

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

**NOTE** – NMFS is in the process of writing individual stock assessment reports for each of the 32 bay, sound and estuary stocks of bottlenose dolphins in the Gulf of Mexico. Until this effort is completed and 32 individual reports are available, some of the basic information presented in this report will also be included in the report: “Northern Gulf of Mexico Bay, Sound and Estuary Stocks”.

### STOCK DEFINITION AND GEOGRAPHIC RANGE

Bottlenose dolphins are distributed throughout the bays, sounds and estuaries of the Gulf of Mexico (Mullin 1988). Long-term (year-round, multi-year) residency by at least some individuals has been reported from nearly every site where photographic identification (photo-ID) or tagging studies have been conducted in the Gulf of Mexico (e.g., Irvine and Wells 1972; Shane 1977; Gruber 1981; Irvine *et al.* 1981; Wells 1986a; Wells *et al.* 1987; Scott *et al.* 1990; Shane 1990; Wells 1991; Bräger 1993; Bräger *et al.* 1994; Fertl 1994; Wells *et al.* 1996a,b; Wells *et al.* 1997; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Wells 2003; Hubard *et al.* 2004; Irwin and Würsig 2004; Shane 2004; Balmer *et al.* 2008; Urian *et al.* 2009). In many cases, residents predominantly use the bay, sound or estuary waters, with limited movements through passes to the Gulf of Mexico (Shane 1977; Shane 1990; Gruber 1981; Irvine *et al.* 1981; Shane 1990; Maze and Würsig 1999; Lynn and Würsig 2002; Fazioli *et al.* 2006). Early studies indicating year-round residency to bays in both the eastern and western Gulf of Mexico led to the delineation of 33 bay, sound and estuary stocks, including Choctawhatchee Bay, with the first stock assessment reports in 1995.

More recently, genetic data also support the concept of relatively discrete bay, sound and estuary stocks (Duffield and Wells 2002; Sellas *et al.* 2005). Sellas *et al.* (2005) examined population subdivision among Sarasota Bay, Tampa Bay, Charlotte Harbor, Matagorda Bay, Texas, and the coastal Gulf of Mexico (1-12 km offshore) from just outside Tampa Bay to the south end of Lemon Bay, and found evidence of significant population differentiation among all areas on the basis of both mitochondrial DNA control region sequence data and 9 nuclear microsatellite

loci. The Sellas *et al.* (2005) findings support the identification of bay, sound and estuary populations distinct from those occurring in adjacent Gulf coastal waters. Differences in reproductive seasonality from site to site also suggest genetic-based distinctions among areas (Urian *et al.* 1996). Additionally, photo-ID and genetic data from several

