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

STOCK DEFINITION AND GEOGRAPHIC RANGE

Thirty-six common bottlenose dolphin stocks have been designated in the northern Gulf of Mexico (i.e., U.S. Gulf of Mexico; Waring *et al.* 2016). Northern Gulf of Mexico inshore habitats have been separated into 31 bay, sound and estuary stocks. Three northern Gulf of Mexico coastal stocks inhabit coastal waters from the shore to the 20-m isobath. The northern Gulf of Mexico Continental Shelf Stock inhabits waters from 20 to 200 m deep. The northern Gulf of Mexico Oceanic Stock inhabits the waters from the 200-m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ; Figure 1).

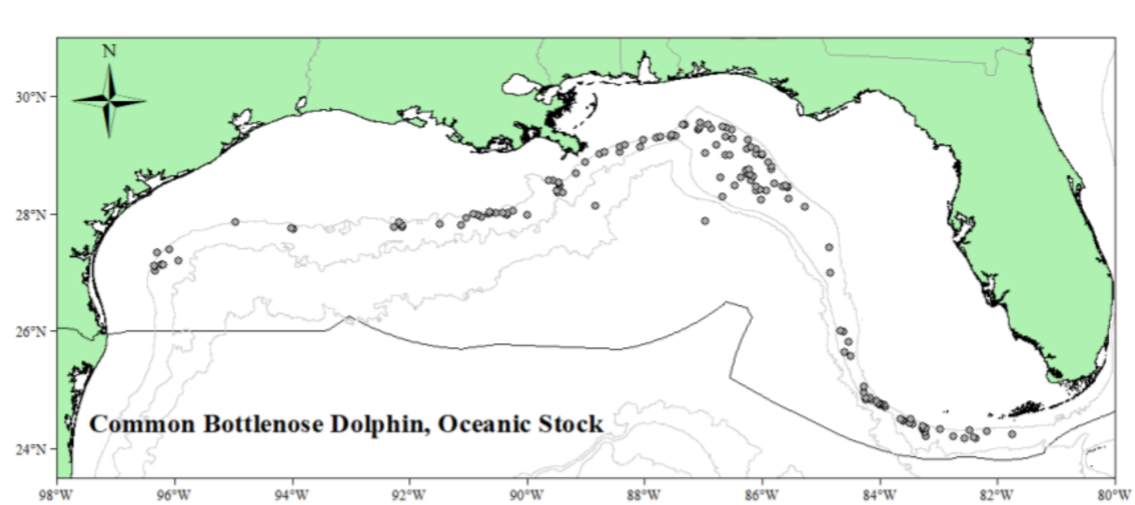

Figure 1. Distribution of common bottlenose dolphin on-effort sightings in oceanic waters from SEFSC vessel surveys during spring 1996–2001, summer 2003, spring 2004, summer 2009, summer 2017, and summer/fall 2018. Isobaths are the 200-m, 1,000-m, and 2,000-m depth contours. The darker line indicates the U.S. EEZ.

Both "coastal" and "offshore" ecotypes of common bottlenose dolphins (Mead and Potter 1995) occur in the Gulf of Mexico (Vollmer 2011, Vollmer and Rosel 2013), but the distribution of each is not well defined. The offshore and coastal ecotypes are genetically distinct based on both mitochondrial and nuclear markers (Hoelzel *et al.* 1998, Vollmer 2011). Ongoing research is aimed at better defining stock boundaries in coastal, continental shelf and oceanic waters of the Gulf of Mexico. Although the boundaries are not certain, all 141 *Tursiops* samples collected during 1994−2008 in waters greater than 200 m were of the offshore ecotype (Vollmer 2011), and so the Oceanic Stock as currently defined is thought to be composed entirely of bottlenose dolphins of the offshore ecotype.

All the cetacean species found in the oceanic northern Gulf of Mexico almost certainly occur in similar habitat beyond U.S. boundaries in the southern Gulf. There are fewer cetacean sighting and stranding records in the southern Gulf due to more limited effort. Nevertheless, there are records for most oceanic species in the southern Gulf (e.g., Ortega Ortiz 2002; Ortega-Argueta *et al.* 2005; Jefferson *et al.* 2008; Vázquez Castán *et al.* 2009; Whitt *et al.* 2011). This is therefore likely a transboundary stock with both Cuba and Mexico. Because U.S. waters only comprise about 40% of the entire Gulf of Mexico and 35% of the oceanic (i.e., >200 m) Gulf of Mexico (Mullin and Fulling 2004), abundance and stock boundaries of oceanic species are poorly known.

