

# **Preliminary Observations of Bottlenose Dolphins around Bonaire, Netherland Antilles**

DANIELA MALDINI<sup>1,2</sup>

<sup>1</sup>*Okeanis, P.O. Box 818, Pacific Grove, California, U.S. 95039*

<sup>2</sup>*Council for International Educational Exchange, Research Station Bonaire, Kralendjik, Bonaire,  
Netherland Antilles*

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## **ABSTRACT**

Coastal bottlenose dolphins have never been studied around the Island of Bonaire. This project collected preliminary information on historical sightings, current abundance and distribution patterns, and habitat use. It also collated the first photo-identification catalogue for this population. Between February and May 2008, bottlenose dolphins around Bonaire generally traveled in a counter-clockwise pattern around the island with a 24-hr circumnavigation time. There was an absence of sightings between May and December suggesting dolphin presence around the island may be seasonal. The same individuals are present suggesting a local population at least seasonally. The main behavioral mode on the west side is consistent and sustained travel at 5-7 knots.

## **KEYWORDS**

bottlenose dolphin, abundance, distribution, photo-identification, habitat use, Bonaire, Netherland Antilles, Caribbean

## INTRODUCTION

Cetaceans are top predators and their presence in certain areas, especially when feeding, is often an indicator of productivity of the surrounding waters. In fact, differences in productivity between waters in the vicinity of islands and the open ocean are especially pronounced in tropical climates (Dandonneau and Charpy, 1985). Bonaire's inshore waters, with their pristine coral reefs, should be attractive to local populations of cetaceans by providing an abundance of food as compared to the surrounding ocean.

Little is known about abundance and distribution patterns of cetaceans around the Netherland Antilles, and the authors could only find a few published references (Soot-Ryen 1961, Bree et al. 1973, Bree and Kristensen 1974, Bree 1975, Kristensen 1979, DeBrot and Barros 1994, and LeDuc and Perrin 1997), mainly documenting the occurrence of stranded specimens. Based on these reports, 12 species of cetaceans have been recorded in the Netherlands Antilles (Table 1). However, little is known of the abundance and distribution patterns of these animals in the area.

No formal study of cetaceans has ever been conducted around the Island of Bonaire. Local operators and members of the public are reporting frequent sightings of bottlenose (*Tursiops truncatus*), spinner (*Stenella longirostris*) and spotted dolphins (*Stenella attenuata*) on the leeward side of the island (STINAPA pers. comm.). Sightings of schools of up to 100 animals have been reported (De Leon pers. comm.), but opportunistic observers were often not able to identify the animals by species.

Bottlenose dolphins in particular have attracted public attention, as divers, boaters and swimmers frequently interact with these animals along western beaches. The

following preliminary study compiled available historical information, and looked at sighting frequency, distribution and movement patterns, and relative abundance of bottlenose dolphins around Bonaire and sought to establish baselines for a more detailed study.

## **MATERIALS AND METHODS**

### ***Study Site***

The Island of Bonaire (12° N, 068° W) is one of five islands in two groups separated by about 520 km and forming the Netherland Antilles. Bonaire lies approximately 60 km NE of the coast of Venezuela (Fig. 1). The study area for preliminary survey work, conducted by boat and car was the approximately 34 km long leeward shore between Punt Wekua (NW) and Lacre Punt (SW). The East side of the island was not surveyed due to the lack of an appropriate vessel to handle the rough and windy conditions found on this side of the island, and the lack of roads adjacent to the coastline. Shore-based observations were conducted near Punt Vierkant (12° 07' 18.6"; 068° 17' 36.21") at a site where a 5 km stretch of coastline could be easily monitored with the use of high powered binoculars. The observable coastline was located north and west of the observation site (Fig. 1).

### ***Methods***

Fifteen interviews with key people on the island (naturalists, park rangers, dive operators, long-time residents involved with water activities and fishermen) were conducted to collect information about species observed and general patterns of

occurrence. Interviews were informal and provided a baseline to establish observation schedules and data collection protocols.

Opportunistic observations were collected between January 2005 and May 2008 from a shore observation site located at Punt Vierkant on the western shore of the island (Fig. 1). Date time, location of sighting and dolphin direction of travel was noted as well as general behavioral trends.