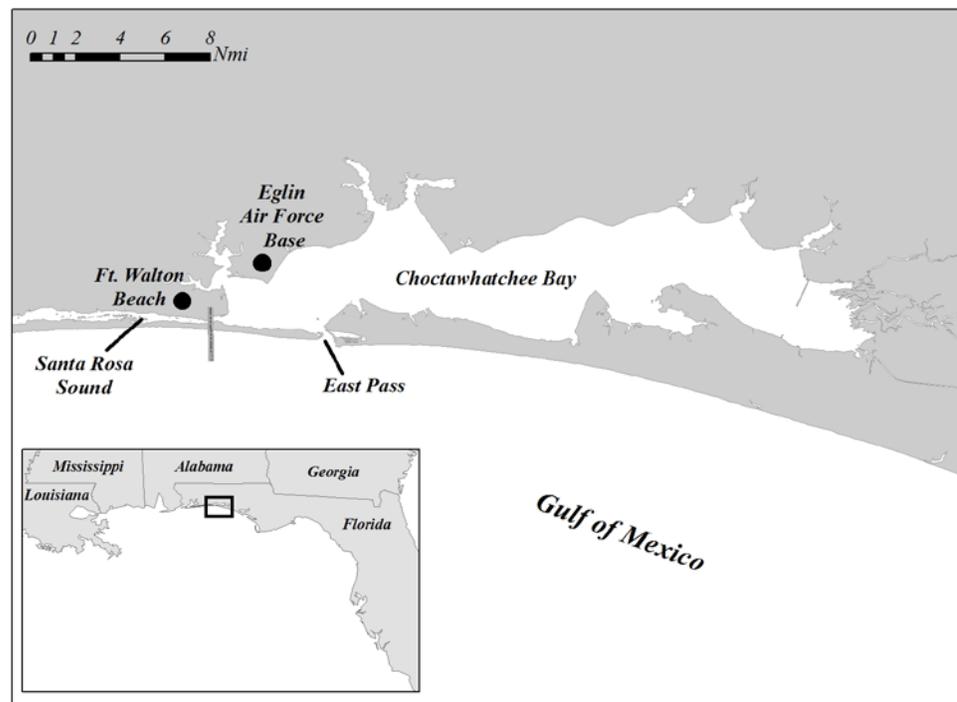


Figure 1. Geographic extent of the Choctawhatchee Bay Stock, located in the Florida panhandle. The western border (with Santa Rosa Sound) is denoted by a solid line.

inshore areas of the southeastern United States also support the existence of resident estuarine animals and a differentiation between animals biopsied along the Atlantic coast and those biopsied within estuarine systems at the same latitude (Caldwell 2001; Gubbins 2002; Zolman 2002; Mazzoil *et al.* 2005; Litz 2007; Rosel *et al.* 2009; NMFS unpublished).

Choctawhatchee Bay is located in the Florida panhandle and connected to the Gulf of Mexico by a single pass, East Pass (Figure 1). The bay is approximately 348km<sup>2</sup> in surface area, 43km in length and 2-10km in width (Florida Department of Environmental Protection 2010; Conn *et al.* 2011). The bay is relatively shallow with steep slopes. Water depth averages 8m in western portions and 3m in eastern portions, with an overall mean depth of 3.8m. Fresh water flows into Choctawhatchee Bay from the Choctawhatchee River primarily (90% of freshwater input), and from numerous small creeks and bayous as well. Salinity varies from 0 to 34ppt on an east to west basis from the river delta in the east to East Pass in the west. Choctawhatchee Bay is bordered by forested wetlands and marshes (FL Department of Environmental Protection 2010). To the north and east, development is limited, partly due to the presence of Eglin Air Force Base. To the south and west are well-developed tourist areas (Conn *et al.* 2011). Both commercial and recreational fishing, as well as oyster harvesting, occur in Choctawhatchee Bay. Environmental concerns for this area include eutrophication and its associated problems (e.g., harmful algal blooms, hypoxia) and loss of seagrass beds and tidal marshes (FL Department of Environmental Protection 2010).

Bottlenose dolphins utilizing Choctawhatchee Bay are of particular concern to the NMFS due to the potential impacts of recent Unusual Mortality Events (UMEs) on the population (Conn *et al.* 2011; see ‘Other Mortality’ section). Partly as a result of elevated stranding levels in recent years, Choctawhatchee Bay was chosen by the NMFS as the first in a series of north-central Gulf of Mexico bay, sound and estuary stocks to produce abundance estimates for bottlenose dolphins. Photo-ID surveys were conducted during July–August 2007 and mark-recapture models were used to generate abundance estimates for residents and for residents plus transients (Conn *et al.* 2011).

