

## BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*): Gulf of Mexico Eastern Coastal Stock

### STOCK DEFINITION AND GEOGRAPHIC RANGE

Bottlenose dolphins inhabit coastal waters throughout the northern Gulf of Mexico (i.e., U.S. Gulf of Mexico) (Mullin *et al.* 1990). Northern Gulf of Mexico coastal waters have been divided for management purposes into 3 bottlenose dolphin stocks: eastern, northern and western. As a working hypothesis, it is assumed that the dolphins occupying habitats with dissimilar climatic, coastal and oceanographic characteristics might be restricted in their movements between habitats, and thus constitute separate stocks. Coastal waters are defined as those from shore, barrier islands or presumed bay boundaries to the 20-m isobath (Figure 1). The Eastern Coastal bottlenose dolphin stock area extends from 84°W longitude to Key West, Florida; the Northern Coastal bottlenose dolphin stock area from 84°W longitude to the Mississippi River Delta; and the Western Coastal bottlenose dolphin stock area from the Mississippi River Delta to the Texas-Mexico border. The Eastern Coastal stock area is temperate to subtropical in climate, is bordered by a mixture of coastal marshes, sand beaches, marsh and mangrove islands, and has an intermediate level of freshwater input. It is bordered on the north by an extensive area of coastal marsh and marsh islands typical of Florida's Apalachee Bay. The Northern Coastal stock area is characterized by a temperate climate, barrier islands, sand beaches, coastal marshes and marsh islands, and has a relatively high level of freshwater input. The Western Coastal stock area is characterized by an arid to temperate climate, sand beaches in southern Texas, extensive coastal marshes in northern Texas and Louisiana, and low to high levels of freshwater input.

Portions of the coastal stocks may co-occur with the northern Gulf of Mexico continental shelf stock and bay, sound and estuarine stocks, and the Western Coastal stock is trans-boundary with Mexico.

The seaward boundary for coastal stocks, the 20-m isobath, generally corresponds to survey strata (Scott 1990; Blaylock and Hoggard 1994; Fulling *et al.* 2003), and thus represents a management boundary rather than an ecological boundary. Both "coastal/nearshore" and "offshore" ecotypes of bottlenose dolphins (Hersh and Duffield 1990) occur in the Gulf of Mexico (LeDuc and Curry 1998), and both could potentially occur in coastal waters. The offshore and coastal ecotypes are genetically distinct using both mitochondrial and nuclear markers (Hoelzel *et al.* 1998). In the northwestern Atlantic Ocean, Torres *et al.* (2003) found a statistically significant break in the distribution of the ecotypes at 34 km from shore. The offshore ecotype was found exclusively seaward of 34 km and in waters deeper than 34 m. Within 7.5 km of shore, all animals were of the coastal ecotype. The distance of the 20-m isobath ranges from 4 to 90 km from shore in the northern Gulf. Because the continental shelf is much wider in the Gulf, results from the Atlantic may not apply.

Research on coastal stocks is limited. Fazioli *et al.* (2006) conducted photo-identification surveys of coastal waters off Tampa Bay, Sarasota Bay and Charlotte Harbor/Pine Island Sound over 14 months. They found coastal waters were inhabited by both 'inshore' and 'Gulf' dolphins but that the two types used coastal waters differently. Dolphins from the inshore communities were observed occasionally in Gulf near-shore waters adjacent to their inshore range, whereas 'Gulf' dolphins were found primarily in open Gulf of Mexico waters with some displaying seasonal variations in their use of the study area. The 'Gulf' dolphins did not show a preference for waters near