The northern Gulf of Mexico Oceanic Stock of common bottlenose dolphins is managed separately from the western North Atlantic Offshore Stock of common bottlenose dolphins. One line of evidence to support this decision comes from Baron *et al.* (2008), who found that Gulf of Mexico common bottlenose dolphin whistles (collected from oceanic waters) were significantly different from those in the western North Atlantic Ocean (collected from continental shelf and oceanic waters) in duration, number of inflection points and number of steps. Coupled with evidence for population structure in other areas and the fact that the western North Atlantic and Gulf of Mexico belong to distinct marine ecoregions (Spalding *et al.* 2007), designation of the two stocks is reasonable and consistent with maintaining stocks as functioning elements of their ecosystems. Restricted genetic exchange has been documented among offshore populations within the Gulf of Mexico, suggesting multiple demographically-independent populations of the offshore morphotype exist (Vollmer and Rosel 2017).

POPULATION SIZE

The best abundance estimate (Nest) for the northern Gulf of Mexico Oceanic Stock of common bottlenose dolphins is 7,462 (CV=0.31; Table 1). This estimate is from summer 2017 and summer/fall 2018 oceanic surveys covering waters from the 200-m isobath to the seaward extent of the U.S. EEZ (Garrison *et al.* 2020).

Earlier Abundance Estimates

Five point estimates of abundance for the oceanic stock of common bottlenose dolphins have been made based on data from surveys during: 2003 (June−August), 2004 (April−June), 2009 (July−August), 2017 (July−August), and 2018 (August−October). Each of these surveys had a similar design and was conducted using the same vessel or a vessel with a similar observation platform. Surveys in 2003, 2004, and 2009 employed a single survey team while the 2017 and 2018 surveys employed two survey teams. In addition, the 2017 and 2018 surveys were conducted in "passing" mode rather than “closing” mode. Passing mode eliminates the problems of fragmented tracklines associated with using closing mode in areas with high densities of animals. When using the closing mode with the two-team method, both teams must be allowed the opportunity to see a mammal group and allow it to pass behind the ship before turning to close on it, making it difficult to reacquire the group and resulting in long periods spent chasing the group, with the increased potential for off-effort sightings. For passive acoustics, in closing mode the vessel often turns before the acoustic team is able to achieve a good localization. This is especially important for deep-diving species where visual surveys are less optimal for abundance estimates. However, passing mode can result in increased numbers of unidentified sightings and may have affected group size estimation for distant groups of dolphins and small whales. Comparisons of the survey results over the years 2003 through 2009 required adjustments for these differences, including apportioning unidentified species among identified taxa to address the first issue, applying the model for detection probability on the trackline from the summer 2017 survey to the abundance estimates from the 2003, 2004, and 2009 surveys, and examining relationships between sighting distance and estimated group size (Garrison *et al.* 2020). This resulted in revised abundance estimates of: 2003, N=21,350 (CV=0.47); 2004, N=8,864 (CV=0.50); and 2009, N=9,640 (CV=0.66).

Recent Surveys and Abundance Estimates

An abundance estimate for the oceanic stock of common bottlenose dolphins was generated from vessel surveys conducted in the northern Gulf of Mexico from the continental shelf edge (~200 m isobath) to the seaward extent of the U.S. EEZ (Garrison *et al.* 2020). One survey was conducted from 2 July to 25 August 2017 and consisted of 5,104 km of on-effort trackline, and the second survey was conducted from 11 August to 6 October 2018 and consisted of 5,205 km of on-effort trackline within the surveyed strata. Both surveys used a double-platform data-collection procedure, which allowed estimation of the detection probability on the trackline using the independent observer approach assuming point independence (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 accounted for the effects of covariates (e.g., sea state, glare) on detection probability within the surveyed strip. The surveys were conducted in passing mode (e.g., Schwarz *et al.* 2010) while all prior surveys in the Gulf of Mexico have been conducted in closing mode. The abundance estimate for this stock included sightings of unidentified dolphins that were apportioned among identified species based on their relative density within the survey strata (Garrison *et al*. 2020). The 2017 and 2018 estimates were N=8,756 (CV=0.41) and N=5,833 (CV=0.46), respectively. The inverse variance weighted mean abundance estimate for common bottlenose dolphins in oceanic waters during 2017 and 2018 was 7,462 (CV=0.31; Table 1; Garrison *et al.* 2020). Unlike previous abundance estimates, this estimate was corrected for the probability of detection on the trackline.