A more focused study was conducted between February-May 2008. Dolphins were located with the help of a sighting network of local volunteers around the island and sighting reports were followed-up by either car or boat-based surveys depending on the circumstances and availability of observers. Photo-identification data were collected either from shore at a distance of approximately 20-50 m or by driving a 25ft Boston Whaler parallel to the dolphins' direction of travel and approaching at a distance of approximately 5-8 m. Digital photos were taken with a Canon 30D equipped with a 100-400mm Image Stabilized Canon zoom lens. Behavioral focal follows were collected by driving a car along the coastal road on the west side of the island, following the dolphins which were generally easily visible from the road. GPS coordinates and behavioral states were recorded every 15-min or every time the animals changed behavior. Behavioral states used were traveling, milling, foraging and socializing. In addition, observations on boating behavior around the dolphins were collected opportunistically and the general reaction of the animals to various types of approaches was recorded.

## **RESULTS**

### ***Interviews***

People interviewed reported sighting only three species of odontocetes in coastal waters: bottlenose, spinner and spotted dolphins. The most frequently sighted animals were bottlenose dolphins followed by spinner dolphins.

Bottlenose dolphins were always reported close to shore just beyond the reef drop-off. Spinner and spotted dolphins were more frequently seen in open water, often swimming above small schools of tuna.

Bottlenose dolphins around Bonaire were reported to always travel in a north-south direction on the west side of the island at all times of day. They were also reported circumnavigating the small island of Klein Bonaire (Fig. 1) in a counterclockwise manner and then crossing over to the town of Kralendijk to resume north-south movements. Bottlenose dolphins were reported feeding in two locations: the southernmost and northernmost points of the island (Lacre Punt and Nord Punt). They were also seen giving birth in a shallow area south of Lac Bay.

Bottlenose dolphins were seen regularly on the east side of the island and possibly traveled from south to north in this area suggesting they may circumnavigate Bonaire. One live stranding occurred in Lac Bay in 2007 confirming dolphins use this side of the island (STINAPA pers. comm.).

### ***Historical Observations***

One-hundred and fourteen opportunistic bottlenose dolphin sightings were recorded between January 2005 and December 2007 at the Punt Vierkant shore station

thanks to the effort of a local observer whose house lies directly above the observation point (Fig. 1). School size ranged between 10 and 60 animals. The direction of travel was north to south 100% of the time. Bottlenose dolphins were observed year round (Fig. 2). Comparison of frequency of occurrence between months and years, however, is not statistically meaningful since effort was not recorded and was variable and inconsistent throughout the observation period.

Bottlenose dolphins were recorded passing the Punt Vierkant shore-based site at all times between dawn and dusk (Fig. 3). In this case, as well, a comparison of frequency of occurrence between months and years would not be statistically meaningful. Observations beyond daylight hours were never collected.

The time difference between all pairs of consecutive-day sightings (21 occurrences) was 23.9 hrs (S.D. = 0.71) on average indicating dolphins are on a consistent schedule when doubling Punt Vierkant (Fig. 3). This may indicate dolphins travel a regular loop taking approximately one day.

### *Surveys*

Twenty-one bottlenose dolphin sightings were reported along the west coast of Bonaire by members of the sighting network between February and May 2008. Of these 12 were on consecutive days.

Eight boat-based and two land-based surveys were conducted in response to sighting reports by the Bonaire sighting network. These surveys resulted in four encounters with bottlenose dolphins by boat (three photo-identification sessions) and two car-based focal follows (two photo-identification sessions).

During all encounters dolphins traveled at a consistent speed of 5-7 knots, staying just beyond the reef drop-off (<60 m). Average overall school size was 64 animals (S.D. = 7) with smaller groups breaking off and reforming continuously. Calves averaged nine animals (S.D. = 1) and generally traveled in a large group in the middle of the adults. Dolphins consistently came into shallower water (<15 m) when approaching Pink Beach.

The photo-identification effort yielded 1364 photographs (34% identifiable, 8% unidentifiable and 58% rejected for poor quality). Three of the photo-identification days provided a complete set of photos (58-71% of adults/juveniles present were identified).