The boundaries of this stock include waters of Choctawhatchee Bay from Point Washington and Jolly Bay in the east to Fort Walton Beach in the west as this is the area surveyed during the most recent mark-recapture photo-ID abundance surveys. The boundaries are likely to change as additional research is conducted. Some animals sighted multiple times in Choctawhatchee Bay have also been sighted in Santa Rosa Sound and/or Pensacola Bay to the west (Shippee 2010), suggesting the geographic area encompassing this stock may have to be expanded westward to include some or all of these areas as well. Further research is needed to fully determine the degree of overlap between dolphins inhabiting primarily Choctawhatchee Bay and those inhabiting primarily Pensacola Bay and waters in between, and the degree of genetic exchange between dolphins in these areas. Dolphins have been observed leaving Choctawhatchee Bay through the pass and entering nearshore coastal waters (Shippee 2010). Further information is needed to determine how often this stock utilizes these waters. Information on the use of nearshore waters will be important when considering exposure to coastal fisheries as estuarine animals that make use of nearshore coastal waters would be at risk of entanglement in fishing gear while moving along the coast.

## **POPULATION SIZE**

In order to estimate abundance of residents and of residents plus transients, photo-ID mark-recapture surveys were conducted during July–August 2007 in Choctawhatchee Bay using “racetrack” (sampling the perimeter of the bay, taking about 3 days to complete) and “zigzag” (sampling open waters and sections of the racetrack, taking about 4 days to complete) tracklines (Conn *et al.* 2011). Each survey was conducted in Beaufort Sea State 3 or less, in good weather, at a survey speed of 12-14kts. Twenty-one percent of dolphins photographed had non-distinctive dorsal fins, and 188 individuals were identified overall. Conn *et al.* (2011), averaging over all fitted models, estimated resident abundance as 179 (CV=0.04) and resident plus transient abundance as 232 (CV=0.06). Therefore, the best available abundance estimate of the resident Choctawhatchee Bay Stock is 179 (CV=0.04). Because this estimate does not account for the proportion of the population with unmarked fins, it is negatively biased. A reanalysis of the data using a method that accounts for unmarked fins is required for a less negatively biased estimate.

### **Minimum Population Estimate**

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate for the Choctawhatchee Bay Stock is 179 (CV=0.04). The resulting minimum population estimate is 173.

### **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 Choctawhatchee Bay Stock of bottlenose dolphins is 173. 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 this stock of bottlenose dolphins is 1.7.

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

The total annual human-caused mortality and serious injury of the Choctawhatchee Bay Stock of bottlenose dolphins during 2006–2010 is unknown.

### **Fishery Information**

The commercial fisheries which potentially could interact with this stock are the shrimp trawl, blue crab trap/pot, stone crab trap/pot, menhaden purse seine, and Atlantic Ocean commercial passenger fishing vessel (hook and line) fisheries (Appendix III). There have been no documented interactions between Choctawhatchee Bay bottlenose dolphins and the shrimp trawl fishery. There have been no documented mortalities of Choctawhatchee Bay bottlenose dolphins in crab trap/pot fisheries. There is no systematic observer coverage of crab trap/pot fisheries; therefore, it is not possible to quantify total mortality. There are no recent observer program data for the Gulf of Mexico menhaden purse seine fishery. The menhaden fishery in this area is very limited. During 2010, there was only 1 fishing trip for Walton County, Florida, and none for Okaloosa County, Florida (Florida Fish and Wildlife Conservation Commission 2011).

### **Hook and Line Fisheries**

During 2008 there was 1 mortality resulting from a rescue attempt to disentangle a calf from monofilament line. Also during 2008, an additional live entanglement was documented. The mortality and live entanglement were included in the stranding database and are included in the stranding totals presented in Table 1.

### **Other Mortality**

From 2006 to 2010, 47 bottlenose dolphins were reported stranded within the Choctawhatchee Bay Stock area (Table 1; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 November 2011). It was not possible to make any determination of possible human interaction for 31 of these strandings. For 12 dolphins, no evidence of human interactions was detected. For the remaining 4 dolphins, evidence of human interactions was found, 3 of which were fishery interactions. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals that die or are seriously injured in fishery interactions are discovered, reported or investigated, nor will all of those that are found necessarily show signs of entanglement or other fishery interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interactions.

