



Cetacean occurrence in the Tayrona National Park, a marine protected area in the Colombian Caribbean

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Located on Colombia's northern coast (74°03'W, 11°21'N), the Tayrona National Park (TNP) lies at the foothills of the Sierra Nevada de Santa Marta massif, the highest coastal mountain in the world, reaching 5800m only 60km from the coast (Correa and Morton 2010¹). The coastal environments of the TNP and neighboring areas contain some of the most important and diverse ecosystems of Colombia's coast on the Caribbean Sea (Diaz and Acero, 2003). The park was established in 1964 by the Colombian government² and in 1979 a Biosphere Reserve comprising both the Sierra Nevada de Santa Marta and the TNP was designated by UNESCO³. The TNP includes a terrestrial area of 120km² and a marine protected area (MPA) of 30km² (Figure 1) in which the only allowed extractive use of resources is for subsistence fisheries⁴.

A MPA is 'a marine or coastal area, or a combination of the two, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values' (Dudley, 2008). The MPA of the TNP extends from the coastline out to 1000m offshore and was established to preserve the critical ecosystems of the park and the unique marine species that inhabit them, including algae, cnidarians, arthropods, echinoderms, mollusks, fish and sponges (Sánchez-Herrera *et al.*, 2006⁵).

The continental shelf off the TNP is very narrow and the coastline is shaped by the alternation of rocky headlands and deep bays (Correa and Morton, 2010¹). The ocean environment in the region is seasonally affected by two dominant oceanographic processes: cool waters resulting from coastal upwelling forced by northeast trade winds from November to May (the dry season), and warm, stratified conditions resulting from the intensification of the Panama-Colombia Countercurrent from May to October (the wet season). The latter period is also characterized by increased precipitation and continental runoff (Ramírez, 1983; Franco-Herrera *et al.*, 2006; Ruiz-Ochoa *et al.*, 2012).

¹Correa, I.D. and Morton, R.A. (2010) Coasts of Colombia. Coastal and Marine Geology Program, St. Petersburg Coastal and Marine Science Center. Available online at <<http://coastal.er.usgs.gov/coasts-colombia/index.html>>. Consulted on 16 March 2012.

²Resolución No. 191, 31 August 1964. Instituto Colombiano de la Reforma Agraria (INCORA), Republica de Colombia. Available online at <<http://www.parquesnacionales.gov.co/PNN/portel/libreria/pdf/Resolucion0191.pdf>>. Consulted on 17 March 2012.

³UNESCO (2011) World Network of Biosphere Reserves 2010: Sites for Sustainable Development. Page 510. United Nations Educational, Scientific and Cultural Organization –UNESCO-Man and Biosphere Program, Gobierno de España, Ministerio de Medio Ambiente y Medio Rural y Marino. Available online at <<http://www.unesco.org/mabdb/br/brdir/directory/biores.asp?mode=all&code=COL+03>> Consulted on 17 March 2012.

⁴Resolución No. 0234, 17 December 2004. Ministerio de Ambiente y Desarrollo Territorial and Unidad Administrativa Especial del Sistema de Parques Nacionales Naturales. Available online at <<http://www.parquesnacionales.gov.co/PNN/portel/libreria/pdf/Ressolucion0234de2004.pdf>>. Consulted on 17 March 2012.

⁵Sánchez-Herrera, G., Hernandez-Turriago, M.L., Mayor-Aragón, G., Gómez-Rangel, C., Corredor-Bobadilla, I.P., Puentes-Amaya, M.Y., Blanco-Ortiz, W., Muñoz-Díaz, M., Pinzón-Cáceres, J.M. and Franke-Ante, R. (2006) Plan de Manejo 2005-2009 Parque Nacional Natural Tayrona. Unidad administrativa del Sistema de Parques Nacionales Naturales and Ministerio de Ambiente y Desarrollo Territorial. Santa Marta, Colombia, 298 pp. Available online at <<http://www.parquesnacionales.gov.co/PNN/portel/libreria/pdf/TayronaPM2009.pdf>> Consulted on 17 March 2012.

