

COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*) Barataria Bay Estuarine System Stock

NOTE – NMFS is in the process of writing individual stock assessment reports for each of the 31 bay, sound and estuary stocks of common bottlenose dolphins in the Gulf of Mexico. Until this effort is completed and 31 individual reports are available, some of the basic information presented in this report will also be included in the report: “Northern Gulf of Mexico Bay, Sound and Estuary Stocks”.

STOCK DEFINITION AND GEOGRAPHIC RANGE

Common bottlenose dolphins are distributed throughout the bays, sounds, and estuaries (BSE) of the Gulf of Mexico (Mullin 1988). Long-term (year-round, multi-year) residency by at least some individuals has been reported from nearly every site where photographic identification (photo-ID) or tagging studies have been conducted in the Gulf of Mexico (e.g., Irvine and Wells 1972; Shane 1977; Gruber 1981; Irvine *et al.* 1981; Wells 1986; Wells *et al.* 1987; Scott *et al.* 1990; Shane 1990; Wells 1991; Bräger 1993; Bräger *et al.* 1994; Fertl 1994; Wells *et al.* 1996a,b; Wells *et al.* 1997; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Wells 2003; Hubard *et al.* 2004; Irwin and Würsig 2004; Shane 2004; Balmer *et al.* 2008; Urian *et al.* 2009; Bassos-Hull *et al.* 2013). In many cases, residents occur predominantly within estuarine waters, with limited movements through passes to the Gulf of Mexico (Shane 1977; Shane 1990; Gruber 1981; Irvine *et al.* 1981; Shane 1990; Maze and Würsig 1999; Lynn and Würsig 2002; Fazioli *et al.* 2006; Bassos-Hull *et al.* 2013; Wells *et al.* 2017). Genetic data also support the presences of relatively discrete BSE stocks (Duffield and Wells 2002; Sellas *et al.* 2005). Sellas *et al.* (2005) examined population subdivision among dolphins sampled in Sarasota Bay, Tampa Bay, and Charlotte Harbor, Florida; Matagorda Bay, Texas; 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 differentiation among all areas on the basis of both mitochondrial DNA control region sequence data and nine nuclear microsatellite loci. The Sellas *et al.* (2005) findings support the

identification of BSE populations distinct from those occurring in adjacent Gulf coastal waters. Differences in reproductive seasonality from site to site also suggest genetic-based distinctions among areas (Urian *et al.* 1996). Photo-ID and genetic data from several inshore areas of the southeastern United States also support the existence of resident estuarine animals and differentiation between animals biopsied along the Atlantic coast and those biopsied within estuarine systems at the same latitude (Caldwell 2001; Gubbins 2002; Zolman 2002; Mazzoil *et al.* 2005; Litz

