

Sighting frequency and relative abundance of bottlenose dolphins (*Tursiops truncatus*) along the northeast coast of Margarita Island and Los Frailes Archipelago, Venezuela

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Abstract: The study of local cetaceans in Venezuela has a very recent history, and few efforts have been made in the assessment of coastal populations based on field research. The occurrence of whales and dolphins along the northeast coast of Venezuela has been documented through sightings and stranding records. Given the underwater topographical features and the influence of upwelling processes, this area is considered a very productive coastal ecosystem. Our objective was to establish the sighting frequency and relative abundance of bottlenose dolphins in the area. Sighting records were gathered on bottlenose dolphins and other cetacean species occurring along the northeast coast of Margarita Island and Los Frailes Archipelago through direct observation during land-based (6 surveys, 48 hours of observation) and boat-based surveys (24 surveys, 121 hours of observation, 1295 km covered). A *sighting frequency* was calculated using two methodologies and then compared, considering: 1) a mean effective observation time (4.27 hours), and 2) distance covered with cetacean sightings (1108 km). A third method is proposed relating a mean effective distance covered with cetacean sightings and expressed as a percentage. The *abundance index* was calculated using the mean effective observation time. The sighting frequency of *Tursiops truncatus* in the study area was 3 - 4 sightings per day of 4.27 observation hours, or by 185 kilometers covered. The relative abundance was calculated as 35 dolphins in the study area, so a total population of less than 60 dolphins could inhabit the proposed range. *Tursiops truncatus* is the dominant species in the northeast coast of Margarita Island and Los Frailes Archipelago with 70% of all the sightings, so this locality could be termed as the distribution range of a possible local population of bottlenose dolphins. Rev. Biol. Trop. 53(3-4): 595-600. Epub 2005 Oct 3.

Key words: *Tursiops truncatus*, abundance, sighting frequency, Margarita Island, Venezuela.

The study of local cetaceans in Venezuela has a very recent history and few efforts have been made in the assessment of coastal populations based on field research. The occurrence of whales and dolphins along the northeast coast of Venezuela has been documented through sightings and stranding records. Given the underwater topographical features and the influence of upwelling processes, this area is considered to be a very productive coastal ecosystem ([Castellanos 1997](#), [Llano et al. 1999](#), [Lorenzini 2000](#)).

Tursiops truncatus is a common species in Caribbean waters, widely documented and reported in literature for the north and central region ([Mignucci 1998](#)) as well as in the south-east Caribbean (Van Bree 1975, [Debrot et al. 1998](#)). In Venezuela as in the Caribbean Basin, the records of the specie evidence a common occurrence in the northeast coast of the country ([Evans et al. 1977](#), [Naveira 1996](#)), with frequent sightings on the central coast ([González 2000](#), [Acevedo 2001](#)). In Nueva Esparta State the genera *Delphinus* and *Stenella* are distributed with a major presence along the southern coast-line for the common dolphin, while the north coast near the shelf edge seemed to be favored by the Atlantic spotted dolphin, the pantropical spotted dolphin and striped dolphin.

The spatial distribution of *Tursiops* on the east coast of Margarita Island and Los Frailes Archipelago suggests the occurrence of a local discrete population with a distribution range defined by topographical boundaries. The objective of this study is to establish the sighting frequency and the relative abundance of bottlenose dolphins in the study area.

Materials and methods

Study area: The study area was comprised of two surveyed zones. The northeast coast, which is the coastline of the east region of Margarita Island from Punta Ballenas to El Tirano, including Los Frailes Archipelago, is strongly influenced by coastal upwelling from the mainland. The second sampled portion was the southeast coast, from Punta Ballenas to Punta de Mangle toward the west, within a submarine depression called Las Marites.

Sampling: Observations were accomplished using two methodologies: a land-based sampling from Punta Ballenas lighthouse on the southeast point of Margarita Island, and boat-based observations through three different kinds of sampling cruises. One cruise extended from the coastal town of El Tirano to Los Frailes Archipelago, about 19 kilometers. The southeast cruise ranged from Punta Ballenas to Punta de Mangle, approximately 35 kilometers at 500 m from coast. The southeast - northeast cruise covered the area from Punta Ballenas toward Los Frailes Archipelago, 25 kilometers.