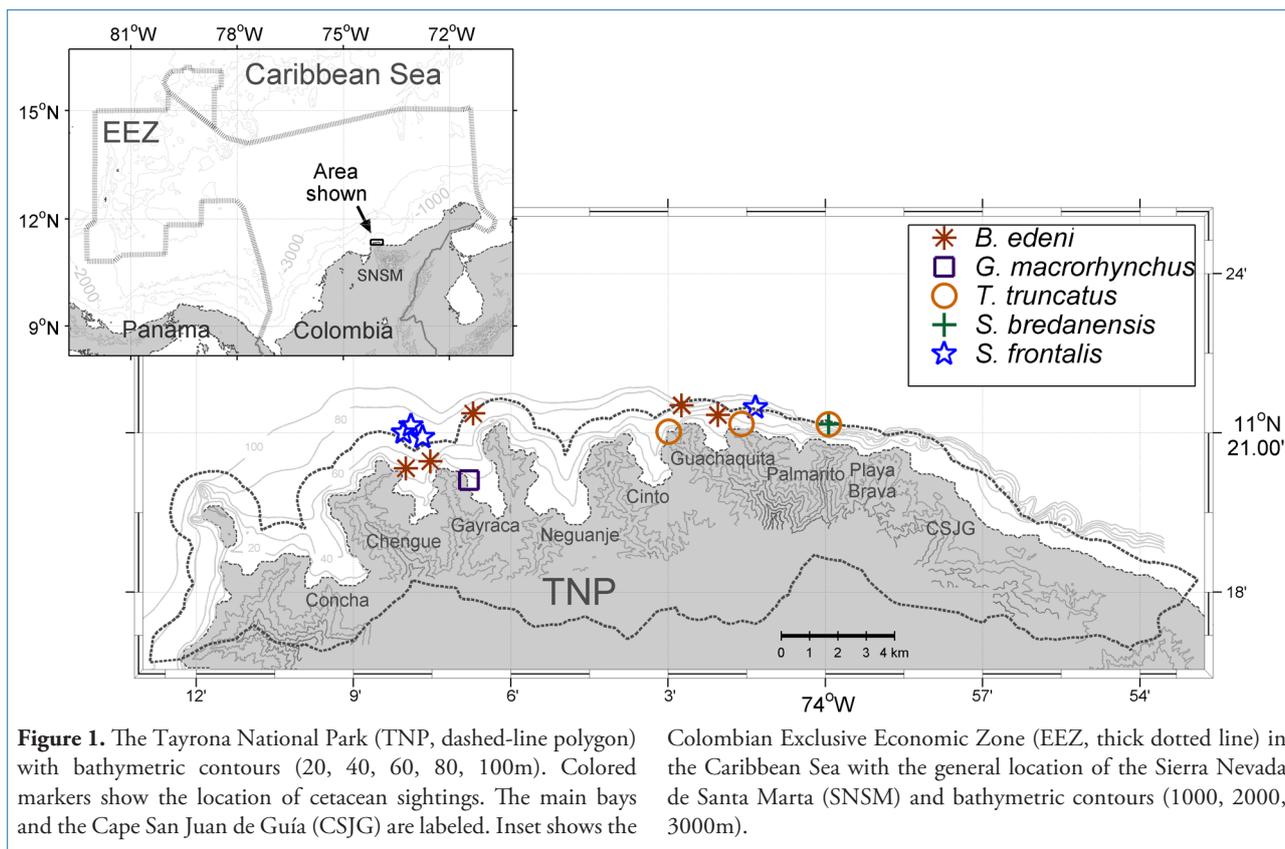


Figure 1. The Tayrona National Park (TNP, dashed-line polygon) with bathymetric contours (20, 40, 60, 80, 100m). Colored markers show the location of cetacean sightings. The main bays and the Cape San Juan de Guía (CSJG) are labeled. Inset shows the

Colombian Exclusive Economic Zone (EEZ, thick dotted line) in the Caribbean Sea with the general location of the Sierra Nevada de Santa Marta (SNSM) and bathymetric contours (1000, 2000, 3000m).

Five cetacean species, or 12% of all species known to occur in the Colombian Caribbean, have been previously reported for the TNP: the humpback whale (*Megaptera novaeangliae*), the short-finned pilot whale (*Globicephala macrorhynchus*), the common bottlenose dolphin (*Tursiops truncatus*), the Atlantic spotted dolphin (*Stenella frontalis*) and the false killer whale (*Pseudorca crassidens*). These records come from isolated sighting or stranding reports (Vidal, 1990; Flórez-González and Capella-Alzueta, 1995) and, more recently, from local studies in the adjacent Santa Marta area that have extended into the TNP (Pardo and Palacios, 2006; Lozano, 2007; Fraija, *et al.*, 2009).