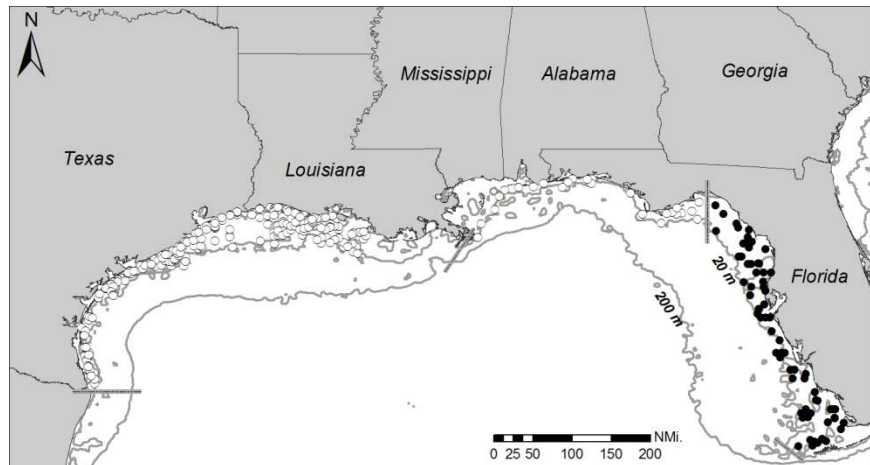


Figure 1. Locations (circles) of bottlenose dolphin groups sighted in coastal waters during aerial surveys conducted in the Western Coastal stock area in 1992 and 1996, and in the Northern Coastal stock and Eastern Coastal stock areas in 2007. Dark circles indicate groups within the boundaries of the Eastern Coastal stock. The 20 and 200m isobaths are shown.

passes as was seen for 'inshore' dolphins, but moved throughout the study area and made greater use of waters offshore of waters used by 'inshore' dolphins. During winter months abundance of 'Gulf' groups decreased while abundance for 'inshore' groups increased. These findings support an earlier report by Irvine *et al.* (1981) of increased use of pass and coastal waters by Sarasota Bay dolphins in winter. Seasonal movements of identified individuals and abundance indices suggest that part of the 'Gulf' dolphin community moves out of the study area during winter, but their destination is unknown. Sellas *et al.* (2005) examined population subdivision among Sarasota Bay, Tampa Bay, Charlotte Harbor, 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 structure 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 separate identification of bay, sound and estuarine stocks from those occurring in adjacent Gulf coastal waters, as suggested by Wells (1986).

Off Galveston, Texas, Beier (2001) reported an open population of individual dolphins in coastal waters, but several individual dolphins had been sighted previously by other researchers over a 10-year period. Some coastal animals may move relatively long distances alongshore. Two bottlenose dolphins previously seen in the South Padre Island area in Texas were seen in Matagorda Bay, 285 km north, in May 1992 and May 1993 (Lynn and Würsig 2002).

### **POPULATION SIZE**

The best abundance estimate available for the northern Gulf of Mexico Eastern Coastal stock of bottlenose dolphins is 7,702 (CV=0.19).

### **Earlier abundance estimates**

Previous estimates of abundance were derived using distance sampling analysis (Buckland *et al.* 1993) and the computer program DISTANCE (Laake *et al.* 1993) with sighting data collected during aerial line-transect surveys conducted during autumn from 1992-1994 (Blaylock and Hoggard 1994; NMFS unpublished data). Systematic sampling transects, placed randomly with respect to the bottlenose dolphin distribution, extended orthogonally from shore out to approximately 9 km past the 18-m isobath. Approximately 5% of the total survey area was visually searched. The previous bottlenose dolphin abundance estimate for the Eastern Coastal stock based on the 1994 survey was 9,912 (CV=0.12).

### **Recent surveys and abundance estimates**

Abundance estimates for the Northern and Eastern Coastal stocks were derived from aerial surveys conducted during 17 July to 8 August 2007. Survey effort covered waters from the shoreline to 200 m depth and was stratified such that the majority of effort was expended in the 0-20 m depth range of the coastal stocks. The survey team consisted of an observer stationed at each of two forward bubble windows and a third observer stationed at a belly window that monitored the trackline. Surveys were typically flown during favorable sighting conditions at Beaufort sea state less than or equal to 3 (surface winds <10 knots). Abundance estimates were derived using distance analysis including environmental covariates that had a significant influence on sighting probability (Buckland *et al.*, 2001), but these estimates were not corrected for  $g(0)$  and are thus negatively biased. The resulting abundance estimate for the eastern stock was 7,702 animals (CV=0.19).

