

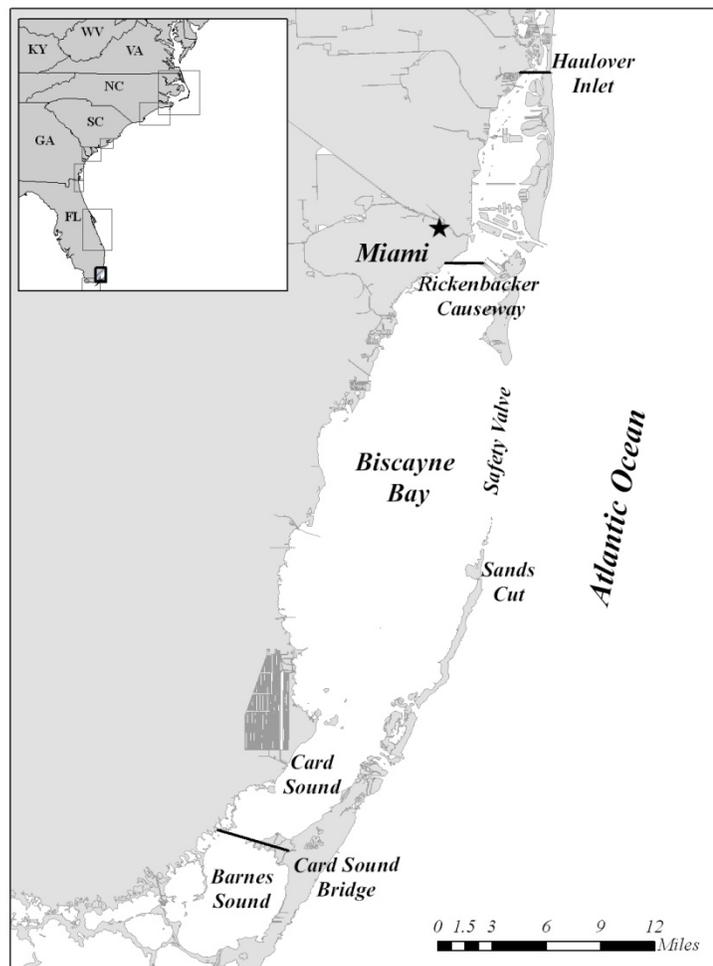
## BOTTLENOSE DOLPHIN (*Tursiops truncatus*) Biscayne Bay Stock

### STOCK DEFINITION AND GEOGRAPHIC RANGE

The coastal morphotype of bottlenose dolphin is continuously distributed along the Atlantic coast south of Long Island, New York, to the Florida peninsula, including inshore waters of the bays, sounds and estuaries. Except for animals residing within the Southern North Carolina and Northern North Carolina Estuarine Systems (e.g., Waring *et al.* 2009), estuarine dolphins along the U.S. east coast have not previously been included in stock assessment reports. Several lines of evidence support a distinction between dolphins inhabiting coastal waters near the shore and those present 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 inshore areas of the southeastern United States (Caldwell 2001; Gubbins 2002; Zolman 2002; Mazzoil *et al.* 2005; Litz 2007), 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between animals biopsied along the coast and those biopsied within the estuarine systems at the same latitude (NMFS unpublished data). Similar results have been found off the west coast of Florida (Sellas *et al.* 2005).

Biscayne Bay is a shallow estuarine system located along the southeast coast of Florida in Miami-Dade county. The Bay is generally shallow (depths <5m) and includes a diverse range of benthic communities including seagrass beds, soft coral and sponge communities, and mud flats. The northern portion of the Bay (Figure 1) is surrounded by the cities of Miami and Miami Beach and is therefore heavily influenced by industrial and municipal pollution sources. The water flow in this portion of the Bay is very restricted due to the construction of dredged islands (Bialczak *et al.* 2001). In contrast, the central and southern portions of the Bay are less influenced by development and are better flushed. Water exchange with the Atlantic Ocean occurs through a broad area of grass flats and tidal channels termed the Safety Valve. The Bay extends south through Card Sound and Barnes Sound, and connects through smaller inlets to Florida Bay (Figure 1). The Biscayne Bay stock of bottlenose dolphins is bounded by Haulover Inlet to the north and Card Sound bridge to the south. This range corresponds to the

extent of confirmed home ranges of bottlenose dolphins observed residing in Biscayne Bay by a long-term photo-ID study conducted by the Southeast Fisheries Science Center (Litz 2007; SEFSC unpublished data). It is likely that the range of Biscayne Bay dolphins extends past these boundaries; however, there have been few surveys outside of this range. These boundaries are subject to change upon further study of dolphin home ranges within the Biscayne Bay estuarine system and comparison to an extant photo-ID catalog from Florida Bay to the south.



