

First Records of the Pantropical Spotted Dolphin (*Stenella attenuata*) for the Puerto Rican Bank, with a Review of the Species in the Caribbean

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Pantropical spotted dolphins (*Stenella attenuata* [Gray 1846]) are known as an oceanic tropical and subtropical species occurring around the world (Perrin et al. 1987; Perrin and Hohn 1994). The species is well documented for the Pacific Ocean, but its geographical range for the Atlantic Ocean is poorly known, except for the Gulf of Mexico (Mullin et al. 1994; Waring et al. 2002). Leatherwood et al. (1976) speculated that it is common in the Caribbean near coastal areas and islands, parapatric to or replacing the Atlantic spotted dolphin (*Stenella frontalis* [Cuvier 1829]) in the West Indies and Lesser Antilles. However, Perrin and Hohn (1994) only report eight records of *S. attenuata* for the Caribbean, and in Puerto Rico alone, for example, over 50 records exist of the Atlantic spotted dolphin (Mignucci-Giannoni 1998), but none of pantropical spotted dolphins. We document the first records of pantropical spotted dolphins from Puerto Rico, review and present new records for the western North Atlantic and the Caribbean and based on

these, describe the species zoogeography in the Caribbean.

We surveyed the coastal and offshore waters of the Puerto Rico Bank (Puerto Rico, U.S. Virgin Islands and British Virgin Islands) between 16 February and 9 March 2001 aboard the 68.3-m NOAA Ship *Gordon Gunter* (Swartz et al. 2001). Transect survey lines covered the area off the north coast of Puerto Rico out to 293 km, the east coast of Puerto Rico out to the Virgin Passage, the waters around the U.S. and British Virgin islands, the south coast of Puerto Rico out to 257 km from shore, and the entire Mona Channel west to the Dominican Republic.

The genus *Stenella* is thought to be an artificial taxon, containing some species more closely related to species of *Tursiops*, *Delphinus* or *Sousa* than to each other (LeDuc et al. 1999). *S. frontalis* is genetically more closely related to *T. truncatus* and *T. aduncus* (Ehrenberg 1833) than to *S. attenuata* (LeDuc et al. 1999). Differentiating between similar species in this group, as in the case of the pantropical and Atlantic spotted dolphins, is not easy for the untrained observer. Roden and Mullin (2000) noted that spotted dolphin records published before the revision of the spotted dolphins by Perrin et al. (1987) are difficult to interpret or corroborate. It is important to have both written and pictorial observation records to confirm the identification of spotted dolphins. For this purpose, we used descriptions for both species of spotted dolphins based on Perrin et al. (1987), Jefferson et al. (1993), Perrin and Hohn (1994), Perrin et al. (1994), and Perrin (2002a,b) (Table 1, Fig. 1), which should help as a future reference in identifying the two species in Caribbean waters. Aside from having spots, the two species are very distinct, and diagnostic differentiation between the two can be summarized: (1) for carcasses, the vertebral count of *S. attenuata* is distinct (74-84) from that of *S. frontalis* (67-72); (2) the color pattern for *S. attenuata* consist of two parts (dark gray dorsal cape with sharply defined border and lighter lateral and ventral areas), while in *S. frontalis* it consists of three parts (dark gray dorsal

cape, lighter gray lateral field, and white ventral field); (3) a lighter gray spinal blaze invades the dorsal cape in *S. frontalis*, and is absent in *S. attenuata*; (4) the penduncle is divided into upper dark and lower light halves in *S. attenuata*, not in *S. frontalis*; (5) *S. frontalis* exhibits a combination of blaze and spots; and (6) *S. attenuata* has white lips and a marked white tip of the snout.

Sightings.—We observed numerous Atlantic spotted dolphins, bottlenose dolphins (*Tursiops truncatus* [Montagu 1821]), rough-tooth dolphins (*Steno bredanensis* [Lesson 1828]), shortfin pilot whales (*Globicephala macrorhynchus* Gray 1846), false killer whales (*Pseudorca crassidens* [Owen 1846]), beaked whales (*Mesoplodon* spp.), Cuvier's beaked whales (*Ziphius cavirostris* Cuvier 1823), sperm whales (*Physeter macrocephalus* Linnaeus 1758) and humpback whales (*Megaptera novaeangliae* [Borowski 1781]) (Swartz et al. 2001). On four occasions, we observed groups of pantropical spotted dolphins (Table 2). These were distinguished from Atlantic spotted dolphins based on morphological features and coloration pattern (Table 1, Fig. 1).

On 16 February 2001, five pantropical spotted dolphins were observed riding the bow wave of the ship, 23.2 km W of Punta Guaniquilla, Cabo Rojo, Puerto Rico. On 18 February, 18 pantropical spotted dolphins were observed over the Puerto Rican Trench, 95.4 km NNE of Cabo San Juan, Fajardo, Puerto Rico. These dolphins were bowriding when three rough-tooth dolphins approached the ship's bow and displaced them. We sighted the species again on 28 February after observing a group of 20 Atlantic spotted dolphins bowriding 11.1 km SW of Punta Cucharas, Ponce, Puerto Rico. Following the departure of the Atlantic spotted dolphins from the ship's bow wave, two pantropical spotted dolphins approached the ship and rode the bow wave (Fig. 2). Later that same day 15 pantropical spotted dolphins were observed 33.3 km SSW of Punta Brea, Guánica, Puerto Rico. These were traveling perpendicular to the ship's course and rode its bow.