### **Minimum Population Estimate**

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for the Eastern Coastal stock of bottlenose dolphins is 7,702 (CV=0.19). The minimum population estimate for the northern Gulf of Mexico Eastern Coastal stock is 6,551 bottlenose dolphins.

### **Current Population Trend**

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

### **CURRENT AND MAXIMUM NET PRODUCTIVITY RATES**

Current and maximum net productivity rates are not known 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 level (PBR) is the product of minimum population size, one-half the maximum productivity rate and a “recovery” factor (Wade and Angliss 1997). The minimum population size is 6,551. 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 the stock is of unknown status. PBR for the northern Gulf of Mexico Eastern Coastal stock of bottlenose dolphin is 66.

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

The total annual human-caused mortality and serious injury of the Eastern Coastal stock of bottlenose dolphins during 2004-2008 is unknown.

## **Fisheries Information**

The commercial fisheries which potentially could interact with the Eastern Coastal stock in the northern Gulf of Mexico are the shark bottom longline, shrimp trawl, blue crab trap/pot and stone crab trap/pot fisheries (Appendix III).

### **Shark Bottom Longline Fishery**

The shark bottom longline fishery has been observed since 1994, and 3 interactions with bottlenose dolphins have been recorded. The incidents include 1 mortality (2003) and 2 hooked animals that escaped at the vessels (1999, 2002; Burgess and Morgan 2003a,b). Based on the water depths of the interactions (~12-60 m), they likely involved animals from the Eastern Coastal and continental shelf stocks. No interactions were observed during 2004-2008 (Hale and Carlson 2007; Hale *et al.* 2007; Richards 2007; Hale *et al.* 2009). For the shark bottom longline fishery in the Gulf of Mexico, Richards (2007) estimated bottlenose dolphin mortalities of 58 (CV=0.99), 0 and 0 for 2003, 2004 and 2005, respectively.

### **Shrimp Trawl Fishery**

Historically, there have been very low numbers of incidental mortality or injury in the stocks associated with the shrimp trawl fishery. A voluntary observer program for the shrimp trawl fishery began in 1992 and became mandatory in 2007. Three bottlenose dolphin mortalities were observed during 2003, 2007 and 2008 which could have belonged to bay, sound and estuarine stocks, the Western Coastal stock, the Northern Coastal stock and the continental shelf stock. During 1992-2008 the observer program recorded an additional six unidentified dolphins caught in a lazy line or turtle excluder device, and one or more of these animals may have belonged to the Eastern or Northern Coastal stocks, and it is likely that 3-4 of the animals belonged to the continental shelf stock or the Atlantic spotted dolphin (*Stenella frontalis*) stock. In two of the six cases, an observer report indicated the animal may have already been decomposed, but this could not be confirmed in the absence of a necropsy. In 2008, an additional dolphin carcass was caught on the tickler of a shrimp trawl; however, the animal's carcass was severely decomposed and may have been captured in this state. This cannot be confirmed without a necropsy. It is likely the unidentified carcass belonged to the bottlenose dolphin Western Coastal stock or continental shelf stock, or possibly to the Atlantic spotted dolphin stock.

### **Blue and Stone Crab Trap/Pot Fisheries**

Bottlenose dolphins have been reported stranded with polypropylene rope around their flukes (NMFS 1991; McFee and Brooks, Jr. 1998; NMFS unpublished data), indicating the possibility of entanglement with crab pot lines. In 2002 there was a calf stranded near Clearwater, Florida, with crab trap line wrapped around its rostrum, through its mouth and looped around its tail. There was an additional unconfirmed report to the stranding network in 2002 of a dolphin entangled in a stone crab trap with the buoy still attached. The animal was reportedly cut loose from the trap and slowly swam off with line and buoy still wrapped around it (NMFS unpublished data). In 2008, a dolphin was disentangled from crab trap gear in Texas from a concerned citizen and swam away with no reported injuries. Also in 2008, a dolphin off Florida, reportedly half the size of an adult, was disentangled by a county marine officer from a crab pot line and swam away with no reported injuries (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009). Since there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab traps/pots.