We conducted 32 systematic cetacean surveys between February-June 2006, totaling 122h of effort. Each survey consisted of two transects at 100m and 2000m from shore, following the coastline between Concha Bay (74°10'W, 11°18'N) and Cape San Juan de Guía (73°57'W, 11°20'N). Surveys lasted 4 to 5h in continuous effort as long as the Beaufort sea state was less than 4, at a speed not exceeding 15km h⁻¹. During the surveys, four observers scanned the sea surface with the naked eye in search of cetaceans from bow, stern, port, and starboard. The first 15 surveys were made from a 6m fishing boat with a 40hp outboard engine and the last one 15 from a 9m boat with two 70hp outboard engines. Data collected for each sighting included geographic position, species identity, group size, age categories and inter-specific associations (Table 1). Species identifications were confirmed with photographs showing diagnostic

features. Group sizes were determined as the average of the independent estimations made by each observer. Age categories were determined comparing the relative sizes of the individuals within each group. Sightings made by a group of local fishermen participating in the project and previously trained to identify the local cetaceans were considered only when sufficient diagnostic information was provided.

We recorded 13 sightings that included five species (Table 1): Bryde's whale (*Balaenoptera edeni*), short-finned pilot whale (*Globicephala macrorhynchus*), common bottlenose dolphin (*Tursiops truncatus*), rough-toothed dolphin (*Steno bredanensis*), Atlantic spotted dolphin (*Stenella frontalis*) and unidentified rorqual (*Balaenoptera* sp.). The Bryde's whale and the rough-toothed dolphin had not been reported previously for the TNP. The overall encounter rate, calculated as the number of sightings divided by the hours of effort during the project was 0.092 sightings per hour.

Bryde's whale (*Balaenoptera edeni*): three sightings were recorded during February (Figures 1 and 2). The first one was made near the coast of Guachaquita Bay. There were two animals, an adult and a juvenile, which exhibited erratic movements during the period of observation. Brown pelicans (*Pelecanus occidentalis*) were seen feeding on sardine and mullet aggregations (Families Clupeidae and Mugilidae). The second sighting corresponded to a solitary animal traveling eastward near Cinto Bay. Its movements were linear and sustained at ~10kmh⁻¹, with dive times of about five minutes. Finally, a single animal was observed in Gayraca Bay, near the coast

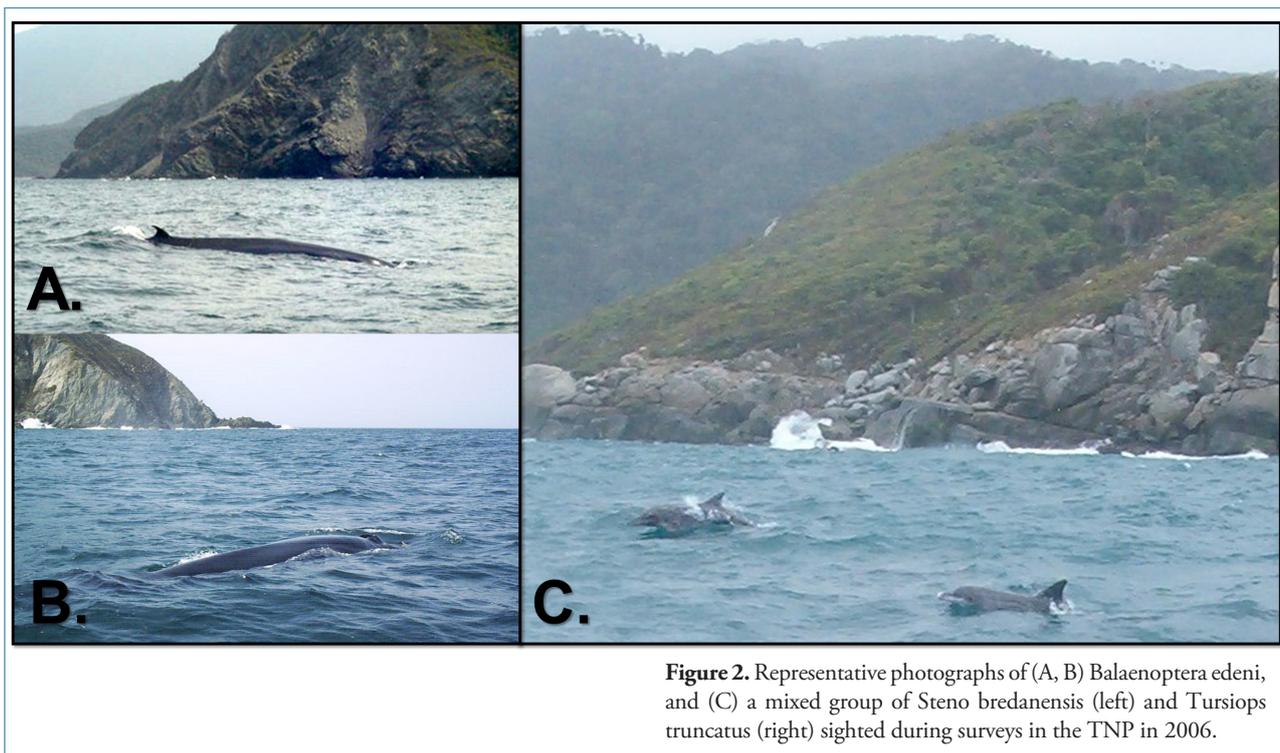


Figure 2. Representative photographs of (A, B) *Balaenoptera edeni*, and (C) a mixed group of *Steno bredanensis* (left) and *Tursiops truncatus* (right) sighted during surveys in the TNP in 2006.

