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BOTTLENOSE DOLPHIN (*Tursiops truncatus*): Northern Gulf of Mexico Coastal Stocks

STOCK DEFINITION AND GEOGRAPHIC RANGE

Bottlenose dolphins inhabit coastal waters throughout the northern 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 climactic, 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 20m isobath (Figure 1). The eastern coastal bottlenose dolphin stock area extends from 84^{o} W longitude to Key West, Florida; the northern coastal bottlenose dolphin stock area from 84^{o} 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. 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 fresh water 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 fresh water input.

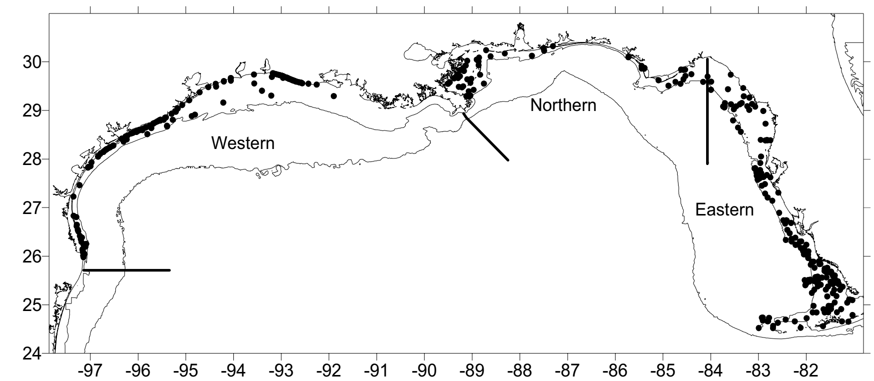

Figure 1. *Locations of bottlenose dolphin groups sighted in coastal waters during aerial surveys in 1992-1994. The 20 and 200 m isobaths are shown.*

Portions of the coastal stocks may co-occur with the northern Gulf of Mexico continental shelf stock and bay, sound and estuary stocks, and the western coastal stock is trans-boundary with Mexico. The seaward boundary for coastal stocks, the 20m isobath, generally corresponds to survey strata (Scott *et al.* 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 34km from shore. The offshore ecotype was found exclusively seaward of 34km and in waters deeper than 34m. Within 7.5km of shore, all animals were of the coastal ecotype. The distance of the 20m isobath ranges from 4 to 90km from shore in the northern Gulf. However, because the continental shelf is much wider in the Gulf, results from the Atlantic may not apply. About 180 genetic samples are available to help assess whether the continental shelf and coastal stocks should be separated, and if so, where. Analysis of these samples is scheduled for 2005-06. Research on coastal stocks is limited. Sellas (2002) found significant genetic differentiation between Sarasota Bay resident dolphins and those occurring primarily in adjacent Gulf coastal waters. Fazioli and Wells (1999) conducted photo-identification surveys of coastal waters off Sarasota Bay over 14 months. They found coastal waters were inhabited by both 'inshore' and 'Gulf' dolphins but that the 2 types used coastal waters differently. While they found a mixture of ranging patterns (seasonal residency, transience), they did find some dolphins displayed many of the community structure characteristics of inshore dolphins. Similar finding were reported by Quintana-Rizzo and Wells (2001) for coastal waters of Cedar Key, Florida. 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, 285km north, in May 1992 and May 1993 (Lynn 1995).

POPULATION SIZE

Population size has not been estimated for the 3 coastal stocks for more than 8 years and therefore the current population size is unknown for each (Wade and Angliss 1997). 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 9km past the 18m isobath. Approximately 5% of the total survey area was visually searched. Previous bottlenose dolphin abundance estimates for each stock based on the 1991-1994 surveys are listed in Table 1.

Table 1. Previous bottlenose dolphin abundance (N_{BEST}), coefficient of variation (CV), and minimum population estimate (N_{MIN}) for northern Gulf of Mexico coastal bottlenose dolphin stocks. Because they are based on data collected more than 8 years ago, all estimates are currently considered unknown. PBR - Potential Biological Removal, UNK - unknown.

