Endangered Species Act Status Review Report: Atlantic Humpback Dolphin (*Sousa teuszii*)

The Atlantic humpback dolphin (*Sousa teuszii*); Photo Credit: Caroline Weir/Ketos Ecology

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Executive Summary

This report was produced in response to a petition received from the Animal Welfare Institute, the Center for Biological Diversity, and VIVA Vaquita on September 8, 2021, to list the Atlantic humpback dolphin (*Sousa teuszii*) as a threatened or endangered species under the U.S. Endangered Species Act (ESA). Under the ESA, if a petition is found to present substantial scientific or commercial information that the petitioned action may be warranted, a status review shall be promptly commenced (16 U.S.C. 1533(b)(3)(A)). On December 2, 2021, the National Marine Fisheries Service (NMFS) announced in the Federal Register that the petition presented substantial information in support of the petitioned action and that a status review would be conducted (86 FR 68452). This report summarizes the best available scientific and commercial information on the Atlantic humpback dolphin and presents an evaluation of its status and extinction risk.

The Atlantic humpback dolphin is considered an obligate shallow water dolphin and is endemic to the coastal Atlantic waters of western Africa, ranging discontinuously from Morocco in the north to Angola in the south. This species occurs in a diverse array of shallow, nearshore habitats strongly influenced by dynamic tidal patterns. Their diet appears to consist predominantly of coastal, estuarine, and reef-associated fish. While data and information regarding life history and reproduction parameters are almost nonexistent for this species, an estimated generation length of 18.4 years is given for the Atlantic humpback dolphin. It is likely that this species has a low reproductive rate, as inferred from available data of other species in the *Sousa* genus.

Available information indicates that the species consists of small, likely fragmented stocks, and is declining across its range. Abundance data are very limited and robust abundance estimates are lacking for most stocks. However, the available information for the species' eleven recognized management stocks indicates that stocks range from the tens to low hundreds of individuals, suggesting that the entire species likely consists of no more than 3,000 individuals.

The greatest threats to the Atlantic humpback dolphin are overutilization of the species, the present or threatened destruction, modification, or curtailment of the species' habitat or range, and the inadequacy of existing regulatory mechanisms to address the threat of overutilization and threats to its habitat. Fisheries bycatch is considered widespread throughout the species' range, and is believed to be the principal cause of population declines. There is also some evidence that bycaught Atlantic humpback dolphins are used as shark bait and for human consumption in some range countries. Threats to the species' nearshore habitats are likely a range-wide issue, as coastal development projects are projected to increase across its range. While the majority of the species' range countries are members or signatories to a diverse array of international and regional conventions and agreements that would require them to take concrete measures to protect the Atlantic humpback dolphin and mitigate threats, few have specific protections for the species, and effective bycatch mitigation has not been documented in most range countries. This is concerning because bycatch is considered to be linked to population declines and is a current and severe threat to the species. Furthermore, government agencies in many range countries lack the resources to effectively monitor and mitigate threats and design and implement research and conservation measures specific to the Atlantic humpback dolphin.

Based on the best available scientific and commercial information, we conclude that the Atlantic humpback dolphin faces an overall high risk of extinction based on the species' low abundance, presumed low reproductive rate, observed or suspected population declines, fragmented distribution with limited connectivity between stocks, restricted geographic range, and range-wide threats which are projected to continue and, in some cases, increase in the future throughout the species' range. The combination of these factors coupled with the fact that existing regulatory mechanisms are inadequate to address threats to the species in much of its range imperil the continued survival of the Atlantic humpback dolphin and indicates a high risk of extinction throughout its range.

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1. INTRODUCTION

1.1 Scope and Intent of the Present Document

On September 8, 2021, the National Marine Fisheries Service (NMFS) received a petition to list the Atlantic humpback dolphin (*Sousa teuszii*) as either threatened or endangered under the U.S. Endangered Species Act (ESA). Under the ESA, if a petition is found to present substantial scientific or commercial information that the petitioned action may be warranted, a status review shall be promptly commenced (16 U.S.C. 1533(b)(3)(A)). NMFS determined the petition presented substantial information for consideration and that a status review was warranted for the species (see following link for the Federal Register notice for the Atlantic humpback dolphin: https://www.federalregister.gov/d/2021-26225). This document is the status review for the Atlantic humpback dolphin (*S. teuszii*). The ESA stipulates that listing determinations should be based on the best scientific and commercial information available. NMFS appointed a biologist in the Office of Protected Resources Endangered Species Conservation Division to undertake the scientific review of the available data and information regarding the biology, population status and trends, threats, and future outlook, and conduct an extinction risk analysis for the species.

This document contains the scientific review as well as conclusions regarding the biological status and extinction risk of the Atlantic humpback dolphin. Where available, we provide literature citations to review articles that provide even more extensive citations for each topic. Data and information were reviewed through April, 2022.

2. LIFE HISTORY AND ECOLOGY

2.1 Taxonomy and Distinctive Characteristics

Scientific Classification

Kingdom	Animalia
Phylum	Chordata
Class	Mammalia
Order	Artiodactyla
Infraorder	Cetacea
Family	Delphinidae
Genus	*Sousa*
Species	*teuszii*

The Atlantic humpback dolphin, *S. teuszii*, is a valid taxonomic species within the family Delphinidae, and order Artiodactyla. Historically, the taxonomy of the genus was largely based on morphology. While the distinctness of the species from other humpback dolphins was questioned in the past (Ross *et al.* 1995), genetic and morphological work (Jefferson and Van Waerebeek 2004; Mendez *et al.* 2013; Jefferson and Rosenbaum 2014) has clarified the taxonomy of the genus *Sousa.* Current taxonomy defines *S. teuszii* as one of four currently recognized species within the genus *Sousa* based on multiple lines of evidence that *S. teuszii* is a species separate from the other three of the genus *Sousa: S. plumbea* (Indian Ocean humpback dolphin), *S. chinensis* (Indo-Pacific humpback dolphin), and *S. sahulensis* (Australian humpback dolphin) (Jefferson and Rosenbaum 2014). Available data indicate that there is "strong and significant genetic and morphologic differentiation between this [*S. teuszii*] and all other sampling units [humpback dolphins]" with "no evidence of exchange or contact" (Mendez *et al.* 2013). Furthermore, a comprehensive study of *Sousa* cranial morphometrics conducted by Jefferson and Van Waerebeek (2004), found that *S. teuszii* have significantly shorter rostra, wider skulls, and lower tooth counts (average of approximately 27-32 teeth per row vs. 31-39 teeth per row for

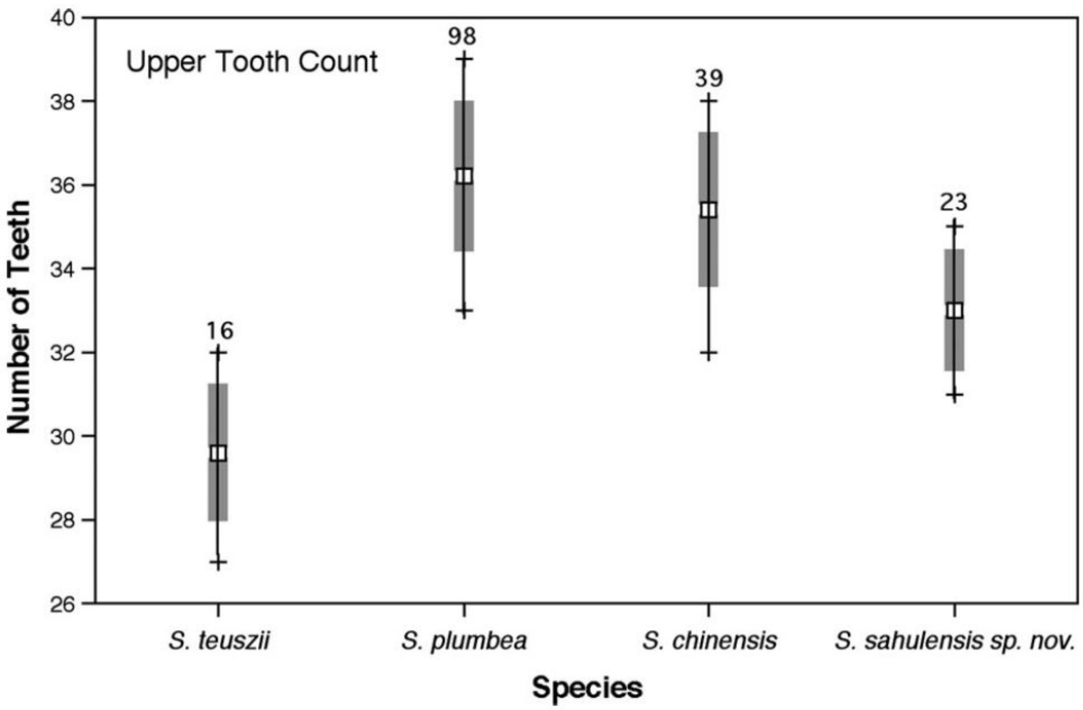

Figure 1. A comparison of tooth counts for the different species of *Sousa*. Squares are means, shaded boxes are ± 1 SD, and vertical bars are ranges. Sample sizes are given above each bar. Source: Jefferson and Rosenbaum (2014)

other *Sousa* species) when compared with 222 Southeast African, Arabian/Persian Gulf, and Indian *Sousa* specimens (Jefferson and Van Waerebeek 2004; Jefferson and Rosenbaum 2014; Figure 1).

The Atlantic humpback dolphin does not share mtDNA haplotypes with other species in the genus *Sousa.* A phylogenetic assessment of combined nuclear and mtDNA datasets indicates that *S. teuszii* is most closely related to the Indian Ocean humpback dolphin (*S. plumbea*) from Southeast Africa (Mendez *et al.* 2013). The most plausible mechanism for their isolation is the Benguela upwelling system, an area dominated by cold upwelling that is located within the ~2,000 km distribution gap between *S. teuszii* and *S. plumbea* (Jefferson and Van Waerebeek 2004; Mendez *et al.* 2013; Collins 2015). The Benguela Current has been described as a "species gate", and acts as an ecological barrier for subtropical *Sousa* and is also inferred in the divergence of the other taxa (Van Waerebeek *et al.* 2004; Collins 2015). The complete mitochondrial genome of *S. teuszii* was recently mapped by McGowen *et al.* (2020), and was found to be 98.1% similar to its closest relative with a sequenced mitogenome, the Indo-Pacific humpback dolphin (*S. chinensis*).

The Atlantic humpback dolphin holotype (a skull) was discovered in 1892 in "Bucht des Kameruner Kriegsshiffhafens," ("Bay of Warships" or "Man O'War Bay"), in Cameroon by the German agronomist Eduard Tëusz (Kükenthal 1892). The holotype was sent to Germany, where it was examined and described by the German zoologist Dr. Willy Kükenthal, who based his description primarily on differences in the skull compared to other humpback dolphins known at the time (Kükenthal 1892; Collins 2015). The species was originally placed in the genus *Sotalia*; the genus named *Sousa* came into general use in the 1960s (Kükenthal 1892; Van Waerebeek *et al.* 2004; Collins 2015). The collection details of the holotype are imprecise, but of interest. The dolphin skull and a shark-mauled carcass of a West African manatee were sent to Kükenthal by Tëusz, who assumed they were from the same animal (Kükenthal 1892; Van Waerebeek *et al.* 2004; Collins 2015; Collins *et al.* 2017). This included the latter's stomach containing "grass, weeds and mangrove fruits", which led Kükenthal to hypothesize that the species was perhaps riparian and vegetarian, an impression reinforced by the holotype's rounded teeth (i.e. worn and likely indicative of an older animal) (Collins 2015). The Belgian zoologist Pierre Joseph Van Beneden (with whom Kükenthal corresponded), compounded the misunderstanding in a separate publication (Kükenthal 1892; Van Beneden 1892; Van Waerebeek *et al.* 2004). This misconception held until the 1950s, when necropsies of fresh Atlantic humpback dolphins confirmed that they were marine and piscivorous (Cadenat 1956; Cadenat and Paraiso 1957).

The Atlantic humpback dolphin is characterized by a prominent dorsal hump, ranging from about 26-32% of body length, giving the species its common name (Jefferson and Rosenbaum 2014, Figures 2 and 3). A small dorsal fin with a rounded tip is situated at the top of the hump (Jefferson and Rosenbaum 2014, Figures 2 and 3). The species has a well-defined long and slender beak; the lower jaw is paler gray in coloration than the upper jaw (Figure 2). Individuals are generally uniform dark gray in color with a lighter ventral surface and broad flippers, with a straight trailing edge and rounded tips (Jefferson and Rosenbaum 2014, Figure 2). Some larger adults are known to have a white margin to the dorsal hump and fin, apparently caused by scarring, and there may be some white or dark oval flecking on the tail stock (see https://www.sousateuszii.org/). Tooth counts are lower than in other *Sousa* species (27-32 teeth per row vs. 31-39 teeth per row) (Jefferson and Rosenbaum 2014, Figure 1). Atlantic humpback dolphins reach maximum body lengths of approximately 2.8 meters (Figure 2). While sexual

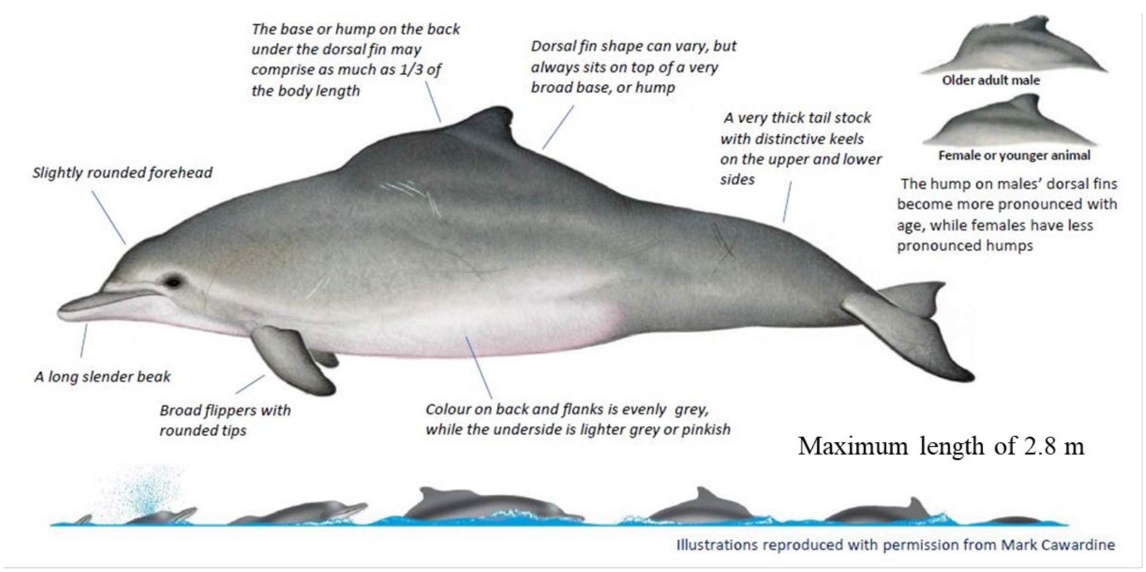

Figure 2. General physical characteristics of *Sousa teuszii*. Source: Adapted from the "*Sousa teuszii* A4 Species Fact Sheet" produced by the Consortium for the Conservation of the Atlantic Humpback Dolphin (CCAHD), available from https://www.sousateuszii.org/resources/ (accessed 1/20/2022).

dimorphism has not been studied in detail (largely due to small sample sizes of specimens), it is suspected that adult males are larger, heavier, and have a more pronounced dorsal hump, than females (Figures 2 and 3). The hump and dorsal fin of some larger adults may be bordered by white pigmentation (Jefferson and Van Waerebeek 2004; Jefferson and Rosenbaum 2014).

Figure 3. The prominent dorsal hump of a presumed mature *Sousa teuszii* male. Source: (Collins 2015).

2.2 Range, Distribution, and Habitat Use

The Atlantic humpback dolphin is described as an obligate shallow water dolphin that is endemic to the tropical and subtropical eastern Atlantic nearshore waters (<30 m) of the west coast of Africa, ranging discontinuously for approximately 7,000 km from Dakhla Bay (Rio de Oro) in Morocco[1] (23°52'N, 15°47'W) to Tômbwa (Namibe Province) in Angola (15°46'S, 11°46'E) (International Whaling Commission 2011; Collins 2015; Weir and Collins 2015; International Whaling Commission 2017; 2020b; Figure 4). Opinions differ regarding whether their historical distribution was ever continuous (Ross *et al.* 1994; Jefferson *et al.* 1997; Van Waerebeek *et al.* 2004; Zwart and Weir 2014; Collins 2015). Work conducted by Mendez *et al.* (2011) which investigated the genetic sub-structuring of *S. plumbea* in the Western Indian Ocean suggested appreciable genetic divergence between populations in neighboring regions, and thus minimal interchange between them over long timeframes. The scale of geographic distribution on the Atlantic African coast is similar, and research suggests that populations of *S. teuszii* occur in a series of localized communities with minimal interchange identified between them, indicating this species may have inherent tendencies for localized residency in some areas (Maigret 1980a,

[1] Per the United States Government Policy set out in the December 2020 Proclamation on Recognizing the Sovereignty of the Kingdom of Morocco over the Western Sahara, the (former) Western Sahara is now part of Morocco. Note that the Atlantic humpback dolphin's range only extends into the southern portion of Morocco (i.e. Dakhla Bay).

b; Ross *et al.* 1994; Jefferson *et al.* 1997; Van Waerebeek *et al.* 2004; Mendez *et al.* 2011; Zwart and Weir 2014; Collins 2015).

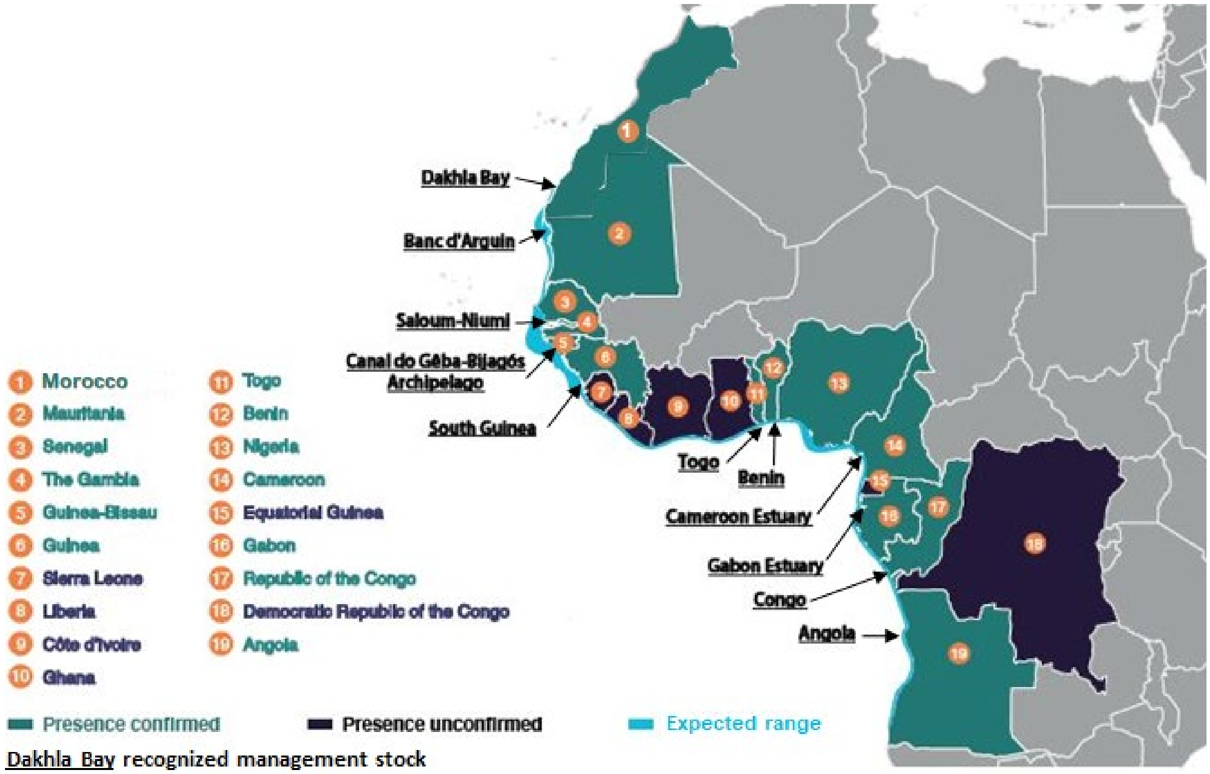

Figure 4. Expected range of the Atlantic humpback dolphin, *S. teuszii*. Countries shaded in teal are those with confirmed *S. teuszii* records, while those shaded in dark blue are countries with no confirmed *S. teuszii* records. Potentially suitable *S. teuszii* habitat (<30m depth) along their expected range is shown in light blue. Underlined localities indicate currently recognized management stocks (Source: Modified from the "*Sousa teuszii* Infographic" produced by the Consortium for the Conservation of the Atlantic Humpback Dolphin (CCAHD), available from https://www.sousateuszii.org/resources/(accessed 4/25/2022), using Van Waerebeek *et al.* (2004) identified management stocks and associated information as summarized in Collins 2015).