Historical review of Caribbean records.—Ninety-two previous records of the pantropical spotted dolphin exist from the Ca-

ribbean (Table 2), most either unpublished, in gray literature or in scattered published literature.

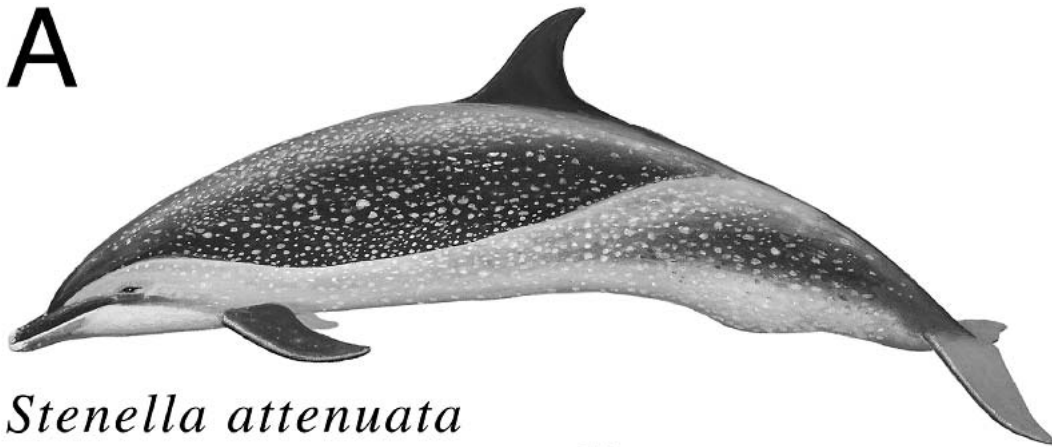
Two *S. attenuata* were captured and killed in the small-cetacean fishery off Saint Vincent in 1967 and 1968 (Caldwell et al. 1971). Taruski and Winn (1976) conducted surveys in the West Indies and Lesser Antilles between 1969 and 1973 aboard the R/V *Trident* and *Sir Horace Lamb*. They recorded 12 sightings of spotted dolphins (*Stenella* spp.), but did not specify which of the two species was observed. They divided the sightings into two groups, one for animals found near the South American mainland (species "A") and one for animals off the island chains (species "B"). However, at this time it is difficult to corroborate whether either group of sightings ("A" or "B") was of *S. attenuata* or *S. frontalis*. At least one sighting off Grenada in February 1972 (not detailed in Taruski and Winn [1976]) is of a *S. attenuata* based on photographic evidence (W. F. Perrin pers. comm.). A pantropical spotted dolphin was reported stranded at Ensenada de Gayraca, Parque Nacional Tayrona, in Magdalena, Colombia in 1974 (Vidal 1990). Two *S. attenuata* were sighted during Bryde's whale (*Balaenoptera edeni* Anderson 1878) research off the west part of the Península de Paria, Venezuela in 1979 (G. N. Di Sciara pers. comm., Romero et al. 2001).

Perrin et al. (1987) reported opportunistic sightings of pantropical spotted dolphins off the western end of Haiti's southern peninsula in 1980, Saint Lucia in 1983, and off western Cuba in 1984 and 1985. A stranded *S. attenuata* was reported at Isla Pirata in the Parque Nacional Natural Corales del Rosario in Bolívar, Colombia in 1983 (C. A. Bohorquez pers. comm., Vidal 1990). Dedicated surveys for cetaceans, especially sperm whales, aboard the *Eleuthera II*, *Ida-Z* and *Abel-J* between 1981 and 1995, yielded numerous sightings of pantropical spotted dolphins off Dominica, Martinique and Guadeloupe (Watkins and Moore 1982, Watkins et al. 1985, Watkins et al. 1993, Watkins et al. 1994, Watkins et al. 1997). Surveys conducted in the southwestern Caribbean aboard the R/V *Siben* in 1988, R/V *Malpelo* in 1990 and R/V *Odyssey* in

TABLE 1. Comparisons of morphological, anatomical and color pattern diagnostic characteristics used in species identification between pantropical spotted dolphins (*Stenella attenuata*) and Atlantic spotted dolphins (*Stenella frontalis*).