Choctawhatchee Bay has been affected by 4 recent unusual mortality events (UMEs). First, between August 1999 and May 2000, 152 bottlenose dolphins died coincident with *K. brevis* blooms and fish kills in the Florida Panhandle. This UME started in St. Joseph Bay, Florida, and was concurrent spatially and temporally with a *K. brevis* bloom that spread east to west. There were 62 bottlenose dolphin strandings within Choctawhatchee Bay during this event, which accounted for about 41% of the total bottlenose dolphin strandings associated with this UME. Second, in March and April 2004, in another Florida Panhandle UME possibly related to *K. brevis* blooms, 105 bottlenose dolphins and 2

unidentified dolphins stranded dead (NOAA 2004). This event also started in St. Joseph Bay, and the majority (76%) of animals stranded in the St. Joseph Bay Stock area with only 2 strandings within Choctawhatchee Bay. Although there was no indication of a *K. brevis* bloom at the time, high levels of brevetoxin were found in the stomach contents of the stranded dolphins (Flewelling *et al.* 2005). Third, a separate UME was declared in the Florida Panhandle after elevated numbers of dolphin strandings occurred in association with a *K. brevis* bloom in September 2005. Dolphin strandings remained elevated through the spring of 2006 and brevetoxin was again detected in the tissues of some of the stranded dolphins. Between September 2005 and April 2006 when the event was officially declared over, a total of 90 bottlenose dolphin strandings occurred (plus strandings of 3 unidentified dolphins), with 44 (49%) occurring within Choctawhatchee Bay. Finally, an UME was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see “Habitat Issues” below), during the spill, and after. During 2010, 2 animals from this stock were considered to be part of the UME.

Table 1. Bottlenose dolphin strandings occurring in the Choctawhatchee Bay Stock area from 2006 to 2010, as well as number of strandings for which evidence of human interaction was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interaction. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 16 November 2011). Please note human interaction does not necessarily mean the interaction caused the animal’s death.

Stock	Category	2006	2007	2008	2009	2010	Total
Choctawhatchee Bay Stock	Total Stranded	32 <sup>a</sup>	8	4	1	2	47
	Human Interaction						
	---Yes	1	0	3	0	0	4
	---No	7	4	0	1	0	12
	---CBD	24	4	1	0	2 <sup>b</sup>	31

<sup>a</sup> This total includes 31 animals that were part of the 2005-2006 UME event.

<sup>b</sup> The 2 strandings from 2010 are part of the ongoing UME event in the northern Gulf of Mexico.

## HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

A substantial number of beaches and wetlands along the Louisiana coast experienced heavy or moderate oiling (OSAT-2 2011). The heaviest oiling in Louisiana occurred west of the Mississippi River on the Mississippi Delta and in Barataria and Terrebonne Bays, and to the east of the river on the Chandeleur Islands. Some heavy to moderate oiling occurred on Alabama and Florida beaches, with the heaviest stretch occurring from Dauphin Island, Alabama, to Gulf Breeze, Florida. Light to trace oil was reported along the majority of Mississippi barrier islands, from Gulf Breeze to Panama City, Florida, and outside of Atchafalaya and Vermilion Bays in western Louisiana (OSAT-2 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing. For coastal and estuarine dolphins, the NOAA-led efforts include: active surveillance to detect stranded animals in remote locations; aerial surveys to document the distribution, abundance, species and exposure of marine mammals and sea turtles relative to oil from DWH spill; assessment of sublethal and chronic health impacts on coastal and estuarine bottlenose dolphins in Barataria Bay, Louisiana, and a reference site in Sarasota Bay, Florida; and assessment of injuries to dolphin stocks

in Barataria Bay and Chandeleur Sound, Louisiana, Mississippi Sound, and as a reference site, St. Joseph Bay, Florida.