This species is the only member of the genus that occurs outside of the Indo-Pacific region (Mendez *et al.* 2013; Jefferson and Rosenbaum 2014; Collins 2015). Although each of the nineteen countries between (and including) Morocco and Angola are presumed to be part of the species' natural range, the current distribution is uncertain due to incomplete research coverage, including an absence of survey effort in many areas. Currently, there are confirmed records of occurrence (confirmed via sightings, strandings, and bycatch data) in the following thirteen countries: Morocco, Mauritania, Senegal, The Gambia, Guinea-Bissau, Guinea, Togo, Benin, Nigeria, Cameroon, Gabon, Republic of the Congo, and Angola (Ayissi *et al.* 2014; Weir and Collins 2015; Collins *et al.* 2017; Van Waerebeek *et al.* 2017; CCAHD 2020; Bamy *et al.* 2021; Minton *et al.* 2022a; Bilal *et al.* 2023; Figure 4; Table 1). The six countries with no confirmed records (Sierra Leone, Liberia, Côte d'Ivoire, Ghana, mainland Equatorial Guinea, and the Democratic Republic of the Congo) have received little or no systematic cetacean or coastal research (Collins 2015; Collins *et al.* 2017, Figure 4, Table 1). Land-based research and port monitoring of artisanal fishing ports and landing sites along the Ghanaian coast from 1996-2004, indicated that *S. teuszii* remained unrecorded in Ghana (Ofori-Danson *et al.* 2003; Van Waerebeek *et al.* 2009). It is thought that absence of *S. teuszii* records in Ghana may be due to localized extirpation of the species in Ghanaian waters (Van Waerebeek *et al.* 2009; Figure 4; Table 1). It remains uncertain whether the absence or scarcity of records in many countries is due to lack of observation effort and reporting, scarcity of the species, or a discontinuous distribution (caused by suboptimal habitat and/or local extirpation) (Weir *et al.* 2021, Table 1). Additionally, the species is not known to occur around any of the larger offshore islands of the Gulf of Guinea, including Sao Tome and Principe or Bioko (Fernando Póo) and Annabon (Pagalu) (Van Waerebeek *et al.* 2004).

Eleven putative "management stocks" (i.e. subpopulations) of *S. teuszii* were identified by Van Waerebeek *et al*. (2004) based on localities or countries where the species has been recorded and evidence of gaps in the species' range (Van Waerebeek *et al.* 2004; Figure 4). These management stocks are meant to serve practical management purposes amongst range countries until intraspecific genetic variation data become available (Van Waerebeek *et al.* 2017). However, Van Waerebeek *et al.* (2017) proposed that the currently recognized management stocks of Canal do Gêba-Bijagós Archipelago (Guinea-Bissau) and South Guinea be combined into a single "Guineas" stock due to multiple records reported from the Tristao Islands and the Río Nuñez Estuary (Weir 2015) in northern Guinea.

Throughout its range, the Atlantic humpback dolphin predominantly occurs shoreward of the 20 m depth isobaths, and often in the shallowest (≤5 m depth) part of that range, in nearshore waters (average sea surface temperatures ranging from 15.8° to 31.8° Celsius), and in a diverse array of dynamic habitats strongly influenced by tidal patterns (*e.g.,* sandbanks, deltas, estuaries, and mangrove systems) (Collins 2015; Weir and Collins 2015; Taylor *et al.* 2020). In this context, 'nearshore' is defined as areas in which the sea floor is affected by wave motion, resulting in dynamic, tide-influenced, habitats (Weir 2015; Weir and Collins 2015).

Consequently, potentially suitable habitats exist over larger areas and at greater distances from shore in geographic regions with shallow-sloping seabeds, such as the area between Senegal and Guinea (Weir and Collins 2015). Documented habitats include: large estuarine systems (including mangrove channels, upstream waters with tidal influence, and the estuary-influenced waters further offshore); exposed marine coasts (often within, or just beyond, the surf zone); coastal archipelagos; tidal mud-flats, sandbanks and seagrass expanses; and large, sheltered enclosed shallow bays (Van Waerebeek *et al.* 2004; Collins 2015; Weir and Collins 2015, Figure 5).

Even though recorded sightings are typically coastal, the species may also occur up to at least 13 km from shore when suitable shallow habitat is present (Van Waerebeek *et al.* 2004; Weir and Collins 2015). It has been recorded some distance upriver, for example a sighting that occurred in the Saloum Delta, Senegal was observed approximately 30 km upriver within the Saloum River, Senegal (Minton *et al.* 2022a). However, there is no evidence that this species travels beyond the influence of marine waters, and is not known to enter the coastal lagoons that are a prevalent feature of equatorial Atlantic African coasts (Maigret 1980a; Van Waerebeek *et al.* 2004; Weir and Collins 2015; Minton *et al.* 2022a). It's northernmost and southernmost

Table 1. Published records (number of individuals sighted, stranded, bycaught, or captured) of Atlantic humpback dolphins (*S. teuszii*) in nineteen range countries. Source: Table modified from Weir *et al.* (2021).

Range Country (North to South)	*S. teuszii* records
Morocco	< 10 records
Mauritania	> 30 records[2]
Senegal	> 30 records; some systematic surveys
The Gambia	< 10 records
Guinea-Bissau	> 30 records
Guinea	10-30 records; some systematic surveys
Sierra Leone	Presence unconfirmed
Liberia	Presence unconfirmed
Côte d'Ivoire	Presence unconfirmed
Ghana	Presence unconfirmed
Togo	< 10 records
Benin	< 10 records
Nigeria	< 10 records[3]
Cameroon	< 10 records; some systematic surveys
Equatorial Guinea	Presence unconfirmed
Gabon	10-30 records; some systematic surveys
Republic of the Congo	> 30 records; some systematic surveys
Democratic Republic of the Congo	Presence unconfirmed
Angola	> 30 records; some systematic surveys

[2] Bilal *et al.* (2023) documented the presence of *S. teuszii* in Mauritanian waters, specifically from a record of a male specimen which washed ashore on the coast of Mauritania just south of Banc d'Arguin National Park on May 10, 2013.

[3] Olakunle and Akanbi (2014) reported three sightings of *S. teuszii* in western Nigeria, totaling 33 individuals, but unfortunately did not document these with positions, circumstances, or photos. The general lack of records in Nigeria can be attributed to scarce scientific observer effort. However, CCAHD noted that five additional sightings of live *S. teuszii* have been documented in Nigeria (data reported to the CCAHD by a member of the public and supported by photographic evidence).

distribution appears to be broadly limited to mean annual water temperatures higher than 15°C (Weir and Collins 2015).

Areas of known occurrence of *S. teuszii* may reflect availability of suitable shallow habitat for the species. The Dakhla Bay, Banc d'Arguin, and Saloum-Niumi stocks are separated from each other by distances exceeding 350 km, and few observations have been recorded between them despite fieldwork over several decades (Collins 2015). This suggests that these stocks may currently be reproductively isolated from each other and from more southern stocks, and that the distribution of *S. teuszii* may be naturally discontinuous in some areas, with highest densities in optimal habitats and occurrence on intervening coasts reduced (Van Waerebeek *et al.* 2004; Collins 2015; Van Waerebeek *et al.* 2017). However, Collins (2015) notes that gaps in the species' range may be a relatively recent phenomenon, due to increased human pressures in once pristine regions (Van Waerebeek and Perrin 2007; Weir *et al.* 2011; Collins 2015). Several sightings and bycaught dolphins were reported from the "Petite Côte" region within the Saloum-Niumi stock, off the southern coast of Senegal (between Dakar, the capital of Senegal, and the Saloum Delta) during the 1950s (*e.g.* Cadenat and Paraiso 1957), but none were reported between 1975 and 1980 (Maigret 1980b). Van Waerebeek *et al.* (2004) identified a single catch (of unknown origin) landed at Fadiouth/Joal in 1997. No records of *S. teuszii* have been reported

Figure 5. Examples of the different habitats occupied by the Atlantic humpback dolphin, *S. teuszii*, including (A) close to shore along exposed marine coasts, (B) several kilometers offshore, (C) inside mangrove channels, and (D) in turbid estuarine-influenced waters. Photo Compilation Credit: (A) Tim Collins/Wildlife Conservation Society (WCS); (B) and (D) Gianna Minton/CCAHD; and (C) Lucy Keith-Diagne/African Aquatic Conservation Fund (AACF).

in Ghana despite consistent monitoring of landing sites over many years and the existence of an active dolphin fishery, which suggests that the species has either been extirpated or is extremely rare in this country (Van Waerebeek *et al.* 2009; Debrah *et al.* 2010). Additionally, Van Waerebeek *et al.* (2004) suggests that *S. teuszii* most likely inhabited the Niger Delta before large-scale oil exploration and extraction altered the coastal environment, and recent social media posts showing bycaught or hunted *S. teuszii* from the Oyorokoto fishing settlement in the Andoni local government area of Rivers State indicate that the species is still present there (Nature News; Prof E. Eniang pers. comm., October 14, 2022). Available data demonstrate that even where dedicated cetacean surveys are conducted, sightings in most areas of known occurrence can be low, and a general absence of records from "gap" areas may indicate occurrence in extremely low densities rather than absence. For instance, in southern Gabon, where *S. teuszii* occurs in the surf zone on open coastlines, boat-based survey work demonstrates that sightings rates can be very low, even with dedicated effort (Minton *et al.* 2017, see Section 3). Additionally, (Moores 2018) reports that based on irregular shore-based effort, sightings of Atlantic humpback dolphins in Dakhla Bay have decreased over the decades with four sightings reported in 1996 with a peak group size of 10 individuals (mean group size of 6.9 individuals). However, sightings between 2010 and 2018 reported no group size exceeded 3 individuals (Moores 2018).

Atlantic humpback dolphin migrations and movements are poorly understood largely because the necessary work (e.g. comparison of identification catalogues, genetic sampling and tagging) has not been conducted (Collins *et al.* 2017). Because Atlantic humpback dolphins feed primarily on coastal, estuarine, and reef-associated fishes, localized movements have been linked to feeding opportunities facilitated by tides (Busnel 1973; Collins 2015; Collins *et al.* 2017). Movements on larger scales have never been documented, but have been inferred using local accounts and sightings from fishers, suggesting movement north of the Banc d'Arguin (Maigret 1980a) and sightings between Nouamghar and Nouakchott (Mauritania) may indicate occasional movements south (Robineau and Vely 1998). More recent observations of *S. teuszii* groups passing between Barra and Buniada Points, indicate routine movement between Senegal and Gambia (Collins 2015). Additionally, swim speeds of 1–7 km/hr (mean of 4 km/hr) were recorded during travel along a linear coastline in Angola, indicating that Atlantic humpback dolphins might be capable of undertaking considerable spatial movements with the potential for relatively large home ranges (Weir 2009). Records suggest transboundary movements between some range countries, such as between Saloum-Niumi (Senegal-The Gambia) and Bijagos (Guinea-Bissau) (Van Waerebeek *et al.* 2004; Collins 2015; Weir 2016; Collins *et al.* 2017). Sightings in the Rio Nuñez region suggest this connectivity extends into Guinea (Weir and Collins 2015). Additionally, beach-based observations indicate routine movements of *S. teuszii* across the Gabon/Republic of the Congo border within the Mayumba-Conkouati transboundary protected area; however, it remains unclear if these individuals range further afield (Collins 2015).

2.3 Diet and Feeding

Knowledge of the Atlantic humpback dolphin's diet and feeding ecology is limited, as few stomach samples have been examined and direct observations of feeding are rare (Van Waerebeek *et al.* 2004; Collins 2015). Additionally, there have not been any targeted studies of its diet or interactions with prey species. However, based on stomach contents of bycaught *S. teuszii* specimens and direct observations of feeding, it is thought that *S. teuszii* diet consists predominantly of coastal, estuarine, and reef-associated fish (Cadenat and Paraiso 1957; Cadenat 1959; Van Waerebeek *et al.* 2004; Weir 2009, Figure 6).

Prey species identified from the stomachs of bycaught specimens or via direct observations of feeding include: grunts (*Pomadasys* spp.), including the Sompat grunt *Pomadasys jubelini*; Bonga shad *Ethmalosa fimbriata*; Gorean snapper *Lutjanus goreensis;* Atlantic emperor *Lethrinus atlanticus*; West African spadefish *Chaetodipterus lippei*; Atlantic bonito *Sarda*; mullets (*Mugil* spp.) (Figure 6), including the South African mullet *Liza richardsonii*, the flathead grey mullet *Mugil cephalus*, and the golden grey mullet *Liza aurata*; Longneck croaker *Pseudotolithus typus*; Cassava croaker *Pseudotolithus senegalensis*; unidentified flounders (*Bothidae* spp., and *Pseudorhombus* spp.); royal threadfin *Pentanemus quinquarius*; sardines (*Sardinella* spp.), and the mantis shrimp *Squilla mantis* (Collins 2015).

There are few accounts of observed Atlantic humpback dolphin predation. In Mauritania, a single Atlantic humpback dolphin was observed twice among bottlenose dolphin pods (*Tursiops truncatus*) fishing for mullet (*M. cephalus* and *L. aurata*) (Busnel 1973; Collins *et al.* 2017). Additionally, *S. teuszii* have been observed chasing mullet in channels between the Tidra and Nair islets (Banc d'Arguin) (Duguy 1976). In Angola, *S. teuszii* has been observed feeding

Figure 6. Atlantic humpback dolphins feeding on mullet (*Mugil* spp.) in Angola (left) and Senegal (right). Photo Compilation Credit: Caroline Weir/Ketos Ecology. These photos shall not be shared or reproduced without express permission from Caroline Weir/Ketos Ecology.

primarily on the South African mullet (*L. richardsonii*). Also observed off the Flamingos, in southern Angola, was the capture of an Atlantic bonito (*S. sarda*) by an individual Atlantic humpback dolphin, and the herding of a school of sardines (*Sardinella* spp.), although it was unclear if they were prey (Weir 2009).

Foraging has been linked to rising (flood) tides (Van Waerebeek *et al.* 2004; Weir 2009). In the Saloum Delta, tides were thought to provide access to inner reaches of mangrove channels (referred to locally as 'bolons') and mangrove edges (Maigret 1980a; Collins 2015). Daily movements of individual Atlantic humpback dolphins into channels inshore were coupled with flood tides in Banc d'Arguin (Maigret 1980a), and (Duguy 1976) reported *S. teuszii* at the Banc d'Arguin chasing mullet in the channels between the Tidra and Nair islets. In the Bijagós Archipelago (Guinea Bissau), *S. teuszii* were most frequently observed during low tide, suggesting that they feed when fish are concentrated in "gullies and creeks" (Spaans 1990; Weir 2009). Additionally, feeding has been observed at river confluences within the Rio Grande de Buba (Van Waerebeek *et al.* 2000). Some groups have been observed widely dispersed, such as groups observed foraging in Saloum and Gabon (Maigret 1980a; Collins *et al.* 2004; Van Waerebeek *et al.* 2004). In other areas, feeding activity coincides with observations of larger groups (e.g. 20 – 40 individuals) (Maigret 1980a; Collins *et al.* 2004; Van Waerebeek *et al.* 2004).

Atlantic humpback dolphins observed off the Flamingos have been observed spending approximately half of the daylight hours engaged in travel and foraging activities and were observed foraging preferentially around rocks and reefs, as well as at the mouths of rivers, including the typically dry Flamingo River (Weir 2009). Off the coast of Guinea, limited observations suggest that *S. teuszii* individuals observed in the shallow waters west of the Île de Taïdi spent relatively more time foraging than those individuals in deeper waters of the outer Río Nuñez estuary (Weir 2015).

2.4 Reproduction and Growth

Data and information regarding life history and reproductive parameters are almost nonexistent for this species. An estimated generation length of 18.4 years is given for the Atlantic humpback dolphin by Taylor *et al.* (2007), although Moore (2015) provided a figure closer to 25 years for the Indo-Pacific humpback dolphin (*S. chinensis*) and Indian Ocean humpback dolphin (*S. plumbea*) (Collins 2015; Collins *et al.* 2017). Available data for other species in the genus can be used to infer that *S. teuszii* likely has a low reproductive rate and low intrinsic potential for population increase (Taylor *et al.* 2007; Jefferson and Rosenbaum 2014; Moore 2015).

In the Saloum Delta (Senegal), births are thought to occur in March and April, based upon observations of juveniles (Maigret 1980b; Van Waerebeek *et al.* 2004; Collins 2015). This pattern was also suggested for Guinea Bissau (Van Waerebeek *et al.* 2004). No neonates have been examined, but lengths at birth may be similar to the 100 cm cited for *S. plumbea* in South Africa (Van Waerebeek *et al.* 2004). The species is suspected to be sexually dimorphic (males larger at maturity and with a more prominent dorsal hump (see Figure 3)), but the sample size of carcasses used to formally assess this trait (~20 individuals) is too small to assess this statistically (Jefferson and Rosenbaum 2014). The data required to estimate other *S. teuszii* vital rates remain unavailable (Taylor *et al.* 2020).

2.5 Social Behavior

Atlantic humpback dolphins have a surfacing behavior that usually comprises calm rolls, during which the beak is often lifted above the water and the body is arched, accentuating its characteristic hump. Overall, the species is naturally unobtrusive, preferring to maintain a distance from boats and engines; however, individuals have been observed occasionally leaping, breaching, spyhopping and tail-slapping (Weir 2015, Figure 7, Figure 5D). Traveling and foraging are the dominant behaviors reported during targeted focal follows of Atlantic humpback dolphins (Weir 2009, 2015, 2016). Some groups have been observed foraging cooperatively to herd prey, driving fish towards the surf and trapping their prey against the coastline (Weir 2009). However, other groups have been observed foraging independently, during which individuals were more widely-dispersed, surfaced unpredictably, and sometimes exhibited tail-up dives (Weir 2009, 2015, 2016).

Atlantic humpback dolphins typically travel in small groups; 65% of reviewed sightings comprised 10 or fewer animals, although larger groups of up to 45 individuals have been reported (Weir and Collins 2015). Mixed-species associations between Atlantic humpback dolphins and bottlenose dolphins (*Tursiops truncatus*) have been observed in Morocco, Mauritania, Senegal, Guinea-Bissau, Gabon, the Republic of the Congo, and Angola (Weir 2009, 2011; Leeney *et al.* 2016). While little is understood about the social affiliations or age and sex composition of Atlantic humpback dolphin groups, there is some evidence for strong social affiliation and stable group structure in some areas (Weir 2009, 2015).

2.6 Population Structure and Genetics

Although analyses of population structure are considered fundamental elements of conservation and management strategies, such as comparison of geographic variation in morphological features or molecular genetics, no such analyses have been conducted to help clarify *S. teuszii* population structure. Thus, the only information available comes from known distribution records and evidence of range gaps, which was the approach initially used by Van Waerebeek *et al.* (2004) to identify Atlantic humpback dolphin management stocks (see Section 2.2).

Although the complete mitochondrial genome of *S. teuszii* has been mapped by McGowen *et al.* (2020), genetic data have been collected for only a few individuals (Mendez *et al.* 2013, see Section 2.1), so estimates of genetic diversity across and within populations are currently not available for this species.

3. ABUNDANCE AND TRENDS

Abundance data are very limited for *S. teuszii* and robust abundance estimates are lacking for most stocks. However, the available information for the eleven recognized management stocks suggests stocks range from the tens to low hundreds of individuals (Collins 2015; Collins *et al.* 2017, Table 2).

