COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*) Jacksonville Estuarine System Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The coastal morphotype of common bottlenose dolphins is continuously distributed along the Atlantic coast south of Long Island, New York, to the Florida peninsula, including inshore waters of the bays, sounds and estuaries. Several lines of evidence support a distinction between dolphins inhabiting coastal waters near the shore and those present in the inshore waters of the bays, sounds and estuaries. Photo-identification (photo-ID) and genetic studies support the existence of resident estuarine animals in several areas (Caldwell 2001; Gubbins 2002; Zolman 2002; Gubbins *et al.* 2003; Mazzoil *et al.* 2005; Litz *et al.* 2012), and similar patterns have been observed in bays and estuaries along the Gulf of Mexico coast (Wells *et al.* 1987; Balmer *et al.* 2008). Recent genetic analyses using both mitochondrial DNA and nuclear microsatellite markers found significant differentiation between animals biopsied in coastal and estuarine areas along the Atlantic coast (Rosel *et al.* 2009), and between those biopsied in coastal and estuarine waters at the same latitude (NMFS unpublished data). Similar results have been found off the west coast of Florida (Sellas *et al.* 2005).

The estuarine habitat around Jacksonville, Florida, is composed of several large brackish rivers, including St. Mary's, Amelia, Nassau, Fort George and St. Johns River (Figure 1). The St. Johns River is a deep, swift moving river with heavy boat and shipping activity (Caldwell 2001). The remainder of the area is made up of tidal marshes and riverine systems averaging 2m in depth over sand, mud or oyster beds, and is bisected by the Intracoastal Waterway.

Caldwell (2001) investigated the social structure of bottlenose dolphins inhabiting the estuarine waters between the St. Mary's River and Jacksonville Beach, Florida, using photo-ID and behavioral data obtained from December 1994 through December 1997. Three behaviorally different communities were identified during this study, namely the estuarine waters north of St. Johns River (termed the Northern area), the estuarine waters south of St. Johns River (the Southern area) and the coastal area, all of which differed in density, habitat fidelity and social affiliation patterns. Caldwell (2001) found that dolphins inhabiting the Northern area were the most isolated, with 96% of the groups observed containing dolphins that had been photographically identified only in this area, demonstrating strong year-round site fidelity. Cluster analyses suggested that dolphins using the Northern area did not socialize with those using the Southern area. In the Southern area, 78% of the groups were photographed only in this region (Caldwell 2001). However, these dolphins migrated into and out of the Jacksonville area each year, returning to the area during 3 consecutive summers, suggesting the Southern area dolphins may show summer site fidelity as opposed to the year-round fidelity demonstrated in the Northern area. Caldwell (2001) found that dolphins found in the coastal areas were highly mobile, had fluid social affiliations, were not sighted more than 8 times over the entire study and showed no long-term (>4 months) site fidelity. Three of these dolphins were also sighted off South Carolina, behind shrimp boats. These coastal dolphins are thus considered to be members of the coastal morphotype stocks.

Caldwell (2001) also examined genetic differentiation among the Northern, Southern and coastal areas of the study site using mitochondrial DNA sequences and microsatellite data. Both mitochondrial DNA haplotype and microsatellite allele frequencies differed significantly between the Northern and Southern sampling areas. Differentiation between the Southern sampling area and the coast was lower, but still significant. These genetic data are in line with the behavioral analyses. However, sample sizes were small for these estuarine regions ($n \leq 25$) and genetic analyses did not account for the high number of closely related individuals within the dataset. Further analyses are necessary to confirm the results.

Gubbins *et al.* (2003) identified oscillating abundance year round for dolphins within the estuarine waters of this area, with low numbers reported in January and December. There was a positive correlation between dolphin abundance and water temperature, with peak numbers seen when water temperatures rose above 16°C.

