortality of bottlenose dolphins (*Tursiops truncatus truncatus*) by stock in the southeast gillnet fisheries in water of the Northern Florida Coastal stock. Data include years sampled (Years), number of vessels reporting effort within the fishery (Vessels), type of data used (Data Type), annual observer coverage (Observer Coverage), mortalities recorded by on-board observers (Observed Mortality), estimated annual mortality (Estimated Mortality), estimated CV of the annual mortality (Estimated CVs), and mean annual mortality (CV in parentheses).

Stock	Years	Vessels	Data Type [a]	Observer Coverage [b]	Observed Serious Injury	Observed Mortality	Estimated Mortality	Estimated CVs	Mean Annual Mortality
Northern Florida Coastal	2004-2008		Obs. Data, SEFSC FVL	0.14, 0.09, 0.02, 0.03, 0	0, 0, 0, 0, unk	0, 0, 0, 0, unk	0, 0, 0, 0, NA	NA	0* (*no observer coverage in 2008)

NA = cannot be calculated

[a] Observer data are used to estimate bycatch rates. The SEFSC Fishing Vessel Logbook (FVL) is used to estimate effort as total number of reported trips with effort inside the stock boundaries. Reported fishery effort includes a number of different fishing methods and target species that cannot be separated.

[b] Percent observer coverage is reported on a per trip basis as limited by reporting to the FVL. Multiple sets may occur on any given trip.

Atlantic Blue Crab/Trap Pot Fishery

During 2004-2008, no stranded animals assigned to the Northern Florida Coastal stock showed evidence of entanglement in trap pot gear.

Southeastern U.S. Shrimp Trawl Fishery

The shrimp trawl fishery operates in waters off the Florida coast. However, there has been little to no observer coverage of this fishery in the last decade. No other bottlenose dolphin mortality or serious injury related to shrimp trawling along the Florida coast has been reported to NMFS.

Other Mortality

Seventy-eight stranded bottlenose dolphins were recovered between 2004 and 2008 in the waters of the Northern Florida Coastal stock (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009). It was not possible to determine whether or not there was evidence of human interaction for 67 of these strandings, and for 8 it was determined there was no evidence of human interaction. The remaining 3 showed evidence of human interaction but none showed evidence of fishery interaction, although 1 animal had rope marks on the caudal peduncle that may have been from a fishery interaction but it is not possible to determine this without examining the rope, which was not found on the animal at the time of stranding. It is worth noting that during winter months, the Northern Florida Coastal stock likely overlaps with the Southern Migratory stock and it is currently not possible to distinguish between them. Hence during winter months, stranded dolphins could come from either of these 2 stocks.

The nearshore 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 bottlenose dolphin inhabiting estuaries along the Atlantic coast and have likewise found evidence of high blubber concentrations, particularly near Charleston, South Carolina, and Beaufort, North Carolina (Hansen *et al.* 2004). The concentrations found in male dolphins from both of these sites exceeded toxic threshold values that may result in adverse effects on health or reproductive rates (Schwacke *et al.* 2002; Hansen *et al.* 2004). 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). While there are no direct measurements of adverse effects of pollutants on dolphins, the exposure to environmental pollutants and subsequent effects on population health is an area of concern and active research.

STATUS OF STOCK

From 1995 to 2001, NMFS recognized only a single migratory stock of coastal bottlenose dolphins in the western North Atlantic, 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 2010 to recognize resident estuarine stocks and migratory and resident coastal stocks. The total U.S. fishery-related mortality and serious injury for the Northern Florida Coastal stock likely is less than 10% of the calculated PBR, and thus can be considered to be insignificant and approaching zero mortality and serious injury rate. However, there are commercial fisheries overlapping with this stock that have no observer coverage. This stock retains the depleted designation as a result of its origins from the originally delineated depleted coastal migratory stock. The species is not listed as threatened or endangered under the Endangered Species Act, but this is a strategic stock due to the depleted listing under the MMPA.

REFERENCES CITED

Balmer, B. C., R. S. Wells, S. M. Nowacek, D. P. Nowacek, L. H. Schwacke, W. A. McLellan, F. S. Scharf, T. K. Rowles, L. J. Hansen, T. R. Spradlin and D. A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. J. Cetacean Res. Manage. 10: 157-167.