Coastal dolphins have been observed with tar balls attached to them and seen swimming through oil slicks close to shore and inland bays (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

#### **STATUS OF STOCK**

The status of the Choctawhatchee Bay Stock relative to OSP is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. The high number of bottlenose dolphin deaths associated with unusual mortality events in the Florida panhandle since 1999 suggests that this stock may be stressed. 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. Because the stock size and PBR are small, and 2 mortalities or serious injuries would exceed PBR, the NMFS considers this stock to be strategic.

#### **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.
- Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). *Mar. Mamm. Sci.* 9: 434-440.
- Bräger, S., B. Würsig, A. Acevedo and T. Henningsen. 1994. Association patterns of bottlenose dolphins (*Tursiops truncatus*) in Galveston Bay, Texas. *J. Mamm.* 75(2): 431-437.
- Caldwell, M. 2001. Social and genetic structure of bottlenose dolphin (*Tursiops truncatus*) in Jacksonville, Florida. Ph.D. dissertation from University of Miami. 143 pp.
- Conn, P.B., A.M. Gorgone, A.R. Jugovich, B.L. Byrd and L.J. Hansen. 2011. Accounting for transients when estimating abundance: A case study of bottlenose dolphins in Choctawhatchee Bay, Florida. *J. Wildl. Manage.* 75(3): 569-579.
- Duffield, D.A. and R.S. Wells 1986. Population structure of bottlenose dolphins: Genetic studies of bottlenose dolphins along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. 16 pp.
- Duffield, D.A. and R.S. Wells 1991. The combined application of chromosome, protein and molecular data for the investigation of social unit structure and dynamics in *Tursiops truncatus*. Pages 155-169 in: A. R. Hoelzel, (ed.) *Genetic Ecology of Whales and Dolphins*. Rep. Int. Whal. Comm., Cambridge, U.K. Special Issue 13.
- Duffield, D.A. and R.S. Wells 2002. The molecular profile of a resident community of bottlenose dolphins, *Tursiops truncatus*. Pages 3-11 in: C. J. Pfeiffer, (ed.) *Cell and Molecular Biology of Marine Mammals*. Krieger Publishing, Melbourne, FL.
- Fazioli, K.L., S. Hofmann and R.S. Wells 2006. Use of Gulf of Mexico coastal waters by distinct assemblages of bottlenose dolphins (*Tursiops truncatus*). *Aquat. Mamm.* 32(2): 212-222.
- Fertl, D.C. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel. *Texas J. Sci.* 46: 299-317.
- Flewelling, L.J., J.P. Naar, J. P. Abbott, D.G. Baden, N.B. Barros, G.D. Bossart, M.D. Bottein, D.G. Hammond, E.M.

