Cetacean ocurrence in the Santa Marta Region, Colombian Caribbean, 2004-2005

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Located on the central coast of the Colombian Caribbean, the region of Santa Marta and the adjacent Tayrona National Natural Park (TNNP) (11º14'N, 74º14'W) comprise a variety of tropical coastal habitats such as rocky shores, coral patches, small mangrove lagoons, sea grass meadows, and sandy bottoms (Garzón-Ferreira and Cano, 1991; Díaz *et al.*, 2000). The geomorphology of the region is shaped by the incursion into the sea of the foothills of a steep coastal mountainous system known as the "Sierra Nevada de Santa Marta", leading to the absence of a wide shelf in most of the region, and to the presence of great depths near the coast (Ramírez, 1983; Molina, 1990[5]) (Figure 1). The two main sources of biological productivity are driven by the climatic regime: during the dry season (December to April), trade winds blowing from the northeast cause upwelling events and phytoplankton blooms at several locations along the coast, whereas in the rainy season (May to November), the ocean is fertilized by coastal runoff and riverine inputs (Müller, 1979; Bula-Meyer, 1985; Pujos *et al.*, 1986; Franco-Herrera *et al.*, 2006).

The presence of cetaceans in this region is known from isolated records for eight species: ordinary Bryde's whale (*Balaenoptera brydei*), humpback whale (*Megaptera novaeangliae*), pygmy sperm whale (*Kogia breviceps*), rough-toothed dolphin (*Steno bredanensis*), marine tucuxi (*Sotalia guianensis*), common bottlenose dolphin (*Tursiops truncatus*), Atlantic spotted dolphin (*Stenella frontalis*) and pantropical spotted dolphin (*Stenella attenuata*), based on sightings, strandings, and preserved specimens (Cuervo *et al.*, 1986; Prieto-Rodríguez, 1988; Vidal, 1990; Palacios, 1993; Flórez-González and Capella, 1995). Given the ecological importance of the region, the present study was conceived as a first attempt at characterizing cetacean occurrence around Santa Marta in a systematic manner. The study was conducted between August and November of 2004 and between January and August of 2005, using primarily boat-based surveys from platforms of opportunity and land-based surveys from fixed points. This information was supplemented with records from secondary sources when they were supported by photographic and/or filmic material, and with well-documented observations made by previously trained personnel. For logistic purposes, the region was divided into five zones, beginning in the southwest at La Loma Point (11°06'59"N, 74°14'04"W), and ending at Arrecifes (11°20'22"N, 73°58'19"W), in the northeast. These zones are labeled in Figure 1 as: Airport (*A*), Gaira Bay (*B*), Santa Marta Bay (*C*), Granate (*D*), and TNNP (*E*).

Boat-based surveys were made parallel to the coastline, from a variety of boats equipped with outboard engines. During the surveys, two trained observers looked out for cetaceans with and without the aid of binoculars (Tasco® 10x50 mm), at speeds between 10 and 15km/h, and a distance of 200 to 2000m from the coast. Once cetaceans were sighted, they were approached to record their geographic position (GPS Garmin® 12), species identity, group structure, behavior, and other information such as the occurrence of natural marks. Land-based surveys were conducted at four fixed points within zones *A-D*, all of them from outposts at heights greater than 20m above sea level, within 20m from the coastline, and with an effective radial field-of-view of about 2000m (Figure 1). Finally, secondary observations were compiled, including photographs, films, and reliable accounts. Altogether, 155 boat-based trips were completed, distributed in the five zones *A-E*, for a total of 1012.5km and 70h of effort. In addition, 17 days of observation were conducted from the land-based points, of 10 hours each (0700h to 1700h), for a total of 174.5h (Figure 1). The filmic and photographic information, as well as the verified testimonies, provided reliable data for five reliably records. A total of 28 cetacean records were obtained during the study (Table 1): 25 sightings, two incidental captures, and one beach-cast skeleton. These correspond to seven species: ordinary Bryde's whale, short-finned pilot whale (*Globicephala macrorhynchus*), marine tucuxi, pantropical spotted dolphin, striped dolphin (*Stenella coeruleoalba*), Atlantic spotted dolphin (the most recorded), and common bottlenose dolphin.