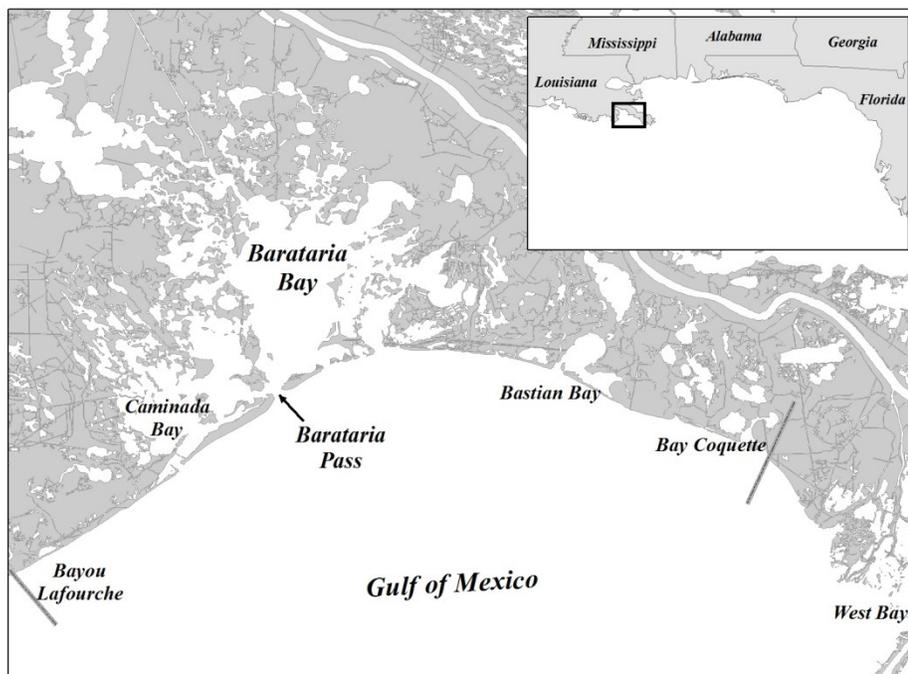


Figure 1. Geographic extent of the Barataria Bay Estuarine System Stock, located on the coast of Louisiana. The borders are denoted by solid lines.

2007; Rosel *et al.* 2009).

Barataria Bay is a shallow (mean depth = 2 m) estuarine system located in central Louisiana. It is bounded in the west by Bayou Lafourche, in the east by the Mississippi River delta and in the south by the Grand Terre barrier islands. Barataria Bay is approximately 110 km in length and 50 km in width at its widest point where it opens into the Gulf of Mexico (Conner and Day 1987). This estuarine system is connected to the Gulf of Mexico by a series of passes: Caminada Pass, Barataria Pass, Pass Abel, and Quatre Bayou Pass. The margins of Barataria Bay include marshes, canals, small embayments, and channels. Bay waters are turbid, and salinity varies widely from south to north with the more saline, tidally influenced portions in the south and freshwater lakes in the north (U.S. EPA 1999; Moretzsohn *et al.* 2010). Barataria Bay, together with the Timbalier-Terrebonne Bay system (referred to as the Barataria-Terrebonne National Estuary Program), has been selected as an estuary of national significance by the Environmental Protection Agency National Estuary Program (see <http://www.btneep.org/BTNEP/home.aspx>). The marshes and swamp forests which characterize Barataria Bay supply breeding and nursery grounds for an assortment of commercial and recreational species of consequence, such as finfish, shellfish, alligators, songbirds, geese, and ducks (U.S. EPA 1999; Moretzsohn *et al.* 2010).

The Barataria Bay Estuarine System (BBES) Stock was delimited in the first stock assessment reports published in 1995 (Blaylock *et al.* 1995). The stock area includes Caminada Bay, Barataria Bay east to Bastian Bay, Bay Coquette, and Gulf coastal waters extending 1 km from the shoreline (Figure 1). During June 1999–May 2002, Miller (2003) conducted 44 boat-based, photo-ID surveys in lower Barataria and Caminada Bays. Dolphins were present year-round, and 133 individual dolphins were identified. One individual was sighted six times, 42% were sighted two to six times, and 58% were sighted only once. More recently, Wells *et al.* (2017) deployed satellite-linked transmitters on 44 bottlenose dolphins captured within Barataria Bay during capture-release health assessments in August 2011, June 2013, and June 2014. It should be noted that the majority of tags were placed on animals captured in western Barataria Bay (see Wells *et al.* 2017 for tag deployment locations). Dolphins are known to inhabit eastern Barataria Bay (e.g., see Figure 1 in Rosel *et al.* 2017), but were not captured for tagging in far eastern waters due to logistical reasons. The tracking data found that the tagged dolphins remained within Barataria Bay, with a few animals occasionally entering coastal waters but venturing, on average, only out to approximately 1.7 km from shore (Wells *et al.* 2017). Telemetry data revealed three distinct ranging patterns for dolphins within the Bay, referred to as Island, West, and East. Island dolphins typically ranged near the western barrier islands of Grand Terre and Grande Isle and the nearby passes and Gulf waters within a few kilometers from the shoreline. West dolphins typically ranged in estuarine waters in the western portion of the Bay, such as Caminada Bay, West Champagne Bay, and Bassa Bassa Bay, as well as estuarine waters near Grand Isle and nearby Gulf waters within a few kilometers from the shoreline. East dolphins typically ranged in estuarine waters near the eastern barrier islands of East Grand Terre and Grand Pierre and in coastal marshes in eastern Barataria Bay. Tagged dolphins had relatively small home ranges (mean <70 km², Wells *et al.* 2017) within the BBES Stock area and displayed year-round, multi-year site fidelity to these home ranges, providing strong evidence of a year-round resident population in Barataria Bay. Molecular genetic analysis of population structure supported the telemetry data. Significant genetic differentiation was found at nuclear microsatellite DNA markers between dolphins sampled in Barataria Bay and those representing the Western Coastal Stock of common bottlenose dolphins that were sampled in coastal waters >2.5 km from shore outside of Barataria Bay (Rosel *et al.* 2017). In addition, the genetic analysis also suggested that there may be further partitioning within Barataria Bay (Rosel *et al.* 2017) similar to what was described from the telemetry data of Wells *et al.* (2017). Together the movement and genetic data provide strong evidence that the dolphins within Barataria Bay represent a demographically independent population separate from the dolphins inhabiting coastal waters. Both datasets also suggest it is plausible the BBES Stock contains multiple demographically independent populations, but further work is needed to better understand how the habitat is partitioned within the bay.