Table 1. Most recent abundance estimate (N_{est}) and coefficient of variation (CV) of northern Gulf of Mexico common bottlenose dolphins in oceanic waters (200 m to the offshore extent of the EEZ) based on the inverse variance weighted mean from summer 2017 and summer/fall 2018 vessel surveys.

Years	Area	N_{est}	CV
2017, 2018	Gulf of Mexico	7,462	0.31

Minimum Population Estimate

The minimum population estimate (Nmin) is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for common bottlenose dolphins is 7,462 (CV=0.31). The minimum population estimate for the northern Gulf of Mexico oceanic stock of common bottlenose dolphin is 5,769 (Table 2).

Current Population Trend

Using revised abundance estimates for surveys conducted in 2003 (June−August), 2004 (April−June), and 2009 (July−August; see above), and the 2017 (July−August) and 2018 (August−October) estimates, pairwise comparisons of the log-transformed means were conducted between years, and significant differences were assessed at alpha=0.10. P-values were adjusted for multiple comparisons. There were no significant differences between survey years (Garrison *et al.* 2020).

However, 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). In addition, because these surveys are restricted to U.S. waters, it is not possible to distinguish between changes in population size and Gulf-wide shifts in spatial distribution.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum productivity rates are unknown for this stock. For purposes of this assessment, the maximum 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 (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 5,769. 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 Gulf of Mexico oceanic common bottlenose dolphin is 58 (Table 2).

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

N_{est}	CV	N_{min}	F_r	R_{max}	PBR
7,462	0.31	5,769	0.5	0.04	58

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total annual estimated fishery-related mortality and serious injury to this stock during 2014–2018 was presumed to be zero, as there were no reports of mortalities or serious injuries to oceanic bottlenose dolphins in the Gulf of Mexico (Table 3). Mean annual mortality and serious injury during 2014–2018 due to other human-caused actions (the *Deepwater Horizon* oil spill) was predicted to be 32. The minimum total mean annual human-caused mortality and serious injury for this stock during 2014–2018 was, therefore, 32.

Table 3. Total annual estimated fishery-related mortality and serious injury for northern Gulf of Mexico oceanic common bottlenose dolphins.

Years	Source	Annual Avg.	CV
2014–2018	U.S. fisheries using observer data	0	-

Fisheries Information

There are three commercial fisheries that interact, or that could potentially interact, with this stock in the Gulf of Mexico: the Category I Atlantic Highly Migratory Species (high seas) longline fishery and Atlantic Ocean, Caribbean, Gulf of Mexico large pelagics longline fishery; and the Category III Gulf of Mexico butterfish trawl fishery (Appendix III).

Percent observer coverage (percentage of sets observed) for the two Category I longline fisheries for each year during 2014–2018 was 18, 19, 23, 13 and 20, respectively. There is very little effort within the Gulf of Mexico by the Atlantic Highly Migratory Species (high seas) longline fishery, and no takes of common bottlenose dolphins within high seas waters of the Gulf of Mexico have been observed or reported thus far. Pelagic swordfish, tunas and billfish are the targets of the large pelagics longline fishery operating in the northern Gulf of Mexico and during 2014–2018 there were no observed mortalities or serious injuries to common bottlenose dolphins by this fishery (Garrison and Stokes 2016, 2017, 2019, 2020a, 2020b).

The Category III Gulf of Mexico butterfish trawl fishery may also interact with this stock (Appendix III). A trawl fishery for butterfish was monitored by NMFS observers for a short period in the 1980s with no records of incidental take of marine mammals (Burn and Scott 1988, NMFS unpublished data), although an experimental set by NMFS resulted in the death of two common bottlenose dolphins (Burn and Scott 1988). There are no other data available with regard to this fishery.

Other Mortality

A total of 1,764 common bottlenose dolphins were found stranded in the northern Gulf of Mexico from 2014 through 2018 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 May 2019). Of these, 177 showed evidence of human interaction (e.g., gear entanglement, mutilation, gunshot wounds). The vast majority of stranded common bottlenose dolphins are assumed to belong to one of the coastal stocks or to bay, sound and estuary stocks. Nevertheless, it is possible that some of the stranded common bottlenose dolphins belonged to the continental shelf or oceanic stock and that they were among those strandings with evidence of human interactions. Strandings do occur for other cetacean species whose primary range in the Gulf of Mexico is outer continental shelf or oceanic waters, but oceanic stocks in the Gulf of Mexico are less likely to strand than nearshore coastal stocks or shelf stocks (Williams *et al.* 2011).