Dolphins residing within estuaries north of this stock along the southeastern coast of Florida are currently not included in any Stock Assessment Report. There are insufficient data to determine whether animals in this region exhibit affiliation to the Biscayne Bay stock, the estuarine stock further to the north in the Indian River Lagoon Estuarine System (IRLES), or are simply transient animals associated with coastal stocks. There is relatively limited estuarine habitat along this coastline; however, the Intracoastal Waterway extends north along the coast to the IRLES. It should be noted that during 2003-2007, there were 3 stranded bottlenose dolphins in this region in enclosed waters. One of these had signs of human interaction from a boat strike and another was identified as an offshore morphotype bottlenose dolphin.

Bottlenose dolphins have been documented in Biscayne Bay since the 1950's (Moore 1953). Live capture fisheries for bottlenose dolphins are known to have occurred throughout the southeastern U.S. and within Biscayne Bay during the 1950's and 1960's; however, it is unknown how many individuals may have been removed from the population during this period (Odell 1979; Wells and Scott 1999).

The Biscayne Bay bottlenose dolphin stock has been the subject of an ongoing photo-ID study conducted by the NMFS Southeast Fisheries Science Center since 1990. From 1990 to 1991, preliminary information was collected focusing on the central portion of the Bay. The survey was re-initiated in 1994, and it was expanded to include the northern portion of the Bay and south to the Card Sound Bridge in 1995 (SEFSC unpublished data; Litz 2007). Through 2007, the photo-ID catalog included 229 unique individuals. Approximately 80% of these individuals may be long-term residents with multiple sightings over the 17 years of the study (SEFSC unpublished data). Analyses of the sighting histories and associations of individuals from the Biscayne Bay photo-ID data demonstrated that there are at least 2 overlapping social groups of animals within Biscayne Bay segregated along a north/south gradient (Litz 2007).

Remote biopsy samples of Biscayne Bay animals were collected between 2002 and 2004 for analyses of population genetic structure and persistent organic pollutant concentrations in blubber. Genetic structure was investigated using both mitochondrial DNA (mtDNA) and nuclear (microsatellite) markers, and the data from Biscayne Bay were compared to data from Florida Bay dolphins to the south (Litz 2007). Within Biscayne Bay, dolphins sighted primarily in the northern half of the Bay were significantly differentiated from those sighted primarily in the southern half at the microsatellite loci but not at the mitochondrial locus. There was not sufficient genetic differentiation between these groups to indicate true population subdivision (Litz 2007). However, genetic differentiation was found between the Biscayne Bay and Florida Bay dolphins in both markers (Litz 2007). The observed genetic differences between resident animals in Biscayne Bay and those in an adjacent estuary combined with the high levels of sight fidelity observed, demonstrate that the resident Biscayne Bay bottlenose dolphins are a demographically distinct population stock.

## **POPULATION SIZE**

The total number of bottlenose dolphins residing within the Biscayne Bay stock is unknown. An initial evaluation of the abundance of bottlenose dolphins in Biscayne Bay was conducted with aerial surveys in 1974-1975 covering predominantly the central portion of the Bay from Rickenbacker Causeway to the northern end of Card Sound. Bottlenose dolphins were observed in the Bay on 7 of 22 aerial surveys with the sightings totaling 67 individuals. Only 1 group was seen on each survey. This led the authors to conclude that there was likely 1 herd of approximately 13 animals occupying the Bay (Odell 1979). It was noted that this encounter rate was much lower than that in the adjacent Everglades National Park, and that the apparent low density of dolphins in Biscayne Bay had limited the effectiveness of the collection of live animals for display.