Atlantic humpback dolphin stocks at the northern (Dakhla Bay, Morocco) and southern (Namibe, Angola) extremes of the range appear to be very small (Weir 2009; Collins 2015; Table 2). Based on observations of three *S. teuszii* individuals in Dakhla Bay, Beaubrun (1990) described this stock as “miniscule”, and additional sightings in the same area between January 20 and February 14, 1996, by Notarbartolo di Sciara *et al.* (1998) reported only 4 sightings with a mean group size of 6.9 individuals (Table 2). Additionally, Van Waerebeek *et al.* (2004) noted that the Dakhla Bay stock is likely limited to a few tens of individuals. More recent verifiable sightings by locals and birders suggest that this stock remains extant in this area (Moores 2018).

The Banc d'Arguin and Saloum-Niumu stocks have been estimated repeatedly at ~100 animals (i.e. via distance sampling, mark-recapture studies, photographic evidence, etc.) since the mid-1970s (Maigret 1980a; Van Waerebeek *et al.* 2003; Van Waerebeek *et al.* 2004). Incidental sightings from the southern Banc d'Arguin suggest that the species is sighted relatively

Figure 7. *S. teuszii* mother and calf travelling along the coast (top), and examples of socializing, breaching, and surfacing behavior (bottom, left to right). Photo Compilation Credit: (Top and bottom middle photos) Gianna Minton/CCAHD; (Bottom far left and right photos) Lucy Keith-Diagne/CCAHD and AACF.

frequently (Collins 2015). However, this stock has never been considered large by those who have completed assessments (Maigret 1980a, b; Robineau and Vely 1998). For the Saloum-Niumi stock, encounter rates and group sizes recorded during surveys since 1997 indicate a small population "unlikely [to] exceed low hundreds, and may be less" (Van Waerebeek *et al.* 2000; Van Waerebeek *et al.* 2004; Table 2). However, between October and November 2015, a systematic survey conducted by Weir (2016) in the Saloum Delta of Senegal produced a minimum population size of 103 animals, which is the highest population estimation recorded for *S. teuszii* within the species' range (Table 2). More recently, a 2022 report to the Scientific Committee of the International Whaling Commission (IWC) provided preliminary results of 2021 and 2022 *S. teuszii* surveys in the Saloum Delta, Senegal (Minton *et al.* 2022a). Results from the 2021 survey documented a total of 14 sightings over 12 days of effort, with the majority of sightings clustered in the Saloum River in the northern portion of the delta; and results from the 2022 survey documented a total of 22 sightings over 16 days of effort, again with the vast majority of sightings in the main Saloum River (Minton *et al.* 2022a). Group sizes over both years of survey ranged from 1-30 with a mean estimated group size of 9 individuals (Minton *et al.* 2022a).

Data and sightings records for the Canal do Gêba-Bijagós Archipelago stock within Guinea-Bissau suggest the continued occurrence of a population of *S. teuszii* into at least the late 1990s (Spaans 1990; Jefferson *et al.* 1997; Van Waerebeek *et al.* 2000; Van Waerebeek *et al.* 2004). Van Waerebeek *et al.* (2004) estimated "at least several hundred, if not more" individuals in this stock. A more recent review of sightings records indicates that *S. teuszii* is still relatively widely distributed in the Canal do Gêba-Bijagós Archipelago stock within Guinea-Bissau (Leeney *et al.* 2016), but sightings appear to be declining in regularity (Collins 2015). More recent sightings in the Río Nuñez Estuary suggest that distribution across the Guinea-Bissau/Guinea border may be contiguous (Collins 2015). Within the Guinea stock, six *S. teuszii* sightings were recorded by Weir (2015) during 817.6 kms of boat-based survey effort in the Río Nuñez Estuary. Photo-identification resulting from this survey resulted in a minimum population estimate of 47 individuals (Weir 2015, Table 2).

Recently, observations of *S. teuszii* in Togolese waters were recorded for the first time by Van Waerebeek *et al.* (2017), providing evidence confirming Togo as a newly documented range country. Van Waerebeek *et al.* (2017) described five sightings recorded from shore in Togo between 2008 and 2015. These sightings occurred predominantly on the eastern coast close to the Benin border, although an additional unconfirmed sighting was reported from the coast near the capital of Lome. However, small group sizes suggest that the species is not very abundant in Togolese waters (Van Waerebeek *et al.* 2017, Table 2).

In Benin, a single small group (n=4) of Atlantic humpback dolphins was sighted and photographed west of Cotonou, Benin, making it the first *S. teuszii* record for the Benin stock (Zwart and Weir 2014, Table 2). Additionally, Collins (2015) noted that 27 individuals were also observed in Beninese waters. In Nigeria, two dolphins killed in artisanal gillnets off Brass Island in 2011 and 2012 were the first authenticated records of *S. teuszii* for this range country. Additionally, as noted in Section 2.2, Olakunle and Akanbi (2014) reported three sightings of Atlantic humpback dolphins, totaling 33 individuals, but unfortunately did not document these with positions, circumstances, or photos. Recently, however, five additional *S. teuszii* sightings have been documented between 2017 and 2021 off the coast of western Nigeria near Lagos (CCAHD, Table 2), and two incidents of bycatch and/or direct hunting were posted on social media by fishing communities in the Niger Delta Area (Nature News; Prof E. Eniang pers. comm., October 14, 2022).

Surveys of the Cameroon Estuary stock between May and June 2011, yielded a single *S. teuszii* sighting on May 17, 2011, despite extensive beach-and boat-based survey effort (Ayissi *et al.* 2014). Additionally, in May 2011, a recorded encounter rate of 0.386 sightings per 100 km (or 3.86 individuals per 100 km) suggests that abundance there may be very low (Ayissi *et al.* 2014, Table 2). Boat-based surveys, conducted in Gabon within the Gabon Estuary stock, between 2003 and 2006 yielded five sightings at an average rate of 0.15 sightings per 100 km (Collins *et al.* 2010; Collins 2015). Boat surveys conducted off the coast of the Gamba region of Gabon between 2013 and 2015, documented *S. teuszii* in Gabonese waters during the survey's first year in 2013, which included three observations with estimated group sizes of 7, 10, and 25 (mean of 14 individuals) and an overall encounter rate of only 0.13 sightings per 100 km of survey effort (Minton *et al.* 2017). However, sightings rates during shore-based work in 2012 in the Republic of the Congo within the Congo stock were much higher (though not directly comparable), and suggest that the coasts of southern Gabon and a limited area in the adjacent Republic of the Congo may harbor a total population in the low hundreds (Collins 2013; Collins 2015, Table 2). While most of the Angolan coast is unsurveyed, intensive survey effort in 2008 along a 35 km stretch of coastline off Angola found a small group of 10 individuals was resident in the Flamingos area (Weir 2009, Table 2).

It is important to note that while photo-identification work has yielded 'minimum estimates' of the number of Atlantic humpback dolphins in a number of study areas discussed above (i.e. Saloum Delta region of Senegal, Río Nuñez Estuary of Guinea, and the Flamingos area of Angola) each of these studies had limited temporal and spatial extents, and (with the possible exception of the Angola study conducted by Weir (2009)) are unlikely to have photographed all *S. teuszii* individuals using those areas. Additionally, while encounter rates are available for a number of other studies noted above, they are not directly comparable due to differing sampling methodologies (*e.g.* platforms, extent of study area, and seasons).

Overall, comprehensive reviews conducted by Collins (2015) and Collins *et al.* (2017) on all available *S. teuszii* population biology data, reinforce general inferences of small total population size. These reviews conclude that the species probably includes fewer than 3,000 individuals (Collins 2015; Collins *et al.* 2017). If it is assumed that 50 percent of these are mature individuals, then the number of mature individuals in the total population would be no more than 1,500 (Taylor *et al.* 2007; Collins *et al.* 2017; Brownell *et al.* 2019).

It has also been noted that the availability of suitable habitat across much of the species' range is limited to a linear band extending only a few kilometers from the shoreline (Weir and Collins 2015; Figure 4; Weir *et al.* 2021). This may naturally limit carrying capacity for the Atlantic humpback dolphin, and thus, this species may have always occurred at a naturally low abundance.

As indicated in Table 2, apart from the systematic surveys in Angola, Republic of the Congo, Gabon, Cameroon, Senegal, and Guinea, no quantitative assessments of population abundance exist in other range countries, thus precluding any quantitative assessments of trend for this species across its range. However, as noted above, based on available evidence, and review of published estimates of abundance in each range country, the best available data and information indicates that most *S. teuszii* stocks are small and that some stocks (i.e. Canal do Gêba-Bijagós Archipelago stock) may be experiencing population declines (Collins 2015; Collins *et al.* 2017). Limited research effort for each putative *S. teuszii* management stock has either identified significant mortality or yielded strong evidence to infer it (Van Waerebeek *et al.* 2004; Collins 2015; Collins *et al.* 2017). According to Van Waerebeek *et al.* (2003), Van Waerebeek *et al.* (2004), Weir (2009), Collins (2015), Weir (2015), Collins *et al.* (2017), and Van Waerebeek *et al.* (2017), artisanal fishing bycatch and directed takes are the principal causes of these declines, although habitat loss is also likely a contributing factor as well (Collins 2015; Collins *et al.* 2017).

Table 2. A summary of available information reported for *S. teuszii* abundance and population sizes for each of the eleven recognized management stocks. Source: Table modified from Collins (2015) with additional information provided for the Dakhla Bay (Notarbartolo di Sciara *et al.* (1998) Moores (2018), and a news article from CCAHD), Saloum-Niumi (Weir 2016), and Benin (Olakunle and Akanbi (2014); CCAHD unpublished data)) management stocks.

Management Stock (*Country/Countries*)	Estimated Size	Date(s) of *S. teuszii* Survey(s), Sighting(s), or Record(s)	Nature of the Study	Reference(s)
Dakhla Bay (*Morocco*)	"Miniscule"	January 1989	[4]local sightings	Beaubrun (1990)
	4 sightings with a mean group size of 6.9 individuals	January – February 1996	boat-based transect survey	Notarbartolo di Sciara *et al.* (1998)
	A group of 3 individuals sighted at the end of Dakhla Bay (overlapping the area of the 1996 sightings above)	2010	local sightings	Moores (2018); CCAHD News Article
Banc d'Arguin (*Mauritania*)	"Probably does not exceed 100 animals"	1979	local sightings	Maigret (1980)
	"Stock is apparently fairly small"	1967-2001	summary of local records	Van Waerebeek *et al.* (2004)
Saloum-Niumi (*Senegal/The Gambia*)	"Low hundreds, and may be less"	1997-2004	summary of local records	Van Waerebeek *et al.* (2004)
	"Minimum population size of 103 animals, the highest recorded for *S. teuszii* anywhere in its range" (reported from	2015	boat-based transect survey and photo-ID	Weir (2016)

[4] 'Local sightings' in this table refers to studies where the data was based on summaries of sightings reported by either local inhabitants, visiting researchers, or tourists.

Management Stock (*Country/Countries*)	Estimated Size	Date(s) of *S. teuszii* Survey(s), Sighting(s), or Record(s)	Nature of the Study	Reference(s)
	the Saloum Delta, Senegal)			
Canal do Gêba-Bijagós Archipelago (*Guinea-Bissau*)	56 sightings recorded during a two month period (1986/1987)	1986-1987	local sightings	Spaans (1990)
	"Several hundred, if not more…until at least 1998"	1993-1997	summary of local records	Van Waerebeek *et al.* (2004)
	"Widespread"	2008-2014	summary of local records and unpublished sightings data	(Leeney *et al.* 2015; Leeney *et al.* 2016)
Guinea (*Guinea*)	Eight sightings in the Río Nuñez Estuary, for a minimum population estimate of 47 animals	October and November 2013	boat-based transect survey and photo-ID	Weir (2015)
Togo (*Togo*)	5 live sightings recorded from shore in Togo between 2008 and 2015 - sightings occurred predominantly along Togo's eastern coast	2008-2015	local sightings	Van Waerebeek *et al.* (2017)
Benin (*Benin/Nigeria*)	4	2013	local sightings	Zwart and Weir (2014)
	3 live sightings documented in western Nigeria, totaling 33 individuals, during a four month period (2009)	2009	boat-based transect survey	Olakunle and Akanbi (2014)
	5 additional sightings documented between	2017-2021	local sightings	Data reported to the CCAHD by a member

Management Stock (*Country/Countries*)	Estimated Size	Date(s) of *S. teuszii* Survey(s), Sighting(s), or Record(s)	Nature of the Study	Reference(s)
	2017 and 2021 off the coast of western Nigeria near Lagos (data reported to the CCAHD by a member of the public and supported by photographic evidence)			of the public and supported by photographic evidence (2021)
Cameroon Estuary (*Cameroon*)	A small group of approximately 10 individuals (min. 8 – max. 12) was sighted and photographed on May 17, 2011	2011	local sightings	Ayissi *et al.* (2014)
Gabon Estuary (*Gabon*)	"Low hundreds"	2012	beach-based sightings records	Collins *et al.* (2013)
Congo (*Republic of the Congo*)	"Low hundreds"	2012	beach-based sightings records	Collins *et al.* (2013)
Angola (*Angola*)	10	2008	boat- and shore-based transect surveys and photo-ID	Weir (2009)

4. Analysis of ESA SECTION 4(a)(1) FACTORS

The ESA requires NMFS to determine whether a species is endangered or threatened due to any one of the five factors specified in section 4(a)(1) of the ESA. (A) the present or threatened destruction, modification, or curtailment of a species' habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; and (E) other natural or manmade factors affecting the species' continued existence. The following sections provide information on each of these factors as they relate to the current status of the Atlantic humpback dolphin.

4.1 (A) Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

The Atlantic humpback dolphin is considered an obligate coastal and shallow water nearshore species preferring dynamic habitats strongly influenced by tidal patterns (International Whaling Commission 2011, 2017; Taylor *et al.* 2020). Additionally, the species has a restricted geographic range, being endemic to the tropical and subtropical waters along the Atlantic African coast from Morocco in the north to the southern region of Angola (Van Waerebeek *et al.* 2004; Collins 2015; Weir and Collins 2015). Within that range, the species' habitat preferences restrict it to a relatively narrow ecological niche. As such, these nearshore habitat requirements increase the vulnerability of Atlantic humpback dolphins to a range of human activities and anthropogenic disturbances (Collins *et al.* 2017).

The destruction, deterioration, or fragmentation of the nearshore habitats relied upon by Atlantic humpback dolphins is likely to be a range-wide issue (Li 2020; Weir *et al.* 2021). A variety of anthropogenic activities may adversely impact the capacity of nearshore habitats to support dolphins, including direct habitat loss to coastal development projects (*e.g.* construction and expansion of ports, liquefied natural gas plants, and mining), damage to benthic environments from trawling and dredging, alterations to water flow and quality from upstream activities such as deforestation and damming, reduction of available prey due to destruction of mangroves, and marine pollution originating from terrestrial, atmospheric, and shipping sources (International Whaling Commission 2011, 2017; PWC 2018; International Whaling Commission 2020a, b; Li 2020; Weir *et al.* 2021). The latter potentially includes runoff of agricultural contaminants, discarding of mining aggregates and other industrial wastes, oilspills, and lack of adequate waste disposal for sewage (introducing bacterial, fungal, and viral pathogens into the Atlantic humpback dolphins' habitat). Additionally, the potential threat of climate change must also be considered. While there has been no direct study of this potential threat on *S. teuszii* and impacts to its habitat, it is likely that climate change could affect all species of marine mammals (Dutton 2010; van Weelden *et al.* 2021).

Below, we discuss several factors that may be contributing to the destruction, modification, or curtailment of the Atlantic humpback dolphin's habitat or range, including coastal development, contaminants and pollutants, and climate change.

Coastal Development

As noted above, habitat loss can result from a variety of coastal development activities within the Atlantic humpback dolphin's range. Increasing coastal development is a potential concern within the eastern tropical Atlantic (ETA), a biogeographic realm that extends from Mauritania to southern Angola, overlapping with much of this species' range (Weir and Pierce 2013). Approximately 40% of the human population inhabiting the ETA region is concentrated in coastal areas (Ukwe 2003; Ukwe and Ibe 2010). For example, 42% of Ghana's population lives within 100km off the coast, while 20% of Nigeria's population lives in large coastal cities (Ukwe and Ibe 2010; Weir and Pierce 2013). The human population of most ETA countries is expanding by 2–3% annually (Weir and Pierce 2013), and populations in coastal areas are set to double within 20–25 years (Ukwe and Ibe 2010). Additionally, the coastal zone is the site of all ports and most airports, factories for processing food and raw materials (*e.g.* petroleum and metals), industrial production of fertilizer, pesticides, pharmaceuticals, paper and plastic, as well as the agriculture, mining, forestry, and tourism industries (Weir and Pierce 2013).

A number of Atlantic humpback dolphin range countries are also major oil producers, specifically Angola, Equatorial Guinea, Gabon, Cameroon, Nigeria, and the Republic of the Congo (Ukwe and Ibe 2010; Minton *et al.* 2017; PWC 2018). Additionally, smaller oil fields exist in several other countries such as Senegal, Côte d'Ivoire, Ghana, and São Tomé and Príncipe (Weir and Pierce 2013). Thus habitat loss as a result of coastal construction (due to development of platforms, ports, pipelines, liquefied natural gas plants) and degradation (*e.g.* due to discharges, accidental oil spills, gas flaring, seismic exploration and explosives used during installation and decommissioning, and high-amplitude sound associated with shipping) can all negatively impact *S. teuszii* habitat. Impacts on marine environments are already evident in some areas. For example, in the Niger Delta, the Nigerian National Petroleum Corporation (NNPC) indicates that approximately 300 oil spills occurred annually from 1975 to 1995 causing pollution in the marine environment and fish mortality (Osuagwu and Olaifa 2018). It has also been noted that *S. teuszii* populations inhabited the Niger Delta prior to the development of large scale oil exploration and extraction, which subsequently altered the coastal environment (International Whaling Commission 2011). Oil-producing companies from Guinea-Bissau to Angola are estimated to discharge 710 tons of oil into the coastal and marine environment annually; a further 2,100 tons originates from oil spills (Ukwe and Ibe 2010). Impacts on small cetaceans, including the Atlantic humpback dolphin, potentially include ingestion of contaminated prey, irritation of skin and eyes, inhalation of toxic fumes causing lung congestion, neurological damage and liver disorders, and displacement from habitat essential to the species (Geraci 1990; Reeves *et al.* 2003; Takeshita *et al.* 2017).

Port developments and other urban construction projects are particularly widespread throughout the Atlantic humpback dolphin's range (see Figure 8), and preferred sites frequently overlap with *S. teuszii* habitat (Collins 2015). With economic growth of sub-Saharan Africa increasing from 2.6% in 2017 to 3.9% in 2022 (PWC 2018; IMF 2022), port developments have also increased over the years with the potential for continued expansion. At least three ports that have recently undergone or are undergoing expansion are close to the locations of recent sightings of Atlantic humpback dolphins (Rogers 2017). These include Badagry (Nigeria) which is close to the location of recent sightings of *S. teuszii* near Lagos (CCAHD unpublished data), Kamsar Port (Guinea) within the Río Nuñez Estuary (Weir 2015), and the deep-sea port of Kribi (Cameroon) (Van Waerebeek *et al.* 2017). The scale of some ports suggests that they present effective physical barriers and thus have potential for disrupting longshore movements (see Figure 9). Indirect or "non-lethal" disturbances are likely during port construction, and may become more permanent if maintenance (*e.g.* dredging) and urban development occurs at port sites (Jefferson *et al.* 2009; Collins 2015). Habitat quality is also affected through increased vessel traffic and the associated underwater noise and risk of ship strikes at port sites. Work on other species (such as bottlenose dolphins (*Tursiops* spp.)), has indicated that short-term disturbances to individuals may translate to longer term consequences for population health and fecundity (Bejder *et al.* 2006), issues that can be exacerbated by coincident ecological constraints (Ayissi *et al.* 2014; Lane *et al.* 2014; Leeney *et al.* 2016).

