COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*): Galveston Bay, East Bay, Trinity Bay 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 estuarine 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, 1996b; 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; Wells *et al.* 2017; Balmer *et al.* 2018). In many cases, residents occur predominantly within estuarine waters, with limited movements through passes to the Gulf of Mexico (Shane 1977; 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). However, several studies in the Bolivar Roads area of Galveston Bay, the primary entryway and ship channel into the Bay, have documented large numbers of dolphins using the deep-dredged channel and jetty habitat (e.g., Henningsen and Würsig 1991; Bräger 1993) and this area been shown to be a foraging "hotspot" (Moreno and Matthews 2018). How much movement of dolphins occurs from Bolivar Roads into the upper parts of the Bay is unknown.

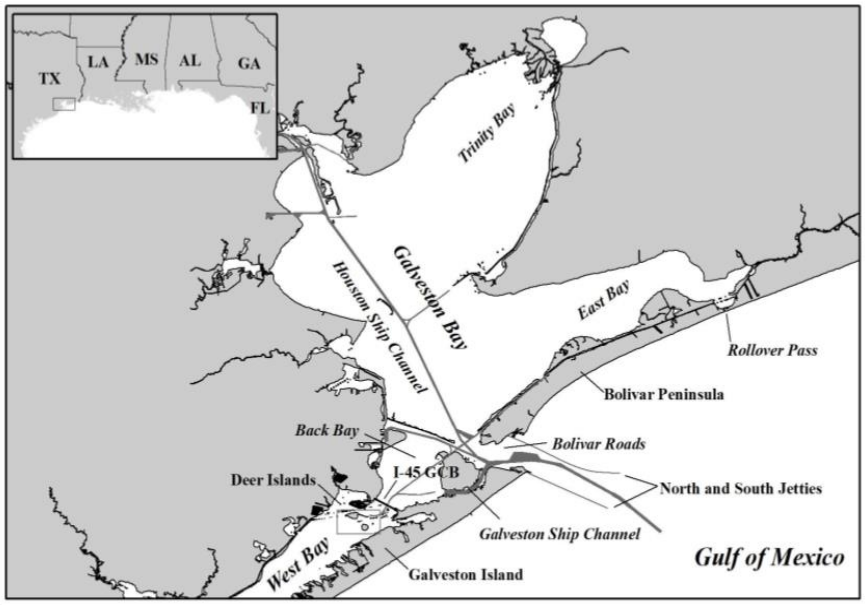

Figure 1. Geographic extent of the Galveston Bay, East Bay, Trinity Bay Stock, located on the northeast coast of Texas. I-45 GCB = I-45 Galveston Causeway Bridge.

Genetic data also support the concept of relatively discrete, demographically independent BSE populations in the Gulf of Mexico (Duffield and Wells 2002; Sellas *et al.* 2005; Rosel *et al.* 2017). 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 genetic population differentiation among all areas. Genetic data also indicate restricted genetic exchange between and demographic independence of BSE populations and those occurring in adjacent Gulf coastal waters (Sellas *et al.* 2005; Rosel *et al.* 2017). Photo-ID and genetic data from several inshore areas of the southeastern United States Atlantic coast 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 2007; Rosel *et al.* 2009).

The Galveston Bay, East Bay, Trinity Bay stock area is part of the Galveston Bay Estuary, a large, shallow estuary located in northeast Texas. Encompassing a surface area of ~1,399 km^2, the estuary averages 2 m in depth (USEPA 1999; Phillips and Rosel 2014), but also includes dredged channels up to 15 m deep used for commercial navigation (Moreno and Matthews 2018; Ronje *et al.* 2018). During times of normal freshwater flow into the system (not drought or flood conditions), salinity ranges from less than 10 psu in Upper Trinity Bay to ~30 psu at Bolivar Roads (Lester and Gonzalez 2011). Galveston Bay, East Bay, and Trinity Bay are separated from the Gulf of Mexico by Galveston Island and Bolivar Peninsula, and connected to the Gulf via Bolivar Roads, also known as Bolivar Pass, and also Rollover Pass, a man-made pass through Bolivar Peninsula (Phillips and Rosel 2014; Figure 1). There are also north and south granite rock jetties extending from the Bolivar Peninsula and Galveston Island, respectively, 3 km into the Gulf of Mexico (Ronje *et al.* 2018). The Houston Ship Channel runs within Bolivar Roads, and the Galveston Ship Channel intersects Bolivar Roads. The Galveston Bay Estuary has been selected as an estuary of national significance by the Environmental Protection Agency National Estuary Program (see http://www.gbep.state.tx.us/). Thus, a comprehensive conservation and management plan has been developed and is being implemented through a partnership of local, state, and federal representatives as well as community stakeholders, to restore and protect the estuary (Lester and Gonzalez 2011).