Dolphins residing in the estuaries southeast of this stock between BBES and the Mississippi River mouth (West Bay) are not currently covered in any stock assessment report. There are insufficient data to determine whether animals in this region exhibit affiliation to the BBES Stock or should be delineated as their own stock. Further research is needed to establish affinities of dolphins in this region and could result in revision to the eastern and/or western BBES Stock boundary. During 2011–2015, no bottlenose dolphins were reported stranded in this region.

POPULATION SIZE

The best available abundance estimate for the BBES Stock of common bottlenose dolphins is 2,306 (95% CI: 2,014–2,603; CV=0.09), which is the average of 10 vessel-based capture-recapture photo-ID surveys conducted from June 2010 to May 2014 (McDonald *et al.* 2017).

Earlier abundance estimates (>8 years old)

Miller (2003) conducted boat-based, photo-ID surveys in lower Barataria and Caminada Bays from June 1999 to May 2002. Miller (2003) identified 133 individual dolphins, and using closed-population unequal catchability models in the program CAPTURE, produced an abundance estimate of 138–238 (95% CI: 128–297) for the study area. Miller's (2003) estimate covered only a portion of the area of the BBES Stock and did not include a correction for the unmarked portion of the population. Therefore, the estimate is considered negatively biased.

Recent surveys and abundance estimates

McDonald *et al.* (2017) conducted vessel-based capture-recapture (C-R) photo-ID surveys from June 2010 to May 2014 to estimate density and abundance of common bottlenose dolphins within Barataria Bay during and after the *Deepwater Horizon* (DWH) oil spill. The study area included ~27% of the stock's area including the estuarine waters from the barrier islands of Grand Isle and Grande Terre, Louisiana, north and west into the main waters of Barataria Bay (McDonald *et al.* 2017). A spatially-explicit robust-design C-R model was used to estimate survival and density for each of 10 primary survey periods, and density and abundance estimates were adjusted for the proportion of the population that had non-distinctive fins. Suitable common bottlenose dolphin habitat (defined as average salinity >7.89 ppt) within the stock area was defined based upon a combined analysis of tag telemetry data (Wells *et al.* 2017) and average salinity maps (Hornsby *et al.* 2017). Common bottlenose dolphin density differed significantly among habitats near barrier islands, the eastern portion of the bay, and the western portion of the bay during the C-R study. Therefore, three habitat-specific densities from the surveyed area were estimated and these were then each appropriately expanded to the entire available suitable dolphin habitat in Barataria Bay (McDonald *et al.* 2017). Extrapolation of density estimates was therefore informed by habitat preferences of dolphins within Barataria Bay and did not include areas dominated by fresh water or shallow, marsh habitats that are not suitable dolphin habitats. Primary period abundances ranged from 1,303 dolphins (95% CI: 1,164–1,424) in June 2010 to 3,150 dolphins (95% CI: 2,759–3,559) in April 2014. The mean abundance for the BBES Stock estimated across the 10 C-R surveys was 2,306 dolphins (95% CI: 2,014–2,603; CV=0.09; McDonald *et al.* 2017). There were no clear seasonal or interannual temporal patterns in abundance. Key uncertainties in this abundance estimate include use of extrapolation from the surveyed area to a total stock abundance based on a preferred habitat model (McDonald *et al.* 2017; Hornsby *et al.* 2017). Also, the surveys for this abundance estimate were conducted during the DWH oil spill event and therefore may not accurately represent the post oil-spill abundance as it does not account for mortality that occurred after 2014 due to the spill.

