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

STOCK DEFINITION AND GEOGRAPHIC RANGE

Common bottlenose dolphins inhabit coastal waters throughout the northern Gulf of Mexico (i.e., U.S. Gulf of Mexico; Mullin *et al.* 1990). 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. Therefore, northern Gulf of Mexico coastal waters have been divided for management purposes into three stock areas: eastern, northern and western, with coastal waters defined as waters between the shore, barrier islands or presumed outer bay boundaries out to the 20-m isobath (Figure 1). The 20-m depth seaward boundary 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. The Northern Coastal common bottlenose dolphin stock area extends from 84ºW longitude to the Mississippi River Delta. This region is characterized by a temperate climate, barrier islands, sand beaches, coastal marshes and marsh islands, and has a relatively high level of freshwater input. It is bordered on the east by an extensive area of coastal marsh and marsh islands typical of Florida's Apalachee Bay. Dolphins belonging to this stock are all expected to be of the coastal ecotype (Vollmer 2011). Recently, genetic analyses of population structure in coastal, shelf, and oceanic waters of the Gulf of Mexico revealed seven demographically independent populations in the northern Gulf of Mexico, suggesting the current stock designations and boundaries in these waters do not accurately reflect the population structure (Vollmer and Rosel 2017). Sampling within the range of the Northern Coastal Stock was limited and further work is necessary to determine the boundaries of these demographically independent populations.

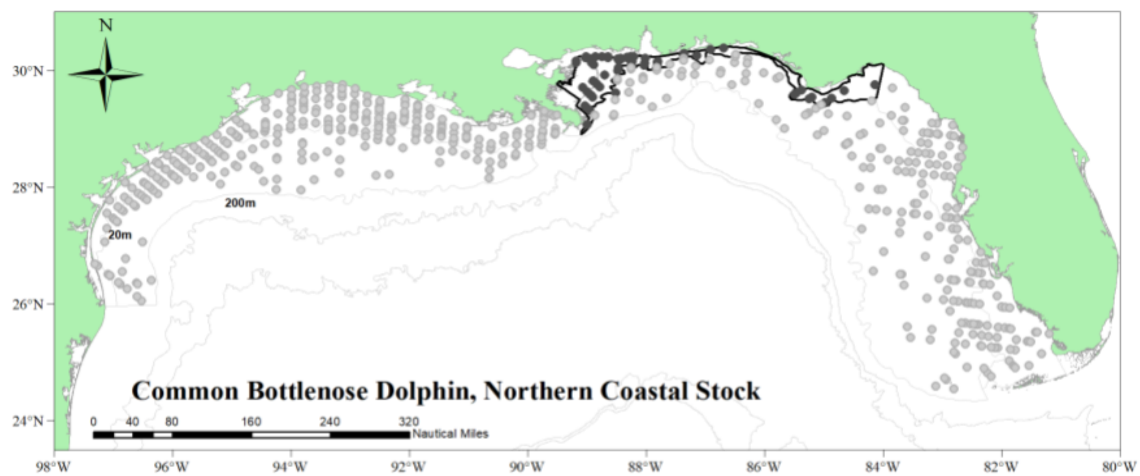

Figure 1. Distribution of common bottlenose dolphin on-effort sightings in coastal and continental shelf waters during SEFSC aerial surveys in summer 2017, winter 2018, and fall 2018. Sightings within the boundaries of the Northern Coastal Stock are denoted by the black circles. Isobaths are the 20-m, 200-m, 1,000-m, and 2,000-m depth contours.

This stock's boundaries abut other common bottlenose dolphin stocks, namely the Continental Shelf Stock, the Eastern and Western Coastal Stocks, and several bay, sound and estuary stocks in Louisiana, Mississippi, Alabama and Florida, and while individuals from different stocks may occasionally overlap, it is not thought that significant mixing or interbreeding occurs between them. Fazioli *et al.* (2006) conducted photo-identification surveys of coastal waters off Tampa Bay, Sarasota Bay and Lemon Bay, Florida, over 14 months. They found both 'inshore' and 'Gulf' dolphins inhabited coastal waters but 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. 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 suggested that part of the ‘Gulf’ dolphin community moved out of the study area during winter, but their destination is unknown (Fazioli *et al.* 2006). In a follow-up study, Sellas *et al.* (2005) examined genetic population subdivision in the study area of Fazioli *et al.* (2006), and found evidence of significant population structure among all areas. Rosel *et al.* (2017) also identified significant genetic differentiation between estuarine residents of Barataria Bay and the adjacent coastal stock, further supporting separation of coastal and estuarine stocks. Finally, 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 Northern Coastal Stock of common bottlenose dolphins is 11,543 (CV=0.19; Table 1; Garrison *et al.* 2021). This estimate is from an inverse-variance weighted average of seasonal abundance estimates from aerial surveys conducted during summer 2017, winter 2018, and fall 2018.