The Galveston Bay, East Bay, Trinity Bay Stock of common bottlenose dolphins was designated in the first stock assessment reports published in 1995 (Blaylock *et al.* 1995). The stock boundaries extend from the I-45 Galveston Causeway Bridge in the southwest and includes Galveston Bay, East Bay, Trinity Bay, Back Bay, the Galveston Ship Channel, Bolivar Roads/Bolivar Pass (the area in between the jetties), and coastal waters 1 km around the jetties and 2 km from shore extending for 5 km on each side of the jetties (Figure 1). A recent photo-identification capture-mark-recapture study (Ronjet *et al.* 2020) observed some individuals in both this coastal strip and inside Galveston Bay. Bolivar Roads appears to serve as a transition zone or mixing area between the Galveston Bay, East Bay, Trinity Bay Stock, the Western Coastal Stock, and potentially also the West Bay and Sabine Lake stocks (Ronje *et al.* 2020). The area between the Deer Islands and the I-45 Galveston Causeway Bridge is being included in the West Bay Stock due to sightings of two animals that were also seen in southern West Bay (Litz *et al.* 2019), but this area may serve as a transition zone between the Galveston Bay, East Bay, Trinity Bay Stock and the West Bay Stock. Additional research may result in a revision to the stock boundaries. Photo-ID data indicate distinct ranging and habitat usage patterns (e.g., Galveston Ship Channel, Fertl 1994; Upper Galveston Bay, Fazioli and Mintzer 2020), suggesting that the stock may contain multiple demographically independent populations.

POPULATION SIZE

The best available abundance estimate for the Galveston Bay, East Bay, Trinity Bay Stock of common bottlenose dolphins is 842 (CV=0.08; 95%CI: 694–990; Table 1), which is the result of vessel-based capture-recapture photo-ID surveys conducted during winter (January) 2016 (Ronje *et al.* 2020).

Recent Surveys and Abundance Estimates

Photo-ID capture-recapture surveys were conducted in two seasons (winter (January) and summer (July) 2016) with three to four surveys per season (Ronje *et al.* 2018). The surveys covered the entirety of this stock's range including Galveston Bay, East Bay, Trinity Bay, Back Bay, the Galveston Ship Channel, and Bolivar Roads. In addition, two 20-km segments of trackline were surveyed in the coastal waters north and south of Bolivar Roads (500 m from shore and 2 km from shore; Ronje *et al.* 2018). Ronje *et al.* (2020) combined these survey data with data from two other study sites, Sabine Lake and West Bay, into a single catalog to compare inter-bay movements and incorporated results from that comparison when estimating abundance for each bay. As a part of this broader study, Ronje *et al.* (2020) excluded dolphins that were sighted in more than one study site from analyses. Data were analyzed with MARK 9.0 software (White and Burnham 1999) using the closed capture Huggins' p and c conditional likelihood approach and each season was analyzed independently. Using the selective dataset that included animals sighted only in coastal waters if sighted in both summer and winter seasons, and that removed animals sighted in more than one study site (see Ronje *et al.* 2020), estimates for Galveston Bay were 842 (CV=0.08; 95%CI: 694–990) in winter and 1,132 in summer (CV=0.13; 95%CI: 846–1,417). These estimates were corrected for the proportion of unmarked individuals.

In order to assure that the abundance estimate for the stock reflects primarily resident animals, the lowest seasonal estimate (winter) was used to determine N_{est} for this stock. The resulting best estimate for the Galveston Bay, East

Bay, Trinity Bay Stock is therefore the winter 2016 estimate, 842 (CV=0.08; 95%CI: 694–990; Table 1; Ronje *et al.* 2020). This is a conservative estimate because it excluded animals sighted in more than one study area.

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 842 (CV=0.08; 95%CI: 694–990). The minimum population estimate for the Galveston Bay, East Bay, Trinity Bay Stock is 787 common bottlenose dolphins (Table 1).

Current Population Trend

There are insufficient data to assess population trends for this stock.

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).

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 Galveston Bay, East Bay, Trinity Bay Stock of common bottlenose dolphins is 787. 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 Texas BSE stocks is greater than 0.8 (Wade and Angliss 1997). PBR for this stock of common bottlenose dolphins is 6.3 (Table 1).