## Strandings

A total of 86 bottlenose dolphins were found stranded in Eastern Coastal waters of the northern Gulf of Mexico from 2004 through 2008 (Table 1; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009). Evidence of human interactions (e.g., gear entanglement, mutilation, gunshot wounds) was detected for 5 of these dolphins. Bottlenose dolphins are known to become entangled in, or ingest recreational and commercial fishing gear (Wells and Scott 1994; Gorzelany 1998; Wells *et al.* 1998; Wells *et al.* 2008), and some are struck by vessels (Wells and Scott 1997; Wells *et al.* 2008).

There are a number of difficulties associated with the interpretation of stranding data. It is possible that some or all of the stranded dolphins may have been from a nearby bay, sound and estuarine stock; however, the proportion of stranded dolphins belonging to another stock cannot be determined because of the difficulty of determining from where the stranded carcass originated. Stranding data probably underestimate the extent of human-related mortality and serious injury because not all of the dolphins which die or are seriously injured due to human interactions wash ashore, nor will all of those that do wash ashore necessarily show signs of fishery-interaction or other human interactions. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of human interaction, and the condition of the carcass if badly decomposed can inhibit the interpretation of cause of death.

Since 1990, there have been 11 bottlenose dolphin die-offs in the northern Gulf of Mexico. From January through May 1990, a total of 367 bottlenose dolphins stranded in the northern Gulf of Mexico. Overall this represented a two-fold increase in the prior maximum recorded strandings for the same period, but in some locations (i.e., Alabama) strandings were 10 times the average number. The cause of the 1990 mortality event could not be determined (Hansen 1992). An unusual mortality event was declared for Sarasota Bay, Florida, in 1991, but the cause was not determined. In March and April 1992, 111 bottlenose dolphins stranded in Texas, about 9 times the average number. The cause of this event was not determined, but carbamates were a suspected cause.

In 1992, with the enactment of the Marine Mammal Health and Stranding Response Act, the Working Group on Marine Mammal Unusual Mortality Events was created to determine when an unusual mortality event (UME) is occurring, and then to direct responses to such events. Since 1992, 8 bottlenose dolphin UMEs have been declared in the Gulf of Mexico. 1) In 1993-1994 an UME of bottlenose dolphins likely caused by morbillivirus started in the Florida Panhandle and spread west with most of the mortalities occurring in Texas (Lipscomb 1993; Lipscomb *et al.* 1994). From February through April 1994, 220 bottlenose dolphins were found dead on Texas beaches, of which 67 occurred in a single 10-day period. 2) In 1996 an UME was declared for bottlenose dolphins in Mississippi when 27 bottlenose dolphins stranded during November and December. The cause was not determined, but a *Karenia brevis* (red tide) bloom was suspected to be responsible. 3) Between August 1999 and May 2000, 152 bottlenose dolphins died coincident with *K. brevis* blooms and fish kills in the Florida Panhandle (additional strandings included 3 Atlantic spotted dolphins, *Stenella frontalis*, 1 Risso's dolphin, *Grampus griseus*, 2 Blainville's beaked whales, *Mesoplodon densirostris*, and 4 unidentified dolphins). 4) In March and April 2004, in another Florida Panhandle UME possibly related to *K. brevis* blooms, 106 bottlenose dolphins and 1 unidentified dolphin stranded dead (NMFS 2004). 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). 5) In 2005, a particularly destructive red tide (*K. brevis*) bloom occurred off of central west Florida. Manatee, sea turtle, bird and fish mortalities were reported in the area in early 2005 and a manatee UME had been declared. Dolphin mortalities began to rise above the historical averages by late July 2005, continued to increase through October 2005, and were then declared to be part of a multi-species UME. The multi-species UME extended into 2006, and ended in November 2006. A total of 190 dolphins were involved, primarily bottlenose dolphins (plus strandings of 1 Atlantic spotted dolphin, *S. frontalis*, and 24 unidentified dolphins). The evidence suggests the effects of a red tide bloom contributed to the cause of this event. 6) 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). 7) During February and March of 2007 an event was declared for northeast Texas and western Louisiana involving 66 bottlenose dolphins. Decomposition prevented conclusive analyses on most carcasses. 8) During February and March of 2008 an additional event was declared in Texas involving 113 bottlenose dolphin strandings. Most of the animals recovered were in a decomposed state. The event has been closed, however, the investigation is ongoing.

