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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 (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 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 20-m 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 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.

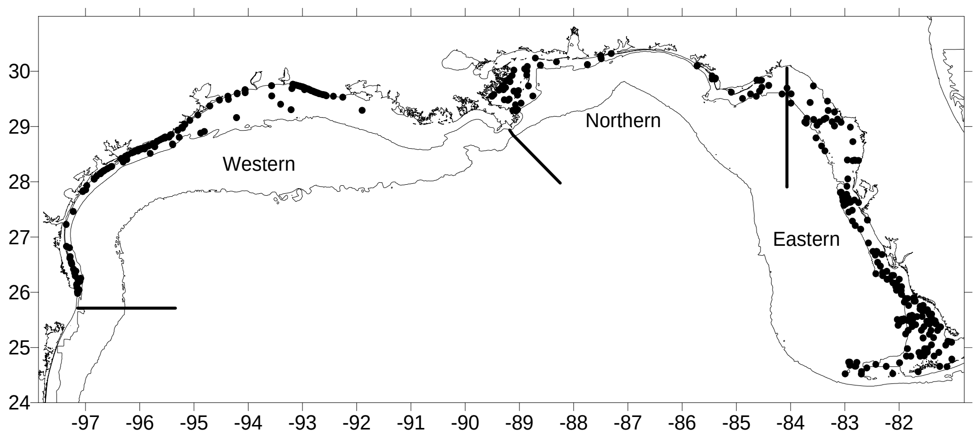

Figure 1. *Locations of bottlenose dolphin groups sighted in coastal waters during aerial surveys in 1992-1994. The 20 and 200-m isobaths are shown.*

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 20-m 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 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. (Sellas *et al.* 2005) examined population subdivision among Sarasota Bay, Tampa Bay, Charlotte Harbor, Matagorda Bay 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. 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 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. 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.

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

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 9 km past the 18-m isobath. Approximately 5% of the total survey area was visually searched. Previous bottlenose dolphin abundance estimates for each stock based on the 1992-1994 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 or undetermined. PBR - Potential Biological Removal; UNK - unknown; UND - undetermined.

Gulf of Mexico Stock Area	$\mathbf{N_{BEST}}$	**CV**	$\mathbf{N_{MIN}}$	**PBR**	**Year**
Eastern	9,912	0.12	UNK	UND	1994
Northern	4,191	0.21	UNK	UND	1993
Western	3,499	0.21	UNK	UND	1992

Minimum Population Estimate

The current minimum population size for each stock is unknown. 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 undetermined 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

There were 3 interactions with the shark bottom longline fishery, including 1 mortality, during 1994-2003, and none during 2004-2007 (Burgess and Morgan 2003a; b; Hale and Carlson 2007; Hale *et al.* 2007; Richards 2007).

As part of its annual coastal dredging program, the Army Corps of Engineers conducts sea turtle relocation trawling during hopper dredging as a protective measure for marine turtles. Five incidents have been documented in the Gulf of Mexico involving bottlenose dolphins and relocation trawling activities. Four of the incidents were mortalities, and 1 occurred during each of the following years: 2003, 2005, 2006, and 2007. An additional incident occurred during 2006 in which the dolphin became free during net retrieval and was observed swimming away normally.

Four mortalities resulted from gillnet entanglements in research gear off Texas and Louisiana during 2003, 2004, 2006 and 2007. Three of the mortalities were a result of fisheries sampling and research in Texas, and 1 mortality (2006) occurred during a gulf sturgeon research project in Louisiana.

Two bottlenose dolphin mortalities were observed in the shrimp trawl fishery. A mortality occurred in 2007 off the coast of Louisiana in the vicinity of Atchafalaya Bay, and 1 mortality occurred in 2003 off the coast of Alabama near Mobile Bay. Each of these animals could have belonged to either a coastal stock or to a bay, sound and estuarine stock.

Table 2. Bottlenose dolphin strandings by state (west Florida to Texas) in the northern Gulf of Mexico from 2003 to 2007, 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 (accessed 16 September 2008). Please note human interaction does not necessarily mean the interaction caused the animal's death.