Barlow, J., S. L. Swartz, T. C. Eagle and P. R. Wade. 1995. U.S. marine mammal stock assessments: Guidelines for preparation, background and a summary of the 1995 assessments. NOAA Tech. Memo. NMFS-OPR-6, 73 pp.

Buckland, S. T., D. R. Andersen, K. P. Burnham, J. L. Laake, D. L. Borchers and L. Thomas. 2001. Introduction to distance sampling: Estimating abundance of biological populations. Oxford University Press, New York, 432 pp.

Caldwell, M. 2001. Social and genetic structure of bottlenose dolphin (*Tursiops truncatus*) in Jacksonville, Florida. Ph.D. dissertation from University of Miami. 143 pp.

Cortese, N. A. 2000. Delineation of bottlenose dolphin populations in the western Atlantic Ocean using stable isotopes. Master's thesis from University of Virginia, Charlottesville. 118 pp.

CETAP (Cetacean and Turtle Assessment Program). 1982. A characterization of marine mammals and turtles in the mid- and North Atlantic areas of the U.S. outer continental shelf. Final Report, Contract AA551- CT8- 48, U.S. NTIS PB83-215855, Bureau of Land Management, Washington, D.C. 576 pp.

Duffield, D. A. and R. S. Wells 2002. The molecular profile of a resident community of bottlenose dolphins, *Tursiops truncatus*. pp. 3-11. *In*: C. J. Pfeiffer, (ed.) Cell and Molecular Biology of Marine Mammals. Krieger Publishing, Melbourne, FL. 464 pp.

Garrison, L. P. 2007. Estimated marine mammal and turtle bycatch in the shark gillnet fisheries along the southeast U.S. Atlantic coast: 2000-2006. Southeast Fisheries Science Center, 75 Virginia Beach Dr., Miami, FL 33149. PRD Document #07/08-10, 22 pp.

Garrison, L. P., P. E. Rosel, A. A. Hohn, R. Baird and W. Hoggard. 2003. Abundance of the coastal morphotype of bottlenose dolphin *Tursiops truncatus*, in U.S. continental shelf waters between New Jersey and Florida during winter and summer 2002. NMFS/SEFSC report prepared and reviewed for the Bottlenose Dolphin Take Reduction Team. Available from: NMFS, Southeast Fisheries Science Center, 75 Virginia Beach Dr., Miami, FL 33149.

Garrison, L. P. and C. Yeung. 2001. Abundance estimates for Atlantic bottlenose dolphin stocks during summer and winter, 1995. NMFS/SEFSC report prepared and reviewed for the Bottlenose Dolphin Take Reduction

Team. Available from: NMFS, Southeast Fisheries Science Center, 75 Virginia Beach Dr., Miami, FL 33149.

Hansen, L. J., L. H. Schwacke, G. B. Mitchum, A. A. Hohn, R. S. Wells, E. S. Zolman and P. A. Fair. 2004. Geographic variation in polychlorinated biphenyl and organohaline pesticide concentrations in the blubber of bottlenose dolphins from the US Atlantic coast. Sci. Total Environ. 319: 147-172.

Hoelzel, A. R., C. W. Potter and P. B. Best. 1998. Genetic differentiation between parapatric nearshore and offshore populations of the bottlenose dolphin. Proc. Royal Soc. London 265: 1177-1183.

Kenney, R. D. 1990. Bottlenose dolphins off the northeastern United States. pp. 369-386. *In:* S. Leatherwood and R. R. Reeves (eds.) The bottlenose dolphin. Academic Press, San Diego, CA. 653 pp.

Kuehl, D. W., R. Haebler, C. Potter. 1991. Chemical residues in dolphins from the US Atlantic coast including Atlantic bottlenose obtained during the 1987/1988 mass mortality. Chemosphere 22: 1071-1084.

Litz, J. A. 2007. Social structure, genetic structure, and persistent organohaline pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, FL. Ph.D. dissertation from University of Miami. 140 pp.

Mazzoil, M., J. S. Reif, M. Youngbluth, M. E. Murdoch, S. E. Bechdel, E. Howells, S. D. McCulloch, L. J. Hansen and G. D. Bossart. 2008. Home ranges of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida: Environmental correlates and implications for management strategies. EcoHealth 5: 278-288.