Table 1. Best and minimum abundance estimates for the Galveston Bay, East Bay, Trinity Bay 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
842	0.08	787	0.4	0.04	6.3

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury for the Galveston Bay, East Bay, Trinity Bay Stock of common bottlenose dolphins during 2015–2019 is unknown. Across all Texas BSE stocks, the total annual estimated mortality for the shrimp trawl fishery was 0.4 (CV=1.62), but the portion of this attributed to the Galveston Bay, East Bay, Trinity Bay Stock is unknown (see Shrimp Trawl section). The mean annual fishery-related mortality and serious injury during 2015–2019 based on strandings and at-sea observations identified as fishery-related was 0.4. Additional mean annual mortality and serious injury during 2015–2019 due to other human-caused sources was 0.6. The minimum total mean annual human-caused mortality and serious injury for this stock during 2015–2019 was therefore 1.0 (Table 2). 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), and 5) the estimate does not include shrimp trawl bycatch (see Shrimp Trawl section).

Fishery Information

There are four commercial fisheries that interact, or that potentially could interact, with this stock. These include one Category II fishery (Southeastern U.S. Atlantic, Gulf of Mexico shrimp trawl) and three Category III fisheries (U.S. Atlantic, Gulf of Mexico trotline; 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 net, 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 without serious injury 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. Mandated 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 2015–2019 based on inshore fishing effort (Soldevilla *et al.* 2021). 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 Texas from Galveston Bay, East Bay, Trinity Bay south to Laguna Madre. The mean annual mortality estimate for Texas BSE stocks for the years 2015–2019 was 0.4 (CV=1.62; Soldevilla *et al.* 2021). Limitations and biases of annual bycatch mortality estimates are described in detail in Soldevilla *et al.* (2015, 2016, 2021).

Trotline

During 2015–2019, one entanglement interaction between commercial trotline gear and the Galveston Bay, East Bay, Trinity Bay Stock was documented in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 25 August 2020; Table 3). The entanglement occurred during 2018 and resulted in a mortality. There is no observer coverage of trotline fisheries in the Gulf of Mexico, so it is not possible to quantify total mortality. The documented interaction in this gear represents a minimum known count of interactions in the last five years.

Blue Crab Trap/Pot

During 2015–2019, there were no documented interactions between commercial blue crab trap/pot gear and the Galveston Bay, East Bay, Trinity Bay Stock. There is no observer coverage of crab trap/pot fisheries in the Gulf of Mexico, so it is not possible to quantify total mortality.

Hook and Line (Rod and Reel)

During 2015–2019, there were two at-sea observations of dolphins entangled in monofilament line. One occurred during 2015, and this animal was considered not seriously injured. The second case occurred during 2019, and this animal was considered to be seriously injured (Maze-Foley and Garrison 2021). The 2019 serious injury was included in the annual human-caused mortality and serious injury total for this stock (Table 2).

It should be noted that, in general, it cannot be determined if rod and reel 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 in the Gulf of Mexico. The documented interaction in this gear represents a minimum known count of interactions in the last five years.

Other Mortality

One mortality was documented in 2018 in the Galveston Bay, East Bay, Trinity Bay Stock area as a result of an incidental entanglement in a fishery research gillnet. An additional interaction was documented in 2017 involving a live animal entangled in unidentified rope/line, and the animal was considered seriously injured. Both of these interactions were included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 25 August 2020) and in the annual human-caused mortality and serious injury total for this stock (Table 2).

During 2015–2019, there were two at-sea observations, one during 2015 and one during 2016, in Galveston Bay, of dolphins entangled in unidentified debris and gear. One of these animals (2016) was considered seriously injured (Maze-Foley and Garrison 2020), and it was included in the annual human-caused mortality and serious injury total

for this stock (Table 2).

NOAA's Office of Law Enforcement has been investigating increased reports from along the northern Gulf of Mexico coast of violence against common bottlenose dolphins, including shootings via guns and bows and arrows, pipe bombs and cherry bombs, and stabbings (Vail 2016). From recent cases that have been prosecuted, it has been shown that fishermen become frustrated and retaliate against dolphins for removing bait or catch, or depredating their fishing gear. To date, there are no records of acts of intentional harm for this stock area.

Depredation of fishing catch and/or bait 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 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). 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 Galveston Bay, East Bay, Trinity Bay Stock are summarized in Table 2.