The Jacksonville Estuarine System (JES) Stock has been defined as a separate estuarine stock primarily by the results of these photo-ID and genetic studies. It is bounded in the north by the Florida/Georgia border at Cumberland Sound, abutting the southern border of the Southern Georgia Estuarine System Stock, and extends south to Jacksonville Beach, Florida. Despite the strong fidelity to the Northern and Southern areas observed by Caldwell (2001), some dolphins were photographed outside their preferred areas, supporting the proposal to include both these areas within the boundaries of the JES Stock. Future analyses may provide additional information on the importance of the Southern area to the resident stock, and thus the inclusion of both areas in this stock boundary

may be modified with additional data or further analyses.

Dolphins residing within estuaries south of this stock down to the northern boundary of the Indian River Lagoon Estuarine System Stock are currently not included in any Stock Assessment Report. There are insufficient data to determine whether animals south of the JES Stock exhibit affiliation to the JES Stock, the IRLES Stock to the south or are simply transient animals associated with coastal stocks. Further research is needed to establish affinities of dolphins in this region. It should be noted that during 2007-2011, there were 36 stranded bottlenose dolphins in this region in estuarine waters. Evidence of human interactions was detected for 11 of these stranded dolphins, 3 of which involved fishery interactions with hook and line gear, including an animal disentangled from recreational gear and released alive without serious injury during 2011 (Maze-Foley and Garrison in prep.). Seven of the 11 human interactions involved boat collisions, and the remaining human interaction was a stranding with signs of mutilation (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012). In addition to animals included in the stranding database, in 2010 there was an at-sea observation of a dolphin entangled in hook and line gear, and during 2011, there was an at-sea observation of a dolphin entangled in crab pot gear, which the animal later shed on its own. Both dolphins were considered not seriously injured (Maze-Foley and Garrison in prep.).

POPULATION SIZE

The total number of bottlenose dolphins residing within the JES Stock is unknown because previous estimates are greater than 8 years old. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates greater than 8 years old are deemed unreliable. Data collected by Caldwell (2001) were incorporated into a larger study that used mark-recapture analyses to calculate abundance in 4 estuarine areas along the eastern U.S. coast (Gubbins *et al.* 2003). Sighting records collected only from May through October were used, as this limited time period was determined to reduce the possibility of violating the mark-recapture model's assumption of geographic closure and mark retention. Based on photo-ID data from 1994 to 1997, 334 individually identified dolphins were observed (Gubbins *et al.* 2003), which included an unspecified number of seasonal residents and transients. Mark-recapture analyses included all the 334 individually identifiable dolphins, and the population size for the JES Stock was calculated to be 412 residents (CV=0.06; Gubbins *et al.* 2003). This was an overestimate of the stock abundance in the area covered by the study because it included non-resident and seasonally resident dolphins. Caldwell (2001) indicated that 122 dolphins were resighted at least 10 times in the JES, with 33 individuals observed primarily in the Northern area, and 89 individuals reported to use the Southern area.

Minimum Population Estimate

Present data are insufficient to calculate a minimum population estimate for the JES Stock of bottlenose dolphins.

Current Population Trend

There are insufficient data to determine the 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 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 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). The minimum population size for the JES Stock is unknown. 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 this stock is of unknown status. PBR is unknown for this stock.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury within the JES Stock during 2007-2011 is unknown. Interactions were documented with crab pot gear and hook and line gear; however, it is not possible to estimate the total number of interactions or mortalities associated with crab pots or hook and line fisheries since there are no systematic observer programs.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

There is a potential for the JES Stock to interact with the Category II Atlantic blue crab trap/pot and Southeastern U.S. Atlantic, Gulf of Mexico stone crab trap/pot fisheries (Appendix III). The JES Stock may also interact with the Category III Atlantic commercial passenger fishing vessel (hook and line) fishery.

Crab Pots

Between 2007 and 2011, 3 strandings within the JES area displayed evidence of interaction with a trap/pot fishery (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2013). Two carcasses were entangled in crab trap gear (identified as commercial blue crab trap gear in one case and unidentified trap/pot gear in the second), and one live animal was observed entangled in commercial crab trap line and buoys. The live animal was observed to shed the gear on its own and was considered not seriously injured (Maze-Foley and Garrison in prep.). In addition to animals included in the stranding database, in 2008 there was an at-sea observation in the JES area of a dolphin entangled in gear consistent with crab trap gear, and this dolphin was considered seriously injured (Maze-Foley and Garrison in prep.).