Characters	<i>Stenella attenuata</i>	<i>Stenella frontalis</i>
Body	Slender and streamlined.	Robust or stocky body, similar to bottlenose dolphins, but with a narrower peduncle.
Snout	Long and narrow, with a clear demarcation with the melon.	Of medium length, not as short as that of the bottlenose dolphin and not as long as that of <i>S. attenuata</i> or the spinner dolphin. There is a clear demarcation between the snout and the melon as in the bottlenose dolphin.
Dorsal fin	Curved, narrow and pointed at the tip.	Tall, distinctly falcated backwards, pointed at the tip, and located at mid-body.
Flippers	Small and pointed.	Curved at the leading edge and pointed at the tips.
Flukes	Pointed at the tips, with a slight notch in the middle and have slightly concave trailing edges.	Thin with a median notch.
Color pattern	Bipartite color pattern. The peduncle is divided into dark upper and light lower halves. It has a sharply defined dark gray cape on its back, running from the melon to behind the dorsal fin. A medium gray flank runs from the apex of the melon, just above the eyes to the peduncle and flukes. A dark gray coloration circles the eye, with a connecting stripe towards the melon and upper jaw, and a stripe towards the flipper, sometimes referred as the bridle. In adults, the lips are strikingly white as well as the tip of the snout, a diagnostic characteristic easily observed from elevated platforms such as airplanes and large vessels.	Three-part color pattern: a dark gray dorsal cape, lighter gray sides and a white belly. The base color is blue or gray. The cape is dark gray and is interrupted on each side by a lighter spinal blaze that sweeps up and back near the dorsal fin. There is a light gray line connecting the flippers with eyes. The tip of the snout is often white, but not as striking as in <i>S. attenuata</i> .
Spotting	In adults, the dark cape region is covered with medium gray spots, while the flank and belly have darker spots. Juveniles and calves have very few or lack spots all together. Spots develop during the onset of puberty, first with dark spots in the underside and then light spots on the upper side.	The ground pattern is superimposed with dark ventral and light dorsal spots. Spots develop at the onset of puberty. The extent of spotting becomes more intense with age, somewhat obscuring the three-part pattern. Smaller individuals lack spots.
Regional spotting	In the Pacific Ocean, offshore individuals are less spotted than coastal forms. Dolphins in the southwestern Caribbean were lightly or not spotted. Animals in the West Indies were more heavily spotted than the animals in the Gulf of Mexico.	In comparison to other areas, Atlantic spotted dolphins from the Caribbean show medium spotting with the underlying ground pattern visible even in mature animals.
Length	160-240 cm.	Smaller than other geographical populations of the species, 165-205 cm, averaging 180 cm when full grown.
Weight	Up to 120 kg.	Up to 143 kg.
Maturity	Females at 190 cm, males at 200 cm.	Females at 186 cm.
Birth size	85 cm.	76-120 cm.
Dentition	Conical teeth, 35-48 on each row of the upper jaw, 34-47 in each side of mandible, totaling 138-190. Tooth size is between 2.6 and 4.1 mm in diameter.	Conical teeth, 32-42 on each row of the upper jaw, 30-40 in each rami of the mandible, totaling 124-164. Tooth size is between 3.2 and 5.3 mm in diameter.
Vertebral formula	$C_7T_{16}L_{20}Ca_{37} = 80$ (74-84)	$C_7T_{14}L_{17}Ca_{32} = 70$ (67-72)

A

*Stenella attenuata*

B

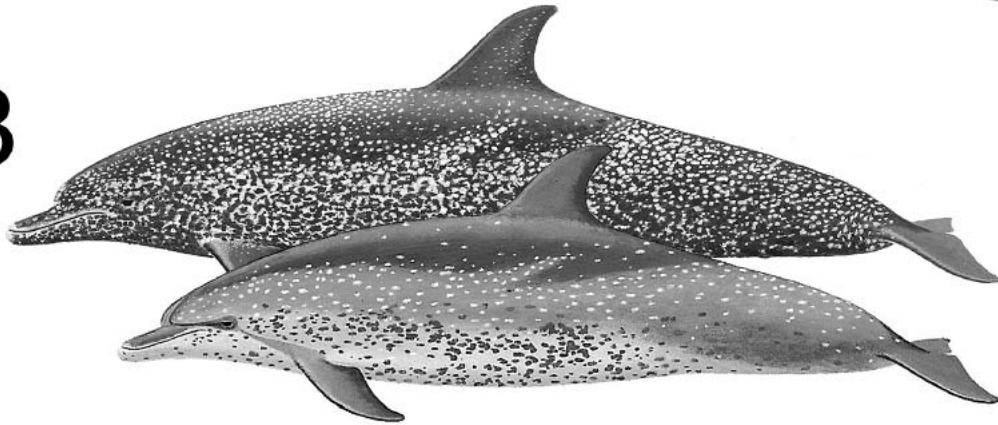
*Stenella frontalis*

FIG. 1. Species portraits of a (A) pantropical spotted dolphin (*Stenella attenuata*) and two (B) Atlantic spotted dolphin (*Stenella frontalis*), illustrating morphological and color pattern diagnostic characteristics used for species identification. Illustration by Pieter Arend Folkens.

1994 (Palacios et al. 1996) yielded a sighting of 300-400 pantropical spotted dolphins in Jamaican waters near the Serranilla Bank in August 1990 (Palacios et al. 1995).

Caribbean surveys by Jefferson and Lynn (1994) in 1991 reported sightings of *S. attenuata* southeast of the Bahamas, near Martinique, north of Santa Marta in Colombia, off Panamá, Honduras and Belize. A July 1991 stranding of a dolphin in Curaçao, Netherland Antilles, initially identified as a striped dolphin (*Stenella coeruleoalba* [Meyen 1833], Debrot and Barros 1994), was later confirmed by genetic analysis to be *S. attenuata* (LeDuc et al. 1997). A stranding initially reported as a female *S. frontalis*



FIG. 2. A pantropical spotted dolphin (*Stenella attenuata*) riding the bow of the NOAA Ship Gordon Gunter south of Puerto Rico in February 2001.

TABLE 2. Sighting, stranding and capture records for the pantropical spotted dolphin (*Stenella attenuata*) in the Caribbean.