Minimum Population Estimate

The minimum population estimate 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 this stock of common bottlenose dolphins is 2,306 (CV=0.09). The minimum population estimate for the BBES Stock is 2,138 bottlenose dolphins.

Current Population Trend

There are insufficient data to assess population trends for this stock. While not a trend analysis, it should be noted it was projected that there was up to a 51% decline in population size resulting from the DWH oil spill (see Habitat Issues section).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown 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 likely do not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995). The current productivity rate may be compromised by the DWH oil spill as Lane *et al.* (2015) and Kellar *et al.* (2017) reported negative reproductive impacts (see Habitat Issues section).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the 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; Wade 1998). The minimum population size of the BBES Stock of common bottlenose dolphins is 2,138. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor is 0.4 because the CV of the shrimp trawl mortality estimate for Louisiana BSE stocks is greater than 0.8 (Wade and Angliss 1997). PBR for this stock of common bottlenose dolphins is 17.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury for the BBES Stock of common bottlenose dolphins during 2011–2015 is unknown. The mean annual fishery-related mortality and serious injury during 2011–2015 for strandings and at-sea observations identified as fishery-related was 0.8 (see Shrimp Trawl section for additional fishery-related mortality). Additional mean annual mortality and serious injury during 2011–2015 due to other human-caused sources (fishery research, at-sea entanglements, gunshot wounds, and DWH oil spill) was 159. The minimum total mean annual human-caused mortality and serious injury for this stock during 2011–2015 was therefore 160 (Table 1). This is a biased estimate 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) the estimate does not include shrimp trawl bycatch (see Shrimp Trawl section), and 6) various assumptions were made in the population model used to estimate population decline for the northern Gulf of Mexico BSE stocks impacted by the DWH oil spill.

Fishery Information

There are four commercial fisheries that interact, or that potentially could interact, with this stock. These include two Category II fisheries (Southeastern U.S. Atlantic, Gulf of Mexico shrimp trawl and Gulf of Mexico menhaden purse seine fisheries) 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) fisheries). Detailed fishery information is presented in Appendix III.

Shrimp Trawl

Between 1997 and 2014, seven common bottlenose dolphins and seven unidentified dolphins, which could have been either common bottlenose dolphins or Atlantic spotted dolphins, became entangled in the net, lazy line, turtle excluder device, or tickler chain gear in the commercial shrimp trawl fishery in the Gulf of Mexico (Soldevilla *et al.* 2016). All dolphin bycatch interactions resulted in mortalities except for one unidentified dolphin that was released alive without serious injury in 2009 (Maze-Foley and Garrison 2016). Soldevilla *et al.* (2015; 2016) provided mortality estimates calculated from analysis of shrimp fishery effort data and NMFS's Observer Program bycatch data. Observer program coverage does not extend into BSE waters, therefore time-area stratified bycatch rates were extrapolated into inshore waters to estimate a five-year unweighted mean mortality estimate for 2010–2014 based on inshore fishing effort (Soldevilla *et al.* 2016). Because the spatial resolution at which fishery effort is modeled is aggregated at the state level (e.g., Nance *et al.* 2008), the mortality estimate covers inshore waters of Louisiana from Sabine Lake east to Barataria Bay, not just the BBES Stock. The mortality estimate for Louisiana BSE stocks for the years 2010–2014 was 61 (CV=1.4; Soldevilla *et al.* 2016). If all of the mortality occurred in Barataria Bay, the mortality estimate would exceed PBR for this stock; however, because bycatch for the BBES Stock alone cannot be quantified at this time, the mortality estimate is not included in the annual human-caused mortality and serious injury total for this stock. It should also be noted that this mortality estimate does not include skimmer trawl effort, which accounts for >48% of shrimp fishery effort in Louisiana, Alabama, and Mississippi inshore waters, because Observer Program coverage of skimmer trawls is limited. Limitations and biases of annual bycatch mortality estimates are described in detail in Soldevilla *et al.* (2015; 2016).