- Haubold, C.A. Heil, M.S. Henry, H.M. Jacocks, T.A. Leighfield, R.H. Pierce, T.D. Pitchford, S.A. Rommel, P.S. Scott, K.A. Steidinger, E.W. Truby, F.M.V. Dolah and J.H. Landsberg. 2005. Red tides and marine mammal mortalities: Unexpected brevetoxin vectors may account for deaths long after or remote from an algal bloom. *Nature* 435: 755-756.
- Florida Department of Environmental Protection. 2010. Site-specific information in support of establishing numeric nutrient criteria for Choctawhatchee Bay. Draft report. Available at: [http://www.dep.state.fl.us/water/wqssp/nutrients/docs/estuarine/tallahassee/choctawhatchee\\_bay\\_081310.pdf](http://www.dep.state.fl.us/water/wqssp/nutrients/docs/estuarine/tallahassee/choctawhatchee_bay_081310.pdf).
- Florida Fish and Wildlife Conservation Commission. 2011. Marine fisheries information system - 2010 annual landings summary. Available at: [http://myfwc.com/media/1540765/sumcnty\\_10.pdf](http://myfwc.com/media/1540765/sumcnty_10.pdf)
- Geraci, J.R. 1990. Physiologic and toxic effects on cetaceans. pp. 167-197 In: J. R. Geraci and D. J. St. Aubin (eds.) *Sea mammals and oil: Confronting the risks*. Academic Press, New York. 259 pp.
- Gruber, J.A. 1981. Ecology of the Atlantic bottlenosed dolphin (*Tursiops truncatus*) in the Pass Cavallo area of Matagorda Bay, Texas. M. Sc. thesis from Texas A&M University, College Station. 182 pp.
- Gubbins, C. 2002. Association patterns of resident bottlenose dolphins (*Tursiops truncatus*) in a South Carolina estuary. *Aquat. Mamm.* 28: 24-31.
- Hubard, C.W., K. Maze-Foley, K.D. Mullin and W.W. Schroeder 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. *Aquat. Mamm.* 30: 299-310.
- Irvine, A.B., M.D. Scott, R.S. Wells and J.H. Kaufmann 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. *Fish. Bull.* 79: 671-688.
- Irvine, B. and R.S. Wells 1972. Results of attempts to tag Atlantic bottlenose dolphins (*Tursiops truncatus*). *Cetology* 13(1-5).
- Irwin, L.J. and B. Würsig 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. *G. Mex. Sci.* 22(1): 13-21.
- Lehr, B., S. Bristol and A. Possolo, eds. 2010. Oil budget calculator: Deepwater Horizon. Technical documentation. Prepared by the Federal Interagency Solutions Group, Oil Budget Calculator Science and Engineering Team for the National Incident Command. Available from: [http://www.restorethegulf.gov/sites/default/files/documents/pdf/OilBudgetCalc\\_Full\\_HQ-Print\\_111110.pdf](http://www.restorethegulf.gov/sites/default/files/documents/pdf/OilBudgetCalc_Full_HQ-Print_111110.pdf)
- Litz, J. A. 2007. Social structure, genetic structure, and persistent organohalogen pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. Ph.D. dissertation from University of Miami. 140 pp.
- Lynn, S.K. and B. Würsig 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. *G. Mex. Sci.* 20(1): 25-37.
- Maze, K.S. and B. Würsig 1999. Bottlenose dolphins of San Luis Pass, Texas: Occurrence patterns, site fidelity, and habitat use. *Aquat. Mamm.* 25: 91-103.
- 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. *Fla. Sci.* 68: 217-226.
- Mullin, K.D. 1988. Comparative seasonal abundance and ecology of bottlenose dolphins (*Tursiops truncatus*) in three habitats of the north-central Gulf of Mexico. Ph.D. thesis. Mississippi State University, Starkville. 135 pp.
- NOAA. 2004. Interim report on the bottlenose dolphin (*Tursiops truncatus*) unusual mortality event along the panhandle of Florida March-April 2004. 36 pp. Available at: [http://www.nmfs.noaa.gov/pr/pdfs/health/ume\\_bottlenose\\_2004.pdf](http://www.nmfs.noaa.gov/pr/pdfs/health/ume_bottlenose_2004.pdf)
- NOAA. 2010a. Frequently asked questions about marine mammal rescue and intervention plans in response to the Deepwater Horizon oil spill. Available from: [http://sero.nmfs.noaa.gov/sf/deepwater\\_horizon/20100726\\_FINAL\\_FAQDWH\\_NOAA\\_marine\\_mammal\\_intervention\\_and\\_rescue.pdf](http://sero.nmfs.noaa.gov/sf/deepwater_horizon/20100726_FINAL_FAQDWH_NOAA_marine_mammal_intervention_and_rescue.pdf)
- NOAA. 2010b. Effects of oil on marine mammals and sea turtles. Available from: [http://sero.nmfs.noaa.gov/sf/deepwater\\_horizon/Marine\\_mammals\\_turtles\\_FACT\\_SHEET.pdf](http://sero.nmfs.noaa.gov/sf/deepwater_horizon/Marine_mammals_turtles_FACT_SHEET.pdf).
- NOAA. 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. Available from: <http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/2011/04/Public-DWH-PEIS-Scoping-Review-Document1.pdf>
- Operational Science Advisory Team (OSAT). 2010. Summary report for sub-sea and sub-surface oil and dispersant detection: Sampling and monitoring. Prepared for P. F. Zukunft, RADM, U.S. Coast Guard, Federal On-Scene Coordinator, Deepwater Horizon MC252, December 17, 2010. Available from:

- [http://www.restorethegulf.gov/sites/default/files/documents/pdf/OSAT\\_Report\\_FINAL\\_17DEC.pdf](http://www.restorethegulf.gov/sites/default/files/documents/pdf/OSAT_Report_FINAL_17DEC.pdf)  
Operational Science Advisory Team (OSAT-2). 2011. Summary report for fate and effects of remnant oil remaining in the beach environment. Annex B: Spatial oil distribution. Available from:  
<http://www.restorethegulf.gov/release/2011/03/01/osat-2-fate-and-effects-oil-beaches>
- Scott, M.D., R.S. Wells and A.B. Irvine 1990. A long-term study of bottlenose dolphins on the west coast of Florida. Pages 235-244 in: S. Leatherwood and R.R. Reeves, (eds.) The bottlenose dolphin. Academic Press, San Diego, CA.
- 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. *Conserv. Genet.* 6(5): 715-728.
- Shane, S.H. 1977. The population biology of the Atlantic bottlenose dolphin, *Tursiops truncatus*, in the Aransas Pass area of Texas. M. Sc. thesis from Texas A&M University, College Station. 238 pp.
- Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. Pages 245-265 in: S. Leatherwood and R.R. Reeves, (eds.) The bottlenose dolphin. Academic Press, San Diego, CA.
- Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. *G. Mex. Sci.* 22(1): 1-12.
- Shippee, S. 2010. Changes in bottlenose dolphin abundance and sighting frequency in the Choctawhatchee Bay estuary in Northwest Florida during 2007-09. Southeast and mid-Atlantic Marine Mammal Symposium (SEAMAMMS), 26-28 March 2010, Virginia Beach, VA.
- Urian, K.W., D.A. Duffield, A.J. Read, R.S. Wells and D.D. Shell 1996. Seasonality of reproduction in bottlenose dolphins, *Tursiops truncatus*. *J. Mamm.* 77: 394-403.
- Urian, K.W., S. Hofmann, R.S. Wells and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. *Mar. Mamm. Sci.* 25(9): 619-638.
- 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.
- Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Ph. D. thesis from Texas A&M University, College Station. 142 pp.
- Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract report to NMFS, SEFSC. Contract No. 45-WCNF-5-00366. Available from: NMFS, Southeast Fisheries Science Center, 75 Virginia Beach Dr., Miami, FL 33149. 58 pp.
- Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. Pages 199-225 in: K. Pryor and K. S. Norris, (eds.) Dolphin societies: Discoveries and puzzles. University of California Press, Berkeley.
- Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. Pages 32-56 in: F. B. M. de Waal and P. L. Tyack, (eds.) Animal social complexity: Intelligence, culture, and individualized societies. Harvard University Press, Cambridge, MA.
- Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr and M.D. Scott 1996a. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. NOAA Tech. Memo. NMFS-SEFSC-384. 36 pp.
- Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr and M.D. Scott 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. Contract report to National Marine Fisheries Service, Southeast Fisheries Center Contribution No. 40-WCNF601958. Available from: NMFS, Southeast Fisheries Science Center, 75 Virginia Beach Dr., Miami, FL 33149.
- 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 Mammalogy, Vol. 1. Plenum Press, New York.
- Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr and M.D. Scott 1996b. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. NOAA Tech. Memo. NMFS-SEFSC-385. 25 pp.
- Zolman, E. S. 2002. Residence patterns of bottlenose dolphins (*Tursiops truncatus*) in the Stono River estuary, Charleston County, South Carolina, U.S.A. *Mar. Mamm. Sci.* 18: 879-892.