in depths of 50-70 m, with diving periods from two to four minutes. After 20 minutes the whale traveled northwest. Surface schools of anchovy (*Anchoviella* sp.), machuelo (*Opisthonema oglinum*) and sardine (*Sardinella* sp.) were recorded during this sighting but we did not observe direct feeding.

The Bryde's whale is not considered a migratory species but its distribution pattern appears to be associated with coastal upwelling processes (e.g. Debrot *et al.*, 1998). In the TNP upwelling is a seasonal phenomenon occurring between November and May while primary productivity peaks in the first months of the year (Ramírez, 1983). Although these are the first records of Bryde's whales in the TNP, three previous sightings have been reported in the surrounding area, all in February (Vidal, 1990; Pardo and Palacios, 2006). Bryde's whales are mostly ichthyophagous, their main prey include clupeids and engraulid fishes (Urbán and Flores-Ramírez, 1996; Debrot *et al.*, 1998; Pauly *et al.*, 1998; Romero *et al.*, 2001), whose abundance increases in the region during the upwelling season (Manjarres *et al.*, 19936; Criales, 2004).

Unidentified rorqual whale (*Balaenoptera* sp.): The fishermen who participated in the study reported two sightings of rorquals near Gayraca Bay in the days of the first and second Bryde's whale sightings described above. While it is possible

that these sightings were of the same whales, the fishermen did not provide sufficient diagnostic information to identify them to species level.

Short-finned pilot whale (*Globicephala macrorhynchus*): We recorded a single group of about 60 animals on the east side of Gayraca Bay (Figure 1). The group remained within the bay for about two hours, relatively inactive in shallow waters and likely resting. Pilot whales typically rest or move slowly during the day, whereas they feed at night mainly on squid that migrate vertically from deep waters (Olson, 2008). Since this part of the TNP has a very narrow continental slope adjacent to the enclosed bays, it may serve as a refuge or resting site during the day, close to their deeper feeding areas. This is the second report of this species for the TNP (see Pardo and Palacios, 2006).

Common bottlenose dolphin (*Tursiops truncatus*): We recorded three sightings of this species, all of them during February (Figures 1 and 2). The first and second sightings were made in the vicinity of Guachaquita and Cinto bays, respectively, and on both occasions the animals approached the boat to bowride. Group size ranged from 20 to 30 individuals, including calves, juveniles and adults. The third sighting was made between Palmarito and Playa Brava, just 100m from the coast. About 15 animals were in a feeding association with 35 rough-toothed dolphins. The behavior was determined by the presence of shoals of needlefish (*Tylosurus crocodilus*) in the area and direct observation of feeding dolphins. There are two previous reports of the species in the western part of the TNP (Pardo and Palacios, 2006), and it also has been observed in Gaira Bay, just outside the TNP (Fraija *et al.*, 2009).

⁶Manjarres, L., Infante, J., Rueda, A. and Escorcía, F. (1993) Carta pesquera del área de Santa Marta. Page 45–53 in Proyecto integral de investigaciones y desarrollo de la pesca Artesanal y Marítima en el área de Santa Marta. Instituto Nacional de Pesca y Acuicultura (INPA). Available from Universidad del Magdalena, Santa Marta, Colombia <<http://www.unimagdalena.edu.co>>. Consulted on 17 March 2012.

Table 1. Cetacean sighting data (species, location, group size and age categories).