Between 1994 and 2007, 394 small boat surveys of Biscayne Bay were conducted for the bottlenose dolphin photo-ID study. A day's survey effort covered either the northern (Haulover Inlet to Rickenbacker Causeway), central (Rickenbacker Causeway to Sands Cut) or southern (Sands Cut to Card Sound Bridge) region of the Bay. Each area was surveyed 8-12 times per year on a monthly basis from 1994 to 2003. From 2003 to 2007, the number of surveys was lower and ranged between 4 and 8 per year, and the lowest amount of effort was expended in the southern portion of the Bay. When dolphins were encountered, estimates of group size were made, and photographs of fins were taken of as many individuals as possible. The fins were cataloged and individuals identified using standard methods (SEFSC unpublished data). There were 157 unique individuals identified in the photo-ID surveys between 2003 and 2007. However, this catalog size does not represent a valid estimate of population size because the residency patterns of dolphins in Biscayne Bay are not fully understood. It is currently not possible to develop a mark-recapture estimate of population size from the photo-ID catalog. However, research is currently underway to estimate the abundance of the Biscayne Bay stock using a photographic mark-recapture method.

### **Minimum Population Estimate**

Present data are insufficient to calculate a minimum population estimate for the Biscayne Bay stock of bottlenose dolphins.

### **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 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 Biscayne Bay stock of bottlenose dolphins is unknown. 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 of unknown status. PBR for the Biscayne Bay stock of bottlenose dolphins is unknown.

### **ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY**

The total annual human-caused mortality and serious injury for the Biscayne Bay stock during 2003-2007 is unknown as there are no observed fisheries or estimates of total mortality. However, there was 1 documented mortality associated with the stone crab fishery in 2006. Thus, the minimum annual commercial-fishery-caused mortality for 2003-2007 is estimated as 0.2 animals per year.

### **Fishery Information**

There have been several documented mortalities of Biscayne Bay bottlenose dolphins in crab and lobster pot fisheries. There is no systematic observer coverage of these fisheries, therefore it is not possible to quantify total mortality.

### **Crab and Lobster Pots**

There have been 3 documented mortalities of bottlenose dolphins in Biscayne Bay associated with entanglement in crab and lobster pot fisheries. One entanglement mortality was documented in 1997 in lobster pot gear just outside of the opening of the Bay to the Atlantic Ocean on the eastern edge of the Safety Valve area. In 2002, an entanglement mortality was observed in the central portion of the Bay in a stone crab pot. Finally, in 2006 there was an entanglement mortality of a known Biscayne Bay resident animal, also in a stone crab pot. This entanglement occurred in the northern portion of the Bay.

### **Other Mortality**

There have been 2 mortalities of known resident Biscayne Bay bottlenose dolphins associated with ingestion and/or entanglement of recreational fishing gear including hooks and monofilament line. These mortalities occurred during 1990 and 1999.

There were 3 additional stranded animals occurring inside Biscayne Bay between 2003 and 2007 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 10 November 2008). The first occurred in 2004, and it was confirmed to be of the offshore morphotype by genetic testing and therefore not a Biscayne Bay resident. Two animals stranded in 2006, and 1 of these was a known Biscayne Bay resident. No definitive evidence of human interaction was detected for either of these animals; however human interaction could not be ruled out in either case.

The nearshore and estuarine habitats occupied by dolphins are adjacent to areas of high human population and some are highly industrialized. Recent studies have examined persistent organic pollutant concentrations in bottlenose dolphin tissues from several estuaries along the Atlantic coast and have likewise found evidence of high pollutant

concentrations in blubber, 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). A study of persistent organic pollutants in bottlenose dolphins of Biscayne Bay demonstrated a strong geographic gradient in pollutant concentrations between dolphins with sighting histories primarily in the northern, more polluted areas compared to dolphins with ranges in the southern portion of the Bay (Litz *et al.* 2007). The observed tissue concentrations of polychlorinated biphenyls (PCBs) for male animals from the northern Bay were 5 times higher than those in southern Biscayne Bay and were also higher than those of dolphins from other Atlantic estuaries including Beaufort, North Carolina, Charleston, South Carolina, Indian River Lagoon, Florida, and Florida Bay (Litz *et al.* 2007). These findings demonstrate differential exposure of bottlenose dolphins to pollutants through the food chain on a very fine spatial scale within Biscayne Bay and between estuaries.