Table 2. Summary of the incidental mortality and serious injury of common bottlenose dolphins (Tursiops truncatus) of the Galveston Bay, East Bay, Trinity Bay Stock. For the shrimp trawl fishery, the bycatch mortality for the Galveston Bay, East Bay, Trinity Bay Stock alone cannot be quantified at this time because mortality estimates encompass all estuarine waters of Texas pooled (see Shrimp Trawl section). The remaining fisheries do not have an ongoing, 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 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	Undetermined for this stock but may be non-zero (see Shrimp Trawl section)	NA
Trotline	2015–2019	Stranding Data and At-Sea Observations	NA	1
Atlantic Blue Crab Trap/Pot	2015–2019	Stranding Data and At-Sea Observations	NA	0
Hook and Line	2015–2019	Stranding Data and At-Sea Observations	NA	1
Mean Annual Mortality due to commercial fisheries (2015–2019)			**0.4**	
Research Takes (5-year Count)			1	

Other Takes (5-year Count)	2
Mean Annual Mortality due to research and other takes (2015–2019)	**0.6**
Minimum Total Mean Annual Human-Caused Mortality and Serious Injury (2015–2019)	**1.0**

Strandings

During 2015–2019, 124 common bottlenose dolphins were reported stranded within the Galveston Bay, East Bay, Trinity Bay Stock area (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 25 August 2020). There was evidence of human interaction (HI) for 11 of the strandings. No evidence of human interaction was detected for 13 strandings, and for the remaining 100 strandings, it could not be determined if there was evidence of human interaction (Table 3). Human interactions were from numerous sources, including an entanglement in commercial trotline gear, an incidental take in a research gillnet, three animals with evidence of a vessel strike, and an entanglement with unidentified rope/line (Table 3). 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 124 strandings ascribed to the Galveston Bay, East Bay, Trinity Bay Stock, 88 were ascribed solely to this stock. It is likely, therefore, that the counts in Table 3 include some animals from the Western Coastal Stock and thereby overestimate the number of strandings for the Stock; those strandings that could not be definitively ascribed to the Galveston Bay, East Bay, Trinity Bay Stock were also included in the counts for the Western Coastal Stock as appropriate. 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.

The Galveston Bay, East Bay, Trinity Bay Stock has likely been affected by five common bottlenose dolphin die-offs or Unusual Mortality Events (UMEs). 1) From January through May 1990, a total of 344 common bottlenose dolphins stranded in the northern Gulf of Mexico. Overall this represented a two-fold increase in the prior maximum recorded number of strandings for the same period in the northern Gulf of Mexico. 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). Three strandings occurred within Galveston Bay and one occurred in the ship channel just outside Galveston Bay. An additional 14 others stranded along the ocean side of Galveston Island and Bolivar Peninsula, but the stock origin of those animals is unknown (Phillips and Rosel 2014). 2) In 1993–1994, a UME of common 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 common bottlenose dolphins were found dead on Texas beaches, of which 67 occurred in a single 10-day period. Four strandings occurred within Galveston Bay, and 26 others occurred along the ocean side of Galveston Island and Bolivar Peninsula, but the stock origin of those animals is unknown (Phillips and Rosel 2014). 3) During February and March of 2007 a UME was declared for northeast Texas and western Louisiana involving 64 common bottlenose dolphins and two unidentified dolphins. Decomposition prevented conclusive analyses on most carcasses (Litz *et al.* 2014). One stranding occurred within Galveston Bay and one occurred in East Bay. Most of the other strandings occurred along the ocean side of Galveston Island or Bolivar Peninsula, but the stock origin of the animals is unknown (Phillips and Rosel 2014). 4) During February and March of 2008 a UME was declared in Texas involving 111 common bottlenose dolphin strandings (plus strandings of one unidentified dolphin and one melon-headed whale,

Peponocephala electra). Most of the animals recovered were in a decomposed state and a direct cause of the mortalities could not be identified. However, there were numerous, co-occurring harmful algal bloom toxins detected during the time period of this UME which may have contributed to the mortalities (Fire *et al.* 2011). Twenty-four strandings occurred along the Gulf side of Galveston Island and Bolivar Peninsula in the vicinity of Galveston Bay, but the stock origin of the animals is unknown (Phillips and Rosel 2014). 5) A UME occurred from November 2011 to March 2012 across five Texas counties and included 126 common bottlenose dolphin strandings. The strandings were coincident with harmful algal blooms of *Karenia brevis* and *Dinophysis* sp. The cause of the bottlenose dolphin UME was determined to be due to biotoxin exposure from brevetoxin and okadaic acid. The additional supporting evidence of fish kills and other species die-offs linked to brevetoxin during the same time and space made a strong case that the harmful algal blooms impacted the dolphins. Three animals stranded within Galveston Bay and were considered to be part of the UME, and an additional 14 strandings occurred along the Gulf side of Galveston Island and Bolivar Peninsula in the vicinity of Galveston Bay, but the stock origin of the animals is unknown (Phillips and Rosel 2014).