Habitat loss resulting from mangrove destruction and altered river sediment loads have also been documented in Guinea-Bissau and Senegal. For example, mangrove habitat loss (i.e. 29% in one protected area) occurred in Guinea-Bissau due to agricultural practices and firewood collection (Vasconcelos *et al.* 2002; Weir and Pierce 2013). Additionally, the completion of the Diama dam on the Senegal River in 1985 resulted in topographical and hydrological changes to the Senegal Delta, with associated ecological changes (*e.g.* in zooplankton communities) (Champalbert *et al.* 2007). These activities may directly and indirectly (via changes in prey) affect Atlantic humpback dolphins, which regularly inhabit estuarine areas (Collins 2015).

Overall, the impact of coastal developments and their varied cumulative effects is likely a range-wide issue for *S. teuszii*. The variety of anthropogenic activities discussed above may adversely impact the capacity of nearshore habitats to support dolphins, resulting from direct habitat loss due to coastal development projects (Weir *et al.* 2021). Oil and gas development and extraction activities occur in the central and southern portions of the species' range, resulting in an increase in port facilities and other coastal development projects (Collins 2015; Collins *et al.* 2017). Because increased coastal developments are prevalent throughout the species' range and frequently overlap with *S. teuszii*'s preferred habitat sites, we have determined that coastal development poses a current threat to the species.

Contaminants and Pollutants

Habitat contamination and pollution likely pose a threat to the health of long-lived marine species such as the Atlantic humpback dolphin. Due to concentrated industrial and human activity throughout its range in the ETA, high levels of pollutants are discharged into the habitat of the Atlantic humpback dolphin resulting in indirect habitat loss through activities such as agricultural run-off, mariculture, eutrophication and oil spills, thus reducing the ability of marine habitats to support cetaceans (Weir and Pierce 2013; International Whaling Commission 2017, 2020a; Li 2020).

Several major port cities (*e.g.* Nouadhibou, Dakar, Conakry, Lagos, Libreville, Douala and Luanda) are situated within the geographic range of Atlantic humpback dolphins, and the tendency for the species to occupy bays and estuarine systems further increases its susceptibility to pollution. Pollutant discharges into the Atlantic humpback dolphin's marine environment can include sewage effluents and run-off from these urban areas (including litter, oils, pathogens, industrial chemicals, human sewage, heavy metals, and sediments) and agriculture (i.e. fertilizers, pesticides, and agrochemicals) (Islam and Tanaka 2004; Weir *et al.* 2021). Agricultural waste can cause eutrophication, oxygen depletion, and decreased local fish abundance, potentially reducing the prey supply for piscivorous cetaceans, like *S. teuszii*. For example, agricultural run-off near Abidjan in Côte d'Ivoire causes year-round eutrophication and frequent drops in oxygen levels resulting in mass fish kills (Affian *et al.* 2009).

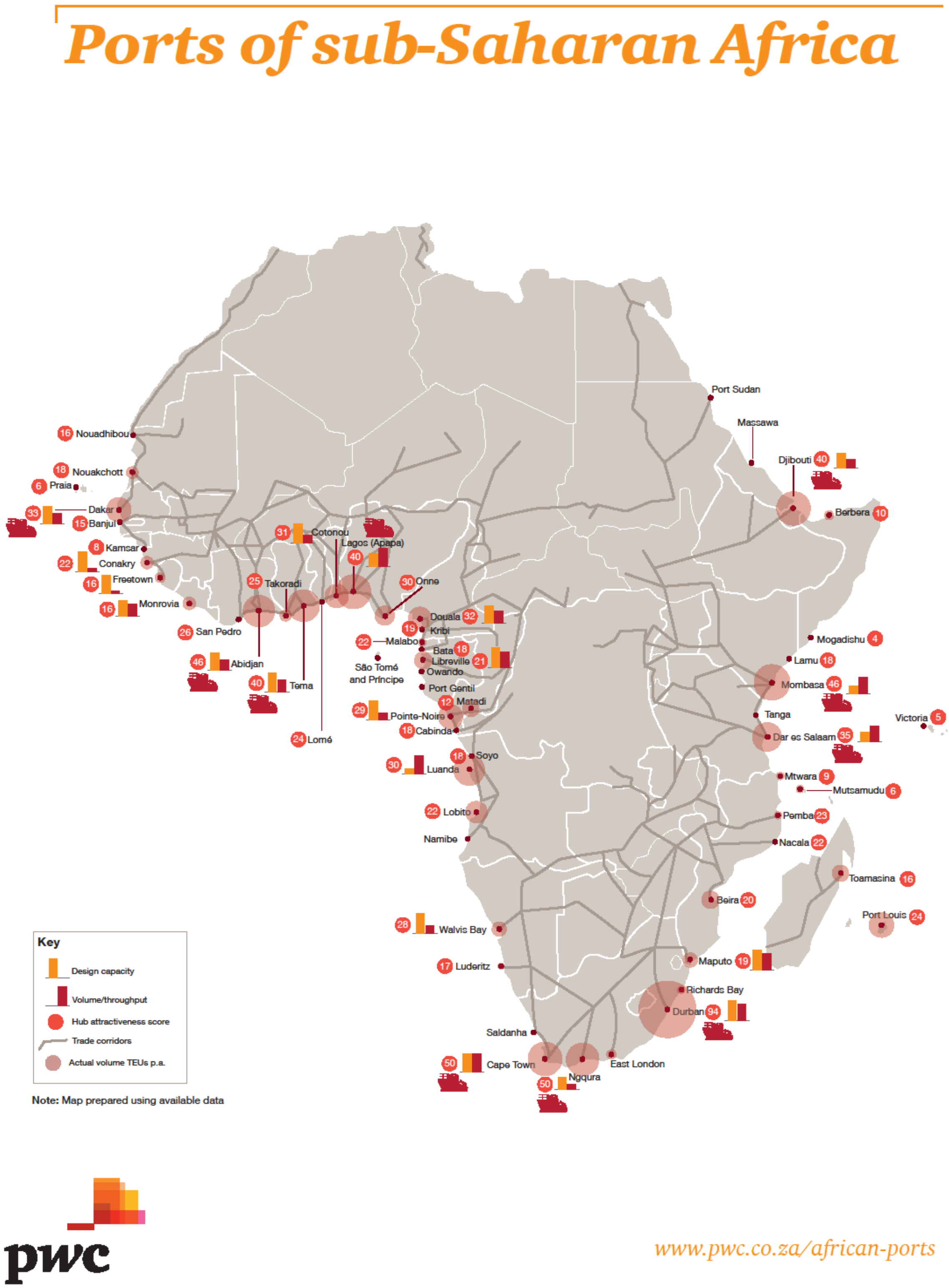

Figure 8. A map featured in the 2018 Price Waterhouse Cooper Review of existing port facilities throughout sub-Saharan Africa. Please note the concentration of facilities in *S. teuszii* range countries. Source: PWC (2018)

In 2002, it was reported that approximately 3.8 million metric tons per year of solid waste was produced in the Gulf of Guinea coastal zone, with much of it ending up in the ocean, and solid waste on Gulf of Guinea beaches largely constitutes plastics (Scheren *et al.* 2002). Human sewage and other domestic waste contain bacterial, fungal, and viral pathogens, which may be transferred into cetaceans via prey,wounds, or mucosa (eyes, mouth, and genitals) (Weir and Pierce 2013). In Nigeria, solid waste or debris occasionally constituted 69% of coastal trawl catches (Solarin 2010; Weir and Pierce 2013), thus increasing the likelihood that cetaceans, especially smaller species like the Atlantic humpback dolphin may be at risk of physical entanglement with certain kinds of debris, including plastics and discarded fishing nets (Laist 1987; Weir and Pierce 2013).

The primary entry for water borne-pollutants into cetaceans is via their prey (Weir and Pierce 2013). Because of their long life spans, position at the top of the food chain and transfer of contaminant loads to their offspring via milk, cetaceans as a whole are vulnerable to bioaccumulation of persistent organic pollutants such as pesticides and chlorinated compounds (*e.g.* dichloro-diphenyl-trichloroethane (DDT) and Polychlorinated Biphenyls (PCBs)), which are lipophilic and resilient to degradation (Islam and Tanaka 2004; Wells *et al.* 2005; Gnandi *et al.* 2011). A number of pesticides and insecticides have been documented in the Atlantic humpback dolphin's habitat of the ETA, including internationally banned agrochemicals such as DDT, aldrin, and lindane (Scheren *et al.* 2002; Weir and Pierce 2013). Organic contaminants can cause mortality, impaired reproduction, disruption of endocrine systems, lesions and cancers, and suppression of immune function in cetaceans (Harwood 2001; Aguilar *et al.* 2002; Islam and Tanaka 2004; OceanCare 2021).

Figure 9. Coastal developments can affect the limited inshore habitats of *S. teuszii*; ports and other large urban areas may present barriers to longshore movement. Source: Collins (2015)

Research into marine mammal contaminant loads off the west coast of Africa is 'extremely limited or non-existent' (Aguilar *et al.* 2002). Nieri *et al.* (1999) noted that tissue pollutant concentrations in the few marine mammal species analyzed off the Northwest coast of Africa indicated extremely low levels of exposure for organochlorine compounds and heavy metals. However, information is scant on PCB concentrations in ETA marine mammals. In addition, mining and industrial processing of raw materials are prevalent in some ETA coastal regions within the Atlantic humpback dolphin's range (Scheren *et al.* 2002), and heavy and trace metal element by-products may concentrate in the liver and muscles of marine mammals and act as immunosuppressants (Weir and Pierce 2013). For example, phosphorites have been mined in Togo since 1960 and mine tailings (containing trace metals including cadmium, chromium, copper, nickel, vanadium, zinc, barium, strontium, fluorine, and uranium) are dumped directly into the ocean (Gnandi *et al.* 2011; Weir and Pierce 2013). Additionally, Gnandi *et al.* 2011 noted that the main source of heavy metal input into the ocean off the coast of Togo was from direct dumping of phosphorite mine tailings. Furthermore, the concentration of trace metals in a few specimens of marine biota (fish and mussels) was high compared to threshold limits set by the World Health Organization, and higher concentrations were observed in areas impacted by phosphorite mining, showing an increasing trend between 2004 and 2006 which was, on average, greater by a factor of 2.5 to 35 depending on the metal (Gnandi *et al.* 2011). While metal concentrations have only been reported for a few ETA cetaceans (i.e. dwarf sperm whale, Clymene dolphin, and *Stenella* dolphins), cetaceans have developed efficient detoxification capabilities that support elevated exposure to some metals (Das *et al.* 2000; Das *et al.* 2002). However, it remains unclear whether these elevated concentrations are harmful to cetaceans.

Overall, the effects of contaminants and pollutants on *S. teuszii* have largely been unstudied. However, extensive work on a related species, *S. chinensis*, indicates that some heavy metals (such as mercury) and some organochlorines (*e.g.* DDT and PCBs) could have negative impacts (Jefferson *et al.* 2006; Cagnazzi *et al.* 2013; Gui *et al.* 2014). Contaminants and pollutants pose a potential threat in some areas and may increase as coastal development accelerates. However, the degree to which contaminants and pollutants are a threat to the Atlantic humpback dolphin remains unknown. Further research is needed to determine impacts, if any, on the species.

Climate Change

Global anthropogenic climate change is responsible for increasing temperatures across the globe on land and sea; the continued trend of this temperature increase is clear, and it is with increasing confidence that the magnitude of change over the next several decades can be predicted (IPCC 2022). Additionally, climate change has the potential to increase the occurrence and intensity of infectious disease outbreaks causing mass mortality events (Sanderson and Alexander 2020). While this is a possible scenario for the Atlantic humpback dolphin, which is a social species and could be catastrophic due to its small population size, the direct effect of climate change on this species' physiology, metabolism, ecology, and health are poorly understood, and thus the risk posed by future climate change related impacts are currently unknown. Moreover, predicted global increases in seawater temperatures associated with climate change could potentially have a favorable outcome for Atlantic humpback dolphins, since its distribution range is broadly limited to areas where mean annual seawater temperatures exceed 15°C (Weir *et al.* 2011; Weir and Collins 2015). Consequently, global warming could increase the availability of suitable habitat and result in range expansion. In the southern part of its range, the latter could eventually result in overlap with the Indian Ocean humpback dolphin (*S. plumbea*), with unknown consequences.

However, the Atlantic humpback dolphin could also show decreased resilience to climate change. The availability of suitable habitat for this species is limited to a linear band extending to only a few kilometers from the shoreline (Weir *et al.* 2021, Figure 4) (with the exception of the gently sloping seabed off the coast of Senegal and Sierra Leone, potentially providing suitable habitat for the species that could extend tens of kilometers from the coast). This may inherently limit carrying capacity resulting in naturally low abundance. This could decrease the Atlantic humpback dolphin's resilience to climate change. Additionally, some known *S. teuszii* habitats include estuaries and mangrove systems that rely on freshwater input from rainfall to regulate salinity. For example, the Saloum Delta in Senegal is an inverse estuary, with mangrove channels that become more saline further inland than where they meet the coast (Ecoutin *et al.* 2010; Gning *et al.* 2010; Dieng *et al.* 2017). A few freshwater springs and regular annual rainfall keep the tidally influenced mangrove channels from becoming hypersaline and maintain their depth and flow (Ecoutin *et al.* 2010; Gning *et al.* 2010; Dieng *et al.* 2017). Climate-change driven reduced rainfall and/or the depletion of aquifers that feed springs could lead to higher salinities, changed fish assemblages, and/or the reduction of water flow in core *S. teuszii* habitat, thus reducing the area of habitat available to the species (Ecoutin *et al.* 2010; Gning *et al.* 2010; Dieng *et al.* 2017). Furthermore, the human population of the ETA will likely be impacted by the increased frequency and severity of storms, flooding, and drought associated with climate change, due to this region's low adaptive capacity, high population density, and high exposure to sea level changes and storm surges (Weir and Pierce 2013). This, in turn, could lead to changes in prey availability related to alterations in water quality such as turbidity, acidity, and salinity. Thus, as inland crops and marine resources diminish, resource-use conflicts between people and ETA cetaceans like the Atlantic humpback dolphin may intensify, and dolphins may experience increased hunting pressure (Weir *et al.* 2011; Weir and Pierce 2013). Overall, potential impacts resulting from climate change are, at present, an unknown threat to the Atlantic humpback dolphin.

Summary

The habitat-related threats discussed in this section are expected to continue well into the future. Additionally, with human populations in the ETA predicted to grow in the coming years, and conditions of overcrowding predicted to increase, habitat-related threats and associated activities (*e.g.* oil and gas activities, port development, and other urban development projects) are projected to increase putting additional pressure on Atlantic humpback dolphins. The effects of contaminants and pollutants on *S. teuszii* have largely been unstudied. While extensive work on another species of humpback dolphin, *S. chinensis*, indicates that some heavy metals and organochlorines could negatively impact the health, survival, and reproduction of *S. chinensis*, the degree to which contaminants and pollutants are a threat to *S. teuszii* remains unknown. Furthermore, while climate change may indirectly affect the Atlantic humpback dolphin's habitat and food availability, overall potential impacts resulting from climate change are unknown. Thus, climate change is an unknown threat to the Atlantic humpback dolphin at present.

4.2 (B) Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no known recreational, scientific or educational use of the Atlantic humpback dolphin at present.

Fisheries Bycatch

The best available information indicates that the primary threat facing the Atlantic humpback dolphin is bycatch in artisanal gillnets. Bycatch in artisanal gillnets is considered widespread throughout the species' range and has been documented in Mauritania, Senegal, Guinea, Guinea-Bissau, Nigeria, Cameroon, and the Republic of the Congo (Campredon and Cuq 2001; Van Waerebeek *et al.* 2004; Collins 2015; Collins *et al.* 2017; Brownell *et al.* 2019; Jefferson 2019; Gascoigne *et al.* 2021a, b, c; Weir *et al.* 2021; Figure 10). Additionally, Weir *et al.* (2022) notes in their report to the Scientific Committee of the IWC that there is substantial overlap between fisheries effort and *S. teuszii* distribution in the Saloum Delta, Senegal based on surveys conducted in 2021 and 2022 with a total of 116 fisheries observations recorded. Traps reported to be targeting cuttlefish ('calamar') and shrimps ('crevettes') were the gear most frequently observed in the inland waters of the Saloum Delta, Senegal (Minton *et al.* 2022a).
A study by Weir and Pierce (2013) summarizing historical accounts of bycaught and hunted cetaceans in the ETA, noted that the Atlantic humpback dolphin was one of four most frequently documented bycaught species within the ETA (the other three species being the harbor porpoise, common dolphin, and bottlenose dolphin). Specifically, Atlantic humpback dolphins were noted to be particularly vulnerable to bycatch in artisanal gillnets: out of 16 reported bycatch events for this species, 13 animals died in artisanal gillnets in Mauritania, Senegal, and the Republic of the Congo, one died in a fish trap in Guinea-Bissau and two were taken in unspecified fishing gear (possibly also gillnets) in Senegal and Guinea (Weir and Pierce 2013; International Whaling Commission 2020a; Table 3; Figure 10). Weir *et al.* (2011) notes that gillnet density is high in parts of the Atlantic humpback dolphin's range (*e.g.* in Angola). Furthermore, Leeney *et al.* (2015) reports that there are at least 4,700 artisanal fishers in The Gambia, 59,500 in Senegal, and 4,141 in Guinea-Bissau, and potentially a lot more in other countries along the Atlantic Coast of Africa within the species' range. However, Notarbartolo di Sciara (1998) notes that the species has also been "fatally entangled in octopus line", and observations of foraging individuals taken near the stern wake of trawlers indicate potential for bycatch in other fisheries.

Work in Conkouati-Douli National Park (Republic of the Congo) provides some indication of the potential scale of *S. teuszii* bycatch and substantial bycatch risk for the species (Collins 2015; Figure 10). An intensive monitoring, enforcement, and cooperative (incentivized) reporting program identified 19 dolphins that were caught as bycatch over 5 years across all artisanal landing sites (n = 14) along a 60-km stretch of protected beach (Collins 2015). Out of the 19 dolphins caught as bycatch, 10 were identified as *S. teuszii,* and the testimony of fishers showed that all were caught in gillnets less than 1 kilometer from shore (Collins 2015; Collins *et al.* 2017). More recently, CCAHD partners in Renatura, Congo documented two adult *S. teuszii* caught in fishing gear in May, 2021 in the village of Bellelo just south of Conkouati-Douli National Park, Congo (CCAHD).

In northern Guinea, bycatch (mostly gillnet entanglements) of Atlantic humpback dolphins has also occurred in small-scale local fisheries surrounding the Marine Protected Area of the Tristao

Islands until at least 2017 (Bamy *et al.* 2010; Van Waerebeek *et al.* 2017; Bamy *et al.* 2021) with documented *S. teuszii* specimens bycaught in low frequency in 2002 (n=1) and in slightly higher frequency from 2011-2012 (n=5) (Van Waerebeek *et al.* 2017, Table 3). While monofilament

Figure 10. An individual Atlantic humpback dolphin bycaught in an artisanal gillnet in the Republic of the Congo. Photo Credit: Tim Collins/Wildlife Conservation Society (WCS).

gillnets are widely deployed, it is still unclear which fishing gear kills most dolphins in this region (Bamy *et al.* 2021).

In Cameroon, a capture of an Atlantic humpback dolphin was reported (supported by photographs), landed by small-scale fishers at Campo, southern Cameroon on an unspecified date in 2012 (Ayissi *et al.* 2014). Additionally, Van Waerebeek *et al.* (2017) reported an adult specimen landed at Londji fish landing site (near Kribi) which became accidentally entangled in an artisanal gillnet in Douala-Edea Fauna Reserve on March 22, 2014 (Table 3).

In Nigeria, two Atlantic humpback dolphins were killed in artisanal gillnets off Brass Island, Niger Delta – an adult female was landed at the Rotel fishing settlement, Brass Island, in November 2011, and a second (juvenile) individual, also taken by local fishermen was landed at Imbikiri quarters, Twon Community, Brass Island in February 2012 (Van Waerebeek *et al.* 2017, Table 3). Both individuals were killed for human consumption. More recently, on October 30th, 2021, at least one adult *S. teuszii* was killed in the village of Oyorokoto in the Andoni area of Rivers State, Nigeria (CCAHD; Nature News). It is likely that the animal was bycaught in fishing gear, and additional information shared on Nature News indicates that the community probably intended to retain the carcass and potentially make use of the meat. Even though mortality figures have been reported for other areas including Banc d'Arguin and the Saloum Delta (Campredon and Cuq 2001), these are based on one-off studies and there are no formal ongoing monitoring programs for cetacean bycatch in these aforementioned areas anywhere else in the species' range (Van Waerebeek *et al.* 2004; Collins 2015; Collins *et al.* 2017). Thus, the reported bycatch figures are likely to be underestimates of the true level of mortality.