Menhaden Purse Seine

During 2011–2015 there were no documented interactions between the menhaden purse seine fishery and the BBES Stock. The menhaden purse seine fishery operates in Gulf of Mexico coastal waters just outside the barrier islands of Barataria Bay (Smith *et al.* 2002). It has the potential to interact with dolphins of this stock that use nearshore coastal waters. Interactions have been reported for nearby coastal and estuarine stocks (Waring *et al.* 2015). Without a systematic 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 stocks from which bottlenose dolphins are being taken.

Blue Crab Trap/Pot

During 2011–2015 there were two documented interactions in commercial blue crab trap/pot gear. There was one documented mortality (in 2011) of a common bottlenose dolphin in trap/pot gear, and one live animal (in 2012) was disentangled from trap/pot gear and released alive without serious injury following mitigation efforts (Maze-Foley and Garrison 2017). Both the mortality and live release were included in the stranding database (NOAA

National Marine Mammal Health and Stranding Response Database unpublished data, accessed 18 May 2016) and in the totals presented in Table 2. The mortality was included in the annual human-caused mortality and serious injury total for this stock (Table 1). There is no systematic observer coverage of crab trap/pot fisheries, so it is not possible to quantify total mortality. The documented interactions in this gear represent a minimum known count of interactions in the last five years.

Hook and Line (Rod and Reel)

During 2011–2015, four interactions with hook and line gear were documented within the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 18 May 2016; Table 2). In 2011, hook and line gear entanglement or ingestion were documented for one mortality and one animal released alive without serious injury following mitigation efforts (Maze-Foley and Garrison 2017). For the 2011 mortality, available evidence from the stranding data suggested the hook and line gear interaction contributed to the cause of death, and this animal was included in the annual human-caused mortality and serious injury total for this stock (Table 1). In 2013, two animals were released alive without serious injury following mitigation efforts after being found with hook and line gear on them during a live-capture-release health assessment (Maze-Foley and Garrison 2017).

In addition to animals included in the stranding database, during 2011–2015, there were two at-sea observations in Barataria Bay of dolphins entangled in fishing gear (monofilament line). The observations occurred during 2011 and 2012, and both dolphins were considered seriously injured (Maze-Foley and Garrison 2017), and both were included in the annual human-caused mortality and serious injury total for this stock (Table 1).

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 systematic 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 long-term injury to stocks affected by the 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 BBES Stock, the model predicted the stock experienced a 51% (95% CI: 32–72) maximum reduction in population size due to the oil spill (DWH MMIQT 2015; DWH NRDAT 2016; Schwacke *et al.* 2017), and for the years 2011–2015, the model projected 789 mortalities (Table 1). 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).

During 2011–2015, one mortality was documented in Barataria Bay (in 2015) as a result of entanglement in a fishery research gillnet, and this animal was included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 18 May 2016) and in the totals presented in Table 2, as well as in the annual human-caused mortality and serious injury total for this stock (Table 1).

During 2011–2015, there were two at-sea observations, one during 2013 and one during 2015, in Barataria Bay, of dolphins entangled around the head by constricting straps, potentially a plastic packing strap in one case. Both of these animals were considered seriously injured (Maze-Foley and Garrison 2017), and both were included in the annual human-caused mortality and serious injury total for this stock (Table 1).