Earlier Abundance Estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions.

Recent Surveys and Abundance Estimates

The Southeast Fisheries Science Center conducted aerial surveys of continental shelf waters (shoreline to 200 m depth) along the U.S. Gulf of Mexico coast from the Florida Keys to the Texas/Mexico border during summer (June–August) 2017 and fall (October–November) 2018, and from Tampa, Florida, to Port O’Connor, Texas, during winter (January–March) 2018 (Garrison *et al.* 2021). The surveys were conducted along tracklines oriented perpendicular to the shoreline and spaced 20 km apart. The total survey effort varied during each survey due to weather conditions, but ranged between 8,046 and 14,590 km. Each of these surveys was conducted using a two-team approach to develop estimates of visibility bias using the independent observer approach with Distance analysis (Laake and Borchers 2004). Abundance was calculated using mark-recapture distance sampling implemented in package mrds (version 2.21; Laake *et al.* 2020) in the R statistical programming language. This approach estimates both the probability of detection on the trackline and within the surveyed strip accounting for the effects of sighting conditions (e.g., sea state, glare, turbidity, and cloud cover). A different detection probability model was used for each seasonal survey (Garrison *et al.* 2021). The survey data were post-stratified into spatial boundaries corresponding to the defined boundaries of common bottlenose dolphin stocks within the surveyed area. The abundance estimates for the Northern Coastal Stock of common bottlenose dolphins were based upon tracklines and sightings in waters from the shoreline to the 20-m isobath and between the Mississippi River Delta and 84°W longitude. The seasonal abundance estimates for this stock were: summer – 4,671 (CV=0.49), winter – 18,194 (CV=0.24), and fall – 7,152 (CV=0.32). Due to the uncertainty in stock movements and apparent seasonal variability in the abundance of the stock, a weighted average of these seasonal estimates was taken where the weighting was the inverse of the CV. This approach weights estimates with higher precision more heavily in the final weighted mean. The resulting weighted mean and best estimate of abundance for the Northern Coastal Stock of common bottlenose dolphins was 11,543 (CV=0.19; Table 1; Garrison *et al.* 2021).

Table 1. Most recent abundance estimate (N_{est}) and coefficient of variation (CV) of the northern Gulf of Mexico Northern Coastal Stock of common bottlenose dolphins (0 – 20-m isobaths) based on summer 2017, winter 2018, and fall 2018 aerial surveys.

Years	Area	N_{est}	CV
2017, 2018	Gulf of Mexico	11,543	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 Northern Coastal Stock of common bottlenose dolphins is 11,543 (CV=0.19). The minimum population estimate for the Northern Coastal Stock is 9,881 common bottlenose dolphins (Table 2).

Current Population Trend

The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long intervals between surveys. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV>0.30) remains below 80% (alpha=0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007). Two point estimates of common bottlenose dolphin abundance for the Northern Coastal Stock have been made based on aerial data from surveys during 2011−2012 and 2017−2018 (Garrison *et al.* 2021). Each of these surveys had a similar design and was conducted using the same aircraft. The model for detection probability on the trackline from the 2017/2018 survey was applied to the abundance estimates from the 2011 and 2012 surveys. The resulting inverse variance weighted best abundance estimates for seasonal surveys were: 2011–2012 – 7,569 (CV=0.22) and 2017−2018 – 11,543 (CV=0.19). A trends analysis is not possible because there are only two abundance estimates available. For further information on comparisons of old and current abundance estimates for this stock see Garrison *et al.* (2021).

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 (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 9,881. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor is 0.45 because the CV of the shrimp trawl mortality estimate is greater than 0.6 (Wade and Angliss 1997). PBR for the northern Gulf of Mexico Northern Coastal Stock of common bottlenose dolphins is 89 (Table 2).

Table 2. Best and minimum abundance estimates of the northern Gulf of Mexico Northern Coastal Stock of common bottlenose dolphins with Maximum Productivity Rate (R_{max}), Recovery Factor (F_r) and PBR.