Table 1. Bottlenose dolphin strandings occurring in Eastern Coastal stock waters of the northern Gulf of Mexico from 2004 to 2008, 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 21 September 2009 and 18 November 2009). Please note human interaction does not necessarily mean the interaction caused the animal's death. Please also note that strandings in coastal waters have been separated by coastal stock and separated from bay, sound and estuarine stocks; therefore, the annual totals below will differ from those reported previously.

Stock	Category	2004	2005	2006	2007	2008	Total
Eastern Coastal Stock	Total Stranded	8	36	31	4	7	86
	Human Interaction	0	1	2	0	2	5
	---Fishery Interaction	-	0	2	-	2	4
	---Other	-	1	0	-	0	1
	No Human Interaction	2	9	5	1	1	18
	CBD	6	26	24	3	4	63

### Other Mortality

The problem of dolphin depredation of fishing gear is increasing in the Gulf of Mexico. There have been 3 recent cases of fishermen illegally “taking” dolphins due to dolphin depredation of recreational and commercial fishing gear. In 2006 a charter boat fishing captain was charged under the MMPA for shooting at a dolphin that was swimming around his catch in the Gulf of Mexico, off Panama City, Florida. In 2007 a second charter fishing boat captain was fined under the MMPA for shooting at a bottlenose dolphin that was attempting to remove a fish from his line in the Gulf of Mexico, off Orange Beach, Alabama. A commercial fisherman was indicted in November 2008 for throwing pipe bombs at dolphins off Panama City, Florida, and charged in March 2009 for “taking” dolphins with an explosive device.

Feeding or provisioning of wild bottlenose dolphins has been documented in Florida, particularly near Panama City Beach in the Panhandle (Samuels and Bejder 2004) and south of Sarasota Bay (Cunningham-Smith *et al.* 2006; Powell and Wells, in press), and also in Texas near Corpus Christi (Bryant 1994). Feeding wild dolphins is defined under the MMPA as a form of ‘take’ because it can alter their natural behavior and increase their risk of injury or death. Nevertheless, a high rate of uncontrolled provisioning was observed near Panama City Beach in 1998 (Samuels and Bejder 2004), and provisioning has been observed south of Sarasota Bay since 1990 (Cunningham-Smith *et al.* 2006; Powell and Wells, in press). There are emerging questions regarding potential linkages between provisioning and depredation of recreational fishing gear and associated entanglement and ingestion of gear, which is increasing through much of Florida. During 2006, an estimated 2% of the long-term resident dolphins of Sarasota Bay died from ingestion of recreational fishing gear (Powell and Wells, in press). Swimming with wild bottlenose dolphins has also been documented. Near Panama City Beach, Samuels and Bejder (2004) concluded that dolphins were amenable to swimmers due to provisioning. Swimming with wild dolphins may cause harassment, and harassment is illegal under the MMPA.