Date	Locality	Latitude/longitude	No. animals	Depth	Temp	Event	Reference
1 Jun 1967	Barrouallie, Saint Vincent, VC	13°14.4'N 61°16.6'W	1	—	—	Capture	Caldwell et al. 1971
24 May 1968	Barrouallie, Saint Vincent, VC	13°14.4'N 61°16.6'W	1	—	—	Capture	Caldwell et al. 1971
-- Feb 1972	Grenada, GD	—	—	—	—	Sighting	Perrin et al. 1987
21 Jun 1974	Ensenada de Gayraca, Magdalena, CO	11°20.0'N 74°05.0'W	1	—	—	Stranding	Vidal 1990
-- --- 1979	6 km N of Isla Picuda Chica, Anzoategui, VE	10°21.8'N 64°33.8'W	2	—	—	Sighting	Romero et al. 2001
22 Jul 1980	50 km WNW of Cap Dame-Marie, HT	18°52.0'N 74°50.0'W	30	1719 m*	—	Sighting	Perrin et al. 1987
23 Jul 1980	30 km WNW of Cap Dame-Marie, HT	18°43.0'N 74°42.0'W	—	1558 m*	—	Sighting	Perrin et al. 1987
-- --- 1983	S coast of Isla Pirata, Islas del Rosario, Bolivar, CO	10°10.8'N 75°46.6'W	1	—	—	Stranding	C. Bohorquez, upubl. data
31 Oct 1983	9 km NW of Pointe Du Cap, LC	14°11.0'N 61°00.0'W	35	746 m*	—	Sighting	Perrin et al. 1987
14 Nov 1983	19 km WSW of Indian Gallows, Saint Vincent, VC	13°12.0'N 61°27.0'W	100	—	—	Sighting	Watkins et al. 1985
19 Mar 1984	1 km W of Point Ronde, DM	15°32.0'N 61°30.0'W	12	819 m*	—	Sighting	Watkins et al. 1985
20 Mar 1984	2 km SW of Prince Rupert Bluff, DM	15°34.0'N 61°30.0'W	10	664 m*	—	Sighting	Watkins et al. 1985
21 Mar 1984	2 km NW of Prince Rupert Bluff, DM	15°33.0'N 61°35.0'W	40	—	—	Sighting	Watkins et al. 1985
23 Mar 1984	7 km W of Cap Salomon, MQ	14°30.0'N 61°10.0'W	20	2300 m*	—	Sighting	Watkins et al. 1985
23 Mar 1984	7 km W of Cap Salomon, MQ	14°30.0'N 61°10.0'W	100	2300 m*	—	Sighting	Watkins et al. 1985
24 Mar 1984	3 km SW of Pointe du Diamont, MQ	14°26.0'N 61°05.0'W	40	750 m*	—	Sighting	Watkins et al. 1985
25 Mar 1984	5 km SW of Pointe du Precheur, MQ	14°46.0'N 61°16.0'W	25+	800 m*	—	Sighting	Watkins et al. 1985
26 Mar 1984	11 km W of Case Pilote, MQ	—	10	—	—	Sighting	Watkins et al. 1985
27 Mar 1984	11 km WSW of Prince Rupert Bluff, DM	15°36.0'N 61°30.0'W	20	806 m*	—	Sighting	Watkins et al. 1985
27 Mar 1984	5 km WSW of Grand Savanne, DM	15°25.0'N 61°30.0'W	30+	888 m*	—	Sighting	Watkins et al. 1985
27 Mar 1984	7 km WNW of Grand Savanne, DM	15°27.0'N 61°31.0'W	80+	—	—	Sighting	Watkins et al. 1985
29 Mar 1984	4 km WSW of Cape Melville, DM	15°38.0'N 61°30.0'W	10	753 m*	—	Sighting	Watkins et al. 1985
29 Mar 1984	4 km WSW of Cape Melville, DM	15°38.0'N 61°30.0'W	30	753 m*	—	Sighting	Watkins et al. 1985
3 Oct 1984	52 km NW of Cabo Jutias, CU	23°00.0'N 84°20.0'W	12-25	—	—	Sighting	Perrin et al. 1987
18 Sep 1985	168 km S of Cabo Corrientes, CU	20°14.0'N 84°35.0'W	5	—	—	Sighting	Perrin et al. 1987
18 Sep 1985	183 km S of Cabo Corrientes, CU	20°06.0'N 84°29.0'W	25	—	—	Sighting	Perrin et al. 1987
28 Apr 1987	3 km W of Prince Rupert Bluff, DM	15°35.0'N 61°31.0'W	2+	1063 m*	—	Sighting	This paper
29 Apr 1987	8 km WSW of Point Ronde, DM	15°31.0'N 61°34.0'W	3+	1685 m*	—	Sighting	This paper
30 Apr 1987	2 km ESE of Pointe du Precheur, MQ	14°47.0'N 61°13.0'W	300	400 m*	—	Sighting	This paper
1 May 1987	2 km SW of Prince Rupert Bluff, DM	15°34.0'N 61°30.0'W	100	664 m*	—	Sighting	This paper
5 May 1987	20 km NNE of Pointe du Marigot, MQ	15°00.0'N 61°00.0'W	20	850 m*	—	Sighting	This paper
7 May 1987	25 km W of Pointe Bottereau, GP	16°00.0'N 61°00.0'W	100	1024 m*	—	Sighting	This paper
6 Aug 1990	330 km SSW of South Negril Point, JM	15°25.0'N 79°17.0'W	300-400	2222 m*	—	Sighting	Palacios et al. 1986
17 Oct 1990	3 km W of Woodbridge Bay, DM	15°18.9'N 61°25.9'W	40	—	—	Sighting	This paper
18 Oct 1990	2 km WNW of Point Ronde, DM	15°32.5'N 61°30.5'W	2+	770 m*	—	Sighting	This paper
18 Oct 1990	1 km NNW of Point Cabrier, DM	15°29.8'N 61°28.9'W	5+	817 m*	—	Sighting	This paper

NOTES

385

TABLE 2. Continued.