Gulf of Mexico Stock Area	N_{BEST}	CV	N_{MIN}	PBR	Year
Eastern	9,912	0.12	8,963	UNK	1994
Northern	4,191	0.21	3,518	UNK	1993
Western	3,499	0.21	2,938	UNK	1992

Minimum Population Estimate

The current minimum population size for each stock is unknown. The previous minimum population estimates for each stock based on the 1992-1994 surveys are listed in Table 1. 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).

Current Population Trend

There are insufficient data to determine population trends for these stocks.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for these stocks. 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 currently unknown for each stock. PBR is the product of minimum population size, one-half the maximum productivity rate and a "recovery" factor (Wade and Angliss 1997). The "recovery" factor, which accounts for endangered, depleted and threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5 because the stocks are of unknown status.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

A total of 1,377 bottlenose dolphins were found stranded in the northern Gulf of Mexico from 1999 through 2003 (Table 2) (NMFS unpublished data). Of these, 73 or 5% showed evidence of human interactions as the cause of death (e.g., gear entanglement, mutilation, gunshot wounds). Bottlenose dolphins are known to become entangled in recreational and commercial fishing gear (Wells and Scott 1994; Wells *et al.* 1998; Gorzelany 1998), and some are struck by recreational and commercial vessels (Wells and Scott 1997).

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 estuary 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.

The Gulf of Mexico menhaden fishery was observed to take 9 bottlenose dolphins (3 fatally) between 1992 and 1995 (NMFS unpublished data). During that period, there were 1,366 sets observed out of 26,097 total sets, which if extrapolated for all years suggests that as many as 172 bottlenose dolphins could have been taken in this fishery with up to

57 animals killed. Without an observer program it is not possible to obtain statistically reliable information for this fishery on the number of sets annually, the incidental take and mortality rates, and the communities from which bottlenose dolphins are being taken.

Feeding or provisioning, and swimming with wild bottlenose dolphins have been documented in Florida, particularly near Panama City Beach in the Panhandle. 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, Samuels and Bejder (2004) observed a high rate of uncontrolled provisioning near Panama City beach in 1998. The effects of swim-with activities on dolphins and their legality under the MMPA are less clear and are currently under review. Near Panama City Beach, Samuels and Bejder (2004) concluded that dolphins were amenable to swimmers due to provisioning.

Table 2. Bottlenose dolphin strandings in the U.S. Gulf of Mexico (West Florida to Texas) from 1999 to 2003. Data are from the Southeast Marine Mammal Stranding Database (SESUS). Percent of animals with human interactions were calculated based on animals which were determined as "yes" or "no" for human interactions. Animals that were "CBD" (could not be determined) were excluded from % with human interactions calculations.

State		1999	2000	2001	2002	2003	Total
Florida							
	No. Stranded	156	130	57	82 [a]	64 [d]	483
	No. Human Interactions	5	8	2	6	7	28
	No. CBD	106	76	26	44	34	286
	% With Human Interactions	10%	15%	6%	16%	23%	14%
Alabama							
	No. Stranded	12	15	17	12	7	63
	No. Human Interactions	0	0	2	0	1	3
	No. CBD	8	7	8	9	4	36
	% With Human Interactions	0%	0%	22%	0%	33%	11%
Mississippi							
	No. Stranded	25	27	22	21 [b]	37 [e]	126
	No. Human Interactions	0	1	0	0	0	1
	No. CBD	17	15	8	6	29	75
	% With Human Interactions	0%	8%	0%	0%	0%	2%
Louisiana							
	No. Stranded	25	14	0	2	33 [f]	69
	No. Human Interactions	1	0	-	0	0	1
	No. CBD	19	14	-	2	29	64
	% With Human Interactions	17%	CBD	-	CBD	0%	20%
Texas							
	No. Stranded	102	113	116	154 [c]	154 [g]	636
	No. Human Interactions	2	7	6	15	10	40
	No. CBD	40	47	5	57	101	250
	% With Human Interactions	3%	11%	5%	15%	19%	10%
Totals							
	No. Stranded	320	299	212	271	295	1377
	No. Human Interactions	8	16	10	21	18	73
	No. CBD	190	159	47	118	197	711
	% With Human Interactions	6%	11%	6%	14%	18%	11%

