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SPERM WHALE (*Physeter macrocephalus*): Puerto Rico and U.S. Virgin Islands Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Sperm whales are found throughout the world's oceans in deep waters to the edge of the ice at both poles (Leatherwood and Reeves 1983; Rice 1989; Whitehead 2002). Sperm whales throughout the world exhibit a geographic social structure where females and juveniles of both sexes occur in mixed groups and inhabit tropical and subtropical waters. Males, as they mature, initially form bachelor groups but eventually become more socially isolated and more wide-ranging, inhabiting temperate and polar waters as well (Whitehead 2003).

Sperm whales were commercially hunted in the Caribbean Sea by American whalers from sailing vessels until the early 1900s (Townsend 1935). Reeves *et al.* (2001) noted that it was not unusual for nineteenth century American whalers to go to Hispaniola, Puerto Rico or the Bahamas to hunt sperm whales on their way north following humpback whaling voyages to the Grenadines. In waters surrounding Puerto Rico and the U.S. Virgin Islands, NMFS winter ship surveys indicate that sperm whales inhabit continental slope and oceanic waters (Figure 1; Roden and Mullin 2000; Swartz and Burks 2000; Swartz *et al.* 2002). Earlier sightings from the northeastern Caribbean have been reported by Erdman (1970), Erdman *et al.* (1973) and Taruski and Winn (1976), and these and other sightings from Puerto Rican waters are summarized by Mignucci-Giannoni (1988). Mignucci-Giannoni (1998) found 43 r ecords for sperm whales up to 1989 f or waters of Puerto Rico, U.S. Virgin Islands and British Virgin Islands, and suggested they occur from late fall through winter and early spring but are rare from April to September. In addition, sperm whales are one of the most common species to strand in waters of Puerto Rico and the Virgin Islands (Mignucci-Giannoni *et al.* 1999).

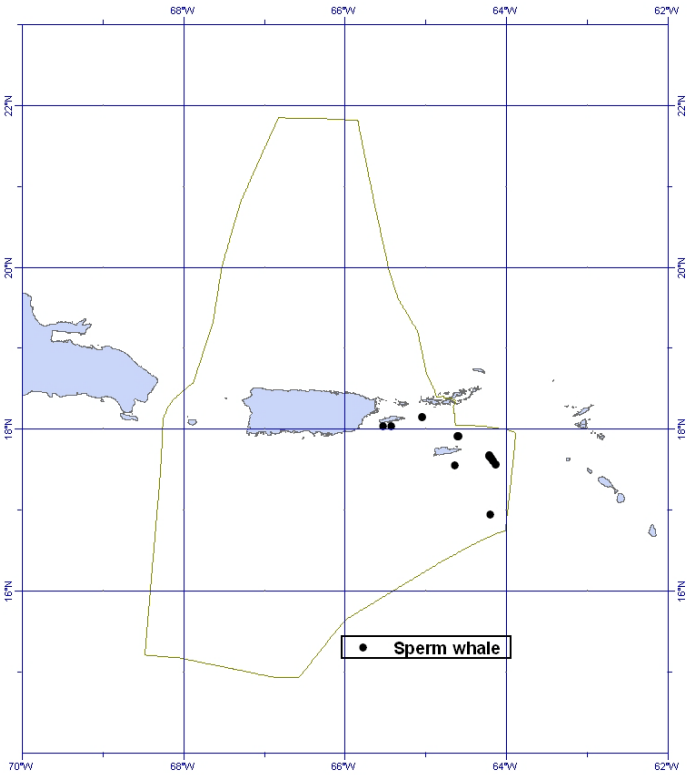

Figure 1. *Distribution of sperm whale sightings from SEFSC vessel surveys during winters of 1995, 2000 and 2001. The solid line indicates the boundary of the U.S. EEZ.*

Sperm whales have not been studied extensively in the waters around Puerto Rico and the U.S. Virgin Islands. However, research has been conducted in the eastern Caribbean Sea (islands of Dominica, Guadeloupe, Grenada, St. Lucia and Martinique) by Gero *et al.* (2007), who found that the population of sperm whales was small and quite isolated as evidenced by high regional resighting rates of photo-identified whales. Additionally, no matches were made from animals photo-identified in the eastern Caribbean Sea with either animals from the Sargasso Sea or the Gulf of Mexico. Gero *et al.* (2007) suggested that movements of sperm whales between the adjacent areas of the Caribbean Sea, Gulf of Mexico and Atlantic may not be common. Gero *et al.* (2009) also found differences in some aspects of the social organization of sperm whales in the eastern Caribbean compared to the Sargasso Sea. For example, group size estimates for the Sargasso Sea were almost twice as large as those for the Caribbean. Clusters containing calves were also significantly larger in the Sargasso Sea compared to the Caribbean. The system of alloparental caregiving to calves differed between the Sargasso and Caribbean Seas as well. Generally, in the Sargasso Sea calves were escorted by two individuals whereas only one escort was present in the Caribbean. In the Caribbean 1 female provided most of the allocare but did not nurse the calf. In the Sargasso multiple females provided care for and nursed calves.