Date	Locality	Latitude/longitude	No. animals	Depth	Temp	Event	Reference
21 Oct 1990	4 km S of Taron Point, DM	15°27.8'N 61°32.3'W	150	—	—	Sighting	This paper
12 Jun 1991	256 km NE of Mayaguana Island, BH	24°10.0'N 71°14.0'W	20	5300 m	27.5°C	Sighting	Jefferson and Lynn 1994
28 Jun 1991	9 km W of Pointe de la Batterie, MQ	14°40.0'N 61°15.0'W	40	2010 m	—	Sighting	Jefferson and Lynn 1994
1 Jul 1991	10 km W of Cap Enrage, MQ	14°38.0'N 61°15.0'W	30	2050 m	—	Sighting	Jefferson and Lynn 1994
10 Jul 1991	216 km N of Cabo de la Aguja, Santa Marta, CO	13°12.0'N 74°16.0'W	6	3915 m	—	Sighting	Jefferson and Lynn 1994
11 Jul 1991	273 km NNE of Punta San Blás, PA	11°50.0'N 78°05.0'W	2	3630 m	27.8°C	Sighting	Jefferson and Lynn 1994
12 Jul 1991	71 km NW of Punta Manzanillo, PA	10°05.0'N 79°58.0'W	50	1865 m	27.8°C	Sighting	Jefferson and Lynn 1994
13 Jul 1991	10 km SE of Kaap St. Marie, Curaçao, AN	12°08.0'N 69°00.0'W	1	—	—	Stranding	LeDuc et al. 1997
16 Jul 1991	143 km NNE of Cabo Falso, HN	16°20.0'N 82°38.0'W	4	50 m	—	Sighting	Jefferson and Lynn 1994
17 Jul 1991	117 km NNE of Isle Guanajas, HN	17°21.0'N 85°20.0'W	4	4875 m	—	Sighting	Jefferson and Lynn 1994
17 Jul 1991	148 km ENE of Turneffe Island, BZ	17°32.0'N 86°22.0'W	4	4100 m	27.8°C	Sighting	Jefferson and Lynn 1994
-- Aug 1991	Playa La Restinga, Isla Margarita, Nueva Esparta, VE	10°59.7'N 64°02.5'W	1	—	—	Stranding	L. A. Bermudez, unpubl. data
24 Oct 1991	3 km SW of Point Ronde, DM	15°30.9'N 61°30.5'W	12	—	—	Sighting	This paper
24 Oct 1991	5 km W of Cape Melville, DM	15°38.5'N 61°30.6'W	20	753 m*	—	Sighting	This paper
25 Oct 1991	1 km W of Point Ronde, DM	15°32.0'N 61°30.0'W	20	606 m*	—	Sighting	This paper
25 Oct 1991	4 km S of Taron Point, DM	15°21.0'N 61°25.6'W	25	536 m*	—	Sighting	This paper
26 Oct 1991	2 km SW of Point Cachacrou, DM	15°12.0'N 61°24.0'W	25	941 m*	—	Sighting	This paper
26 Oct 1991	4 km WSW of Cape Melville, DM	15°37.5'N 61°30.2'W	10-12	175 m	—	Sighting	Walkins et al. 1994
27 Oct 1991	4 km WSW of Cape Melville, DM	15°38.0'N 61°30.0'W	15	782 m*	—	Sighting	Watkins et al. 1997
18 Apr 1993	3 km WNW of Point Cabrier, DM	15°30.3'N 61°30.2'W	50+	—	—	Sighting	This paper
21 Apr 1993	7 km W of Taron Point, DM	15°22.8'N 61°29.9'W	—	1602 m*	—	Sighting	This paper
22 Apr 1993	9 km W of Point Cabrier, DM	15°30.4'N 61°33.6'W	30+	—	—	Sighting	This paper
26 Apr 1993	9 km WNW of Point Cabrier, DM	15°30.6'N 61°31.0'W	40+	—	—	Sighting	This paper
6 May 1994	3 km WNW of Point Ronde, DM	15°32.6'N 61°31.2'W	2+	1069 m*	—	Sighting	This paper
6 May 1994	2 km N of Point Ronde, DM	15°32.1'N 61°30.8'W	2+	606 m*	—	Sighting	This paper
6 May 1994	2 km W of Point Ronde, DM	15°32.2'N 61°30.8'W	2+	606 m*	—	Sighting	This paper
6 May 1994	3 km WSW of Prince Rupert Bluff, DM	15°34.5'N 61°31.1'W	6	1000 m*	—	Sighting	This paper
10 May 1994	3 km SW of Prince Rupert Bluff, DM	15°34.2'N 61°30.5'W	15	913 m*	—	Sighting	This paper
11 May 1994	6 km W of Woodbridge Bay, DM	15°18.9'N 61°27.5'W	4	1032 m*	—	Sighting	This paper
1 Mar 1995	24 km S of Cabo Beata, DO	17°23.0'N 71°27.0'W	12	640 m	26.7°C	Sighting	Roden and Mullin 2000
2 Mar 1995	66 km SSW of Cap Tiburon, HT	17°46.0'N 74°38.0'W	12	733 m	27.5°C	Sighting	Roden and Mullin 2000
2 Mar 1995	63 km SSW of Cap Tiburon, HT	17°46.0'N 74°33.0'W	12	725 m	27.4°C	Sighting	Roden and Mullin 2000
2 Mar 1995	62 km SSW of Cap Tiburon, HT	17°46.0'N 74°31.0'W	13	2430 m	27.3°C	Sighting	Roden and Mullin 2000
2 Mar 1995	43 km SW of Pointe a Gravois, HT	17°42.0'N 74°08.0'W	100	1540 m	27.2°C	Sighting	Roden and Mullin 2000
8 Mar 1995	95 km NNW of Grand Cayman Island, KY	20°07.0'N 81°52.0'W	23	1300 m	26.7°C	Sighting	Roden and Mullin 2000

TABLE 2. Continued.