Sighting frequency: The sighting frequency (SF) was calculated according to [Aguayo et al. \(1998\)](#), in order to establish a relationship between the number of dolphins sighted and an observation period expressed as a day of 4.27 observation hours. The data were discriminated by sampling year, observation methodology and sampling zonification of the study area. Another SF was used with the association of number of dolphins sighted and the distance searched with positive observations in the study area ([Bello et al. 1998](#)). A third SF is proposed considering a mean number of kilometers searched with effective observations which could easily take 4.27 hours to cover. This one is given as percentage, thus facilitating the contrast with other estimates and species:

$$SF = \text{No S} / \text{MeKm} \times 100$$

SF is the sighting frequency; No S is the number of sightings, and MeKm is the mean effective number of kilometers covered in the study area. The abundance index was also calculated using the same treatment as the observation time sighting frequency ([Aguayo et al. 1998](#)).

Results

Sighting records were gathered on bottle-nose dolphins and other cetacean species occurring along the northeast coast of Margarita Island and Los Frailes Archipelago through direct observation during land-based (6 surveys, 48 hours of observation) and boat-based surveys (24 surveys, 121 hours of observation, 1295 kilometers covered). Three kinds of sighting frequencies were calculated for *T. truncatus*. A discrimination of the indices by year, sampling method, and study area zone was done:

Mean effective observation time with cetacean sightings ([Table 1](#)): This frequency was discriminated as follows: sampling year 1999 showed 1 sighting per 4.27 hours of observations in a day, while in year 2000 there were 3 sightings per day. If the observation method is considered, the land-based method had a much lower SF (0.5) than the observation cruises with 3 sightings. The northeast portion of the study area registered 3 sightings per day, while the southeast had just 2 sightings per day. The total study area had a SF of 4 sightings per day

TABLE 1
Abundante index and sighting frequency of bottlenose dolphin associated to the observation time in the field according to Aguayo et al. (1998)

	Number of Sightings	Number of Dolphins	Abundance index	Sighting Frequency
1999	5	59	13.81	1.17
2000	13	90	21.07	3.04
Landbased sampling	2	14	3.28	0.46
Boatbased Sampling	16	133	31.15	3.75
Northeast Área	11	62	14.52	2.58
Southeast Área	7	87	20.37	1.64
Total	18	149	34.89	4.21

Total distance searched with positive sightings (Table 2): For this SF, both years 1999 and 2000 showed 3 sightings each per 185 kilometers surveyed. The northeast area had a SF of 4 sightings and the southeast area had 2. The entire study area registered 3 sightings per 185 kilometers surveyed.

TABLE 2
Sighting frequency of bottlenose dolphin associated to 185 kilometers covered in the field, according to Bello et al. (1998)

	Number of Sightings	Total Distance with Sightings (km)	Sighting Frequency
1999	5	331.29	2.79
2000	11	766.64	2.65
Northeast Área	11	492.17	4.14
Southeast Área	5	605.75	1.52
Total Sampling Area	16	1097.94	2.69

Mean effective distance covered in the study area (Table 3): This frequency, expressed as a percentage, highlights a differential by species. *T. truncatus*, with 70% of the sighting events per 42.23 kilometers covered, is the dominant species among *Delphinus* ssp, (13%), *Balaenoptera edeni* (6%) and other cetaceans sighted without specific identification.

TABLE 3
Sighting frequency given as percentage, associated to mean distances with positive observations covered in the field (42.23 kilometers)

Species - Family	Number of Sightings	Sighting Frequency (%)
<i>Delphinus</i> sp	3	13.16
<i>Balaenoptera edeni</i>	2	6.145
Delphinidae	1	4.38
Balaenopteridae	2	6.145
<i>Tursiops truncatus</i>	16	70.17
Total	24	100

Abundance index ([Table 1](#)): The study area had a relative AI of 35 individuals of *T. truncatus* per 4.27 daily hours of observation. In 1999 the AI was 14 individuals, while year 2000 had 21 individuals. The northeast sampling area had a lower AI (15), compared with the southeast area with 20. When methodologies area contrasted, the AI of the land based observations is significantly lower (3 dolphins) than the 31 dolphins per day obtained through observation cruises.

Discussion

The indices presented in this contribution are perfectly suited for the field work of this research, provided that the temporal periodicity in the observations is not relevant in the calculation of such numerical expressions. Although this factor is indeed a potential source of bias. The frequency and abundance in relation with the mean effective observation time ([Table 1](#)), allow a degree of independence once the type of sampling is considered, whether boat-based or land-based. The sighting frequency for bottlenose dolphins in 1999 and 2000 evidenced a great influence of a major observation effort during the second year of sampling. The land-based sampling had the lowest sighting frequency while the boat-based clearly showed that the odds of achieving positive observations are greater once an area with high occurrence expectations is searched systematically.