Sperm whales make vocalizations used in a social context called "codas" that have distinct patterns and are apparently culturally transmitted (Watkins and Schevill 1977; Whitehead and Weilgart 1991; Rendell and Whitehead 2001), and based on degree of social affiliation, mixed groups of sperm whales worldwide can be placed in recognizable acoustic clans (Rendell and Whitehead 2003). Antunes (2009) examined variation in sperm whale coda repertoires in the North Atlantic Ocean, including the Azores, Sargasso Sea, Iceland, Dominica, Panama and Gulf of Mexico. He found that variation in the Gulf of Mexico and North Atlantic basins is mostly geographic. His work suggested sperm whale coda differentiation of the Gulf of Mexico from the North Atlantic, and weak but detectable spatial variation in the North Atlantic. Two coda repertoires from Dominica were more similar to each other than to any other repertoire, and they were more similar to coda repertoires of the North Atlantic basin than to the Gulf of Mexico.

The Puerto Rico and U.S. Virgin Islands sperm whale population is provisionally being considered a separate stock for management purposes, although there is currently limited information to differentiate this stock from the Atlantic Ocean stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation. Engelhaupt *et al.* (2009) included 15 genetic samples from the Caribbean in their analyses of female philopatry in coastal basins and male dispersion across the North Atlantic. Three samples were from Puerto Rico and the remaining samples were from Dominica (Engelhaupt, pers. comm.). Additional genetic samples from the U.S. Caribbean and surrounding areas are needed. Sperm whales of this stock are likely trans-boundary with, at a minimum, waters near adjacent Caribbean islands and are not likely to occur exclusively within the bounds of the U.S. EEZ.

POPULATION SIZE

The best abundance estimate available for the Puerto Rico and U.S. Virgin Islands stock of sperm whales is unknown. A line-transect survey was conducted during January-March 1995 on NOAA Ship *Oregon II*, and was designed to cover a wide range of water depths surrounding Puerto Rico and the Virgin Islands. However, due to the bottom topography of the region and the size of the vessel, most waters surveyed were >200 m deep. Eight sightings of sperm whales were made, 6 of which occurred in and near U.S. waters (Roden and Mullin 2000). Another line-transect survey for humpback whales was conducted during February-March 2000 aboard NOAA Ship Gordon Gunter in the eastern and southern Caribbean Sea. A portion of the survey effort occurred in U.S. waters during transit, and 8 sightings of sperm whales were made in and near U.S. waters. During February-March 2001 a line-transect survey was conducted in waters of the eastern Bahamas, eastern Dominican Republic, Puerto Rico and Virgin Islands. Five sightings of sperm whales were made near Puerto Rico and the Virgin Islands (in and near U.S. waters). It was not possible to estimate abundance from these surveys using line-transect methods due to so few sightings.

Minimum Population Estimate

Present data are insufficient to calculate a minimum population estimate for this stock of sperm whales.

Current Population Trend

There are insufficient data to determine the population trends for this stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The maximum net productivity rate is assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal level (PBR) is the product of the minimum population size, one half the maximum net productivity rate and a recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is unknown. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.1 because the sperm whale is an endangered species. PBR for this stock of sperm whales is unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Annual human-caused mortality and serious injury is unknown for this stock.

Fisheries Information

The level of past or current, direct, human-caused mortality of sperm whales in Puerto Rico and the U.S. Virgin Islands is unknown. Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the Caribbean Sea. There has been no reported fishing-related mortality of a sperm whale during 1998-2008 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009).

A commercial fishery for sperm whales operated in the Caribbean Sea during the late 1700s to the early 1900s, but the exact number of whales taken is not known (Townsend 1935).

Other Mortality

A total of two sperm whales were found stranded in U.S. waters of the Caribbean Sea from 2004 through 2008 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 September 2008 and 21 September 2009). No evidence of human interactions was detected for these stranded animals. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals which die or are seriously injured in fishery interactions wash ashore, not all that wash ashore are discovered, reported or investigated, nor will all of those that do wash ashore necessarily show signs of entanglement or other fishery interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interactions.

The potential impact, if any, of coastal pollution may be an issue for this species in portions of its habitat, though little is known on this to date.

Ship strikes to whales occur world-wide and are a source of injury and mortality. One sperm whale mortality due to a vessel strike has been documented for Puerto Rico. The incident occurred in 2001 when a 154 m U.S. Navy vessel struck and killed a sperm whale 20 miles south of Puerto Rico (Jensen and Silber 2003).

In the past U.S. Navy activity in the area of Puerto Rico was commonplace. The U.S. Navy and the U.S. Marine Corps used the Atlantic Fleet Weapons Training Facility operated out of Vieques Island, Puerto Rico, from 1948 to 2003, including the training of pilots for live ordnance delivery and amphibious assault landings by the Marine Corps. The naval station at Roosevelt Roads in Puerto Rico operated from 1943 to 2004 (between 1943 and 1957 it was opened and closed multiple times). It operated as a major training site for fleet exercises.

STATUS OF STOCK

The status of sperm whales in Puerto Rico and the U.S. Virgin Islands, relative to OSP, is unknown. This species is listed as endangered under the Endangered Species Act (ESA). There are insufficient data to determine the population trends for this species. Total human-caused mortality and serious injury for this stock is not known. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. This is a strategic stock because the sperm whale is listed as an endangered species under the ESA.

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