The nearshore habitat occupied by the 3 coastal stocks is adjacent to areas of high human population and in some areas, such as Tampa Bay, Florida, Galveston, Texas, and Mobile, Alabama, is highly industrialized. Concentrations of anthropogenic chemicals such PCBs and DDT and its metabolites vary from site to site, and can reach levels of concern for bottlenose dolphin health and reproduction in the southeastern U.S. (Schwacke *et al.* 2002). PCB concentrations in 3 stranded dolphins sampled from the Eastern Coastal stock area ranged from 16-46µg/g wet weight. Two stranded dolphins from the Northern Coastal stock area had the highest levels of DDT derivatives of any of the bottlenose dolphin liver samples analyzed in conjunction with a 1990 mortality investigation conducted by NMFS (Varanasi *et al.* 1992). The significance of these findings is unclear, but there is some evidence that increased exposure to anthropogenic compounds may reduce immune function in bottlenose dolphins (Lahvis *et al.* 1995), or impact reproduction through increased first-born calf mortality (Wells *et al.* 2005). Concentrations of chlorinated hydrocarbons and metals were relatively low in most of the bottlenose dolphins examined in conjunction with an anomalous mortality event in Texas bays in 1990; however, some had concentrations at levels of possible toxicological concern (Varanasi *et al.* 1992). Agricultural runoff following periods of high rainfall in 1992 was implicated in a high level of bottlenose dolphin mortalities in Matagorda Bay, which is adjacent to the Western Coastal stock area (NMFS unpublished data).

## STATUS OF STOCK

The status of the Eastern Coastal stock relative to OSP is not known and population trends cannot be determined due to insufficient data. This species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine population trends for this stock. Total human-caused mortality and serious injury for this stock is not known and there is insufficient information available to determine whether the total fishery-related mortality and serious injury is insignificant and approaching zero mortality and serious injury rate. Additionally, there is no systematic monitoring of all fisheries that may take this stock. The potential impact, if any, of coastal pollution may be an issue for this species in portions of its habitat, though little is known on this to date. This is not a strategic stock because it is assumed that the average annual human-related mortality and serious injury does not exceed PBR.

## REFERENCES CITED

- 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.
- Beier, A. G. 2001. Occurrence, distribution, and movement patterns of outer coastline bottlenose dolphins off Galveston, Texas. Master's thesis from Texas A&M University. 97 pp.
- Blaylock, R. A. and W. Hoggard. 1994. Preliminary estimates of bottlenose dolphin abundance in southern U.S. Atlantic and Gulf of Mexico continental shelf waters. NOAA Tech. Memo NMFS-SEFSC-356, 10 pp.
- Bryant, L. 1994. Report to Congress on results of feeding wild dolphins: 1989-1994. National Marine Fisheries Service, Office of Protected Resources, 23 pp.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance sampling: Estimating abundance of biological populations. Chapman & Hall, London. 446 pp.
- Buckland, S. T., D. R. Anderson, 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, Oxford, UK.
- Burgess, G. and A. Morgan. 2003a. Commercial shark fishery observer program. Renewal of an observer program to monitor the directed commercial shark fishery in the Gulf of Mexico and South Atlantic: 1999 fishing season. Final Report, U.S. National Marine Fisheries Service, Highly Migratory Species Management Division Award NA97FF0041.
- Burgess, G. and A. Morgan. 2003b. Commercial shark fishery observer program. Renewal of an observer program to monitor the directed commercial shark fishery in the Gulf of Mexico and the south Atlantic: 2002(2) and 2003(1) fishing seasons. Final Report, U.S. National Marine Fisheries Service, Highly Migratory Species Management Division Award NA16FM0598.
- Cunningham-Smith, P., D. E. Colbert, R. S. Wells and T. Speakman. 2006. Evaluation of human interactions with a wild bottlenose dolphin (*Tursiops truncatus*) near Sarasota Bay, Florida, and efforts to curtail the interactions. *Aquat. Mamm.* 32(3):346-356.
- 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.
- 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. JACOBS, T. A. Leighfield, R. H. Pierce, T. D. Pitchford, S. A. Rommel, P. S. Scott, K. A. Steidinger, E. W. Truby, F. M. Van 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.
- Fulling, G. L., K. D. Mullin and C. W. Hubard. 2003. Abundance and distribution of cetaceans in outer continental shelf waters of the U.S. Gulf of Mexico. *Fish. Bull.* 101: 923-932.
- Gorzelany, J. F. 1998. Unusual deaths of two free-ranging Atlantic bottlenose dolphins (*Tursiops truncatus*) related to ingestion of recreational fishing gear. *Mar. Mamm. Sci.* 14(3): 614-617.
- Hale, L. F. and J. K. Carlson. 2007. Characterization of the shark bottom longline fishery: 2005-2006. NOAA Tech. Memo. NMFS-SEFSC-554, 28 pp.
- Hale, L. F., L. D. Hollensead and J. K. Carlson. 2007. Characterization of the shark bottom longline fishery: 2007. NOAA Tech. Memo. NMFS-SEFSC-564, 25 pp.
- Hale, L. F., S. J. B. Gulak and J. K. Carlson. 2009. Characterization of the shark bottom longline fishery, 2008. NOAA Tech. Memo. NMFS-SEFSC-586, 23 pp.