N_{est}	N_{est} CV	N_{min}	F_r	R_{max}	PBR
11,543	0.19	9,881	0.45	0.04	89

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury for the Northern Coastal Stock of common bottlenose dolphins during 2015–2019 is unknown because this stock is known to interact with unobserved fisheries (see below). The five-year unweighted mean annual mortality estimate for 2015–2019 for the commercial shrimp trawl fishery was 6.5 (CV=0.64; see Shrimp Trawl section below). The mean annual fishery-related mortality and serious injury during 2015–2019 for strandings identified as fishery-caused was 1.4. Mean annual mortality and serious injury during 2015–2019 due to other human-caused actions (the *Deepwater Horizon* oil spill) was predicted to be 20. The minimum total mean annual human-caused mortality and serious injury for this stock during 2015–2019 was 28 (Table 3). This is considered a minimum because 1) not all fisheries that could interact with this stock are observed and/or observer coverage is very low, 2) stranding data are used as an indicator of fishery-related interactions and not all dead animals are recovered by the stranding network (Peltier *et al.* 2012; Wells *et al.* 2015), 3) cause of death is not (or cannot be) routinely determined for stranded carcasses, 4) the estimate of fishery-related interactions includes an actual count of verified fishery-caused deaths and serious injuries and should be considered a minimum (NMFS 2016), 5) various assumptions were made in the population model used to estimate population decline for the northern Gulf of Mexico Bay Stock and Estuaries (BSE) stocks impacted by the *Deepwater Horizon* (DWH) oil spill.

Fisheries Information

There are seven commercial fisheries that interact, or that potentially could interact, with this stock. These include four Category II fisheries (Southeastern U.S. Atlantic, Gulf of Mexico shrimp trawl; Southeastern U.S. Atlantic, Gulf of Mexico stone crab trap/pot; Gulf of Mexico menhaden purse seine; and Gulf of Mexico gillnet); and two Category III fisheries (Gulf of Mexico blue crab trap/pot; and Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line)). Detailed fishery information is presented in Appendix III.

Note: Animals reported in the sections to follow were ascribed to a stock or stocks of origin following methods described in Maze-Foley et al. (2019). These include strandings, observed takes (through an observer program), fisherman self-reported takes (through the Marine Mammal Authorization Program), research takes, and opportunistic at-sea observations.

Shrimp Trawl

Between 1997 and 2019, 13 common bottlenose dolphins and nine unidentified dolphins, which could have been either common bottlenose dolphins or Atlantic spotted dolphins, became entangled in the lazy line, turtle excluder device or tickler chain gear in observed trips of the commercial shrimp trawl fishery in the Gulf of Mexico (Soldevilla *et al.* 2021). All dolphin bycatch interactions resulted in mortalities except for one unidentified dolphin that was released alive in 2009 (Maze-Foley and Garrison 2016). Soldevilla *et al.* (2015, 2016, 2021) provided mortality estimates calculated from analysis of shrimp fishery effort data and NMFS's Observer Program bycatch data. Annual mortality estimates were calculated for the years 2015–2019 from stratified annual fishery effort and bycatch rates, and the five-year unweighted mean mortality estimate was calculated for Gulf of Mexico dolphin stocks (Soldevilla *et al.* 2021). The four-area (TX, LA, MS/AL, FL) stratification method was chosen because it best approximates how fisheries operate (Soldevilla *et al.* 2015, 2016, 2021). The mean annual mortality estimate for the Northern Coastal Stock of common bottlenose dolphins is 6.5 (CV=0.64). Limitations and biases of annual bycatch mortality estimates are described in detail in Soldevilla *et al.* (2015, 2016, 2021).

Blue Crab and Stone Crab Trap/Pot

During 2015–2019, one entanglement associated with the commercial blue crab trap/pot fishery was documented which was ascribed to the Northern Coastal Stock or the Mississippi Sound, Lake Borgne, Bay Boudreau Stock. This mortality was included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 25 August 2020) and in the stranding totals presented in Table 4, and it is also included in the annual human-caused mortality and serious injury total for this stock (Table 3).

Since there is no observer program for these fisheries, it is not possible to estimate the total number of interactions or mortalities associated with crab traps/pots. The documented mortality in this gear represents a minimum known count of interactions in the last five years.