a Florida mass stranding of 2 animals in December 2002
b Mississippi mass stranding of 2 animals in March 2002
c Texas mass strandings (2 animals in January 2002, 2 animals in March 2002)
d Florida mass stranding of 2 animals in May 2003
e Mississippi mass stranding of 2 animals in April 2003
f Louisiana mass stranding of 3 animals in July 2003
g Texas mass stranding of 5 animals in March 2003

Fisheries Information

The commercial fisheries which potentially could interact with coastal stocks in the northern Gulf of Mexico are the shrimp trawl, blue crab trap/pot, stone crab trap/pot, menhaden and gillnet fisheries (Appendix I). Historically, there have been very low numbers of incidental mortality or injury in the stocks associated with the shrimp trawl fishery. 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. The blue crab fishery has not been monitored by observers and there are no estimates of bottlenose dolphin mortality or serious injury for this fishery. There is no observer program data for the menhaden fishery but incidental mortality of bottlenose dolphins has been reported for this fishery (Reynolds 1985). No marine mammal mortalities associated with gillnet fisheries have been reported, but stranding data suggest that gillnet and marine mammal interaction does occur, causing mortality and serious injury.

Other Mortality

The nearshore habitat occupied by these 3 stocks is adjacent to areas of high human population and in some areas, such as the Tampa Bay, Florida; Galveston, Texas; and Mobile, Alabama, is highly industrialized. Concentrations of anthropogenic chemicals such PCB's 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 16-46Φg/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). 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).

The Mississippi River, which drains about two-thirds of the continental U.S., flows into the north-central Gulf of Mexico and deposits its nutrient load which is linked to the formation of 1 of the world's largest areas of seasonal hypoxia (Rabalais *et al.* 1999). This area is located in Louisiana coastal waters west of the Mississippi River delta. How it affects bottlenose dolphins is not known.

Since 1990, there have been 6 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). In March and April 1992, 111 bottlenose dolphins stranded in Texas; about 9 times the average number. Seven of 34 live-captured bottlenose dolphins (20%) in 1992 from Matagorda Bay, Texas, tested positive for previous exposure to cetacean morbillivirus and it is possible that other stocks have been exposed to the morbillivirus (Duignan *et al.* 1996).

In 1992, NOAA Fisheries' Working Group on Unusual Marine Mortality Events was formalized and developed protocols to declare Unusual Mortality Events (UME) and respond to them. Since 1992, 4 UMEs involving bottlenose dolphins have been investigated in the northern Gulf of Mexico. In 1993-1994 a UME of bottlenose dolphins 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). In 1996 a UME was declared for bottlenose dolphins in Mississippi and while the cause was not determined, *Karenia brevis* (red tide) was suspected. Between August 1999 and February 2000, at least 120 bottlenose dolphins died coincident with *K. brevis* blooms and fish kills in the Florida Panhandle. In March and April 2004, in another Florida Panhandle UME possibly related to *K. brevis* blooms, 107 bottlenose dolphins stranded dead (NMFS 2004).

STATUS OF STOCK

The status of each 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. The total known human-related mortality and serious injury for each stock cannot be assessed relative to PBR because the PBR is unknown for each stock, and therefore cannot be considered to be insignificant and approaching zero mortality and serious injury rate. Each is a strategic stock because the known level of human-related mortality or serious injury relative to PBR is unknown. Also, there is no systematic monitoring of all fisheries that may take these stocks. Insufficient information is available to determine whether the total fishery mortality and serious injury for coastal bottlenose dolphin stocks is insignificant and approaching zero mortality and serious injury rate. 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.

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