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[5] Molina, A. (1990) *Estudio geológico de la plataforma continental Caribe (Santa Marta-Punta Morro Hermoso)*. Page 120 *In* Memorias, VII Seminario Nacional de Ciencias y Tecnologías del Mar, 30 October - 2 November, Cali, Colombia.

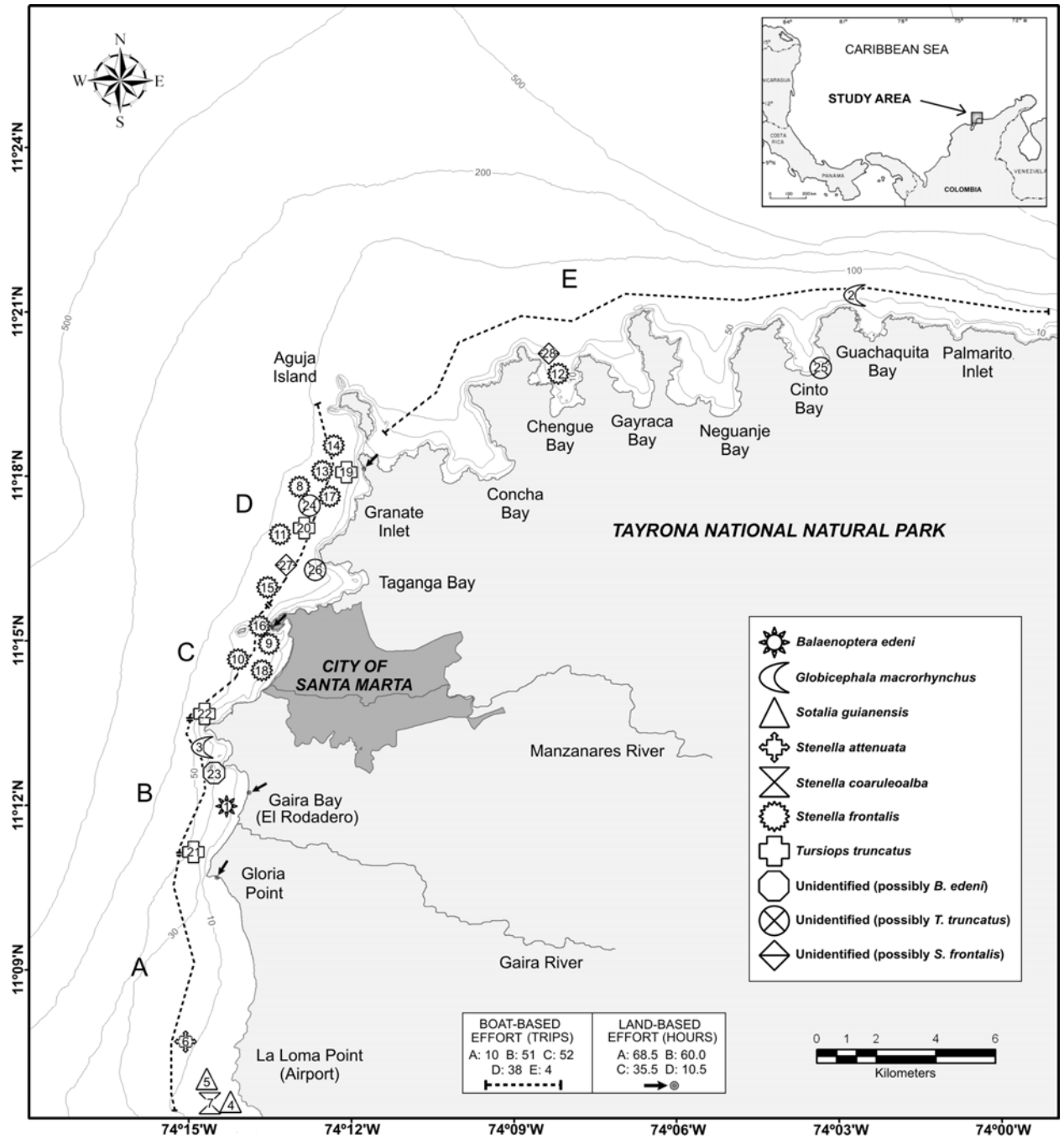

Figure 1. Map of the study area, showing the five zones *A-E*, the routes of boat-based surveys (dotted lines), and the location of the outposts (black arrows) used for the land-based surveys. Insets show the number of trips (for the boat-based surveys) and the effort hours (for the land-based surveys). The map also shows the location of all the records for the period August 2004 – August 2005. The numbers inside the record symbols correspond to those in Table 1. Source of base map: Sistema de Información Ambiental Marino (SIAM), LabSI, INVEMAR, 2006.

Ordinary Bryde's whale. The only record corresponds to a sighting, initially detected within Gaira Bay (Figure 1) from the land-based point. It was then picked up by the survey boat, and followed for about two hours. The animal moved in erratic, circling patterns, suggestive of feeding activities. Its dive intervals ranged from one to two minutes, although towards the end of the follow-up, its behavior shifted to traveling, with more prolonged dive times. This species has been previously reported for Gaira and Santa Marta Bays (Prieto-Rodríguez, 1988; Vidal, 1990), in association with the seasonal upwelling phenomenon occurring during the first months of the year (January and March). Sightings off Santa Marta Bay have consisted of small groups or solitary animals (Flórez-González and Capella, 1995). In contrast, in the Guajira region (11°36'N, 72°58'W), where the upwelling is more

permanent year-round, the species has been reported in May (Vidal, 1990), at a time when this phenomenon is not active in Santa Marta and the TNNP. The sighting in this study (February) corroborates the seasonal occurrence pattern of the species in association with upwelling centers. During this season, ordinary Bryde's whales may find in Santa Marta a reliable food source based on the abundant round sardinella (*Sardinella aurita*) and Atlantic thread herring (*Opisthonema oglinum*), both schooling fish whose populations appear to closely depend on the upwelling-driven productivity (Manjarrés *et al.*, 1993).

Short-finned pilot whale. It was recorded on two occasions (Figure 1), in both cases traveling. These are the first recorded live sightings for the Colombian Caribbean, since the previous records (Vidal, 1990) are of a mass stranding on San Andrés Island (12°32'N, 81°43'W), and several individual strandings along the coast of the Guajira region. Given the steep bathymetric profile of the study area, it is possible that this typically offshore species uses the near-shore habitats during the daytime for transiting or resting, after feeding at night in deeper habitats, as has been documented off

Table 1. Details of the records by species recorded in the Santa Marta region, Colombian Caribbean.