Menhaden Purse Seine

During 2015–2019, one interaction between the Northern Coastal Stock and the menhaden purse seine fishery was documented (in 2018) through the Marine Mammal Authorization Program (MMAP). There is currently no observer program for the Gulf of Mexico menhaden purse seine fishery. Without an ongoing 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. The documented interaction in this gear represents a minimum known count of interactions in the last five years.

Gillnet

No marine mammal mortalities associated with gillnet fisheries have been reported or observed for the Northern Coastal Stock. There is limited observer coverage of gillnet fisheries in federal waters (e.g., Mathers *et al.* 2020), but none currently in state waters, although during 2012–2018 NMFS placed observers on commercial vessels (state permitted gillnet vessels) in the coastal state waters of Alabama, Mississippi, and Louisiana (Mathers *et al.* 2016). No takes were observed in state coastal waters during that time. However, stranding data suggest that gillnet and marine mammal interactions do occur (Read and Murray 2000), causing mortality and serious injury. During 2015–2019, nine stranded common bottlenose dolphins were recovered with markings indicative of interaction with gillnet gear (Read and Murray 2000), but no gear was attached to the carcasses and it is unknown whether the interactions with the gear contributed to the death of these animals. Seven of the nine cases were ascribed to the Northern Coastal Stock alone, and two were ascribed to both the Northern Coastal and Mississippi Sound, Lake Borgne, Bay Boudreau stocks. Because there is no observer program within this stock's boundaries, it is not possible to estimate the total number of interactions or mortalities associated with gillnet gear.

Hook and Line (Rod and Reel)

During 2015–2019, two mortalities involving hook and line gear entanglement or ingestion were documented for the Northern Coastal Stock. The mortalities occurred in 2015 and 2017, and available evidence from the stranding records suggested the hook and line gear interactions contributed to the cause of death. The mortalities were included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 25 August 2020) and in the stranding totals presented in Table 4, and were included in the annual human-caused mortality and serious injury total for this stock (Table 3).

In addition to animals included in the stranding database, during 2015–2019, there were three at-sea observations in the Northern Coastal Stock area of live common bottlenose dolphins entangled in hook and line fishing gear, and all three were considered seriously injured (Maze-Foley and Garrison 2020). The serious injuries occurred in 2015, 2016, and 2017, and were included in the annual human-caused mortality and serious injury total for this stock (Table 3).

It should be noted that, in general, it cannot be determined if hook and line gear originated from a commercial (i.e., charter boat and headboat) or recreational angler because the gear type used by both sources is typically the same. Also, it is not possible to estimate the total number of interactions with hook and line gear because there is no observer program. The documented interactions in this gear represent a minimum known count of interactions in the last five years.

Other Mortality

A population model was developed to estimate the injury in lost cetacean years and time to recovery for stocks affected by the *Deepwater Horizon* (DWH) oil spill (see Habitat Issues section), taking into account long-term effects resulting from mortality, reproductive failure, and reduced survival rates (DWH MMIQT 2015; Schwacke *et al.* 2017). For the Northern Coastal Stock, this model predicted the stock will have experienced a 50% (95%CI: 32–73) maximum reduction in population size (DWH MMIQT 2015; Schwacke *et al.* 2017), and for the years 2015–2019, the model projected 101 mortalities (Table 3). This population model has a number of sources of uncertainty. The baseline population size was estimated from studies initiated after initial exposure to DWH oil occurred. Therefore, it is possible that the pre-spill population size was larger than this baseline level and some mortality occurring early in the event was not quantified. The duration of elevated mortality and reduced reproductive success after exposure is unknown, and expert opinion was used to predict the rate at which these parameters would return to baseline levels. Where possible, uncertainty in model parameters was included in the estimates of excess mortality by re-sampling from statistical distributions of the parameters (DWH MMIQT 2015; DWH NRDAT 2016; Schwacke *et al.* 2017).

NOAA's Office of Law Enforcement has been investigating increasing numbers of reports from the northern Gulf of Mexico coast of violence against common bottlenose dolphins, including shootings using guns and bows and arrows, throwing pipe bombs and cherry bombs, and stabbings (Vail 2016). During 2015–2019, one mortality ascribed to the Northern Coastal Stock was documented with a bullet present just behind the head. This animal was included within the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 25 August 2020) and in the stranding totals presented in Table 4, but was not included in the annual human-caused mortality and serious injury total for this stock (Table 3) due to the bullet was not believed to be the definitive cause of death. From recent cases that have been prosecuted, it has been shown that fishermen became frustrated and retaliated against dolphins for removing bait or catch from (depredating) their fishing gear (Vail 2016).