STATE		2003	2004	2005	2006	2007	TOTAL
Florida							
	Total Stranded	**63**	**165**	**134**	**164**[c]	**60**	**586**
	Human Interaction						
	--Fishery Interaction	5	4	2	11	4	26
	--Other	2	0	2	9	3	16
	No Human Interaction	18	45	33	33	15	144
	CBD	38	116	97	111	38	400
Alabama							
	Total Stranded	**7**	**17**	**18**	**20**	**5**	**67**
	Human Interaction						
	--Fishery Interaction	0	0	0	0	0	0
	--Other	1	0	0	1	0	2
	No Human Interaction	1	0	1	2	0	4
	CBD	5	17	17	17	5	61
Mississippi							
	Total Stranded	**35**	**27**	**11**	**8**	**8**	**89**
	Human Interaction						
	--Fishery Interaction	0	0	0	0	0	0
	--Other	0	1	0	0	0	1
	No Human Interaction	4	5	2	2	0	13
	CBD	31	21	9	6	8	75

Louisiana							
	Total Stranded	**33 [a]**	**26**	**21**	**13**	**12**	**105**
	Human Interaction						
	--Fishery Interaction	0	0	0	0	0	0
	--Other	0	2	0	0	1	3
	No Human Interaction	2	0	6	3	0	11
	CBD	31	24	15	10	11	91
Texas							
	Total Stranded	**154 [b]**	**110**	**96**	**96**	**122**	**578**
	Human Interaction						
	--Fishery Interaction	2	2	2	3	0	9
	--Other	7	9	1	3	5	25
	No Human Interaction	35	20	29	18	30	132
	CBD	110	79	64	72	87	412
TOTAL							
	Total Stranded	**292**	**345**	**280**	**301**	**207**	**1425**
	Human Interaction						
	--Fishery Interaction	7	6	4	14	4	35
	--Other	10	12	3	13	9	47
	No Human Interaction	60	70	71	58	45	304
	CBD	215	257	202	216	149	1039

[a] Louisiana mass stranding of 3 animals in July 2003
[b] Texas mass stranding of 5 animals in March 2003
[c] Florida mass strandings (2 animals in July 2006, 3 animals in November 2006)

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 purse seine, gillnet, and shark bottom longline fisheries (Appendix III). 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. Two bottlenose dolphin mortalities were observed during 2003 and 2007 which could have belonged to either a coastal or a bay, sound and estuarine stock. During 1992-2007 the observer program recorded an additional 6 unidentified dolphins caught in a lazy line or turtle excluder device, and 1 or more of these animals may have belonged to a coastal stock. In 2 of the 6 cases, an observer report indicated the animal may have already been decomposed, but this could not be confirmed in the absence of a necropsy. Bottlenose dolphins have been reported stranded with polypropylene rope around their flukes (NMFS 1991; NMFS unpublished data; McFee and Brooks 1998), 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). 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 are no recent observer program data for the Gulf of Mexico menhaden purse seine fishery but incidental mortality of bottlenose dolphins has been reported for this fishery (Reynolds 1985). Through the Marine Mammal Authorization Program, there have been 11 self-reported incidental takes (all mortalities) of bottlenose dolphins in northern Gulf of Mexico coastal and estuarine waters by the menhaden purse seine fishery: 2 takes of single bottlenose dolphins were reported in Louisiana waters during 2005 (1 of the animals may have been dead prior to capture); 1 take of a single bottlenose dolphin was reported in Louisiana waters during 2004; 2 takes of single unidentified dolphins were reported during 2002 (1 in Mississippi and 1 in Louisiana waters); 1 take of a single bottlenose dolphin was reported in Louisiana waters during 2001; and 3 takes were reported in 2000, 2 of which were for single dolphins (1 bottlenose, 1 unidentifed) in Louisiana waters and the third was for 3 bottlenose dolphins in a single purse seine in Mississippi waters. The menhaden purse seine 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. 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. Four research-related gillnet mortalities occurred between 2003 and 2007 in Texas and Louisiana. 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; Hale and Carlson 2007; Hale *et al.* 2007; Richards 2007). Based on the water depths of the interactions (~12-60 m), they likely involved animals from the eastern coastal and continental shelf stocks. 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.

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.

Other Mortality

A total of 1,425 bottlenose dolphins were found stranded in the northern Gulf of Mexico from 2003 through 2007 (Table 2; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 September 2008). Evidence of human interactions (e.g., gear entanglement, mutilation, gunshot wounds) was detected for 82 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 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.

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 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).

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 a 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, 107 bottlenose dolphins 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 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.

Feeding or provisioning, and swimming with wild bottlenose dolphins have been documented in Florida, particularly near Panama City Beach in the Panhandle, and near Sarasota Bay (Cunningham-Smith *et al.* 2006). 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.

The nearshore habitat occupied by these 3 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).

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 one 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.

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. There are insufficient data to determine population trends for each of these stocks. Total human-caused mortality and serious injury for each stock is not known and there is insufficient information available to determine whether the total fishery-related mortality and serious injury for each stock is insignificant and approaching zero mortality and serious injury rate. Because for each stock the stock size is currently unknown and PBR undetermined, and because there are documented cases of human-related mortality from a number of sources, each stock is a strategic stock. Additionally, there is no systematic monitoring of all fisheries that may take these stocks. 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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