Table 3. Common bottlenose dolphin strandings occurring in the Galveston Bay, East Bay, Trinity Bay 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
Galveston Bay, East Bay, Trinity Bay Stock	Total Stranded	18	19	31	26	30	124
	Human Interaction						
	---Yes	2	1[a]	1[b]	6[c]	1[d]	11
	---No	0	3	3	2	5	13
	---CBD	16	15	27	18	24	100

a. An animal with evidence of a vessel strike (mortality).
b. An entanglement interaction with unidentified rope/line (alive, seriously injured).
c. Includes 1 entanglement interaction in commercial trotline gear (mortality), 1 entanglement interaction in research gillnet gear (mortality), and 1 animal with evidence of a vessel strike (mortality).
d. An animal with evidence of a vessel strike (mortality).

HABITAT ISSUES

The estuarine habitat occupied by this stock is adjacent to the highly populated and industrial areas of Houston and Galveston, Texas and experiences impacts from a variety of anthropogenic sources. This has been an area of continuous economic growth and development over most of the previous 50 years, with much of this growth attributed to the discovery of oil and the construction of the Houston Ship Channel (Lester and Gonzalez 2011). This area is important for transportation, containing three major deep-draft ports within Galveston Bay: Port of Houston, Port of Texas City, and Port of Galveston (see Phillips and Rosel 2014 for a summary). There are over 3,000 oil and natural gas production platforms in all parts of Galveston Bay and the counties surrounding Galveston and West Bays, including pipelines for the transport of these products and many refining facilities (Lester and Gonzalez 2011). Repeated oil spills, from minor to serious in nature, have occurred in the waters of Galveston Bay or in coastal waters off Galveston Island (see Phillips and Rosel 2014 for a summary). Additional impacts to the Bay include discharge from petroleum and chemical refineries and facilities, and agricultural sources (Phillips and Rosel 2014), including high levels of fecal coliform bacteria that have provisionally or permanently closed parts of the Bay to the harvesting of shellfish (Lester and Gonzalez 2011).

Direct impacts to the stock include a recent oil spill, freshwater impacts and potentially harmful algal blooms. In 2014, a vessel collision in Galveston Bay near Texas City released approximately 168,000 gallons of intermediate fuel oil. Through the National Resource Damage Assessment (NRDA) process, impacts of this spill are currently being evaluated and will include impacts to common bottlenose dolphins (NOAA DAARP 2018). In 2017, Hurricane Harvey dropped record amounts of rainfall on the Texas coast leading to significant freshwater runoff and a lowering of the salinity in Galveston Bay. Fazioli and Mintzer (2020) found that skin lesion prevalence increased significantly after the event, and remained high for more than four months after the hurricane. In addition, most dolphins moved out of their common habitat in the upper portion of Galveston Bay, and others shifted their distribution to deeper channels in the bay where salinity increased with depth. Harmful algal blooms and low dissolved oxygen are habitat issues

leading to fish kills almost annually in the summers for Galveston and West Bays (McInnes and Quigg 2010; Rosel and Phillips 2014). For the 2011–2012 UME mentioned above (Strandings section), the strandings were coincident with a large harmful algal bloom of *K. brevis*. The definitive cause of that event has not been determined, but the algal bloom could have contributed to the mortality event. Fire *et al.* (2020) examined common bottlenose dolphins stranded along the Texas coast from 2007–2017 and found a high prevalence of brevetoxin exposure regardless of the association of stranded animals with a *K. brevis* bloom. Their results demonstrated evidence of long-term recurring exposure to *K. brevis* bloom toxins, but the health impacts of such exposure are unknown.

Finally, Galveston Bay experienced significant storm surges during Hurricane Ike in 2008. As a result, discussion and planning for an improved coastal barrier to protect the region from storm surge is in the works. Part of this proposed project includes construction of massive flood gates across the mouth of Galveston Bay and the Houston Ship Channel. Construction of these gates across Bolivar Pass encompasses an area heavily used by common bottlenose dolphins (Ronje *et al.* 2020). In addition, the structure is projected to diminish tidal flow from Galveston Bay by as much as 10% (U.S. Army Corps of Engineers 2020).

STATUS OF STOCK

Common bottlenose dolphins are not listed as threatened or endangered under the Endangered Species Act, and the Galveston Bay, East Bay, Trinity Bay Stock is not a strategic stock under the MMPA. 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 a zero mortality and serious injury rate The status of this stock relative to optimum sustainable population is unknown and there are insufficient data to determine population trends for this stock. However, NMFS has concern for this stock because of documented freshwater impacts, forthcoming large-scale ecosystem projects (e.g., floodwalls), oil spills (e.g., Texas City Y), and a potential underestimation of fishery impacts.

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