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 March 2010 and ending 31 July 2014 (Litz *et al.* 2014, https://www.fisheries.noaa.gov/national/marine-life-distress/2010-2014-cetacean-unusual-mortality-event-northern-gulf-mexico). It included cetaceans that stranded prior to the *Deepwater Horizon* (DWH) oil spill (see "Habitat Issues" 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; see Habitat Issues section). During 2014, 126 common bottlenose dolphins were considered to be part of the UME. The vast majority of stranded common bottlenose dolphins are assumed to come from stocks that live nearest to land, namely the bay, sound and estuary stocks and the three coastal stocks. Nevertheless, it is possible that some of the stranded common bottlenose dolphins considered part of the UME belonged to the continental shelf or oceanic stock, given the overlap in distribution between the spill and distribution of this population.

A population model was developed to estimate the injury and time to recovery for stocks affected by the DWH oil spill, taking into account long-term effects resulting from mortality, reproductive failure, reduced survival rates, and the proportion of the stock exposed to DWH oil (DWH MMIQT 2015). Overall, the model estimated that this stock experienced a 4% maximum reduction in population size due to the oil spill (DWH MMIQT 2015). The mortality projected for the years 2010–2013 due to the spill has not been reported previously. Based on the population model, it was projected that 308 oceanic common bottlenose dolphins died during 2010–2013 (four year annual average of 77) due to elevated mortality associated with oil exposure (see Appendix VI). For the 2014–2018 reporting period of this SAR, the population model, estimated 160 oceanic common bottlenose dolphins died due to elevated mortality associated with oil exposure. The population model used to predict oceanic common bottlenose dolphin mortality due to the DWH event has a number of sources of uncertainty. Model parameters (e.g., survival rates, reproductive rates, and life-history parameters) were derived from literature sources for common bottlenose dolphins occupying waters outside of the Gulf of Mexico. In addition, proxy values for the effects of DWH oil exposure on both survival rates and reproductive success were applied based upon estimated values for common bottlenose dolphins in Barataria Bay. Finally, there was no estimation of uncertainty in model parameters or outputs.

HABITAT ISSUES

The DWH MC252 drilling platform, located approximately 80 km southeast of the Mississippi River Delta in waters about 1,500 m deep, exploded on 20 April 2010. The rig sank, and over 87 days ~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 10% (95%CI: 5–10) of oceanic common bottlenose dolphins in the Gulf were exposed to oil, that 5% (95%CI: 2–6) of females suffered from reproductive failure, and 4% (95%CI: 1–6) of oceanic common bottlenose dolphins suffered adverse health effects (DWH MMIQT 2015). A population model estimated that the stock experienced a 4% maximum reduction in population size (see Other Mortality section above).

The use of explosives to remove oil rigs in portions of the continental shelf in the western Gulf of Mexico has the potential to cause serious injury or mortality to marine mammals. These activities have been closely monitored by NMFS observers since 1987 (Gitschlag and Herczeg 1994). There have been no reports of either serious injury or mortality to common bottlenose dolphins in the oceanic Gulf of Mexico associated with these activities.

Anthropogenic sound in the world's oceans has been shown to affect marine mammals, with vessel traffic, seismic surveys, and active naval sonars being the main anthropogenic contributors to low- and mid-frequency noise in oceanic waters (e.g., Nowacek *et al.* 2015; Gomez *et al.* 2016; NMFS 2018). The long-term and population consequences of these impacts are less well-documented and likely vary by species and other factors. Impacts on marine mammal prey from sound are also possible (Carroll *et al.* 2017), but the duration and severity of any such prey effects on marine mammals are unknown.

STATUS OF STOCK

Common bottlenose dolphins are not listed as threatened or endangered under the Endangered Species Act, and the northern Gulf of Mexico Oceanic Stock is not considered strategic under the MMPA. No fishery-related mortality or serious injury has been observed in recent years; therefore, total fishery-related mortality and serious injury can be considered to be insignificant and approaching zero mortality and serious injury rate. The status of bottlenose dolphins, relative to OSP, in the northern Gulf of Mexico oceanic waters is unknown. There was no statistically significant trend in population size for this stock.

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