NOAA's Office of Law Enforcement has been investigating increased reports from along the northern Gulf of Mexico coast of violence against bottlenose dolphins, including shootings via guns and bows and arrows, throwing pipe bombs and cherry bombs, and stabbings (Vail 2016). During 2011–2015, one mortality was attributed to a shooting. A small caliber bullet was found lodged in the lung of a carcass recovered during 2012, and the gunshot wound was determined to be the cause of death. This animal was included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 18 May 2016) and in the totals presented in Table 2, as well as in the annual human-caused mortality and serious injury total for this stock (Table 1). From recent cases that have been prosecuted, it has been shown that fishermen became frustrated and retaliated against dolphins for removing bait or catch, or depredating, their fishing gear. It is unknown whether

the 2012 shooting involved depredation.

Depredation is a growing problem in Gulf of Mexico coastal and estuary 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 to the dolphin's activity patterns, such as decreases in natural foraging (Powell and Wells 2011). It has been suggested that provisioning, or the illegal feeding, of wild 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). 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). To date there are no records within the literature of provisioning for this stock area.

All mortalities and serious injuries from known sources for the BBES Stock are summarized in Table 1.

Table 1. Summary of the incidental mortality and serious injury of common bottlenose dolphins (<i>Tursiops truncatus</i>) of the Barataria Bay Estuarine System (BBES) Stock. For the shrimp trawl fishery, the bycatch mortality for the BBES Stock alone cannot be quantified at this time and the state-wide mortality estimate for Louisiana has not been included in the annual human-caused mortality and serious injury total for this stock (see Shrimp Trawl section). The remaining fisheries do not have an ongoing, systematic, federal observer program, so 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 stranding and at-sea counts, the number reported is a minimum because not all strandings or at-sea cases are detected. See the Annual Human-Caused Mortality and Serious Injury section for biases and limitations of mortality estimates. 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	2010–2014	Observer Data	Undetermined for this stock (see Shrimp Trawl section)	NA
Menhaden Purse Seine	2011–2015	Pilot Observer Program (2011); MMAP fisherman self-reported takes	NA	0
Atlantic Blue Crab Trap/Pot	2011–2015	Stranding Data	NA	1
Hook and Line	2011–2015	Stranding Data and At-Sea Observations	NA	3
Mean Annual Mortality due to commercial fisheries (2011–2015)			0.8	
Research Takes (5-year Count)			1	
Other Takes (at-sea entanglements, gunshot wound; 5-year Count)			3	
Mortality due to DWH (5-year Projection)			789	
Mean Annual Mortality due to research takes, other takes, and DWH (2011–2015)			159	

Minimum Total Mean Annual Human-Caused Mortality and Serious Injury (2011–2015)

160

Strandings

During 2011–2015, 98 common bottlenose dolphins were reported stranded within the BBES area (Table 2; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 18 May 2016). It could not be determined if there was evidence of human interaction for 72 of these strandings. For eight dolphins, no evidence of human interaction was detected. Evidence of human interactions was detected for 18 stranded dolphins, seven of which stranded visibly oiled. In addition, there were two entanglements with commercial blue crab trap/pot gear (described above), four entanglements with hook and line gear (described above), one incidental take in a fishery research gillnet (described above), three animals with evidence of gunshot wounds, and one animal with evidence of a boat strike (Table 2). Stranding data probably 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). 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.

The BBES Stock has been affected by two bottlenose dolphin die-offs or Unusual Mortality Events (UME). A UME occurred from January through May 1990, included 344 bottlenose dolphin strandings in the northern Gulf of Mexico (Litz *et al.* 2014), and may have affected the BBES Stock because strandings were reported in the Barataria Bay area during the time of the event. However, there is no information available on the impact of the event on the BBES Stock. 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). 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 1 June 2016). This UME included cetaceans that stranded prior to the *Deepwater Horizon* oil spill (see Habitat Issues section), 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.* 2015a; Colegrove *et al.* 2016; DWH NRDAT 2016; see "Habitat Issues" below). During 2011–2014, nearly all stranded dolphins from this stock were considered to be part of the UME (see Table 2).