Another type of fishing gear has been linked to dolphin mortality. The first *S. teuszii* specimen records for Togo were two incidentally bycaught individuals found killed in a beach seine at Agbodrafo along Togo's eastern coast (Van Waerebeek *et al.* 2017; Table 3). Additionally, in December 2021, eight *S. teuszii* individuals were trapped in a beach seine near Port Gentil, Gabon, and subsequently released through the collaborative efforts of local fishers, National Parks Agency staff, and a local non-government organization (NGO) (CCAHD). While *S. teuszii* occurs exclusively in relatively shallow waters and is common in environments close to shore, it remains unclear to what extent beach seines contribute to *S. teuszii* mortality.

The extensive spread of migrant fishers across western Africa over the past few decades is a related concern, which can exacerbate existing fisheries bycatch issues in areas (or even bring these issues to areas where they did not previously exist) (Campredon and Cuq 2001; Collins 2015; Leeney *et al.* 2015; Collins *et al.* 2017). Migrant fishers (including those who move within countries) may not abide by local regulations, taboos, or laws, and are often better equipped and more aggressive in their exploitation of local resources (Campredon and Cuq 2001; Collins 2015; Leeney *et al.* 2015). They have been implicated in the captures of *S. teuszii* in areas adjacent to the Banc d'Arguin (Campredon and Cuq 2001; Collins 2015). Additionally, Collins (2015) notes that migrant fishers from Senegal, Guinea (Conakry), and Sierra Leone have been found exploiting waters of Guinea-Bissau, which has a limited fishing tradition. Furthermore, captures of dolphins and manatees have been reported in the region, raising concern for *S. teuszii* (Campredon and Cuq 2001; Collins 2015; Collins *et al.* 2017).

International fishing activities in ETA waters from industrial fishing fleets from Europe (Ramos and Grémillet 2013), China (estimated at 3 million tons per year) (Pauly *et al.* 2013), and elsewhere further exert considerable pressure on fisheries resources. Additionally, fishing pressure has intensified in recent years due to increased human migration to the coasts (Leeney *et al.* 2015). Burgeoning coastal communities and decreasing fish stocks have forced fishers to exploit new areas, new species, or used different fishing methods and gears, all of which can impact cetacean populations in waters off the Atlantic Coast of Africa (Leeney *et al.* 2015). Industrial fisheries have also been known to fish in zones set aside for artisanal fishers and in areas where dolphins are known to occur (Metcalfe *et al.* 2017). For example, Collins (2015) notes that trawlers fishing illegally within Conkouati-Douli National Park (Republic of the Congo) impel artisanal fishers to set their nets closer to shore (for fear of losing their nets in trawls), raising bycatch risks for coastal species, like *S. teuszii*.

Depletion of Prey Resources

The depletion of prey resulting from intensive and unsustainable commercial and artisanal exploitation of fish stocks is also considered a potential contributing factor to declining Atlantic humpback dolphin populations (Van Waerebeek *et al.* 2004; Weir 2011). While knowledge of the species diet is sparse, some fish predated by Atlantic humpback dolphins (*e.g.* mullet, *Mugil* spp.) are targeted by coastal fisheries (Cadenat 1956; Maigret 1980b; Weir 2016). Within Atlantic humpback dolphin range countries, there is a high level of reliance on artisanal fishing for the protein intake and livelihoods of impoverished coastal communities (Weir *et al.* 2021). As stated above, international fishing activities in West African waters from industrial fishing fleets from Europe (Ramos and Grémillet 2013) and China (estimated at 3 million tons per year) (Pauly *et al.* 2013), contribute substantial pressure on fisheries resources. Adding to these factors that are already depleting fishing resources is illegal, unreported, and unregulated (IUU) fishing. Senegal, Mauritania, Liberia, Ghana, and Sierra Leone are amongst the countries most affected by IUU fishing (Balinga and Dyc 2018), and the presence of *S. teuszii* has been documented in Senegal and Mauritania. Generally, IUU fishing is widespread throughout the species range (Brashares *et al.* 2004), including within protected marine areas such as Conkouati-Douli National Park in the Republic of the Congo (Collins 2015).

Fish biomass in nearshore and offshore waters off the Gulf of Guinea has declined by at least 50% since 1977 due to unsustainable fishing by foreign and domestic fleets (Brashares *et al.* 2004). In the Eastern Central Atlantic, 68% of the main fisheries are considered to be either at full capacity or in decline (Weir and Pierce 2013). Overall, fish biomass in the northwest region of Africa declined by a factor of 13 between 1960 and 2001 (Christensen *et al.* 2004). Consequently, declines in fish biomass may affect Atlantic humpback dolphin populations by increasing artisanal fishing effort and pressure, leading not only to increased bycatch risk, but also potentially reduced prey availability for the species (Collins 2015).

Use and Trade

Although there is no evidence of any organized, directed fisheries for *S. teuszii,* there is a concern that bycatch can develop into "directed entanglement" or "non-target-deliberate acquisition", where fishers may intentionally try to catch Atlantic humpback dolphins in gillnets originally intended for other species (especially if there is a market for such catches) (Clapham and Van Waerebeek 2007; Collins 2015). While the scale of this practice is unknown, the use of cetaceans for human consumption has been documented in 15 (71%) of the 21 countries bordering the ETA (Weir and Pierce 2013), which provides a potential market for cetacean products (Van Waerebeek *et al.* 2004; Clapham and Van Waerebeek 2007; Collins 2015; Leeney *et al.* 2015; Brownell *et al.* 2019; Jefferson 2019; Ingram D.J. *et al.* 2022). Throughout the ETA, declining fisheries resources and rising human populations have accelerated the displacement of a number of communities from their traditional food sources, resulting in new forms of aquatic meat consumption, as well as the rise of illegal local and international trade for generating revenue (Balinga and Dyc 2018). Consequently, this aquatic harvest is impacting large aquatic mammal, reptile, and avian fauna in the region, including *S. teuszii* (Balinga and Dyc 2018; Ingram D.J. *et al.* 2022). Furthermore, one of the main factors contributing to declines in fish biomass, IUU fishing, bycatch and harvesting activities are inadequate policies and institutional frameworks and enforcement of existing laws and regulations throughout much of the species' range countries (Balinga and Dyc 2018; Weir *et al.* 2021). The sale of dolphin meat (from various species) for either human consumption or bait has been documented or suspected from a number of *S. teuszii* range countries. Evidence for use of *S. teuszii* for bait, consumption, and sale specifically has been reported from Ghana, Mauritania, Senegal, Guinea, Guinea-Bissau, Nigeria, Cameroon, and the Republic of the Congo (Cadenat 1956; Van Waerebeek *et al.* 2004; Collins 2015; Van Waerebeek *et al.* 2015; Collins *et al.* 2017; Van Waerebeek *et al.* 2017; International Whaling Commission 2020a; Weir *et al.* 2021). Furthermore, the use of Atlantic humpback dolphins as bait in some of the aforementioned countries has been documented in longline fisheries targeting sharks (Van Waerebeek *et al.* 2017). Stranded or bycaught Atlantic humpback dolphin carcasses are routinely utilized by local communities for fishing bait, primarily targeting sharks (Van Waerebeek *et al.* 2017; Weir *et al.* 2021). Individual dolphin carcasses from stranded individuals already either found dead on the shore (primarily having been bycaught in beach seines), or found dead after being bycaught in artisanal gillnets offshore are also often subsequently brought to shore for use (Weir and Pierce 2013; CCAHD 2020; Weir *et al.* 2021).

Weir and Pierce (2013) documented instances of human consumption of cetaceans, including the Atlantic humpback dolphin, in 15 of the 21 countries bordering the ETA (Mauritania to Angola). In The Gambia, an unidentified dolphin (either bottlenose or Atlantic humpback) found alive in a fishing net in 1996 was killed and butchered (Weir and Pierce 2013). Off the coast of Fadiouth, Senegal, the meat of an Atlantic humpback dolphin caught (capture method unknown) in June 1997 was sold and the remains dumped (Van Waerebeek *et al.* 2000; Van Waerebeek *et al.* 2004). In Guinea, an Atlantic humpback dolphin was found for sale at the Dixinn fish landing site on March 13, 2002 (Bamy *et al.* 2010).

In Imbikiri, Nigeria, dedicated ‘dolphin hunters’ were reported to embark on weekly or fortnightly offshore hunting trips and use large-mesh drift gillnets to capture around two to five dolphins per trip (Uwagbae and Van Waerebeek 2010). Additionally, Van Waerebeek *et al.* (2017) noted that when locals in Guinea, Nigeria, Cameroon, and Togo were queried, they typically admitted that dolphins were butchered and fully utilized (many of these instances involve the incidental use of stranded or bycaught dolphins) (Collins 2015; Collins *et al.* 2017; Weir *et al.* 2021).

In the Republic of Congo, there have been 30 cases of small cetacean carcasses being used for human consumption (30 of 34 bycatches, or 88.2% of cases), most of which were identified as Atlantic humpback dolphins (n=18) and bottlenose dolphins (n=7) (Collins 2015; Collins *et al.* 2017). In the Tristao Islands region of northern Guinea, Bamy *et al.* (2021) noted the use of cetaceans for human consumption is synchronous with and thought to be related to declining fish stocks. Additionally, forensic evidence in the region indicates that bycaught dolphins are often utilized for local consumption (Bamy *et al.* 2021).

In The Gambia, Senegal, and Guinea-Bissau, a survey conducted by Leeney *et al.* (2015) between 2007 and 2012, which carried out 474 interviews of local fishers in the region, reported that at least a quarter of respondents in each country stated they had accidentally caught a dolphin at least once, and greater proportions of interviewees stated that other fishers sometimes caught dolphins. Furthermore, Leeney *et al.* (2015) stated that “59% of interviewees in The Gambia, 40% of respondents in the Saloum Delta and 37% of respondents in Guinea-Bissau stated that they had eaten [dolphin meat] at least once.” Furthermore, while bycaught animals in The Gambia, Senegal, and Guinea-Bissau were usually distributed amongst the community as food, Leeney *et al.* (2015) found that the meat and oil of dolphins were also used to treat various illnesses. Overall, this survey's results suggested that although dolphin meat was not a major source of income for communities in Guinea-Bissau, The Gambia, and the Saloum Delta, it did provide a supplementary source of food.

Clapham and Van Waerebeek (2007) noted that market surveys conducted in ETA coastal nations indicated that the sale and consumption of cetacean products is common. Additionally, these sales contribute to the economic viability of gillnet fisheries in Ghana, which includes the killing of live entangled animals, and using dolphin meat as bait (Van Waerebeek *et al.* 2004; Clapham and Van Waerebeek 2007; Collins 2015). However, it is important to note that because captures may be concealed because of legal prohibitions, acquiring reliable data from surveys remains a challenge in some areas (Van Waerebeek *et al.* 2004; Collins 2015; Collins *et al.* 2017).

Ecotourism

Ecotourism activities are growing within some countries within the Atlantic humpback dolphin's range, as infrastructure and political stability improve. This can increase the perceived value of dolphins among local communities, providing an incentive to conserve the species (Weir *et al.* 2021). However, if not managed appropriately, these activities could impact dolphins directly (i.e. through development of boat-based dolphin or whale watching, increasing the potential for vessel strikes and disturbance) or indirectly (*e.g.* via a kite-surfing industry that overlaps with optimal habitat used by a remnant dolphin population in Dakhla Bay) (Moores 2018; Weir *et al.* 2021). Moores (2018) noted that in March 2016 a lone Atlantic humpback dolphin was observed with a small group of common bottlenose dolphins (*T. truncatus*) midway down the western side of Dakhla Bay, possibly as a result of disturbance in the north of the bay from kite-surfers. All vessels operating in nearshore habitats are a potential source of vessel strikes. However, the risk increases when boats purposefully approach and maneuver around Atlantic humpback dolphins (Weir *et al.* 2021).

There are no records of Atlantic humpback dolphins being captured for exhibition in aquaria (Weir *et al.* 2021). While ecotourism, vessel strikes, and live captures are unlikely to significantly affect Atlantic humpback dolphin populations at present, any additional stressor on the species' population could act synergistically with other more prominent threats and may contribute to the species' extinction risk, particularly given their low abundance in some areas which makes them particularly susceptible to any localized increases in these potential threats (Weir *et al.* 2021).

Summary

Bycatch in fishing gear is the primary cause of documented mortality of *S. teuszii* and is considered to be linked to population declines. Bycatch mortality has been documented throughout much of the species' range. The majority of this bycatch occurs in the extensive artisanal gillnet fisheries along the west coast of Africa (Figure 10). Due to the Atlantic humpback dolphin's preference for shallow, nearshore, and estuarine habitats, it is more vulnerable to inshore artisanal gillnets, beach seines, and other anthropogenic disturbances. Additionally, the use of stranded or bycaught Atlantic humpback dolphins for human consumption and/or fishing bait has been documented throughout the species' range, which

Table 3. A summary of specific records (noted with a *), and anecdotal accounts (noted with a ǂ) of Atlantic humpback dolphin (*S. teuszii*) bycatch in the Eastern Tropical Atlantic (ETA). Note that records are arranged alphabetically by range country. Source: Table modified from Weir and Pierce (2013).

No. of *S. teuszii*[1]	Fishery Type	Range Country	Location	Date	Reference(s)
1	Fishing gear (unspecified)	Cameroon	Campo	2012	Ayissi *et al.* (2014)
1	Gillnet	Cameroon	Londji fish landing site, near Kribi	Mar 22, 2014	Van Waerebeek *et al.* (2017)*
8	Beach seine	Gabon	Port Gentil	Dec 2021	CCAHD*
1	Fishing trap	Guinea-Bissau	Canhabaque Island, Bijagos	Mar 1989	Sequeira and Reiner (1992)*
1	Fishing gear (unspecified)	Guinea	Dixinn	Mar 13, 2002	Bamy *et al.* (2006)*; Bamy *et al.* (2010)*
1	Net (unspecified)	Guinea	Between Katfoura & Nafaya fishcamp	Jun 6, 2012	Van Waerebeek *et al.* (2017 *
2	Net (unspecified)	Guinea	Kaatchek	Jun 7, 2012	Van Waerebeek *et al.* (2017)*
4	Fishing gear (unspecified)	Guinea	Tristao Islands	June 2017	Bamy *et al.* (2021)
1	Gillnet	Mauritania	Banc d'Arguin	Jan 27, 1995	Van Waerebeek *et al.* (2004)*

No. of *S. teuszii*[1]	Fishery Type	Range Country	Location	Date	Reference(s)
1	Gillnet	Nigeria	Brass Island, Niger Delta	Nov 2011	Van Waerebeek *et al.* (2017)[*]
1	Gillnet	Nigeria	Brass Island, Niger Delta	Feb 2012	Van Waerebeek *et al.* (2017)[*]
1	Fishing gear (unspecified)	Nigeria	Oyorokoto (Rivers State)	Oct 30, 2021	CCAHD[*]; Nature News[*]
1	Gillnet	Republic of the Congo	Conkouati-Douli National Park	Oct 30, 2008	Collins *et al.* (2010)[‡]
1 per village per year	Net (unspecified)	Republic of the Congo	Conkouati-Douli National Park	–	Collins *et al.* (2010)[‡]
2	Fishing gear (unspecified)	Republic of the Congo	Bellelo	May 2021	CCAHD[*]
1	Shark net	Senegal	M'bour	Winter 1943	Cadenat (1947)[*]; Cadenat (1956)[*]; Fraser (1949)[*]
1	Shark net	Senegal	Joal	Jun 1949	Cadenat (1949)[‡]
2	Shark net	Senegal	Joal	1955?	Cadenat (1956)[‡]
1	Shark net	Senegal	Joal	Jun 29, 1956	Cadenat (1957)[*]; Cadenat and Paraiso (1957)[*]
1	Shark net	Senegal	Joal	Jul 14, 1956	Cadenat (1957)[*]; Cadenat and Paraiso (1957)[*]

No. of *S. teuszii*[1]	Fishery Type	Range Country	Location	Date	Reference(s)
1	Shark net	Senegal	Joal	Aug 18, 1956	Cadenat (1957)[*]; Cadenat and Paraiso (1957)[*]
3[2]	Shark net	Senegal	Saloum Delta	Feb–Mar 1958	Cadenat (1959)[*]
1	Shark net	Senegal	Joal	Aug 10, 1958	Cadenat (1959)[*]; Maigret (1980)[*]
1	Sardinella net	Senegal	Yene Kao	Aug 15, 1958	Cadenat (1959)[*]; Maigret (1980)[*]
2	Beach seine	Togo	Agbodrafo	Aug 14, 2016	Van Waerebeek *et al.* (2017)[*]
1	Net (unspecified)	The Gambia	Niumi National Park	Oct 25, 1996	Murphy *et al.* (1997)[‡]; Van Waerebeek *et al.* (2000)[‡]
1	Pot/trap line (*e.g.* Octopus line)	Morocco	Dakhla Bay	Jan-Feb 1996	Notarbartolo di Sciara *et al.* 1996

[1] Given the absence of supporting data in most of the reviewed literature which prevented independent verification, the species identifications used here are simply those allocated by the authors of each study.

[2] Individuals caught on three separate dates

could evolve over time into more targeted hunting of the species for sale or personal/community consumption. Bycatch and the use of dolphins for human consumption and/or fishing bait combined with high human population densities, and coastal resource competition are all factors determining the species' distribution and status. Additionally, rapidly expanding coastal communities leading to prey depletion of fish stocks throughout much of the species' range, also contribute to the species' distribution and status. Given the information above, we determine that overutilization of the species is a current range-wide threat to *S. teuszii*.

While ecotourism is increasing in some countries within the species' range, and the activities associated with ecotourism may directly (i.e. vessel strikes) and/or indirectly (i.e. disturbance and modification of behavior) affect the Atlantic humpback dolphin and its habitat, overall potential impacts resulting from ecotourism are unknown. Thus, we determine that overutilization for recreational purposes in regards to ecotourism activities do not appear to pose a threat to the Atlantic humpback dolphin at present.

4.3 (C) Disease or Predation

Disease

Information on disease for the Atlantic humpback dolphin is limited as this species has received very little research focus to date. While work on disease and pathology of the species is largely lacking, a study conducted by Weir and Wang (2016) documented various types of vertebral column anomalies (including lordosis[5], kyphosis[5], and vertebral indents) in several individual Atlantic humpback dolphins off the coast of Angola and Senegal. It was noted that lordosis and kyphosis occurred simultaneously in several individuals (Weir and Wang 2016). While the causative factors for the anomalies are unknown in every case and often remain unclear in delphinids, they can include bacterial infections (Kompanje 1995), physical trauma (Watson *et al.* 2004; Robinson 2014), and/or congenital disorders (DeLynn *et al.* 2011).

While there have not been any direct observations of parasites in the Atlantic humpback dolphin, a handful of parasites have been identified that affect another species within the genus *Sousa* – the Indo-Pacific humpback dolphin (*S. chinensis*). Internal parasites include the nematode *Anisakis alexandri* (Whittaker and Young 2018) and *Halocerus pingi* (Whittaker and Young 2018), which affect the stomach and liver, respectively. Additionally, Lane *et al.* (2014) reported lobomycosis-like disease in an individual *S. plumbea* from the KwaZulu-Natal Coast in South Africa. However, there is currently no data to determine whether these parasites or disease negatively affect the health or population status of the Atlantic humpback dolphin specifically.

Increased interaction with anthropogenic activity, and close proximity to the ETA region's densely populated coastal areas, could put the Atlantic humpback dolphin at increased risk of pathogen exposure; this negative interaction has been observed in another species in the genus – *S. chinensis* (Cagnazzi *et al.* 2013; Gui *et al.* 2014; Whittaker and Young 2018). International trade or travel and increasing human activity in the region most likely facilitate the introduction of new pathogens to ETA waters. In addition, stress derived from close interaction with vessel traffic, industry, noise, and fishing could potentially impair the immune response of Atlantic

[5] Lordosis and kyphosis are types of spinal curvatures. Lordosis is the anterior concavity in the curvature of the lumbar and cervical vertebral column as viewed laterally. Kyphosis is increased convexity in the curvature of the thoracic vertebral column as viewed laterally.

humpback dolphin individuals. However, impacts due to pathogen exposure and decreased health as a consequence of human activities are unknown for this species.