The differences between the abundance numbers per day for the northeast and the southeast zones could be attributed to the fact that most of bigger pods observed were localized around the Punta Ballenas - Farallon area in the southeast, while groups comprised of 7 to 8 dolphins were frequent in the northeast. This tendency could be related to segregated groups of adult and sub-adult males which are frequently bonded by close ties developed in early stages of their life cycle that may be maintained for decades ([Wells and Scott 1999](#)). The bigger groups could be associated with adult females with calves plus some other sub-adult females. During field observations, female-calf affiliation was commonly seen in pods sighted in the southeast. These types of association and segregation patterns are widely documented in the literature.

There is not a significant difference between the sighting frequencies differentiated by year of sampling (1999 - 2000), when covered distance is considered. However, once the study area is zonified for sampling purposes, there is a differential of two sightings events in the southeast, and four in the northeast. This peculiarity might be related to the existence of a possible boundary or limit in the southern portion of the spatial distribution of the species in the study area, so bottlenose dolphins might also concentrate most of their daily activities in inner areas of their range.

The sighting frequencies of [table 1](#) and [table 2](#) clearly show a negative influence when two distinct factors, observation time and sailed distance, are compared. If an interval between these two indices is established, then the sighting frequency for the east coast of Margarita Island and Los Frailes Archipelago could be 3 to 4 events, either spending 4.27 observation hours in the field or covering 185 Km in a sighting cruise. There is another proposed sighting frequency, this one considering mean distance covered (42.23 Km) for comparison. This index indicated a dominance of 70% of the sightings by *T. truncatus* against 13.16% for *Delphinus* ssp, and 6.14% for *B. edeni*.

The abundance of bottlenose dolphins in the study area suggests a dolphin population of less than 60 individuals. This preliminary index is based on an approximate number of observed individuals, not on maximum or minimum numbers. A more accurate abundance reference will be obtained with the increase of research efforts in the study area. The results of sighting frequencies and abundance index seem to indicate that the area comprised of the east coast of Margarita Island and Los Frailes archipelago could be defined as the possible distribution range for *T. truncatus* in the region.

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Resumen

El estudio de cetáceos locales en Venezuela tiene una historia bien reciente. Pocos esfuerzos se han hecho para evaluar las poblaciones costeras de estos mamíferos sobre la base de muestreo en campo. La presencia de ballenas y delfines en la costa noreste de Venezuela ha sido documentada a través de avistamiento y en una mayor proporción por medio de registros de varamientos. Esto está ampliamente relacionado con un ecosistema costanero muy productivo asociado a las características topográficas y los procesos de surgencia. El objetivo de esta contribución es establecer la frecuencia de avistamiento y la abundancia relativa del delfín nariz de botella en el área de estudio. Se colectaron registros de avistamiento de *Tursiops truncatus* y otros cetáceos presentes en la costa noreste de la Isla de Margarita y El Archipiélago de Los Frailes a través de observación directa por medio de muestreos desde plataformas terrestres (6 sesiones, 48 horas de observación) y desde cruceros de investigación en embarcaciones pequeñas (24 muestreos, 121 horas de observación, 1295 kilómetros recorridos). La frecuencia de avistamiento fue calculada y comparada utilizando 2 métodos, considerando. 1) El tiempo de observación promedio con avistamientos (4.27). 2) la distancia recorrida con avistamientos de cetáceos (1108). Una tercera frecuencia es propuesta relacionando el promedio de kilómetros recorridos con avistamiento de cetáceos y expresada en porcentaje. El índice de abundancia fue calculado usando el tiempo de observación promedio con avistamientos. La frecuencia de avistamientos para la zona de estudio es de 3 - 4 eventos por día de 4,27 horas de observación en el campo, o por cada 185 kilómetros recorridos, la abundancia relativa es de 35 delfines, lo que representa posiblemente una población local de menos de 60 delfines nariz de botella. *Tursiops truncatus* es la especie dominante en la costa noreste de la Isla de Margarita y El Archipiélago de Los Frailes con un 70% de los avistamientos. De esta manera la localidad de muestreo se puede considerar dentro del rango de distribución de una posible población local de delfines nariz de botella.

Palabras clave: *Tursiops truncatus*, Abundancia, frecuencia de avistamiento, Isla de Margarita, Venezuela.

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