Date	Locality	Latitude/longitude	No. animals	Depth	Temp	Event	Reference
26 Apr 1995	2 km WSW of Point Ronde, DM	15°31.3'N 61°30.6'W	15	872 m*	—	Sighting	This paper
1 May 1995	6 km WSW of Cape Melville, DM	15°37.4'N 61°31.2'W	1+	782 m*	—	Sighting	This paper
21 May 1995	8 km ESE of Punt Kanon, Curaçao, AN	12°01.0'N 68°40.0'W	50+	330 m*	—	Sighting	Debrot et al. 1998
14 Mar 1998	3 km S of Jan Thiel Baii, Curaçao, AN	12°03.0'N 68°52.0'W	15	1000 m*	—	Sighting	Debrot et al. 1998
14 Apr 1999	4 km WSW of Grand Caille Point, LC	13°51.0'N 61°07.0'W	20	1792 m*	—	Sighting	ECCN, unpubl. data
14 Apr 1999	15 km WNE of Grand Caille Point, LC	13°55.0'N 61°13.0'W	30-50	—	—	Sighting	ECCN, unpubl. data
17 Feb 2000	N coast of Tobago, Tobago, TT	—	20	—	—	Sighting	Carlson et al. 2000
19 Feb 2000	5 km WSW of Pointe Habitants, GP	16°03.0'N 61°49.0'W	11	915 m	26.7°C	Sighting	Swartz and Burks 2000
19 Feb 2000	6 km WNW of Pointe Colibris, GP	16°19.0'N 61°09.0'W	15	1190 m	26.1°C	Sighting	Swartz and Burks 2000
19 Feb 2000	5 km WNW of Pointe Habitants, GP	16°05.0'N 61°49.0'W	175	915 m	26.6°C	Sighting	Swartz and Burks 2000
22 Feb 2000	10 km NW of Grand Caille Point, LC	13°56.0'N 61°09.0'W	45	2507 m	26.6°C	Sighting	Swartz and Burks 2000
19 Mar 2000	9 km WSW of Moliniere Point, GD	12°04.0'N 61°51.0'W	5	1219 m	27.1°C	Sighting	Swartz and Burks 2000
19 Mar 2000	7 km W of Moliniere Point, GD	12°05.0'N 61°50.0'W	15	1215 m	27.3°C	Sighting	Swartz and Burks 2000
19 Mar 2000	7 km W of Moliniere Point, GD	12°06.0'N 61°50.0'W	20	1096 m	27.3°C	Sighting	Swartz and Burks 2000
20 Mar 2000	33 km SE of Galera Point, Trinidad, TT	10°39.0'N 60°40.0'W	15	49 m	27.4°C	Sighting	Swartz and Burks 2000
24 Mar 2000	18 km N of Pointe du Marigot, MQ	14°59.0'N 61°01.1'W	45	791 m	26.8°C	Sighting	Swartz and Burks 2000
25 Mar 2000	1-2 km W of Roseau, DM	15°16.5'N-	10-20	—	—	Sighting	A. Hill, pers. comm.
14 Nov 2000	31 km SE of Punta Garambeo, Isla la Trotuga, VE	10°39.8'N 65°07.7'W	30	800 m*	—	Sighting	ECCN, unpubl. data
16 Feb 2001	23.2 km W of Punta Guaniquilla, Cabo Rojo, PR	18°01.0'N 67°25.6'W	5	655 m	26.8°C	Sighting	This paper
18 Feb 2001	95.4 km NNE of Cabo San Juan, Fajardo, PR	19°14.7'N 65°27.6'W	18	7137 m	26.0°C	Sighting	This paper
28 Feb 2001	11.1 km SW of Punta Cucharas, Ponce, PR	17°52.6'N 66°43.1'W	2	1007 m	26.9°C	Sighting	This paper
28 Feb 2001	33.3 km SSW of Punta Brea, Guánica, PR	17°38.0'N 67°00.7'W	15	3038 m	25.5°C	Sighting	This paper
12 Nov 2001	35 km WSW of Punta Arenas, Sucre, VE	10°20.1'N 64°30.5'W	4	100 m*	—	Sighting	L. A. Bermudez, unpubl. data
9 Mar 2002	1-2 km W of Roseau, DM	15°16.5'N-	50-100	—	—	Sighting	A. Hill, pers. comm.
7 Mar 2003	1-2 km W of Roseau, DM	15°16.5'N-	30-40	—	—	Sighting	A. Hill, pers. comm.