Predation

In terms of predation, information is also lacking for this species. However, sharks have been documented as known predators for other humpback dolphins in the genus *Sousa,* such as the Indian Ocean humpback dolphin (*S. plumbea*), and have been responsible for several known attacks in South Africa (Smith *et al.* 2017), indicating that it is likely that sharks also prey on Atlantic humpback dolphins. In general, other humpback dolphins in the genus *Sousa* have been known to react to sharks, demonstrating either avoidance or aggressive behavior (Saayman and Tayler 1979). Additionally, humpback dolphin individuals have also demonstrated avoidance behavior in the presence of killer whales (*Orcinus orca*); however, predation by killer whales has not been documented for *S. teuszii* (Saayman and Tayler 1979; Jefferson and Karczmarski 2001). While no evidence exists documenting shark attacks on Atlantic humpback dolphins, it is probable that sharks may prey on this species across its range.

Summary

Overall, because of the paucity of information, there is no indication that disease or predation pose a threat to the Atlantic humpback dolphin, thus their associated potential impacts remain unknown.

4.4 (D) Inadequacy of Existing Regulatory Mechanisms

Inadequate regulatory mechanisms can leave the Atlantic humpback dolphin vulnerable to anthropogenic threats, including bycatch in commercial and artisanal fisheries and coastal development. Since the Atlantic humpback dolphin is considered an obligate shallow water dolphin endemic to subtropical waters along the Atlantic African coast, ranging across nineteen countries from Morocco in the north to the southern region of Angola, a number of regulatory and conservation mechanisms at different spatial and temporal scales are needed for adequate management. Below is a summary of regulatory measures that currently apply to the species, and an analysis of whether these are inadequate to protect the species from identified threats.

<u>International Conventions and Agreements</u>

Convention on the Conservation of Migratory Species of Wild Animals (CMS) or Bonn Convention

CMS is an environmental treaty of the United Nations that aims to conserve migratory species, their habitats, and their migration routes. CMS establishes obligations for each State joining the Convention, promotes collaboration among range states, and provides the legal foundation for coordinating international conservation measures throughout a migratory range. Early recognition of the vulnerability of the *Sousa* species was indicated by their inclusion on the CMS Appendix II in 1991 (Weir *et al.* 2021) and on Appendix I in 2009 (CMS Listings), thereby obligating Parties to work regionally to promote their conservation. Parties include all countries that are in the Atlantic humpback dolphin's range except for Sierra Leone (Table 4). The CMS defines Appendix I species as those "that have been assessed as being in danger of extinction throughout all or a significant portion of their range". The Conference of the Parties has further interpreted the term 'endangered' as meaning 'facing a very high risk of extinction in the wild in the near future'" (CMS Appendix I). The listing under Appendix I is the highest level of protection under CMS and is for species threatened with extinction. The listing obligates the Parties to strive towards protecting these animals (including the Atlantic humpback dolphin), conserving and restoring their habitats, and mitigating obstacles to migration and controlling other factors that might endanger them. However, while 18 out of the 19 range countries of *S. teuszii* are Parties to CMS, conservation of the Atlantic humpback dolphin is often not a high priority for governments of range countries, despite the efforts of the Convention's National Focal Points to promote the issue recognizing that relevant government agencies in many range countries currently lack the resources to monitor and enforce CMS provisions (Doumbouya *et al.* 2017; Weir *et al.* 2021; CMS 2022).

CMS Memorandum of Understanding (MoU) Concerning the Conservation of the Manatee and Small Cetaceans of Western Africa and Macaronesia
The CMS has been closely involved with efforts to conserve the Atlantic humpback dolphin since the early 1990s and has funded two West African Cetacean Research and Conservation Programme (WAFCET) projects during the late 1990s to collect information on this (and other) species, and stimulate regional involvement in conservation efforts (Van Waerebeek *et al.* 2000; Van Waerebeek *et al.* 2003; Van Waerebeek *et al.* 2004; Weir *et al.* 2021). A series of CMS meetings were held on West African cetaceans, which culminated in the signing of a MoU Concerning the Conservation of the Manatee and Small Cetaceans of Western Africa and Macaronesia in 2008 (CMS 2008). This MoU came into effect on October 3, 2008, and will remain open for signature indefinitely. It aims to achieve and maintain a favorable conservation status for manatees and small cetaceans of West Africa and Macaronesia (including the Atlantic humpback dolphin) and their habitats to help safeguard the associated values of these species for the people of the region. Thus far, 17 West African and Macaronesian range states and 6 collaborating organizations have signed the MoU, including 12 of the countries within the Atlantic humpback dolphin's range (Table 4), thereby obligating the signatories to conserve manatees and small cetaceans in West Africa (including the Atlantic humpback dolphin). In 2017, a CMS Concerted Action (CA) was adopted specifically for the Atlantic humpback dolphin (CMS CA Plan), requiring a meeting of delegates from countries within the species range and the formulation of an Action Plan over 2018–2023. However, progress on its implementation was substantially delayed, and a CA with a revised timeline of 2021-2025 was adopted in 2020 (Weir *et al.* 2021). As such, very little progress has been made in applied conservation of the Atlantic humpback dolphin across its range. Additionally, as part of the work on the Atlantic humpback dolphin's Draft CA Plan, a formal review of the legal status and protections for the species in each range country is also underway (CMS 2022). Based on currently available information, it seems that the species is legally protected under general categories such as "marine mammals," "aquatic animals," or "Family Delphinidae" in most range countries (CMS 2022)(CMS CA; CMS Listings). However, in many range countries there is a lack of resources to effectively monitor and mitigate bycatch and/or design and implement other research and conservation measures, leading to little enforcement of laws relating to retention and use of bycaught individuals (CMS 2022; Minton *et al.* 2022b).

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
CITES is an international convention that aims to ensure that international trade in animals and plants does not threaten their survival. CITES affords varying degrees of protection to over 37,000 species, which are classified into three appendices: Appendix I includes species

threatened with extinction, and trade in specimens of these species is permitted only in exceptional circumstances; Appendix II includes species not necessarily threatened with extinction, but trade must be controlled to ensure utilization is compatible with their survival; and Appendix III contains species that are protected in at least one country that has asked other CITES Parties for assistance in controlling the trade in specimens of that species. CITES measures are legally binding for Parties.

The Atlantic humpback dolphin was included on CITES Appendix I in 1979, as a species threatened with extinction for which trade is permitted only in exceptional circumstances (CITES Appendices). Under Resolution Conference 8.4 (Rev. CoP15), the CITES National Legislation Project identifies those Parties whose domestic measures do not provide them with the authority to execute four minimum requirements under CITES. A Party is classed as a "Category 1 State" if its legislation is believed generally to meet the following four minimum requirements for the implementation of the Convention: (i) the State has designated at least one Management Authority and one Scientific Authority; (ii) it has legislation that prohibits trade in specimens in violation of the Convention; (iii) it penalizes such trade; and (iv) provides for the confiscation of specimens illegally traded or possessed. Parties are classed as a "Category 2 State" if their legislation is believed to only partially meet these four CITES implementation requirements, and as a "Category 3 State" if their legislation is believed generally not to meet these four CITES implementation requirements (CITES National Legislation Project). According to the CITES National Legislation Project, 10 out of the total 19 range countries that are a Party to CITES, are classified as either a "Category 2 State" or "Category 3 State", indicating that they lack the legal framework to effectively implement CITES provisions (CITES Legislative Status Table). Furthermore, while the remaining 9 range countries are classified as "Category 1", government agencies in many of these range countries lack the resources to fully monitor and enforce CITES provisions.

International Whaling Commission (IWC)

The IWC was established in 1946 as the global body responsible for management of whaling and conservation of whales. It is an inter-governmental organization with a current membership of 88 governments from all over the world, including 14 out of the 19 range countries of *S. teuszii* (IWC Members, Table 4). The legal framework of the IWC is the International Convention for the Regulation of Whaling. The Convention established the Commission and is one of the first international agreements to include a conservation mandate. In 2002, the IWC's Small Cetacean Sub-Committee identified the Atlantic humpback dolphin as a priority for research, spurring a genus-wide review, and in 2010, it identified a range of specific research and conservation objectives for the Atlantic humpback dolphin (International Whaling Commission 2011). In 2015, the Small Cetaceans sub-committee identified the Atlantic humpback dolphin as one of the cetacean populations with high priority for designation of task teams and potential development of Conservation Management Plans (Genov *et al.* 2015).These objectives incorporated expert scientific opinion and considered earlier conservation agreements and strategies, including the MoU for the Conservation of Small Cetaceans of Western African and Macaronesia (Van Waerebeek and Perrin 2007). Additionally, the IWC's Bycatch Mitigation Initiative (BMI) is focused on raising awareness of the issue of cetacean bycatch and available approaches and solutions to assessing, monitoring, and reducing bycatch (IWC BMI). Currently, the initiative's focus is on bycatch in gillnets, particularly in small-scale fishing fleets, which includes Atlantic humpback dolphin range countries (CCAHD 2020). While a number of *S. teuszii* range countries are IWC member nations and thus are party to the conservation initiatives set forth under the IWC, effective bycatch mitigation has not been documented in most *S. teuszii* range countries. This is primarily because a number of government agencies lack the resources to effectively monitor and mitigate bycatch or design and implement other research and conservation measures (CMS 2022; Minton *et al.* 2022b). Furthermore, the objectives set forth under the IWC's BMI are either at the planning or pilot project stage, and full implementation of this initiative (and subsequent results) has not been completed within *S. teuszii* range countries (IWC BMI) (CCAHD 2020).

Convention on Biological Diversity (CBD)
The primary objectives of the CBD treaty are: (1) the conservation of biological diversity, (2) the sustainable use of the components of biological diversity, and (3) the fair and equitable sharing of the benefits arising out of the utilization of genetic resources. This Convention entered into force on December 29, 1993, and has been ratified by 196 nations, including all countries that are in the Atlantic humpback dolphin's range (Table 4). While the Convention provides a framework within which broad conservation objectives may be pursued, it does not specifically address Atlantic humpback dolphin conservation.

United Nations Convention on the Law of the Sea (UNCLOS)
UNCLOS is an international treaty that was adopted and signed in 1982 in Montego Bay, Jamaica. The Law of the Sea Convention defines the rights and responsibilities of nations with respect to their use of the world's oceans, establishing guidelines for businesses, the environment, and the management of marine natural resources through mandating sustainable fishing practices and protecting freedom of scientific research on the high seas. The convention has been ratified by 168 parties, which includes 167 countries, which includes all 19 range countries of *S. teuszii* (UNCLOS). The importance of collaborative management for highly migratory species is addressed in Article 64, which states: The coastal State and other States whose nationals fish in the region for the highly migratory species listed in Annex I shall cooperate directly or through appropriate international organizations with a view to ensuring conservation and promoting the objective of optimum utilization of such species throughout the region, both within and beyond the exclusive economic zone. While the family *Delphinidae* is listed on Annex I, Highly Migratory Species, of UNCLOS, the Atlantic humpback dolphin species is not listed (UNCLOS). Furthermore, a number of government agencies in many range countries lack the resources to fully implement any conservation measures resulting from this Convention (Doumbouya *et al.* 2017; CMS 2022; Minton *et al.* 2022b).

Ramsar Convention
The Convention on Wetlands, signed in Ramsar, Iran, in 1971, is an intergovernmental treaty, which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. As of October 2021, there are 172 parties, which includes all 19 range countries of *S. teuszii* (Ramsar Convention), and 2,347 designated sites. One of these is the Saloum Delta, Senegal which is listed as a Wetland of International Importance under this Convention (Ramsar Convention), and is known to host possibly the largest known population of *S. teuszii*. While this Convention provides indirect benefits to the species by providing protection of key habitat areas along the west coast of

Africa, the level of protection varies at each site (Collins 2013; Weir and Pierce 2013; Taylor *et al.* 2020).

Regional Conventions and Agreements

The Convention for Cooperation in the Protection, Management and Development of the Marine and Coastal Environment of the Atlantic Coast of the West, Central and Southern Africa Region (Abidjan Convention)

The Abidjan Convention covers the marine environment, coastal zones, and related inland waters from Mauritania to Namibia. The Abidjan Convention is an agreement for the protection and management of the marine and coastal areas that highlights sources of pollution, including pollution from ships, dumping, land-based sources, exploration and exploitation of the sea-bed, and pollution from or through the atmosphere. The Convention also identifies where co-operative environmental management efforts are needed. These areas of concern include coastal erosion, especially protected areas, combating pollution in cases of emergency, and environmental impact assessment. Additionally, the Convention promotes scientific and technological collaboration (including exchanges of information and expertise) as a means of identifying and managing environmental issues. The Action Plan and the Abidjan Convention were adopted by the Governments in March, 1981; the Convention entered into force on August 5th, 1984 (The Abidjan Convention Articles). The contracting parties that have ratified the Abidjan Convention are: Benin, Cameroon, Republic of the Congo, Côte d'Ivoire, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mauritania, Morocco, Nigeria, Senegal, Sierra Leone, South Africa and Togo, which includes 16 out of the 19 range countries of *S. teuszii* (The Abidjan Convention Articles, Morroco World News, Table 4). The remaining 3 range countries including Angola, Democratic Republic of the Congo, and Equatorial Guinea are located in the Abidjan Convention area but have not yet ratified the Convention (The Abidjan Convention Articles). However, while the Convention provides a framework within which broad conservation and environmental protection objectives may be pursued and collaborated among African countries at a regional scale, it does not specifically address Atlantic humpback dolphin conservation. Furthermore, relevant government agencies in many range countries lack the resources to fully implement any conservation measures resulting from this Convention (Doumbouya *et al.* 2017; CMS 2022; Minton *et al.* 2022b).

Accra Declaration of the Ministerial Committee of the Gulf of Guinea Large Marine Ecosystem (GOG-LME)-1998 Abuja Declaration of the Guinea Current Large Marine Ecosystem Project-2006

In 1998, the environmental ministers of Côte d'Ivoire, Ghana, Togo, Benin, Nigeria, and Cameroon signed the Accra Declaration to strengthen regional capacity to prevent and correct pollution in the LME and prevent and correct degradation of critical habitats. The ministers identified the living resources and management problems in the area. The countries decided on a detailed survey of industries, defined regional effluent standards, instituted community based mangrove restoration activities, and created a campaign for the reduction, recovery, recycling, and re-use of industrial wastes (GOG-LME). In 2006, the Guinea Current LME Project expanded the project scope to 10 neighboring countries (Guinea-Bissau, Guinea, Sierra Leone, Liberia, Sao Tome and Principe, Equatorial Guinea, Gabon, Republic of the Congo, Democratic Republic of the Congo, and Angola) (GOG-LME, Table 4). The Guinea Current LME Project includes 15 out of the 19 countries within the Atlantic humpback dolphin's range and is a regional effort to assess, monitor, and restore the ecosystem and enhance its sustainability (which aims to conserve and prevent the degradation of the nearshore habitats along portions of the Atlantic Coast of Africa). However, government agencies in many range countries lack the resources to fully implement any conservation measures resulting from this declaration (Doumbouya *et al.* 2017; CMS 2022; Minton *et al.* 2022).

Revised African Convention on the Conservation of Nature and Natural Resources (Revised African Convention)

The Convention was adopted by the Assembly of the African Union on July 11, 2003 in Maputo, Mozambique and entered into force on July 23rd, 2016 (Revised African Convention). This Convention is the result of a thorough revision of the original Algiers Convention (adopted in 1968) (African Convention). The Revised African Convention is a comprehensive regional treaty on environment and natural resources conservation, and the first to deal with an array of sustainable development matters, including quantitative and qualitative management of natural resources such as soil and land, air and water, and biological resources (Revised African Convention). The main objectives of this Convention are: (1) to enhance environmental protection, (2) to foster the conservation and sustainable use of natural resources, and (3) to harmonize and coordinate policies in these fields. The contracting parties that are signatories to the Revised African Convention are: Angola, Mauritania, Senegal, Guinea-Bissau, Nigeria, Equatorial Guinea, Democratic Republic of the Congo, The Gambia, Guinea, Togo, Benin, Gabon, Republic of the Congo, Sierra Leone, Liberia, Côte d'Ivoire, and Ghana, which includes 17 out of the 19 range countries of *S. teuszii* (Revised African Convention, Table 4). As of February, 2022, 7 of these range countries (Angola, The Gambia, Benin, Republic of the Congo, Liberia, Côte d'Ivoire, and Ghana) have officially ratified the Convention (Revised African Convention). While the Revised African Convention provides a framework within which broad conservation and sustainable development objectives may be pursued to provide environmental regulation at the regional level, it does not specifically address Atlantic humpback dolphin conservation. Furthermore, financing the Revised African Convention has been a challenge and is crucial to implementation of its provisions as well as managing compliance of its parties. The provisions of the 2003 Revised African Convention emphasize the need for its member states to mobilize financial resources individually or jointly from bilateral or multilateral funding sources (Erinosho 2013). While the financial provisions of the 2003 Revised African Convention are an improvement on the 1968 African Convention (which was silent on issues of funding) the funding provisions are largely generic (Erinosho 2013). The successful implementation of the Revised African Convention is dependent on its procedures for implementation and compliance which are made possible with adequate financial backing from its parties. However, this remains a challenge for a number of African countries that are signatories to the Revised African Convention, as resources to fully implement the treaty are currently lacking (Erinosho 2013).

Domestic Laws and Regulations

Information on the existence of domestic laws or regulations that specifically apply to the Atlantic humpback dolphin is sparse. However, four countries within the species' range, Morocco, Senegal, Cameroon, and Gabon, have laws and measures in place to protect the species and reduce cetacean bycatch (CMS 2022).

Morocco

To help mitigate threats to the Atlantic humpback dolphin, Morocco's Order of the Minister of Agriculture, Maritime Fisheries, Rural Development and Waters and Forests, relating to the temporary ban on fishing for mammals, turtles, and certain other marine species, prohibits fishing for *S. teuszii* in Moroccan maritime waters for a period of 25 years, beginning on June 1, 2023 (Arrêté N° 464-23, signed on February 21, 2023).

Senegal
In Senegal, monofilament nets are officially banned in Senegalese waters (Belhabib *et al.* 2014). Senegal enacted a prohibition on the import, sale, purchase, and use of monofilament nets in 1987[6]. Updated versions of the law were passed in 1988 and 2015[6]. However, the law is not well enforced and gillnets are still widely used in the nearshore waters of Senegal (Belhabib *et al.* 2014; Thiao *et al.* 2017). Lack of enforcement is largely because Senegal has neither the resources nor the capacity to enforce fishing regulations (Diedhiou and Yang 2018). In an April 2023 news article from "*Voice of America",* which discusses the threats faced by the Atlantic humpback dolphin in Senegalese waters, the author observed that enforcement of the monofilament net ban was largely 'nonexistent'[6]. Additionally, Senegal's Director of Marine Fisheries also acknowledged the nets are still used (but insisted the ban is enforced)[6].

Cameroon
In Cameroon, recent advocacy efforts by CCAHD partners led to the full legal protection of the Atlantic humpback dolphin (along with four other marine mammal species) in 2020 (Arrêté N°0053/MINFOF, passed on April 1, 2020; Minton *et al.* 2022b). Receiving full legal protection may help mitigate threats to the Atlantic humpback dolphin in the waters of Cameroon.

Gabon
In Gabon, there is a ban for setting gillnets in estuaries under Law No. 042/2018 of July 5, 2019 on the Penal Code in the Gabonese Republic and under the Gabonese Decree 0579/PR/MPE of November 30, 2015 (CMS 2022) (G. Minton pers. comm., January 16, 2023). However, this law and decree are not well enforced (G. Minton pers. comm., January 4, 2023). Additionally, a local agreement on beach seine practices is intended to reduce bycatch in Gabon, however, limited progress is being made regarding bycatch mitigation (CCAHD).