#	SPECIES	ZONE	DATE (D/M/Y)	TIME (HOURS)	DISTANCE TO SHORE (m)	GROUP STRUCTURE	BEHAVIOR
	Balaenoptera brydei						
01		Gaira Bay (*B*)	15/02/2005	0730	1000 - 2500	1 (1*A*)	Feeding / traveling
	Globicephala macrorhynchus						
02		Guachaquita (*E*)	04/01/2005	1100	<500	60 (*C*, *J*, *A*)	Traveling
03		Gaira Bay (*B*)	-/01/2005	Morning	2000	30 (30*U*)	Traveling
	Sotalia guianensis						
04		Airport (*A*)	-/09/2003	Morning	-	2 (1*C*, 1*A*)	Entanglement
05		Airport (*A*)	10/09/2004	Morning	1000	10 (10*U*)	Traveling
	Stenella attenuata						
06		Airport (*A*)	17/10/2004	0802	1000	3 (1*C*, 2*A*)	Feeding
	Stenella coeruleoalba						
07		Airport (*A*)	12/06/2002	2200	-	1 (1*C*)	Stranding
	Stenella frontalis						
08		Granate (*D*)	26/06/2004	Morning	-	3 (3*A*)	Traveling
09		Santa Marta (*C*)	01/07/2004	Morning	<500	30 (30*U*)	Traveling
10		Santa Marta (*C*)	05/07/2004	Morning	<500	25 (25*U*)	Traveling
11		Granate (*D*)	10/08/2004	Morning	<500	3 (3*A*)	Traveling
12		Chengue (*E*)	01/09/2004	1300	<500	12 (2*C*, 10*A*)	Traveling
13		Granate (*D*)	03/10/2004	1330	500	10 (10*U*)	Traveling
14		Granate (*D*)	01/11/2004	0915	500	5 (2*C*, 3*A*)	Traveling
15		Taganga (*D*)	22/01/2005	Morning	1000	1 (1*A*)	Traveling
16		Santa Marta (*C*)	25/03/2005	0925	30	30 (30*U*)	Traveling
17		Granate (*D*)	08/04/2005	0830	50	10 (10*U*)	Traveling
18		Santa Marta (*C*)	15/04/2005	0910	>500	10 (10*U*)	Traveling
	Tursiops truncatus						
19		Granate (*D*)	08/06/2004	Morning	-	2 (2*A*)	Traveling
20		Granate (*D*)	28/01/2005	Morning	>500	2 (2*A*)	Traveling
21		Gaira Bay (*B*)	18/03/2005	1000	500 – 1000	15 (3*C*, 5*J*, 7*A*)	Feeding / traveling
22		Santa Marta (*C*)	18/08/2005	0940	100 - 300	20 (3*C*, 4*J*, 13*A*)	Traveling
	Unidentified whale (possibly *B. brydei*)						
23		Gaira Bay (*B*)	15/02/2005	1730	1000	1(1*U*)	-
	Unidentified dolphin (possibly *T. truncatus*)						
24		Granate (*D*)	11/11/2003	Morning	100	2 (1*C*, 1*A*)	Traveling
25		Cinto (*E*)	15/05/2004	Morning	-	1 (1*U*)	-
26		Taganga (*D*)	21/05/2004	Morning	>500	1(1*A*)	Traveling
	Unidentified dolphin (possibly *S. frontalis*)						
27		Taganga (*D*)	24/09/2004	Morning	>800	1 (1*A*)	Traveling
28		Chengue (*E*)	29/10/2004	Morning	300	10 (10*U*)	Traveling

Abbreviations in group structure are: *C* = calf, *J* = juvenile, *A* = adult; and *U* = undetermined.

Hawaii (Baird *et al.*, 2003[6]) and the Canary Islands (Heimilich-Boran, 1993).

Marine tucuxi. It was recorded on two occasions; a sighting and an incidental capture. A lactating mother and a juvenile became entangled in a discarded artisanal gillnet, and died later. A necropsy was conducted, but the cause of death was not evident. The juvenile presented deep wounds, mainly to the caudal peduncle, that already were healing over the net, so it is believed that the animal had been entangled for some time, unlike the mother, whose injuries were superficial. The sighting record corresponds to a traveling group of around 10 individuals, seen in zone *A*, about 1000m from the coast (Figure 1). The species appears to be common in zone *A*, which lies at the northern end of the Gulf of Salamanca, and presents a transitional geomorphology influenced by the great coastal-estuarine mangrove system of "Ciénega Grande de Santa Marta". Sedimentation rates in this system are much higher than further to the north, resulting in a shallow, gently sloped bathymetric profile (Pujos *et al.*, 1986). This agrees well with the species' affinity for near-shore, estuarine-influenced habitats (Borobia *et al.*, 1991; Geise *et al.*, 1999).

Pantropical spotted dolphin. In the single sighting of this species (Figure 1), feeding activity was evident. This is the first live report of the species in coastal waters of the Colombian Caribbean. Previously, it was sighted in oceanic waters 216km off Aguja Island (Jefferson and Lynn, 1994). A stranding was also reported at the Rosario Islands (10º09'N, 75º45'W), and a skull was found in Gayraca (TNNP) (Vidal, 1990). Since only a single record of the species was obtained during this study, it is not possible to make inferences about its local occurrence.