Date (D/M/Y)	Cetacean sightings		
	Species	Location	Group composition
02/02/2006	<i>Balaenoptera edeni</i>	74°02'5.6"W, 11°20'58.4"N	2 (C/A)
	<i>Balaenoptera</i> sp.*	74°06'43.1"W, 11°21'21.9"N	1 (A)
03/02/2006	<i>Balaenoptera edeni</i>	74°02'44.4" W, 11°21'31"N	1 (A)
	<i>Balaenoptera</i> sp.*	74°07'32.1"W, 11°20'27.9"N	1 (A)
04/02/2006	<i>Balaenoptera edeni</i>	74°08'11"W, 11°20'19"N	1 (A)
07/02/2006	<i>Globicephala macrorhynchus</i> *	74°06'47.8"W, 11°20'6.5"N	60 (C/J/A)
18/02/2006	<i>Tursiops truncatus</i> *	74°01'36"W, 11°20'48"N	30 (C/J/A)
19/02/2006	<i>Tursiops truncatus</i> *	74°02'59,4"W, 11°21'1,3"N	20 (C/J/A)
22/02/2006	<i>Tursiops truncatus</i>	73°59'00"W, 11°20'44,1"N	15 (A)
	<i>Steno bredanensis</i>	73°59'00"W, 11°20'44,1"N	35 (C/J/A)
09/06/2006	<i>Stenella frontalis</i>	74°01'0.1"W, 11°21'21.1"N	30 (C/J/A)
10/06/2006	<i>Stenella frontalis</i> *	74°08'2.6"W, 11°21'0"N	20 (C/J/A)
13/06/2006	<i>Stenella frontalis</i> *	74°07'54"W, 11°21'7.9"N	20 (C/J/A)
14/06/2006	<i>Stenella frontalis</i> *	74°07'40.8"W, 11°20'55.1"N	20 (C/J/A)

C: Calf; J: Juvenile; A: Adult; *: Sighting made by fishermen.

Rough-toothed dolphin (*Steno bredanensis*): The only sighting of this species was the one described above in a feeding association with common bottlenose dolphins. This is the first record of the rough-toothed dolphin for the TNP. Although the distribution of rough-toothed dolphin is mainly oceanic (Miyazaki and Perrin, 1994), we found them within 100m from the coast. Inter-specific associations between rough-toothed and bottlenose dolphins are common worldwide (e.g. Miyazaki and Perrin, 1994; Lodi and Hetzel, 1999).

Atlantic spotted dolphin (*Stenella frontalis*): Four sightings were recorded, all of them during June. The first one was of 30 individuals (50% adults) near Palmarito bay in 200m depth. The other three were in same area, a fishing zone, about 1.5km of Chengue Bay in 80m depth. Group sizes ranged between 20 and 40 individuals, and there were calves, juveniles and adults, as determined by the degree of spotting and relative body size.

Atlantic spotted dolphins are usually found over sharp bathymetric gradients extending to the 200m isobath (Moreno *et al.*, 2005; Luksenburg, 2011) but may also occur in shallow water (-20m) (Davis *et al.*, 1998; Moreno *et al.*, 2005). This is the species most frequently recorded in the TNP and surrounding areas, mainly during the wet season and the transition period (Flórez-González and Capella-Alzuet, 1995; Pardo and Palacios, 2006), when the water is warmer. These conditions may be conducive to an increase in the availability of their potential prey, such as squid, flying fish, and benthic invertebrates, as has been described for other regions of the Atlantic and the Caribbean (Perrin, 2002; Moreno *et al.*, 2005; Luksenburg, 2011).

The MPA of the TNP was primarily established to protect the coastal environments (within 1000m from shore) and the species associated with them. We have demonstrated the occurrence of five cetacean species within the MPA, indicating that the TNP also provides suitable habitat for marine megafauna. This information, together with that from similar efforts in local waters (Pardo and Palacios, 2006; Lozano, 2007; Fraija *et al.*, 2009), provides some of the first data on cetacean occurrence and diversity for this part of the Caribbean. Considering the region's marked oceanographic seasonality, steep bathymetric relief and complex coastal geomorphology, it is not surprising that a diverse cetacean assemblage including species of oceanic habits occurs close to shore, underscoring the need to conduct further surveys extending to the offshore environments to more completely characterize their populations (*e.g.* Pardo *et al.*, 2009).

Conservation science ascribes cetaceans and other marine megafauna a role as sentinels of the status and health of coastal habitats (*e.g.* Hooker and Gerber, 2004). However most existing MPAs are very small and may be insufficient to offer adequate coverage for cetaceans (Gómez and Méndez, 2004; Bearzi, 2012). We recommend that information regarding cetacean occurrence within the TNP be incorporated into its management plan to ensure complete representation of ecologically sensitive areas for a wide spectrum of marine species. Furthermore, as highly mobile species that regularly occur in the region, cetaceans could be used to inform existing proposals to create a network of MPAs along the northeastern coast of Colombia (Alonso *et al.*, 2008), echoing the recommendations by the Protocol on Specially Protected Areas and Wildlife (SPA) for the Wider Caribbean (Hoyt, 2005) and elsewhere (*e.g.* Bearzi, 2012).

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