Summary
Overall, the majority of *S. teuszii* range countries are members or signatories to a number of international and regional conventions and agreements that would require them to take concrete measures to protect the Atlantic humpback dolphin and mitigate threats (Table 4). Furthermore, as part of the work on drafting an Action Plan for the CMS CA, a formal review of the legal status and relevant protection measures and instruments for the species in each range country is currently underway, which is likely to confirm that the Atlantic humpback dolphin is legally protected in most range countries (CMS 2022). However, despite this diverse array of legal instruments, CCAHD members report that legal protection 'on paper' has not translated into meaningful or effective protection on the ground in many range countries. This is largely

[6] Voice of America, Senegal: Critically Endangered Dolphin Threatened by Illegal Fishing Nets (April 11, 2023), available at *https://www.voanews.com/a/senegal-critically-endangered-dolphin-threatened-by-illegal-fishingnets/7045150.html.*

because a number of government agencies in many range countries lack the resources to effectively monitor and mitigate bycatch or design and implement research and conservation measures specific to the Atlantic humpback dolphin (Minton *et al.* 2022b). Moreover, a recent study by Doumbouya *et al.* (2017) found that the capacity for monitoring, control, and surveillance systems of illegal fishing within the waters of six *S. teuszii* range countries (The Gambia, Guinea, Guinea-Bissau, Mauritania, Senegal, and Sierra Leone) was 'relatively weak'. The study attributed the weakness to 'poor governance and high corruption combined with high monitoring costs' (Doumbouya *et al.* 2017). Furthermore, while many range countries appear to have general protections for marine mammals in fisheries (*e.g.* prohibiting directed catch of protected species), few have specific protections for the Atlantic humpback dolphin and effective bycatch mitigation has not been documented in most *S. teuszii* range countries (CCAHD 2020; CMS 2022) (CCAHD). This is of particular concern, given that bycatch is considered the primary cause of *S. teuszii* mortality and poses an immediate threat to the species. Thus, we determine that existing regulatory mechanisms are inadequate and pose an immediate range-wide threat to the species.

4.5 (E) Other Natural or Manmade Factors Affecting the Species' Continued Existence

Anthropogenic Underwater Noise

Small odontocete cetaceans, including the Atlantic humpback dolphin, rely upon a highly developed acoustic sensory system and rely on echolocation to navigate, feed, and communicate with other individuals in the marine environment (Weilgart 2017). It is also widely recognized that anthropogenic sound sources and the resulting anthropogenic underwater noise can have potential impacts on cetaceans' welfare including hearing loss, tissue damage, behavioral disturbance, displacement from important habitats, masking of communication sounds and even cognition when the added noise exceeds the threshold levels of the species (Wartzok and Ketten 1999; Whittaker and Young 2018; Erbe *et al.* 2019; Stevens *et al.* 2021). Additionally, anthropogenic underwater noise has been shown to elicit a variety of stress responses from other cetacean species, such as the bottlenose dolphin and beluga whale, with a possible connection to a higher likelihood in occurrence of strandings (Ketten 1995; Gordon and Moscrop 1996; Richardson and Wursig 1997; Nowacek *et al.* 2007; Whittaker and Young 2018).

Underwater noise from coastal development activities such as drilling, pile-driving, explosions, and dredging are likely to affect many of the coastal habitats relied upon by Atlantic humpback dolphins (Weir *et al.* 2021). Additionally, engine, propeller cavitation, and sonar noise from different vessel types (*e.g.* pirogues, dredgers, trawlers and tankers) may reach sufficient amplitude and duration such that the health and/or behavior of coastal marine mammals in the area (including Atlantic humpback dolphins) are negatively affected (Whittaker 2018; Erbe *et al.* 2019; Weir *et al.* 2021). Hydrocarbon exploration using high-amplitude impulsive sounds may also affect Atlantic humpback dolphins, as has been noted in other cetaceans (Cerchio *et al.* 2014; Weir *et al.* 2021). Even though geophysical seismic surveys along the Atlantic coast of Africa are primarily focused on the continental slope, some also occur in neritic habitat (Weir *et al.* 2021).

Small odontocete cetaceans use clicks and whistles for communication with other individuals, and are strongly dependent on passive hearing and active echolocation for navigation, finding prey, and predator avoidance (Reeves *et al.* 2003; Stevens *et al.* 2021). Although studies in this species have been scarce, there are acoustic recordings of the species made in Namibe province, Angola (Weir 2010). The whistles of the Atlantic humpback dolphin were found to be comparable to *S. chinensis,* composed of general low frequencies and a 92% occurrence of harmonics (Weir 2010). Therefore, knowledge on this species indicates that sound is important to Atlantic humpback dolphin functioning and survival. Given the increasing development activities within the dolphin's habitat along the west coast of Africa particularly related to coastal construction activities (especially port construction and expansion) and the oil and gas industry (*e.g.* development of platforms, ports, pipelines, liquefied natural gas plants), anthropogenic underwater noise to the Atlantic humpback dolphin is likely to increase in the future.

Summary
Overall, anthropogenic underwater noise is expected to continue and likely increase well into the future. Additionally (as noted in Section 4.1(A)), habitat-related threats and associated coastal development activities (*e.g.* oil and gas activities, port development, and other urban development projects) are projected to increase resulting in increased anthropogenic underwater noise to the Atlantic humpback dolphin's habitat. While there are no studies analyzing the impacts of anthropogenic underwater noise on Atlantic humpback dolphins specifically, findings have been made in other dolphin species (such as bottlenose dolphins) to indicate that

Table 4. A summary of the international and regional conventions and agreements to which *S. teuszii* range countries are signatories and/or parties. Source: Table modified from information provided by CCAHD.

Country	CMS	CMS Western African Aquatic Mammals MoU	CITES[1]	Abidjan Convention	IWC	CBD	GOG-LME	UNCLOS	Ramsar Convention	Revised African Convention
Angola	✓	✓	✓[2]			✓	✓	✓	✓	✓
Benin	✓	✓	✓[3]	✓	✓	✓	✓	✓	✓	✓
Cameroon	✓		✓2	✓	✓	✓	✓	✓	✓	
Côte d'Ivoire	✓	✓	✓[4]	✓	✓	✓	✓	✓	✓	✓
Democratic Republic of the Congo	✓		✓2			✓	✓	✓	✓	✓
Equatorial Guinea	✓	✓	✓2			✓	✓	✓	✓	✓
Gabon	✓	✓	✓3	✓	✓	✓	✓	✓	✓	✓
Ghana	✓	✓	✓4	✓	✓	✓	✓	✓	✓	✓
Guinea	✓	✓	✓3	✓	✓	✓	✓	✓	✓	✓
Guinea-Bissau	✓	✓	✓2	✓	✓	✓	✓	✓	✓	✓
Liberia	✓	✓	✓4	✓	✓	✓	✓	✓	✓	✓
Mauritania	✓	✓	✓2	✓	✓	✓		✓	✓	✓
Morocco	✓		✓2	✓	✓	✓		✓	✓	
Nigeria	✓		✓2	✓		✓	✓	✓	✓	✓
Republic of the Congo	✓	✓	✓3	✓	✓	✓	✓	✓	✓	✓

[1] CITES member designations as Category 1, 2, or 3 are based on the document "Status of Legislative Progress for Implementing CITES" (updated November 2022), available at https://cites.org/sites/default/files/documents/legislation-status/legislation-status.pdf.
[2] Country is a Category 1 CITES member
[3] Country is a Category 2 CITES member
[4] Country is a Category 3 CITES member

Country	CMS	CMS Western African Aquatic Mammals MoU	CITES[1]	Abidjan Convention	IWC	CBD	GOG-LME	UNCLOS	Ramsar Convention	Revised African Convention
Senegal	✓		✓2	✓	✓	✓		✓	✓	✓
Sierra Leone			✓4	✓		✓	✓	✓	✓	✓
The Gambia	✓		✓3	✓	✓	✓		✓	✓	✓
Togo	✓	✓	✓3	✓	✓	✓	✓	✓	✓	✓

[1]CITES member designations as Category 1, 2, or 3 are based on the document "Status of Legislative Progress for Implementing CITES" (updated November 2022), available at https://cites.org/sites/default/files/documents/legislation-status/legislation-status.pdf.
[2] Country is a Category 1 CITES member
[3] Country is a Category 2 CITES member
[4] Country is a Category 3 CITES member

anthropogenic underwater noise negatively affects dolphins' welfare and inhibits their functioning and survival (Ketten 1995; Gordon and Moscrop 1996; Richardson and Wursig (Ketten 1995; Gordon and Moscrop 1996; Richardson and Wursig 1997; Nowacek *et al.* 2007; Whittaker and Young 2018; Erbe *et al.* 2019). Vulnerability to anthropogenic underwater noise is an issue of particular concern for all odontocete cetaceans, which are sensitive to a wide range of acoustic frequencies and are dependent on their echolocation abilities to survive (Jefferson 2019). Thus, based on the available information, we conclude that anthropogenic underwater noise likely poses some degree of a threat to the Atlantic humpback dolphin at present.

5. EXTINCTION RISK ANALYSIS

5.1 Approach to Assessing Extinction Risk

According to section 4 of the ESA, the Secretary (of Commerce or the Interior) determines whether a species is threatened or endangered as a result of any (or a combination) of the following factors: destruction or modification of habitat, overutilization, disease or predation, inadequacy of existing regulatory mechanisms, or other natural or manmade factors. Collectively, we simply refer to these factors as "threats." In addition to reviewing the best available data on threats to the Atlantic humpback dolphin, it is important to consider both the demographic risks facing the species, as well as current and potential threats that may affect the species' status. To this end, we assessed the extinction risk for the Atlantic humpback dolphin by considering two types of information: (1) demographic viability, as assessed by its abundance, growth rate/productivity, spatial structure/connectivity, and genetic diversity; and (2) threats faced by the species (*e.g.,* fisheries bycatch, habitat destruction, inadequate regulatory mechanisms) as described in terms of the ESA 4(a)(1) factors (see Section 4.0).

Demographic characteristics of, and threats to, the Atlantic humpback dolphin, now and in the foreseeable future, were used to estimate the overall risk of extinction. We analyzed the contribution of each factor to the risk of extinction separately and considered the synergistic effects of all relevant factors. Specifically, we considered information for each of the four Viable Population (VP) factors of abundance, productivity, spatial distribution, and diversity as described in McElhany *et al.* (2000) and Wainwright and Kope (1999). These factors are useful indicators of extinction risk when considered alongside threats to the species, and reflect concepts well-founded in conservation biology. These demographic factors reflect the manifestation of past threats that have contributed to the species' current status, and consideration of these factors also informs our evaluation of the biological response of the species to present and future threats. This approach has been used in many status reviews and has been successful in assessing extinction risk for a number of species listed under the ESA including Pacific salmonids, Pacific hake, Pacific cod, black abalone, thresher sharks, hammerhead sharks, oceanic whitetip sharks, killer whales, and the Taiwanese humpback dolphin (see http://www.nmfs.noaa.gov/pr/species/ for links to these reviews). These characteristics were analyzed using the best available scientific and commercial information as required by the ESA.

Because information on the Atlantic humpback dolphin is frequently sparse and often non-quantitative, we used qualitative risk categories to characterize each demographic risk factor and each threat. We assigned a qualitative risk score to each of the four VP factors (abundance, productivity, spatial distribution, and diversity) and each threat (as described in terms of the ESA 4(a)(1) factors (see Section 4.0)). All demographic factors and threats were ranked on a scale of 0 ("unknown risk") to 3 ("high risk") based on their likelihood to contribute to the Atlantic humpback dolphin's risk of extinction. If there were insufficient data available to assess a particular demographic risk factor or threat, we ranked it as 0 ("unknown risk"); the determination of risk relied upon the most current literature and best scientific understanding of the species' status and threat impact. We first considered each demographic factor and threat separately. However, evaluating demographic factors and threats separately may underestimate the synergy and interaction among them. Thus, demographic factors and threats were also evaluated holistically to determine the overall likelihood of extinction now, and in the foreseeable future.

Below are the definitions that were used for each ranking:

0 = Unknown: The current level of information is either unavailable or unknown for this particular factor, such that the contribution of this factor to the species' risk of extinction cannot be determined.

1 = Low risk: It is unlikely that the particular factor directly contributes or will contribute significantly to the species' risk of extinction.

2 = Moderate risk: It is likely that the particular factor directly contributes or will contribute significantly to the species' risk of extinction.

3 = High risk: It is highly likely that the particular factor directly contributes or will contribute significantly to the species' risk of extinction.

(*Please Note: the term "significantly" is used here as it is generally defined – i.e., in a sufficiently great or important way as to be worthy of attention.*)

Lastly, all information from the demographic risk analysis and the threats assessment was synthesized to estimate the overall risk of extinction for the Atlantic humpback dolphin. For this analysis, we used three levels of extinction risk ("low," "moderate," and "high"), as defined in the NMFS Guidance on Responding to Petitions and Conducting Status Reviews under the Endangered Species Act (updated February 1, 2021):

1 = Low risk: A species is at low risk of extinction if it is not at moderate or high level of extinction risk (see "Moderate risk" and "High risk" definitions below). A species may be at low risk of extinction if it is not facing threats that result in declining trends in abundance, productivity, spatial structure, or diversity. A species at low risk of extinction is likely to show stable or increasing trends in abundance and productivity with connected, diverse populations.

2 = Moderate risk: A species is at moderate risk of extinction if it is on a trajectory that puts it at a high level of extinction risk in the foreseeable future (see description of "High risk" below). A species may be at moderate risk of extinction due to current and/or projected threats or declining trends in abundance, productivity, spatial structure, or diversity. The appropriate time horizon for evaluating whether a species is more likely than not to be at high risk in the foreseeable future depends on various case- and species-specific factors. For example, the time horizon may reflect certain life history characteristics (*e.g.,* long generation time or late age-at-maturity) and should also reflect the time frame or rate over which identified threats are likely to impact the biological status of the species (*e.g.,* the rate of disease spread).

3 = High risk: A species with a high risk of extinction is at or near a level of abundance, productivity, spatial structure, and/or diversity that places its continued persistence in question. The demographics of a species at such a high level of risk may be highly uncertain and strongly influenced by stochastic or depensatory processes. Similarly, a species may be at high risk of extinction if it faces clear and present threats (*e.g.,* confinement to a small geographic area; imminent destruction, modification, or curtailment of its habitat; or disease epidemic) that are likely to create imminent and substantial demographic risks.

It is important to note that at no point in this analysis was an explicit recommendation made to list the species as threatened or endangered. Rather, we made scientific conclusions about the overall risk of extinction faced by the species under present conditions and in the foreseeable future based on an evaluation of the species' demographic risks and assessment of threats.

Defining the "Foreseeable Future"
The appropriate time horizon for evaluating whether a species is likely to be at a high level of risk in the "foreseeable future" depends on various case- and species-specific factors. For example, the time horizon may reflect certain life history characteristics (*e.g.,* long generation time or late age-at-maturity) and the time scale over which identified threats are likely to impact the biological status of the species (*e.g.,* the rate of disease spread). In other words, the "foreseeable future" represents the period of time over which we can reasonably determine that both the specific threats facing the species and the species' response to those threats are likely. We note however, that the foreseeable future is not limited to the period that status can be quantitatively modeled or predicted within predetermined limits of statistical confidence. The "foreseeable future" also need not be identified as a specific period of time and may vary depending on the particular threat.

In considering an appropriate "foreseeable future" for this extinction risk analysis, we took into account the best available information regarding both the life history of the Atlantic humpback dolphin and threats to the species. Due to uncertainty regarding the species' life history parameters, we do not define a quantitative "foreseeable future" timeframe in the risk assessment sections below. Thus, "foreseeable future" is stated qualitatively, in terms of the projected trend of each threat.

5.2 Demographic Risk Assessment

Abundance
There are no historical abundance estimates for the Atlantic humpback dolphin. While historical and robust range-wide abundance estimates are lacking, and there are no robust estimates

available for most of the recognized management stocks, the available information for the eleven recognized management stocks suggests stocks range from the tens to low hundreds of individuals (Table 2). Most stocks for which data are available are extremely small and several appear to be isolated and risk local extirpation (*e.g.* Dakhla Bay, Banc d'Arguin, and Angola) (Van Waerebeek *et al.* 2003; Van Waerebeek *et al.* 2004; Weir 2009; Weir *et al.* 2011; Collins 2015; Van Waerebeek *et al.* 2017; Table 2). Considering the relatively small numbers observed, and taking into account the many areas of the species' range where there has been little or no assessment, available published estimates suggest that the species' total abundance consists of no more than 3,000 individuals (Collins 2015; Collins *et al.* 2017), indicating that the number of mature individuals is likely less than 1,500 (following Taylor *et al.* 2007). Additionally, declines in abundance have been observed or are suspected, and continued declines are expected due to the ongoing and projected expansion of identified threats throughout the species' range as described in Section 4.0. Bycatch in fisheries, which is considered the main cause of these declines, has not ceased and may be increasing as new fishing areas are targeted and fishery pressures increase, thus placing additional pressure on already low and declining Atlantic humpback dolphin stocks.

With fewer than 3,000 individuals likely remaining and available information indicating that the species consists of small, fragmented stocks (with some numbering in the tens of individuals) coupled by observed or suspected declines throughout the species' range, even a single mortality event could impact some of the smaller stocks' continued viability. Furthermore, the species' low abundance and fragmented and narrow distribution greatly increases the impact of anthropogenic perturbations (*e.g.* coastal development and anthropogenic underwater noise) on the species as a whole, and decreases the species resilience to environmental change (*e.g.* climate change) (Davidson *et al.* 2012; Collins 2015; Weir *et al.* 2021). Overall, the available information indicates that the Atlantic humpback dolphin's low abundance poses a **high** risk, meaning it is highly likely that the particular factor directly contributes or will contribute significantly to the species' risk of extinction (Table 5).

Growth Rate and Productivity

Although information on Atlantic humpback dolphin reproduction is almost completely absent, some data regarding reproductive parameters for other species in the genus, (*e.g. S. chinensis* and *S. plumbea*), are available. For example, *S. chinensis* has an annual estimated birth rate of 0.053 ± 0.025, with an annual recruitment rate of 0.028 ± 0.024, and a calf survival rate to 1 year old of 0.600 ± 0.392, with females experiencing a long inter-birth interval (4.27 ± 1.06 y) (Zeng *et al.* 2021). *S. plumbea* has a reported ovulation rate of 0.2 with a 5-year calving interval (Plon *et al.* 2015). Thus, this can be used to infer that *S. teuszii* likely has a low reproductive rate as well. *S. teuszii*'s likely low reproductive rate coupled with a population growth rate (r) of 0.00, calculated by Taylor *et al.* (2007), indicates a low intrinsic potential for population increase (Taylor *et al.* 2007; Jefferson and Rosenbaum 2014; Collins 2015; Moore 2015). However, it should be noted that the calculation by Taylor *et al.* (2007) was based on several reproductive parameters that are lacking for this species. Thus, this calculation may not be indicative of the actual population growth rate for this species (due to data deficiencies). Consequently, taking into consideration the ongoing and projected increase of identified range-wide threats, this species may be experiencing a low population growth rate. An estimated generation length of 18.4 years is given for *S. teuszii* by Taylor *et al.* (2007), although Moore (2015) provided a

figure closer to 25 years for the Indo-Pacific humpback dolphin (*S. chinensis*) and Indian Ocean humpback dolphin (*S. plumbea*) (Collins 2015; Collins *et al.* 2017).
Because Atlantic humpback dolphins are thought to consist of small, fragmented stocks, any mortality over and above natural rates is likely to lead to appreciable declines in abundance (Pimm *et al.* 1988). Moore (2015) estimated that given an inferred generation time of 25 years (as estimated for *S. chinensis* and *S. plumbea*), an average annual adult mortality rate of approximately 4% across the species' range would lead to a 50% decline over 75 years (i.e. three generations) (Collins 2015; Collins *et al.* 2017). The International Union for Conservation of Nature's (IUCN) assessment for this species uses Moore's estimate and further notes that a slightly higher adult mortality rate of 5.3% per year (equal to one or two additional deaths per year per 100 mature individuals) would lead to an 80% decline over 75 years (i.e. three generations) (Moore 2015; Collins *et al.* 2017). Data for some areas (*e.g.,* The Republic of the Congo) indicate that human-caused mortality (particularly via bycatch) is high and when those data are considered alongside the scale of other anthropogenic pressures (*e.g.* coastal development), a population decline of 50% over three generations is highly likely (Moore 2015; Collins *et al.* 2017). While the actual rate of decline is unknown, the available abundance and bycatch data (see Sections 3.0 and 4.2) suggest the species is declining throughout its range, and there is no information to suggest such a trend would reverse. Additionally, given the available information and likely low population growth rate (as discussed above), it is likely that the low population growth rate poses a **moderate** risk to the species meaning it is likely to directly contribute or will contribute significantly to the species' risk of extinction (Table 5).