BS = Bahamas, BZ = Belize, KY = Cayman Islands, CO = Colombia, CU = Cuba, DM = Dominica, DO = Dominican Republic, GD = Grenada, GP = Guadeloupe, HT = Haiti, HN = Honduras, JM = Jamaica, MQ = Martinique, AN = Netherland Antilles, PA = Panama, PR = Puerto Rico, LC = Saint Lucia, VC = Saint Vincent and the Grenadines, TT = Trinidad and Tobago, TC = Turks and Caicos, VE = Venezuela.

*Calculated depth from nautical chart.

— (dash) Data not collected or available.

NOTES

at Playa La Restinga on Isla Margarita, Venezuela in August 1991 and now catalogued in the Museo Oceanológico Hermano Benigno Román, Estación de Investigaciones Marinas de Margarita (EDIMAR) at Fundación La Salle de Ciencias Naturales, was identified by vertebral counts to be *S. attenuata* (J. Bolaños pers. comm., L. A. Bermúdez unpubl. data). Surveys conducted in 1995 aboard the NOAA Ship *Oregon II* off the West Indies and upper Lesser Antilles, documented pantropical spotted dolphins off the south coast of the Dominican Republic, south of the southern peninsula of Haiti and northwest of the Cayman Islands (Roden and Mullin 2000). Opportunistic sightings of *S. attenuata* were reported for Curaçao in 1995 and 1998 (Debrot et al. 1998), for Saint Lucia in 1999 and for Isla La Tortuga in Venezuela in 2000 by the Eastern Caribbean Cetacean Network (N. Ward pers. comm.).

A sighting of a pantropical spotted dolphin was reported during visual and acoustic surveys for cetaceans conducted off Tobago Island aboard the *Silurian* (Carlson et al. 2000). An earlier survey aboard the NOAA Ship *Gordon Gunter* in the Lesser Antilles and off the central and east coast of Venezuela in 2000 yielded nine sightings of *S. attenuata* in Guadeloupe, Martinique, Saint Lucia, Grenada, and Trinidad (Swartz and Burks 2000). Opportunistic sightings of pantropical spotted dolphins have been reported off Dominica during pelagic bird watching cruises in March 2000, 2002 and 2003 (A. Hill pers. comm.), and off the western part of the Paria Peninsula in Venezuela in November 2001 (L. A. Bermúdez pers. comm.).

No sightings or strandings were previously reported in waters of Puerto Rico or the Virgin Islands based on interviews with fishermen and boaters, or previous research efforts or surveys (Erdman 1970, Erdman et al. 1973; Levenson and Leapley 1978; Marion 1987; Mattila 1984, Mattila and Clapham 1989, Mattila et al. 1998; McLean 1983; Mignucci-Giannoni 1989, Mignucci-Giannoni 1998, Mignucci-Giannoni et al. 1993, Mignucci-Giannoni et al. 2000, Rodriguez-Ferrer 2001). Thus, the 2001 sightings

constitute the first records of *S. attenuata* for the Puerto Rican Bank.

Zoogeographical review.—Caribbean pantropical spotted dolphins were sighted in groups that varied between 2 and 400 individuals, with an average of 34.8 individuals per group (SE = 5.9, $n = 87$). In the Gulf of Mexico, average group sizes were between 45.4 and 67.4 individuals (range 5-650, Davis et al. 2000), 71.8 individuals (range 7-186, $n = 23$, Mullin et al. 1994) and 47.2 individuals (range 3-180, $n = 164$, CV=0.20; K. D. Mullin pers. comm.). The average group size in the U.S. Atlantic was 77.5 (range 35-145, $n = 6$, Mullin and Fulling 2003).

Mixed-species sightings of pantropical spotted dolphins with other delphinids were reported in eight encounters in the Caribbean, including with Fraser's dolphins (*Lagenodelphis hosei* Fraser 1956, three encounters), striped dolphins (two encounters), spinner dolphins (*Stenella longirostris* [Gray 1828], one encounter), Atlantic spotted dolphins (one encounter), rough-tooth dolphins (one encounter), and common dolphins (*Delphinus* sp., one encounter). Two of these were three-species combinations: spinner, striped and pantropical spotted dolphins in Martinique, and Fraser's, striped and pantropical spotted dolphins in Dominica. Multi-species associations like these involving *S. attenuata* have been reported for the eastern tropical Pacific (Au and Perryman 1985) but not for the Gulf of Mexico (Mullin et al. 1994). Pantropical spotted dolphins were observed bowriding in 13.3 percent of the sightings recorded for the Caribbean.

The species was observed in all seasons, whether defined as winter (December-February), spring (March-May), summer (June-August) or fall (September-November), or as rainy (June-November) or dry (December-May) seasons, which is more appropriate for the Caribbean. Sightings were recorded during all months of the year except January and December, most probably due to lack of effort in those months. The highest number of sightings was during March, an artifact of winter surveys for humpback and sperm whale surveys in the area. There may be a slight in-

crease of sighting rate during the spring months, even if corrected for the increase in effort in March. Water temperature depends on season, although it varies little in the tropical Caribbean, ranging from a cold average of 26.2°C in February to a warm average of 28.8°C in October (Corredor and Morel 2001). Surface water temperatures taken with each sighting (during February, March, June, and July), varied from 25.5°C to 27.8°C (mean 27.0°C, SD = 0.6, SE = 0.13, $n = 23$), similar to those encountered in the Gulf of Mexico (mean 25.0°C, range 24–27.5°C, $n = 62$, NMFS SEFSC unpubl. data). It appears from the 89 records with data on month of occurrence that pantropical spotted dolphins are year-round residents of the Caribbean. While the seasonality of the species in the Gulf of Mexico is still unresolved (K. D. Mullin pers. comm.), Mullin et al. (1994) and Davis et al. (2000) sighted the species during all seasons except winter, but mostly during the summer, and Hansen et al. (1996) observed the species in all seasons during more extensive seasonal surveys in the Gulf of Mexico. In the Southeastern U.S., it was recorded during aerial surveys in the winter (NMFS SEFSC unpubl. data) and along the U.S. mid-Atlantic

coast in July and August (Waring et al. 2002).