Depredation of fishing catch and/or bait is a growing problem in Gulf of Mexico coastal and estuarine waters and globally, and can lead to serious injury or mortality via ingestion of or entanglement in gear (e.g., Zollett and Read 2006; Read 2008; Powell and Wells 2011; Vail 2016), as well as changes in dolphin activity patterns, such as decreases in natural foraging (Powell and Wells 2011). It has been suggested that provisioning, or the illegal feeding, of wild common bottlenose dolphins, may encourage depredation because provisioning conditions dolphins to approach humans and vessels, where they then may prey on bait and catches (Vail 2016). Such conditioning increases risks of subsequent injury and mortality (Christiansen *et al.* 2016). Illegal feeding/provisioning has been documented in the literature in Florida and Texas (Bryant 1994; Samuels and Bejder 2004; Cunningham-Smith *et al.* 2006; Powell and

Wells 2011; Powell *et al.* 2018).

Feeding or provisioning of wild common bottlenose dolphins has been documented in Florida, particularly near St. Andrew Bay (Panama City Beach) in the Panhandle (Samuels and Bejder 2004; Powell *et al.* 2018) and south of Sarasota Bay (Cunningham-Smith *et al.* 2006; Powell and Wells 2011), 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 provisioning has been observed south of Sarasota Bay since 1990 (Cunningham-Smith *et al.* 2006; Powell and Wells 2011), and near St. Andrew Bay in 1998 (Samuels and Bejder 2004) and in 2014 (Powell *et al.* 2018). For many years within certain areas of St. Andrew Bay and adjacent coastal waters, it has been typical to see wild dolphins surrounded by multiple boats, multiple personal watercraft, and multiple swimmers. Studies have documented a high rate of unregulated food provisioning and recorded many interactions with humans that put dolphins at risk of injury, illness, or death (Samuels and Bejder 2004; Powell *et al.* 2018). Research by Powell *et al.* (2018) during 2014 indicated the number of conditioned individual dolphins (conditioned to human interaction by food reinforcement; animals that accepted food handouts from people on a regular basis) tripled (n=21) compared to those documented in 1998 by Samuels and Bejder (2004; n=7), and that overall the problems of illegal feeding and harassment had increased. Powell *et al.* (2018) found that conditioned dolphins spent the majority of their time approaching boats to beg for food and patrolling among boats and swimmers looking for handouts, which in turn increases their risk of boat strike, entanglement in or hooking by fishing gear, or retaliation by angry fishermen (Wells and Scott 1997; Powell and Wells 2011; Adimey *et al.* 2014; Powell *et al.* 2018).

Swimming with wild common bottlenose dolphins has also been documented in Florida in Key West (Samuels and Engleby 2007) and near Panama City Beach (Samuels and Bejder 2004). Near Panama City Beach, Samuels and Bejder (2004) concluded that dolphins were amenable to swimmers due to illegal provisioning. Swimming with wild dolphins may cause harassment, and harassment is illegal under the MMPA.

All mortalities and serious injuries from known sources for the Northern Coastal Stock are summarized in Table 3.

Table 3. Summary of the incidental mortality and serious injury of common bottlenose dolphins (Tursiops truncatus) of the Northern Coastal Stock. For fisheries that do not have an ongoing, federal observer program, counts of mortality and serious injury were based on stranding data, at-sea observations, or fisherman self-reported takes via the Marine Mammal Authorization Program (MMAP). For strandings, at-sea counts, and fisherman self-reported takes, the number reported is a minimum because not all strandings, at-sea cases, or gear interactions are detected. See the Annual Human-Caused Mortality and Serious Injury section for biases and limitations of mortality estimates, and the Strandings section for limitations of stranding data. NA = not applicable.