Table 2. Common bottlenose dolphin strandings occurring in the Barataria Bay Estuarine System Stock area from 2011 to 2015, 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 18 May 2016). Please note HI does not necessarily mean the interaction caused the animal's death.

Stock	Category	2011	2012	2013	2014	2015	Total
Barataria Bay Estuarine System Stock	Total Stranded	36 ^a	18 ^a	18 ^a	15 ^a	11	98
	Human Interaction						
	---Yes	11 ^b	2 ^c	3 ^d	1 ^e	1 ^f	18
	---No	6	2	0	0	0	8
	---CBD	19	14	15	14	10	72

^a All strandings were part of the ongoing UME event in the northern Gulf of Mexico.

^b Includes 6 animals stranded visibly oiled (mortalities), 1 entanglement interaction in commercial blue crab pot gear (mortality), and 2 entanglement interactions with hook and line gear (1 mortality and 1 animal released alive without serious injury [the live animal also had evidence of a boat strike]), and 1 animal with a gunshot wound (mortality).

^c Includes 1 animal that stranded visibly oiled and with evidence of gunshot wounds (mortality), and 1 entanglement interaction with commercial blue crab trap/pot gear (released alive without serious injury).

^d Includes 2 entanglement interactions with hook and line gear (both were released alive without serious injury).

^e One animal with evidence of gunshot wounds (mortality)

^f One entanglement interaction in research gillnet gear (mortality).

HABITAT ISSUES

Issues Related to the DWH Oil Spill

The DWH 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). A substantial number of beaches and wetlands along the Louisiana coast experienced heavy or moderate oiling (OSAT-2 2011; Michel *et al.* 2013). The heaviest oiling in Louisiana occurred on the tip of the Mississippi Delta, west of the Mississippi River in Barataria, Terrebonne and Timbalier Bays, and to the east of the river on the Chandeleur Islands (Michel *et al.* 2013).

A suite of research efforts indicate the DWH oil spill negatively affected the BBES Stock of common bottlenose dolphins. Capture-release health assessments and analysis of stranded dolphins during the oil spill both found evidence of moderate to severe lung disease and compromised adrenal function (Schwacke *et al.* 2014; Venn-Watson *et al.* 2015a). Based on data collected during a health assessment in Barataria Bay in 2011, 48% of the dolphins sampled were given a guarded or worse health prognosis, and 17% were given a poor prognosis, indicating that they would likely not survive (Schwacke *et al.* 2014). Subsequent health assessments in 2013 and 2014 revealed that the percentage of the population with a guarded or worse health prognosis decreased from levels measured in 2011 but still remained elevated when compared to the Sarasota Bay, Florida, reference site (DWH NRDAT 2016; Smith *et al.* 2017). Pulmonary abnormalities and impaired stress response were still detected four years after the DWH oil spill (Smith *et al.* 2017). De Guise *et al.* (2017) suggested immune systems were weakened due to the DWH oil exposure, most noticeably in 2011 compared to subsequent years. Stranding rates in the northern Gulf of Mexico were also higher in the years following the oil spill than previously recorded (Litz *et al.* 2014; Venn-Watson *et al.* 2015b) and 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 1 June 2016). Investigations to date have determined that the DWH oil spill is 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.* 2015a; Colegrove *et al.* 2016). During 2011–2014, 87 stranded dolphins from this stock were considered to be part of the UME. Rosel *et al.* (2017) used genetic assignment tests to estimate stock of origin for stranded dolphins recovered between 2010 and 2013 in the estuary and along the coast of Barataria Bay and found that 83–84% of the stranded dolphins sampled originated from the BBES Stock, while the rest were assigned to the adjacent Western Coastal Stock. Balmer *et al.* (2015) suggested it is unlikely that persistent organic pollutants (POP) significantly contributed to the unusually high stranding rates following the DWH oil spill because POP concentrations from six northern Gulf sites were comparable to or lower than those previously measured by Kucklick *et al.* (2011) from southeastern U.S. sites; however, the authors cautioned that potential synergistic effects of oil exposure and POPs should be considered as the extra stress from oil exposure added to the background POP levels could have intensified toxicological effects. Morbillivirus infection, brucellosis, and biotoxins were also ruled out as a primary cause of the UME (Venn-Watson *et al.* 2015a).