- Hansen, L. J. (ed.). 1992. Report on investigation of 1990 Gulf of Mexico bottlenose dolphin strandings. NOAA-NMFS-SEFSC Contribution MIA-92/93-21. Available from: NMFS, Southeast Fisheries Science Center, 75 Virginia Beach Dr., Miami, FL 33149.
- Hersh, S. L. and D. A. Duffield. 1990. Distinction between Northwest Atlantic offshore and coastal bottlenose dolphins based on hemoglobin profile and morphometry. pp. 129-139. *In*: S. Leatherwood and R. R. Reeves (eds.) *The bottlenose dolphin*. Academic Press, San Diego, CA. 653 pp.
- Hoelzel, A. R., C. W. Potter and P. B. Best. 1998. Genetic differentiation between parapatric 'nearshore' and 'offshore' populations of bottlenose dolphins. *Proc. R. Soc. Lond., Ser. B: Biol. Sci.* 265: 1177-1183.
- 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. U.S.* 79: 671-688.
- Laake, J. L., S. T. Buckland, D. R. Anderson and K. P. Burnham. 1993. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins. 72 pp.
- Lahvis, G. P., R. S. Wells, D. W. Kuehl, J. L. Stewart, H. L. Rhinehart and C. S. Via. 1995. Decreased lymphocyte responses in free-ranging bottlenose dolphins (*Tursiops truncatus*) are associated with increased concentrations of PCB's and DDT in peripheral blood. *Environ. Health Perspect.* 103: 67-72.
- LeDuc, R. G. and B. E. Curry. 1998. Mitochondrial DNA sequence analysis indicates need for revision of the genus *Tursiops*. *Rep. Int. Whal. Commn.* 47: 393.
- Lipscomb, T. P. 1993. Some answers to questions about morbillivirus. pp. 4-5. *In*: R. A. Blaylock, B. Mase and D. K. Odell (eds.) *Strandings*, Vol. 2, No. 3, SEFSC Miami Laboratory, Miami, Florida, 7 pp.
- Lipscomb, T. P., S. Kennedy, D. Moffet and B. K. Ford. 1994. Morbilliviral disease in an Atlantic bottlenose dolphin (*Tursiops truncatus*) from the Gulf of Mexico. *J. Wildl. Dis.* 30(4): 572-576.
- Lynn, S. K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. *G. Mex. Sci.* 20(1): 25-37.
- McFee, W. E. and W. Brooks, Jr. 1998. Fact finding meeting of marine mammal entanglement in the crab pot fishery: A summary. U.S. Fish and Wildlife Service unpublished report. Available from: NMFS, Southeast Fisheries Science Center, 75 Virginia Beach Dr., Miami, FL 33149.
- Mullin, K. D., R. R. Lohofener, W. Hoggard, C. L. Roden and C. M. Rogers. 1990. Abundance of bottlenose dolphins, *Tursiops truncatus*, in the coastal Gulf of Mexico. *Northeast Gulf Sci.* 11(2): 113-122.
- NMFS. 1991. Proposed regime to govern the interactions between marine mammals and commercial fishing operations after October 1, 1993. Draft Environmental Impact Statement, June 1991. Available from: NMFS, Southeast Fisheries Science Center, 75 Virginia Beach Dr., Miami, FL 33149.
- NMFS. 2004. Interim report on the bottlenose dolphin (*Tursiops truncatus*) unusual mortality event along the Panhandle of Florida, March-April 2004. 35 pp. Available from: NMFS, Southeast Fisheries Science Center, 75 Virginia Beach Dr., Miami, FL 33149.
- Powell, J. R. and R. S. Wells. In press. Recreational fishing depredation and associated behaviors involving common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. *Mar. Mamm. Sci.*
- Richards, P. M. 2007. Estimated takes of protected species in the commercial directed shark bottom longline fishery 2003, 2004, and 2005. NMFS SEFSC Contribution PRD-06/07-08, June 2007, 21 pp.
- Samuels, A. and L. Bejder. 2004. Chronic interactions between humans and free-ranging bottlenose dolphins near Panama City Beach, Florida, USA. *J. Cetacean Res. Manage.* 6: 69-77.
- 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: 2752-2764.
- Scott, G. P. 1990. Management-oriented research on bottlenose dolphins by the Southeast Fisheries Center. pp. 623-639. *In*: S. Leatherwood and R. R. Reeves (eds.) *The bottlenose dolphin*. Academic Press, San Diego, CA. 653 pp.
- 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: 715-728.
- Torres, L. G., P. E. Rosel, C. D'Agrosa and A. J. Read. 2003. Improving management of overlapping bottlenose dolphin ecotypes through spatial analysis and genetics. *Mar. Mamm. Sci.* 19(3): 502-514.
- Varanasi, U., K. L. Tilbury, D. W. Brown, M. M. Krahn, C. A. Wigren, R. C. Clark and S. L. Chan. 1992. pp. 56-86. *In*: L. J. Hansen (ed.) Report on investigation of 1990 Gulf of Mexico bottlenose dolphin strandings, Southeast Fisheries Science Center Contribution MIA-92/93-21, 219 pp.
- Wade, P. R. and R. P. Angliss. 1997. Guidelines for assessing marine mammal stocks: Report of the GAMMS Workshop April 3-5, Seattle, WA. NOAA Tech. Memo. NMFS-OPR-12, 93 pp.