Caldwell et al. (1971), and later Taruski and Winn (1976), made distinctions between the distributions of *S. frontalis* and *S. attenuata* in the Caribbean, noting that *S. attenuata* was distributed around the Greater Antilles and that *S. frontalis* near the continents. Taruski and Winn (1976) supported this statement based on their loosely identified spotted dolphin data. Leatherwood et al. (1976) described the distribution of *S. attenuata* in the Caribbean as primarily near coastal areas and islands, e.g., the West Indies, and suggested that *S. attenuata* replaces *S. frontalis* around the West Indies. Based on the 96 records presented here, the pantropical spotted dolphin is distributed in all major areas of the Caribbean Sea (Fig. 3), including the eastern coast of Central America (5.2% of the records), the northern coast of South America (12.5%), the West Indies (17.7%), and more commonly in the Lesser Antilles (64.6%). Gaps in distribution, especially off Central America, are related to the lack of survey effort.

S. attenuata were commonly found in the Caribbean in oceanic waters, off the shelf

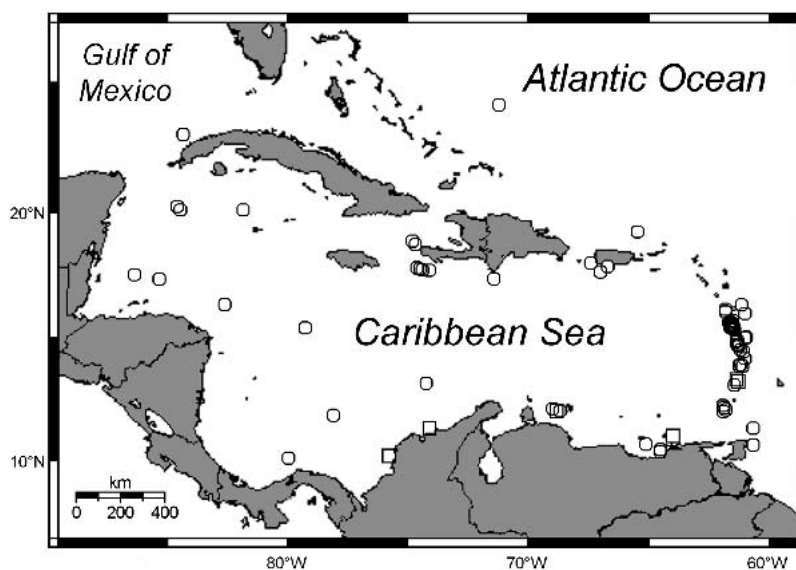


FIG. 3. Distribution of sighting and stranding records of the pantropical spotted dolphin (*Stenella attenuata*) for the Caribbean (circles = sightings, squares = strandings or captures).

edge. Depths at sighting locations ranged from 49 to 7137 m (27-3900 fathoms, mean = 1393.5 m, SE = 151.3, $n = 70$), but pantropical spotted dolphins were found most commonly in areas with a bathymetry between 600 and 2500 m (328-1367 fathoms). One of the sightings was recorded over the Puerto Rican Trench, one of the deepest areas in the world. This is consonant with records in the Gulf of Mexico, where animals were well away from the shelf edge and the upper continental slope, throughout oceanic deep waters (Mullin et al. 1994; Davis et al. 2000; Baumgartner et al. 2001). Davis et al. (2000) reported that in the northern Gulf of Mexico, stenellids including *S. attenuata*, are frequently found in cyclonic, cold-core eddies and are less frequently encountered in anticyclone, warm-core eddies, but this has not been investigated for the Caribbean. Off the eastern U.S. seaboard, from Florida to Georges Bank, *S. attenuata* are found at the continental shelf edge and over continental slope areas (Waring et al. 2002). In the Gulf of Mexico, *S. attenuata* and *S. frontalis* are parapatric, occupying adjacent but not overlapping areas (Mullin and Hansen 1999). However, in the Caribbean, *S. frontalis* and *S. attenuata* are sympatric, occupying the same area, contrary to the assertion by Leatherwood et al. (1976) that they are parapatric.

Pantropical spotted dolphins are the most abundant cetacean in the oceanic northern Gulf of Mexico (Davis et al. 2000; Mullin and Hoggard 2000; Baumgartner et al. 2001) but not in the eastern U.S. Atlantic. Population estimates for the Gulf of Mexico are 91,321 (CV = 0.16, K. D. Mullin pers. comm.), while they were 12,747 (CV = 0.56) in the eastern U.S. Atlantic (Mullin and Fulling 2003). No estimates can be made for the Caribbean at this time, but based on the sighting records presented here, the Atlantic spotted dolphin is probably more common. Future aerial and ship surveys are needed to calculate abundance estimates for these and other cetacean species.

Future studies and surveys in the Caribbean should pay attention to pantropical spotted dolphin sightings and strandings to further document presence of this tropical

species in the Caribbean, its zoogeography and life history.

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