Hook and Line Fisheries

During 2007-2011, 2 dolphins within the JES area stranded dead with hook and line gear attached. Both animals were recovered with monofilament fishing line. These mortalities were included in the stranding database and are included in the stranding totals presented in Table 1.

Other Mortality

During 2007-2011, 39 strandings were documented within the JES area, including 8 strandings with evidence of a human interaction. The 3 crab trap interactions and 2 hook and line gear interactions noted above account for 5 of the human interactions (Table 1; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2013). One additional fishery interaction was documented (unknown type), as well as evidence of 1 boat collision (well-healed propeller scars). Also, 1 live animal was observed entangled in and trailing unknown material/gear, and this animal was considered seriously injured (Maze-Foley and Garrison in prep.). For 7 strandings, no evidence of human interactions was found, and for 24 strandings, it could not be determined if there was evidence of human interactions. Stranding data underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals that die or are seriously injured in fishery interactions are discovered, reported or investigated, nor will all of those that are found necessarily show signs of entanglement or other fishery interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interactions.

An Unusual Mortality Event (UME) was declared for the St. Johns River area during May-September 2010, including 14 strandings assigned to the JES Stock and 4 strandings within estuaries to the south not currently included in any stock assessment report. The cause of this UME is still under investigation.

This stock inhabits areas with significant drainage from industrial and urban sources, and as such is exposed to contaminants in runoff from these. No contaminant analyses have yet been conducted in this area, so there is no estimate of indirect human-caused mortality from pollution or habitat degradation for this stock. In other estuarine areas where such analyses have been conducted, exposure to anthropogenic contaminants have been found to likely have an effect (Hansen *et al.* 2004; Schwacke *et al.* 2004; Reif *et al.* 2008).

Table 1. Bottlenose dolphin strandings occurring in the Jacksonville Estuarine System, South Carolina, from 2007 to 2011, as well as number of strandings for which evidence of human interactions (HI) was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interactions. Data are from the NOAA National Marine Mammal Health and Stranding Response Database

(unpublished data, accessed 13 September 2012). Please note human interaction does not necessarily mean the interaction caused the animal's death.

Stock	Category	2007	2008	2009	2010	2011	Total
Jacksonville Estuarine System	Total Stranded	4	5	7	16[c]	7	39
	Human Interaction						
	---Yes	0	2[a]	3[b]	1[d]	2[e]	8
	---No	2	0	0	4	1	7
	---CBD	2	3	4	11	4	24

[a] These HIs include 1 fishery interaction (FI; hook and line gear) and 1 boat collision (well-healed propeller scars)
[b] These HIs include 3 FIs, 1 of which was an animal (mortality) entangled in crab pot gear.
[c] 14 of these strandings were part of the St. Johns River UME during May-September 2010.
[d] This HI was an animal entangled in crab pot gear; the animal shed the gear on its own and was not considered to be seriously injured.
[e] These HIs include 1 mortality from an entanglement in commercial blue crab pot gear. Also included is 1 animal observed entangled in and trailing unknown material/gear and considered to be seriously injured.

STATUS OF STOCK

Bottlenose dolphins in the western North Atlantic are not listed as threatened or endangered under the Endangered Species Act. However, because the abundance of the JES Stock is currently unknown, but likely small, and relatively few mortalities and serious injuries would exceed PBR, NMFS considers this to be a strategic stock under the Marine Mammal Protection Act. The documented annual average human-caused mortality for this stock for 2007 – 2011 is 0.8. However, there are several commercial fisheries, including crab trap/pot fisheries operating within this stock's boundaries and these fisheries have little to no observer coverage. The impact of crab trap/pot fisheries on estuarine bottlenose dolphins is currently unknown, but has been shown previously to be considerable in the similar Charleston Estuarine System Stock area (Burdett and McFee 2004). Therefore, the documented mortalities must be considered minimum estimates of total fishery-related mortality. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to OSP is unknown. There are insufficient data to determine the population trends for this stock.

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