Fishery	**Years**	**Data Type**	**Mean Annual Estimated Mortality and Serious Injury Based on Observer Data**	**5-year Minimum Count Based on Stranding, At-Sea, and/or MMAP Data**
Shrimp Trawl	2015–2019	Observer Data	6.5 (CV=0.64)	NA
Crab Trap/Pot	2015–2019	Stranding Data	NA	1
Menhaden Purse Seine	2015–2019	MMAP Fisherman self-reported takes	NA	1
Gillnet	2015–2019	Observer Data and Stranding Data	NA	0
Hook and Line	2015–2019	Stranding Data and At-Sea Observations	NA	5

Mean Annual Mortality due to commercial fisheries (2015–2019)	**7.9**
Mortality due to DWH (5-year Projection)	**101**
Mean Annual Mortality due to DWH (2015–2019)	**20**
Minimum Total Mean Annual Human-Caused Mortality and Serious Injury (2015–2019)	**28**

Strandings

A total of 137 common bottlenose dolphins were found stranded in Northern Coastal Stock waters of the Gulf of Mexico from 2015 through 2019 (Table 4; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 25 August 2020). There was evidence of human interaction (HI) for 22 of the strandings. No evidence of human interaction was detected for five strandings, and for the remaining 110 strandings, it could not be determined if there was evidence of human interaction. Human interactions were from several sources, including nine with markings indicative of interaction with gillnet gear, two entanglements with hook and line gear, one entanglement in commercial blue crab trap/pot gear, two animals with evidence of a vessel strike, and one animal with a gunshot wound. It should be noted that evidence of human interaction does not necessarily mean the interaction caused the animal's stranding or death.

The assignment of animals to a single stock is impossible in some regions where stocks overlap, especially in nearshore coastal waters (Maze-Foley *et al.* 2019). Of the 137 strandings ascribed to the Northern Coastal Stock, 78 were ascribed solely to this stock. The counts in Table 4 may include some animals from the Mississippi Sound, Lake Borgne, Bay Boudreau Stock and/or the St. Joseph Bay Stock and thereby overestimate the number of strandings for the Northern Coastal Stock. Stranded carcasses are not routinely identified to either the offshore or coastal morphotype of common bottlenose dolphin, therefore it is possible that some of the reported strandings were of the offshore form, though that number is likely to be low (Byrd *et al.* 2014).

There are a number of other difficulties associated with the interpretation of stranding data. Stranding data underestimate the extent of human and fishery-related mortality and serious injury because not all of the dolphins that die or are seriously injured in human interactions wash ashore, or, if they do, they are not all recovered (Peltier *et al*. 2012; Wells *et al*. 2015; Carretta *et al.* 2016). Additionally, not all carcasses will show evidence of human interaction, entanglement or other fishery-related interaction due to decomposition, scavenger damage, etc. (Byrd *et al*. 2014). Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of human interaction.

Since 1990, there have been 15 bottlenose dolphin die-offs or Unusual Mortality Events (UMEs) in the northern Gulf of Mexico (http://www.nmfs.noaa.gov/pr/health/mmume/events.html, accessed 5 November 2020), and eight of these have occurred within the boundaries of the Northern Coastal Stock and may have affected the stock. 1) From January through May 1990, a total of 344 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), however, morbillivirus may have contributed to this event (Litz *et al.* 2014). 2) 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; Litz *et al.* 2014). From February through April 1994, 236 bottlenose dolphins were found dead on Texas beaches, of which 67 occurred in a single 10-day period. 3) In 1996 a UME was declared for bottlenose dolphins in Mississippi when 31 bottlenose dolphins stranded during November and December. The cause was not determined, but a *Karenia brevis* (red tide) bloom was suspected to be responsible. 4) Between August 1999 and May 2000, 150 bottlenose dolphins died coincident with *K. brevis* blooms and fish kills in the Florida Panhandle (additional strandings included three Atlantic spotted dolphins, *Stenella frontalis*, one Risso's dolphin, *Grampus griseus*, two Blainville's beaked whales, *Mesoplodon densirostris*, and four unidentified dolphins). Brevetoxin was determined to be the cause of this event (Twiner *et al.* 2012; Litz *et* *al.* 2014). 5) In March and April 2004, in another Florida Panhandle UME attributed to *K. brevis* blooms, 105 bottlenose dolphins and two unidentified dolphins stranded dead (Litz *et al.* 2014). 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; Twiner *et al.* 2012). 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 most of the stranded dolphins and determined to be the cause of the event (Twiner *et al.* 2012; Litz *et al.* 2014). Between September 2005 and April 2006 when the event was officially declared over, a total of 88 bottlenose dolphin strandings occurred (plus strandings of five unidentified dolphins). 7) A UME was declared for cetaceans in the northern Gulf of Mexico beginning 1 March 2010 and ending 31 July 2014 (Litz *et al.* 2014; http://www.nmfs.noaa.gov/pr/health/mmume/cetacean_gulfofmexico.htm, accessed 2 December 2020). It includes cetaceans that stranded prior to the DWH oil spill (see Habitat Issues section below), during the spill, and after. Exposure to the DWH oil spill was determined to be the primary underlying cause of the elevated stranding numbers in the northern Gulf of Mexico after the spill (e.g., Schwacke *et al.* 2014; Venn-Watson *et al.* 2015; Colegrove *et al.* 2016; DWH NRDAT 2016). During 2011–2014, nearly all stranded dolphins from this stock were considered to be part of the UME. 8) During 1 February 2019 to 30 November 2019, a UME was declared for the area from the eastern border of Taylor County, Florida, west through Alabama, Mississippi, and Louisiana (http://www.nmfs.noaa.gov/pr/health/mmume/cetacean_gulfofmexico.htm, accessed 5 November 2020). A total of 337 common bottlenose dolphins stranded during this event, with 45 of them being from the Northern Coastal Stock. The largest number of mortalities occurred in eastern Louisiana and Mississippi. An investigation concluded the event was caused by exposure to low salinity waters as a result of extreme freshwater discharge from rivers. The unprecedented amount of freshwater discharge during 2019 (e.g., Gasparini and Yuill 2020) resulted in low salinity levels across the region.