Mead, J. G. and C. W. Potter. 1995. Recognizing two populations of the bottlenose dolphin (*Tursiops truncatus*) off the Atlantic coast of North America: Morphological and ecological considerations. IBI Reports 5: 31-44.

McLellan, W. M., A. S. Friedlaender, J. G. Mead, C. W. Potter and D. A. Pabst. 2003. Analysing 25 years of bottlenose dolphin (*Tursiops truncatus*) strandings along the Atlantic coast of the USA: Do historic records support the coastal migratory stock hypothesis? J. Cetacean Res. Manage. 4: 297-304.

NMFS. 2001. Stock structure of coastal bottlenose dolphins along the Atlantic coast of the US. NMFS/SEFSC Report prepared for the Bottlenose Dolphin Take Reduction Team. Available from: NMFS, Southeast Fisheries Science Center, 75 Virginia Beach Dr., Miami, FL 33149.

Palka, D. 1995. Abundance estimate of the Gulf of Maine harbor porpoise. pp. 27-50. *In:* A. Bjørge and G.P. Donovan. Biology of Phocoenids. Rep. Int. Whal. Comm., Special Issue 16, Cambridge, U.K.

Rosel, P. E., L. Hansen and A. A. Hohn. 2009. Restricted dispersal in a continuously distributed marine species: Common bottlenose dolphins *Tursiops truncatus* in coastal waters of the western North Atlantic. Mol. Ecol. 18: 5030–5045.

Schwacke, L. H., E. O. Voit, L. J. Hansen, R. S. Wells, G. B. Mitchum, A. A. Hohn and P. A. Fair. 2002. Probabilistic risk assessment of reproductive effects of polychlorinated biphenyls on bottlenose dolphins (*Tursiops truncatus*) from the southeast United States coast. Env. Toxic. Chem. 21: 2752-2764.

Scott, G. P., D. M. Burn and L. J. Hansen. 1988. The dolphin die off: Long term effects and recovery of the population. Proceedings: Oceans '88, IEEE Cat. No. 88-CH2585-8, Vol. 3: 819-823.

Scott, M. D., R. S. Wells and A. B. Irvine. 1990. A long-term study of bottlenose dolphins on the west coast of Florida. pp. 235-244. *In:* S. Leatherwood and R. R. Reeves (eds.) The bottlenose dolphin. Academic Press, San Diego, CA. 653 pp.

Stolen, M. K., W. N. Durden and D.K. Odell. 2007. Historical synthesis of bottlenose dolphin (*Tursiops truncatus*) stranding data in the Indian River Lagoon system, Florida, from 1977-2005. Fla. Sci. 70: 45-54.

Speakman, T., E. S. Zolman, J. Adams, R. H. Defran, D. Laska, L. Schwacke, J. Craigie and P. Fair. 2006. Temporal and spatial aspects of bottlenose dolphin occurrence in coastal and estuarine waters near Charleston, South Carolina. NOAA Tech. Memo. NOS-NCCOS-37, 243 pp.

Wade, P. R. and R. P. Angliss. 1997. Guidelines for assessing marine mammal stocks: Report of the GAMMS Workshop April 3-5, Seattle, Washington. NOAA Tech. Memo. NMFS-OPR-12, 93 pp.

Weller, D. W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Ph.D. dissertation from Texas A&M University, College Station. 142 pp.

Wells, R. S., M. D. Scott and A.B. Irvine. 1987. The social structure of free ranging bottlenose dolphins. pp. 247-305. *In:* H. Genoways (ed.) Current Mammalogy, Vol. 1. Plenum Press, New York. 519 pp.

Wells, R. S., V. Tornero, A. Borrell, A. Aguilar, T. K. Rowles, H. L. Rhinehart, S. Hofmann, W. M. Jarman, A. A. Hohn and J. C. Sweeney. 2005. Integrating life history and reproductive success data to examine potential relationships with organochlorine compounds for bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Sci. Total Environ. 349: 106-119.

Wells, R. S., K. W. Urian, A. J. Read, M. K. Bassos, W. J. Carr and M. D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. NOAA Tech. Memo. NMFS-SEFSC- 385, 25 pp. + 6 Tables, 8 Figures, and 4 Appendices.

Zolman, E. S. 2002. Residence patterns of bottlenose dolphins (*Tursiops truncatus*) in the Stono River Estuary, Charleston County, South Carolina. Mar. Mamm. Sci.18: 879-892.