Striped dolphin. A net entanglement of a striped dolphin calf took place in zone *A* on 12 June 2002. The individual was transferred alive to the pool of a local aquarium, and its initial condition was described as "unstable", with sudden and erratic movements in the pool, which stopped later. It had a wound on the jaw, which was partially separated from the head, and its feces contained numerous parasites, probably trematodes. The calf, of 128cm in length and 37kg, died 46h after being transferred to the aquarium. A necropsy was conducted, indicating only an infestation of parasites in the brain, but no confirmed cause of death. This is the first time that the striped dolphin is confirmed for the Colombian Caribbean. Although Cuervo *et al.* (1986) reported the species near the Rosario Islands, their record lacks any details that substantiate a positive identification, to the extent that Flórez-González and Capella (1995) disregarded all the records from those authors, considering them unreliable. The occurrence of *S. coeruleoalba* in the Santa Marta region is probably rare, considering the oceanic nature of the species and its overall infrequency in the Caribbean (Debrot *et al.*, 1998; Mignucci-Giannoni, 1998).

Atlantic spotted dolphin. For the 11 sightings of the species (Figure 1), group size varied from 1-30, being more common those greater than 10 ($\bar{x}$ = 12.6 ± 10.7s.d.). The species tended to be found where the bathymetric gradient is more pronounced, but otherwise no clear distribution pattern was detected, and it was never seen feeding. Thus, it is believed that the groups sighted are oceanic in nature, and that they make brief incursions to the deeper coastal zones, using them occasionally for transit. Atlantic spotted dolphins have only been reported twice before: once in Gaira Bay (D.M. Palacios, personal observations, included in Flórez-González and Capella, 1995), and once about 39km northeast of Arrecifes (TNNP) (Perrin *et al.*, 1987).

Common bottlenose dolphin. The observed groups (Figure 1) were usually traveling, except for the sighting in Gaira Bay, in which the group alternated its travel with feeding on fish at the surface, made evident by the association with birds, mainly magnificent frigate birds (*Fregata magnificens*). Considering the distribution of the records, it can be assumed that the species is found throughout the study area, including zone *A*. It may use the coastal region of Santa Marta and the TNNP for foraging as well as for resting purposes within the bays. The species has only been sighted once previously in Gaira Bay (D.M. Palacios, personal observations, in Flórez-González and Capella, 1995), and captures for aquaria have been also documented for Santa Marta and Cartagena (Vidal, 1990).

Ecological considerations. The combination of a complex geomorphology, the presence of diverse coastal environments in a relatively small area, and the local high biological production make the Santa Marta and TNNP region a potentially exploitable habitat for a variety of species for purposes of foraging, resting, or transiting. Active feeding was observed for three species (ordinary Bryde's whale, pantropical spotted dolphin, and common bottlenose dolphin), suggesting that they take advantage of the seasonal influx of large schools of pelagic fish like round sardinella, Atlantic thread herring, frigate tuna (*Auxis thazard*), and little tunny (*Euthynnus alletteratus*), associated with the wind-driven upwelling and the fertilization by continental waters. For other species, the presence of protected bays near deep water may offer protection and a resting place from open-ocean currents and winds. Since the exploration of this study was limited to a narrow strip near the coast, it is not possible to advance conclusions about the true

[6] Baird, R. W., D. J. McSweeney, M. R. Heithaus and G.J. Marshall. (2003) *Short-finned pilot whale diving behavior: deep feeders and day-time socialites*. *In* Abstracts, 15th Biennial Conference on the Biology of Marine Mammals, 14 – 19 December, Greensboro, NC, USA.

distribution or abundance of the different species throughout the region. It will be necessary to carry out systematic oceanic surveys to quantify the relative abundance and distribution patterns of the most abundant species.

Anthropogenic threats. It is important to evaluate in detail the impacts from anthropogenic pressure, especially the incidental mortality by entanglement in artisanal gillnets. Aside from the two cases documented in this study, it is informally known that this is a common occurrence in the adjacent Gulf of Salamanca, particularly involving marine tucuxis. Other detected sources of pressure include possible percussion injuries and acoustic pollution resulting from fishing with explosives, which is a common practice in the region and that has been previously implicated in a mass stranding of Atlantic spotted dolphins in zone *A* (Palacios, 1993). The industrial marine traffic in Santa Marta Bay, where an international shipping port is located, and the vicinity of the airport, with a coal- and oil-supply wharf are additional sources of noise pollution.

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