Table 4. Common bottlenose dolphin strandings occurring in the Northern Coastal Stock area from 2015 to 2019, including the number of strandings for which evidence of human interaction (HI) was detected and number of strandings for which it could not be determined (CBD) if there was evidence of HI. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 25 August 2020). Please note HI does not necessarily mean the interaction caused the animal's death.

Stock	Category	2015	2016	2017	2018	2019	Total
Northern Coastal Stock	Total Stranded	23	26	24	15	49[e]	137
	Human Interaction						
	---Yes	5[a]	5[b]	6[c]	2[d]	4[f]	22
	---No	1	1	1	2	0	5
	---CBD	17	20	17	11	45	110

a. Includes 1 entanglement interaction with hook and line gear (mortality) and 2 mortalities with evidence of a vessel strike.
b. Includes 4 fisheries interactions (FIs), 2 of which were mortalities with markings indicative of interaction with gillnet gear; also includes 1 mortality with a gunshot wound.
c. All 6 are FIs, including 1 entanglement interaction with hook and line gear (mortality) and 3 mortalities with markings indicative of interaction with gillnet gear.
d. Both are FIs, including 1 entanglement interaction with commercial blue crab trap/pot gear (mortality).
e. 45 strandings were part of the UME event in the northern Gulf of Mexico.
f. All 4 are FIs, all of which were mortalities with markings indicative of interaction with gillnet gear.

HABITAT ISSUES

The *Deepwater Horizon* MC252 drilling platform, located approximately 80 km southeast of the Mississippi River Delta in waters about 1500 m deep, exploded on 20 April 2010. The rig sank, and over 87 days up to ~3.2 million barrels of oil were discharged from the wellhead until it was capped on 15 July 2010 (DWH NRDAT 2016). 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 were conducted to determine potential impacts of the spill on marine mammals. These studies estimated that 82% (95%CI: 55–100) of the Northern Coastal Stock of common bottlenose dolphins in the Gulf were exposed to oil, that 37% (95%CI: 17–53) of females suffered from reproductive failure, and 30% (95%CI: 11–47) suffered adverse health effects (DWH MMIQT 2015). A population model estimated that the stock experienced a 50% maximum reduction in population size (see Other Mortality section above).

The nearshore habitat occupied by the three 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 three 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).

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 common bottlenose dolphins is not known.

STATUS OF STOCK

The common bottlenose dolphin is not listed as threatened or endangered under the Endangered Species Act, and the Gulf of Mexico Northern Coastal Stock is not considered strategic under the Marine Mammal Protection Act. However, the occurrence of a UME of unprecedented size and duration has impacted the Northern Coastal Stock area and is a cause for concern. The DWH damage assessment estimated that the stock experienced a 50% (95%CI: 32–73) maximum reduction in population size due to the oil spill (DWH MMIQT 2015; Schwacke *et al.* 2017). Total U.S. fishery-related mortality and serious injury for this stock is unknown, but at a minimum is greater than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate. The status of this stock relative to optimum sustainable population in the Gulf of Mexico EEZ is unknown. There are insufficient data to determine the population trends for this stock.

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