Spatial Structure and Connectivity
The Atlantic humpback dolphin has a restricted range and fragmented distribution, being a shallow water dolphin endemic to (sub)tropical nearshore waters along the Atlantic coast of Africa, ranging discontinuously for approximately 7,000 km from Morocco in the north to Angola in the south (Collins 2015; Weir and Collins 2015; Collins *et al.* 2017). Within that range, the species' habitat preferences appear to limit it to habitats shoreward of the 20 m depth isobaths (Weir and Collins 2015; Weir *et al.* 2021), and thus they are often in immediate vicinity to the coast. Use of nearshore habitat increases the species' vulnerability to incidental capture (i.e. bycatch) in non-selective fishing gears and to habitat-related threats from human activities (i.e. coastal development). Additionally, the species fragmented distribution makes stocks more vulnerable to local extirpation.

Direct data on connectivity among Atlantic humpback dolphin stocks are sparse. Although the mitogenome of *S. teuszii* (n = 1) has been sequenced, genetic data to assess population structure and connectivity are not available. Thus, the genetic connectivity across and within stocks cannot be directly assessed. However, work investigating the genetic substructure for the Indian Ocean humpback dolphin, *S. plumbea* (the species that is geographically and morphologically most similar to *S. teuszii*) indicated appreciable genetic divergence between populations in neighboring regions with less diversity between neighboring populations and low overall mtDNA diversity (Mendez *et al.* 2011; Lampert *et al.* 2021). This suggests that similar structuring is possible within *S. teuszii* (Collins 2015).

Research suggests that individuals occur in a series of localized communities with little interchange identified between them (Maigret 1980a; Van Waerebeek *et al.* 2003; Van

Waerebeek *et al.* 2004; Weir 2009; Collins 2015; Weir 2016; Collins *et al.* 2017; Section 2.2). Movements on larger scales are rarely documented, but have been inferred (Collins 2015; Section 2.2). While records suggest transboundary movements between some range countries, such as between Saloum-Niumi (Senegal-The Gambia), Bijagos (Guinea-Bissau), and across the Gabon/Congo border, it remains unclear if these individuals range farther afield (Van Waerebeek *et al.* 2004; Collins 2015; Weir 2016; Collins *et al.* 2017). The threat of habitat loss due to coastal development projects (i.e. port development), is widespread, increasing, and frequently overlaps with the species' preferred habitat (Collins 2015; Figure 9). Habitat loss due to ongoing and expanding coastal development projects could also cause additional fragmentation of stocks, thus increasing the risk of extirpation of stocks in the near future.

Overall, based on the Atlantic humpback dolphin's restricted range and fragmented distribution, coupled with evidence for the species' tendency for localized residency, indicates that connectivity of *S. teuszii* is limited. Limited exchange between stocks would reduce the recovery potential for resident stocks that have experienced severe declines. Thus, given the available information, it is likely that this demographic factor poses a **moderate** risk to the species, meaning it is likely to directly contribute or will contribute significantly to the species' risk of extinction. However, additional research on this topic is needed for the Atlantic humpback dolphin to further elucidate this species' population structure and genetic diversity (Table 5).

Genetic Diversity

As discussed in Section 2.6 and in the above section, data do not exist to address the genetic diversity of the Atlantic humpback dolphin. Additionally, most of the genetic data that have been collected to date for this species were generated to investigate the overall phylogenetic relationships within the *Sousa* genus, and no study has examined *S. teuszii* population structure or genetic diversity (CCAHD 2020). Thus, it is unclear how much genetic diversity exists within the species as a whole, whether it occurs as genetically-distinct populations (with limited inter-population breeding, due to geographic isolation), and if any connectivity in gene flow exists between those populations (either at present, or in the past) (CCAHD 2020; Weir *et al.* 2021). Consequently, without any genetic analyses to determine diversity or effective population size for *S. teuszii*, it is **unknown** at this time whether this demographic factor is a threat contributing to the species' risk of extinction (Table 5).

Table 5. Summary of demographic risk factors for *S. teuszii* and the relative likelihood that each factor is contributing to extinction risk for the species. Characterizations of the relative likelihood (unknown, low, moderate, high) that a particular factor is contributing in a significant way to the extinction risk of the species are explained further in the text above.

Demographic Risk	Likelihood
Abundance	High
Growth Rate and Productivity	Moderate
Spatial Structure and Connectivity	Moderate
Genetic Diversity	Unknown

5.3 Threats Assessment

Based on the analysis of the five ESA section 4(a)(1) factors (see Section 4.0) the risk of extinction for the species was assessed over the foreseeable future. As noted in Section 5.1, we determined "foreseeable future" qualitatively, in terms of the projected trend of each threat and the general timeframe over which we could reasonably determine the impact of the particular threat.

Of the five ESA section 4(a)(1) factors, overutilization, habitat destruction, modification, or curtailment, and inadequacy of existing regulatory mechanisms were identified as most concerning in terms of their contribution to the species' risk of extinction. The other factors, including disease and predation, and other natural or manmade factors affecting the species' continued existence, were not identified as contributing significantly to the species' risk of extinction now or in the foreseeable future. Below is a summary of the conclusions regarding the main threats to the Atlantic humpback dolphin.

Habitat Destruction, Modification, or Curtailment

The Atlantic humpback dolphin is a narrowly distributed species, known to occur shoreward of the 20 m depth isobaths (Weir and Collins 2015; Weir *et al.* 2021) within the (sub)tropical nearshore waters of the Atlantic African coast (Van Waerebeek *et al.* 2004; Collins 2015; Weir and Collins 2015; Collins *et al.* 2017). This places the species within areas that are in the vicinity of or overlapping with a number of coastal development projects (i.e. port development projects and liquefied natural gas plants) which occur in many locations within the species' range (Collins 2015; Li 2020; Weir *et al.* 2021). Additionally, oil and gas exploration and extraction activities currently occur in a number of countries in the central and southern portions of the species' rangea (Ukwe and Ibe 2010; Weir and Pierce 2013; Minton *et al.* 2017). It has also been noted that *S. teuszii* populations inhabited the Niger Delta prior to the development of large scale oil exploration and extraction, which subsequently altered the coastal environment (International Whaling Commission 2011). Furthermore, several major port cities are situated within the geographic range of Atlantic humpback dolphins, and the tendency for the species to occupy bays and estuarine systems increases its susceptibility to contaminants and pollution, and disturbance from shipping and industrial activities associated with cities and ports. With economic growth of sub-Saharan Africa increasing (PWC 2018; IMF 2022), port developments have also increased over the years and are projected to expand, along with an associated increase in vessel traffic (see Section 4.1). At least three ports that have recently undergone or are undergoing expansion are close to areas where Atlantic humpback dolphins were recently sighted (Rogers 2017).

Predicted global increases in seawater temperatures associated with climate change could potentially have a favorable outcome for Atlantic humpback dolphins, since the species is generally limited to areas where mean annual seawater temperatures exceed 15°C (Weir *et al.* 2011; Weir and Collins 2015). Consequently, global warming could increase the availability of suitable habitat and result in range expansion. However, it is also noted that the Atlantic humpback dolphin's narrow distribution and limited range restricts it to a relatively narrow ecological niche which could also decrease its resilience environmental change (Davidson *et al.* 2012; Collins 2015; Weir *et al.* 2021). Thus, due to the absence of data, it is currently unknown if climate change poses a significant threat to the Atlantic humpback dolphin at present.

Widespread coastal development results in extensive damage to benthic environments, alterations to water flow and quality, and contamination and pollution, all of which degrade or eliminate the already restricted nearshore habitat of the Atlantic humpback dolphin. Additionally, habitat fragmentation resulting from these activities, has serious implications for a species already restricted to narrow geographic and ecological niches consisting of small, fragmented stocks. Coastal development activities have increased over the past decade, with little indication that these activities will decline or cease in the foreseeable future. Thus, the impacts of these threats on the Atlantic humpback dolphin will likely continue and may intensify in the foreseeable future. Thus, we determined that destruction, modification, and curtailment of habitat in the form of coastal development poses a **high** risk, meaning it is highly likely that it directly contributes or will contribute significantly to the species' risk of extinction (Table 6). We are confident that this risk will be exacerbated in the foreseeable future. Because the effects of contaminants and pollutants on the Atlantic humpback dolphin have not been studied, the degree to which contamination and pollution of habitat impact the species' continued viability remains **unknown** (Table 6). Furthermore, while climate change may indirectly affect the Atlantic humpback dolphin's habitat and food availability, it is currently **unknown** if climate change is a factor that contributes to the Atlantic humpback dolphin's extinction risk, now or in the foreseeable future (Table 6).

Overutilization
The Atlantic humpback dolphin's preference for shallow, nearshore, and estuarine habitats, increases its susceptibility and exposure to inshore artisanal and commercial fisheries and associated gear such as artisanal gillnets, beach seines, and pot/trap line (*e.g.* octopus trap lines). The best available information indicates that the primary threat facing the Atlantic humpback dolphin is bycatch in artisanal gillnets. Bycatch in artisanal gillnets is considered widespread throughout the species' range, and is considered linked to population declines (Campredon and Cuq 2001; Van Waerebeek *et al.* 2004; Collins 2015; Leeney *et al.* 2015; Collins *et al.* 2017; Brownell *et al.* 2019; Jefferson 2019; Weir *et al.* 2021; Figure 10). As noted in Section 4.2, bycatch in fisheries has not ceased and may intensify in the foreseeable future as new fishing areas are targeted and fishing pressure increases (Collins 2015). The use of stranded or bycaught Atlantic humpback dolphins for human consumption or fishing bait has also been documented throughout the species' range (Clapham and Van Waerebeek 2007; Weir and Pierce 2013; Collins 2015; Van Waerebeek *et al.* 2017; Ingram D.J. *et al.* 2022). While there is some indication of secondary (i.e. non-targeted) use of dolphin bycatch, it is evident that the species has been, and is directly and increasingly being targeted for food in many areas across its range (Weir and Pierce 2013; Collins 2015; Leeney *et al.* 2015). This, coupled with the fact that effective bycatch mitigation has not been documented in most *S. teuszii* range countries (CCAHD 2020) and lack of effective monitoring and enforcement throughout much of the species' range to protect the species from targeted hunting places additional pressure on already small, likely fragmented, and declining Atlantic humpback dolphin stocks (Doumbouya *et al.* 2017; CMS 2022; Minton *et al.* 2022b).

The depletion of prey resulting from intensive and unsustainable commercial and artisanal exploitation of fish stocks may be a contributing factor to declining Atlantic humpback dolphin stocks (Van Waerebeek *et al.* 2004; Weir 2011), which is likely to increase in the foreseeable future, as some fish predated by Atlantic humpback dolphins (*e.g.* mullet, *Mugil* spp.) are targeted by coastal fisheries (Cadenat 1956; Maigret 1980b; Weir 2016). Additionally, resource competition between dolphin and human communities will continue for the foreseeable future due to a high reliance on artisanal fishing for the protein intake and livelihoods of impoverished coastal communities within the range countries (Weir *et al.* 2021).

The future potential for ecotourism activities to grow into a recreational use of the species exists, as infrastructure and political stability improve in some *S. teuszii* range countries. If managed responsibly, dolphin watching and/or more general marine and coastal eco-tourism activities could provide economic incentive to protect Atlantic humpback dolphins and their habitats. However, if not managed appropriately, these activities could directly or indirectly impact the dolphins and their habitat (Moores 2018; Weir *et al.* 2021). However, the overall potential impacts resulting from ecotourism activities are **unknown** at this time.

Given the information above, we determined that overutilization of the species for commercial, recreational, scientific, or educational purposes in the form of fisheries bycatch and human use both poses a **high** level threat to the Atlantic humpback dolphin now and in the foreseeable future (Table 6). Depletion of the Atlantic humpback dolphin's prey resources due to overfishing by commercial and artisanal fisheries likely impact the continued viability of the species by targeting some fish species that this dolphin is known to feed upon. Thus, we determined that depletion of prey resources poses a **moderate** level threat to the Atlantic humpback dolphin, meaning it is likely that it directly contributes or will contribute significantly to the species' risk of extinction, and we expect this threat to continue over the foreseeable future. (Table 6). While ecotourism is increasing in some countries within the species' range, and the activities associated with ecotourism may affect the Atlantic humpback dolphin and its habitat, it is currently **unknown** if ecotourism is a threat that contributes to the Atlantic humpback dolphin's extinction risk, now or in the foreseeable future (Table 6).

Disease or Predation

It is possible that increased human activity may increase the Atlantic humpback dolphin's exposure or susceptibility to new and invasive parasites or disease across its range, and some parasites have been identified which affect other species within the genus *Sousa* (i.e. *S. chinensis*) (Yang *et al.* 2013; Whittaker and Young 2018; Banlunara *et al.* 2019). However, no species-specific data exist to determine whether parasites negatively affect the health or population status of the Atlantic humpback dolphin now or in the foreseeable future. Additionally, even though various types of vertebral column anomalies have been documented in several Atlantic humpback dolphins (Weir and Wang 2016), causative factors remain unknown and there is no data to indicate that these anomalies are contributing to the species' extinction risk now or in the foreseeable future. Sharks have been documented as known predators for other humpback dolphins in the genus *Sousa,* (i.e. *S. plumbea*), and have been responsible for several known attacks in South Africa (Yang *et al.* 2013; Whittaker and Young 2018; Banlunara *et al.* 2019). Furthermore, avoidance behaviors in the presence of killer whales have been observed in several humpback dolphins in the *Sousa* genus, but predation by killer whales has not been documented for the Atlantic humpback dolphin (Saayman and Tayler 1979; Jefferson and Karczmarski 2001). Thus, due to the absence of data, it is currently **unknown** if disease or predation are factors that contribute to the Atlantic humpback dolphin's extinction risk, now or in the foreseeable future (Table 6).

Inadequacy of Existing Regulatory Mechanisms
While a majority of Atlantic humpback dolphin range countries are members or signatories to a diverse array of international and regional conventions and agreements that would require them to take concrete measures to protect the Atlantic humpback dolphin and mitigate threats (Section 4.4; Table 4), such as CITES trade restrictions and protections afforded to CMS Appendix I species, few have adopted specific protections for the species, and effective bycatch mitigation has not been documented in most *S. teuszii* range countries (CCAHD 2020). This is a serious concern, given that bycatch is considered linked to the species' population decline and poses an immediate range-wide threat (Brashares *et al.* 2004; Van Waerebeek and Perrin 2007; Ayissi *et al.* 2014; Belhabib *et al.* 2014; Collins 2015; Collins *et al.* 2017). Additionally, regulatory mechanisms that currently exist are not adequately enforced or do not address the species' primary threats. Furthermore, government agencies in many range countries lack the resources to effectively monitor and mitigate threats and design and implement research and conservation measures specific to the Atlantic humpback dolphin (Doumbouya *et al.* 2017; CMS 2022). Thus, we determined that inadequacy of existing regulatory mechanisms, particularly due to lack of enforcement, resources, implementation, and/or effectiveness within each range country, contributes to a **high** risk of extinction meaning that it is highly likely that it directly contributes or will contribute significantly to the species' risk of extinction (Table 6).

Other Natural or Manmade Factors Affecting the Species' Continued Existence
We identified that other natural or manmade factors affecting the species' continued existence in the form of anthropogenic underwater noise poses a threat to the Atlantic humpback dolphin at present. Anthropogenic underwater noise is a serious concern for the Atlantic humpback dolphin, since (like other odontocete species) it is strongly dependent on vocalizations to maintain social bonds, and on passive hearing and active echolocation to communicate, navigate, find food, and avoid predators. As discussed in detail in Section 4.5, while there are no studies analyzing the impacts of anthropogenic underwater noise on Atlantic humpback dolphins, anthropogenic underwater noise has been found to disrupt the behavior and affect the functioning and survival of other dolphin species (Ketten 1995; Gordon and Moscrop 1996; Richardson and Wursig 1997; Nowacek *et al.* 2007; Weilgart 2017; Whittaker and Young 2018; Erbe *et al.* 2019). This threat is likely to increase in the foreseeable future along with the projected increase of port construction, associated increased vessel traffic, and other coastal development activities (which host major sources of noise) within the Atlantic humpback dolphin's habitat. Thus, we determined that anthropogenic underwater noise contributes a **moderate** risk of extinction meaning that it is likely that it directly contributes or will contribute significantly to the species' risk of extinction (Table 6).

Table 6. Summary of threats organized by the ESA section 4(a)(1) factors and their associated likelihood rankings. Characterizations of the relative likelihood (unknown, low, moderate, or high) that a particular threat is contributing or will contribute significantly to the Atlantic humpback dolphin's extinction risk are explained further in the text above.

ESA Factor	Threat	Likelihood
Habitat	Coastal Development	High
	Contaminants and Pollutants	Unknown
	Climate Change	Unknown
Overutilization	Fisheries Bycatch	High
	Depletion of Prey Resources	Moderate
	Use and Trade	High
	Ecotourism	Unknown
Disease or Predation	Disease	Unknown
	Predation	Unknown
Inadequate Regulations	Lack of Enforcement, Resources, Implementation, or Effectiveness	High
Other	Anthropogenic Underwater Noise	Moderate

5.4 Overall Extinction Risk

We identified several threats that likely affect the continued survival of the Atlantic humpback dolphin, including destruction modification, and curtailment of its habitat (*e.g.,* coastal development projects), overutilization of the species via fisheries bycatch (particularly in artisanal gillnets), depletion of prey resources, and human use, as well as anthropogenic underwater noise, and the inadequacy of existing regulatory mechanisms, particularly the lack of enforcement, resources, implementation, and/or effectiveness of such mechanisms. Of these threats, overutilization of the species in the form of fisheries bycatch and human use as well as destruction, modification, and curtailment of habitat in the form of coastal development, and the inadequacy of existing regulatory mechanisms to address the threat of overutilization and threats to the species' habitat contribute most significantly to the Atlantic humpback dolphin's risk of extinction. These threats are immediate and range-wide, and their intensity is likely to increase in the future throughout the species' range. Few countries within the species' range have specific protections for the Atlantic humpback dolphin, and effective bycatch mitigation has not been documented in most range countries.

Analysis of demographic factors identified several characteristics that elevate the population's vulnerability to these threats. For example, observed or suspected population declines of already small, likely fragmented stocks throughout the species' range drastically elevates the impact of single mortality events; and continued declines are highly likely given the projected increase of identified threats that affect most of the species' known range (e.g. coastal development and fisheries bycatch). Additionally the species' restricted geographic range along the Atlantic coast of Africa and reliance on nearshore habitat make it highly vulnerable to human activities. The limited, available evidence also suggests that there is limited connectivity between stocks within the species' range, which would reduce the recovery potential for resident stocks that have experienced severe declines (i.e. Dakhla Bay). Finally, it is likely that the Atlantic humpback dolphin exhibits a low reproductive rate and thus a low intrinsic potential for population increase. Given the immediacy and prevalence of threats range-wide, and demographic characteristics increasing the species' vulnerability, we conclude that the Atlantic humpback dolphin currently faces an overall **high** risk of extinction throughout its range.

6. SYNTHESIS AND CONCLUSION

Some of the demographic characteristics of the Atlantic humpback dolphin are lacking accurate and precise data. However, the best available scientific and commercial information does provide multiple lines of evidence to support a conclusion that this species is currently facing a high risk of extinction. With fewer than 3,000 dolphins likely remaining (and some stocks apparently isolated and numbering in the tens of individuals), observed or suspected declines increase the risk of local extirpation for extremely small stocks (*e.g.* Dakhla Bay and Angola) in the near future. Continued declines in abundance are also expected given the ongoing and projected increase of identified range-wide threats (specifically fisheries bycatch and coastal development), suggesting that the species will continue to decline in the absence of interventions. Existing regulatory mechanisms to protect the species from habitat loss and mortality are limited or entirely lacking across its range, and unlikely to prevent further species' decline. Thus, the interaction of low and/or declining abundance, restricted range, reliance on nearshore habitat, fragmented distribution, and immediate range-wide threats all suggest a high risk of extinction in the near term. Thus, following consideration of the best available scientific and commercial information summarized in this report, we conclude that the Atlantic humpback dolphin, *S. teuszii*, currently faces a high risk of extinction throughout its range.

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