- Wells, R. S. 1986. Structural aspects of dolphin societies. Ph.D. dissertation from University of California, Santa Cruz. 234 pp.
- Wells, R. S. and M. D. Scott. 1994. Incidence of gear entanglement for resident inshore bottlenose dolphins near Sarasota, Florida. p. 629. *In*: W. F. Perrin, G. P. Donovan and J. Barlow (eds.) Gillnets and cetaceans. Rep. Int. Whal. Commn., Special Issue 15.
- Wells, R. S. and M. D. Scott. 1997. Seasonal incidence of boat strikes on bottlenose dolphins near Sarasota, Florida. *Mar. Mamm. Sci.* 13(3): 475-480.
- Wells, R. S., S. Hofmann and T. L. Moors. 1998. Entanglement and mortality of bottlenose dolphins, *Tursiops truncatus*, in recreational fishing gear in Florida. *Fish. Bull.* 96(3): 647-650.
- 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., J. B. Allen, S. Hoffman, K. Bassos-Hull, D. A. Fauquier, N. B. Barros, R. E. DeLynn, G. Sutton, V. Socha and M. D. Scott. 2008. Consequences of injuries on survival and reproduction of common bottlenose dolphins (*Tursiops truncatus*) along the west coast of Florida. *Mar. Mamm. Sci.* 24: 774-794.