Reproductive success also was compromised after the oil spill. Kellar *et al.* (2017) reported a reproductive success rate for Barataria Bay of 0.185, meaning that less than one in five detected pregnancies resulted in a viable calf. This rate was much lower than the expected rate, 0.647, based on previous work in non-oiled reference areas (Kellar *et al.* 2017). In addition, Lane *et al.* (2015) monitored 10 pregnant dolphins in Barataria Bay and determined that only 20% (95% CI: 2.50–55.6%) produced viable calves, as compared with a reported pregnancy success rate of 83% in a reference population. The reproductive failure rates are also consistent with findings of Colegrove *et al.*

(2016) who examined perinate strandings in Louisiana, Mississippi, and Alabama during 2010–2013 and found that common bottlenose dolphins were prone to late-term failed pregnancies and occurrence of *in utero* infections, including pneumonia and brucellosis.

Congruent with evidence for compromised health and poor reproductive success in Barataria Bay dolphins, McDonald *et al.* (2017) reported low survival rate estimates for these dolphins. Estimated survival rates in the first three years following the DWH oil spill using data from C-R photo-ID surveys ranged from 0.80 to 0.85 (McDonald *et al.* 2017), and are lower than those reported previously for other southeastern U.S. estuarine areas, such as Charleston, South Carolina (0.95; Speakman *et al.* 2010), or Sarasota Bay, Florida (0.96; Wells and Scott 1990).

Other Habitat Issues

Like much of coastal southeastern Louisiana, the Barataria Bay Basin has experienced significant wetland loss resulting in more open water and less marsh habitat (CPRA 2017). Subsidence, sea-level rise, storms, winds and tides, and human activities including levee construction and loss of sediment input, and channelization (navigational channels and oil and gas canals), all play a role in the habitat degradation (CPRA 2017). The impact to bottlenose dolphins from these changes to the habitat are unknown, although the marshes do serve as important nursery areas for many fish and invertebrates that may be prey species (CPRA 2017). The State of Louisiana has a wetland restoration master plan for the area to build and maintain land (CPRA 2017), which could result in additional changes to the Barataria Bay habitat, including significant and prolonged reductions in salinity levels. Bottlenose dolphins are typically found in salinities ranging from 20–35 ppt and can experience significant health impacts and/or death due to low salinity exposure (e.g., Andersen 1973; Holyoake *et al.* 2010).

STATUS OF STOCK

Common bottlenose dolphins are not listed as threatened or endangered under the Endangered Species Act. Because the estimate of human-caused mortality and serious injury exceeds PBR, NMFS considers this a strategic stock under the MMPA. The documented mean annual human-caused mortality for this stock for 2011–2015 was 160. However, it is likely the estimate of annual fishery-caused mortality and serious injury is biased low as indicated above (see Annual Human-Caused Mortality and Serious Injury), and there are uncertainties in the population model used to estimate population decline due to the DWH oil spill, also indicated above (see Habitat Issues). Because a UME of unprecedented size and duration (March 2010–July 2014) has impacted the northern Gulf of Mexico, including Barataria Bay, and because the health assessment findings of Schwacke *et al.* (2014) and others indicate compromised health and reproductive success of dolphins sampled within Barataria Bay as a result of the DWH oil spill, NMFS finds cause for concern about this stock. The DWH damage assessment estimated that the stock experienced a 51% (95% CI: 32–72) maximum reduction in population size due to the oil spill (DWH MMIQT 2015; Schwacke *et al.* 2017). It is therefore likely that this stock is below its optimum sustainable population (NMFS 2016). In the absence of any additional non-natural mortality or restoration efforts, the DWH damage assessment estimated this stock will take 39 years to recover to pre-spill population size (DWH MMIQT 2015). The total human-caused 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. There are insufficient data to determine population trends for this stock.

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