## 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 as a result of the 1987-1988 mortality event. Scott *et al.* (1988) suggested that dolphins residing in the bays, sounds and estuaries adjacent to these coastal waters were not affected by the mortality event and these animals were explicitly excluded from the depleted listing (Federal Register: 54(195), 41654-41657; 56(158), 40594-40596; 58(64), 17789-17791).

The status of the Biscayne Bay stock relative to OSP is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine population trends for this stock. The total human-caused mortality and serious injury for this stock is unknown and there is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. Documented human-caused mortalities in recreational fishing gear entanglement and ingestion of gear reinforce concern for this stock. Because the stock size is currently unknown, but likely small and relatively few mortalities and serious injuries would exceed PBR, the NMFS considers this stock to be a strategic stock.

## 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(2): 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.
- Bialczak, M., J.R. Murley and L. Cantral 2001. Biscayne Bay Partnership Initiative; Survey team final reports. Miami, FL 320 pp.
- Caldwell, M. 2001. Social and genetic structure of bottlenose dolphin (*Tursiops truncatus*) in Jacksonville, Florida. thesis. University of Miami, Coral Gables, FL. 143 pp.
- Gubbins, C. 2002. Association patterns of resident bottlenose dolphins (*Tursiops truncatus*) in a South Carolina estuary. *Aquatic Mammals* 28(1): 24-31.
- 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 organochlorine pesticide concentrations in the blubber of bottlenose dolphins from the U.S. Atlantic coast. *Sci. Total Environ.* 319: 147-172.
- Litz, J.A. 2007. Social structure, genetic structure, and persistent organohalogen pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. Ph.D. thesis. University of Miami. 140 pp.
- Litz, J.A., L.P. Garrison, L.A. Fieber, A. Martinez, J.P. Contillo and J.R. Kucklick 2007. Fine scale spatial variation of persistent organic pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. *Env. Sci. and Tech.* 41(21): 7222-7228.
- Mazzoil, M., S.D. McCulloch and R.H. Defran 2005. Observations on the site fidelity of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. *Florida Scientist* 68(4): 217-226.
- Moore, J.C. 1953. Distribution of marine mammals to Florida waters. *Am. Midl. Nat.* 49: 117-157.
- Odell, D.K. 1979. A preliminary study of the ecology and population biology of the bottlenose dolphin in Southeast Florida; Final report to the Marine Mammal Commission in fulfillment of contract MM4AC003. Miami,

- FL: University of Miami.
- 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. *Environ. Toxicol. Chem.* 21(12): 2752-2764.
- Scott, G.P., D.M. Burn and L.J. Hansen 1988. The dolphin dieoff: Long-term effects and recovery of the population. Conference proceedings, Oceans '88. IEEE Cat. No. 88-CH2585-8.
- Sellas, A.B., R.S. Wells and P.E. Rosel 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. *Conservation Genetics* 6(5): 715-728.
- Wade, P.R. and R.P. Angliss 1997. Guidelines for assessing marine mammal stocks: Report of the GAMMS Workshop April 3-5, 1996, Seattle, Washington. NOAA Tech. Memo. NMFS-OPR-12. 93 pp.
- Waring, G.T., E. Josephson, C.P. Fairfield-Walsh and K. Maze-Foley, eds. 2009. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments -- 2008. NOAA Tech Memo. NMFS NE 210. 440 pp.
- Wells, R.S. and M.D. Scott 1999. Bottlenose dolphins. Pages 137-182 *in*: S.H. Ridgway and R. Harrison, (eds.) Handbook of marine mammals. Vol. 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA.
- Wells, R.S., M.D. Scott and A.B. Irvine 1987. The social structure of free ranging bottlenose dolphins. Pages 247-305 *in*: H. Genoways, (ed.) Current Mammology, Vol. 1. Plenum Press, New York. Vol. 1.
- Zolman, E.S. 2002. Residence patterns of bottlenose dolphins (*Tursiops truncatus*) in the Stono River estuary, Charleston County, South Carolina, U.S.A. *Marine Mammal Science* 18(4): 879-892.