Forty-nine individuals were identified by the nicks and notches on the leading and trailing edge of the dorsal fin. Of these individuals 14% were identified during four of the surveys, 41% during three, 20% during two and the rest (24%) were identified only once. Seven were confirmed to be females because of the presence of a small calf at their side.

### ***Behavior***

Dolphins were followed moving north to south from Bachelor Beach to the southern point of the island where they were generally lost due to the rough conditions on the east side. Dolphins spent 100% of the time traveling at a speed between 5-7 knots until the very end of the island where feeding started and they were generally lost.

### ***Boat Interactions***

Boats were seen frequently following dolphins in two main areas, the stretch of coast encompassing the town of Kralendjik, and the Kite Surfing area south of there. Dolphins were actively followed by both pleasure boats and dive operation boats.

Boating behavior around the animals varied from slow follows at a distance of 10m from the moving school to close circles on top of the school at high speed, with frequent chases, cross-overs by the boat and launching of swimmers on top of the school. Dolphins were observed scattering and leaving the area when boats crossed their directional path of movement and generally dove out of sight for prolonged periods of time.

## **DISCUSSION**

Although waters around the island of Bonaire host at least 12 species of cetaceans, inshore waters are frequented regularly by three species (bottlenose, spinner and spotted dolphins). Bottlenose dolphins are the most commonly sighted species and are found in shallow waters right along or just beyond the reef drop off. This is consistent with many other studies of bottlenose dolphins around the world (Irvine et al. 1981, Gruber 1981, Balance 1992, Defran and Weller 1999, Gubbins 2002, Ingram and Rogan 2002, Bearzi et al. 2005).

Based on historical sightings, bottlenose dolphins occur around Bonaire year round but the opportunistic nature of the sighting record (which lacks to reflect total observation effort per month) does not provide for the necessary statistical rigor to make comparisons between months or years. Based on the information provided by interviews with locals, it is possible that frequency of sightings may vary with the season. Between February and May 2008, sightings were frequent indicating dolphins may have used waters around Bonaire on a daily basis.

Between February and May 2008 the same group of approximately 64 dolphins (i.e., 57 adults and 7 calves is the best estimate) was present around Bonaire. This is supported by the photo-identification data with 49 identifiable individuals added to the catalogue during five identification sessions and being re-sighted with a rate of 67% (based on three complete photo-identification sessions). Coastal bottlenose dolphins in many areas of the world are known to display seasonal or inter-annual site-fidelity to specific areas of the coastline (Irvine et al. 1981, Shane et al. 1986, Wells et al. 1987, Wilson et al. 1993, Defran and Weller 1999).

This consistent social affiliation may be ephemeral, since the current study is only based on little data collected opportunistically. However, studies support the possibility that long-term affiliation may be occurring (Shane et al. 1986, Wells et al. 1987, Connors et al. 1992; 2001). The group observed consisted primarily of juveniles, calves and their mothers suggesting Bonaire to be part of a female range. Mature male bottlenose dolphins have been found to roam between female areas to associate with female groups for mating purposes (Shane et al. 1986, Wells et al. 1987, Quintana-Rizzo and Wells 2001). These affiliations in other parts of the world are of variable duration (Shane et al. 1986, Wells et al. 1987, Connors et al 1992; 2001).

It is unclear whether Bonaire dolphins also travel to other nearby islands and to the coast of Venezuela, all within a 60 km radius of the island. In Aruba, located to the north east of Bonaire, the predominant species seen inshore is the rough-toothed dolphin (*Steno bredanensis*), while bottlenose dolphin sightings are infrequent (Dominguez pers. comm.). There is no recent information for the island of Curacao.

Both historical data and 2008 data support the possibility that dolphins circumnavigate the island when in the area taking approximately one day to complete the loop. The patterns of movement were remarkably consistent suggesting the dolphins circumnavigate the island in a counterclockwise manner, swimming against the current and feed in areas of upwelling at the tips of the island where mixing occurs due to the convergence of current flow and wind shear. The circle-island movements appear to take approximately one day. However, dolphins are not reported on a daily basis on the west side of the island suggesting that either they spend more time on the east side or they travel to nearby areas or offshore in a consistent pattern.

Because dolphins are reported passing through the same observation site at all times of day it may also be possible that they pass by at night or in the early morning hours when they would be missed by observers.

### ***Boat Interactions***

Several studies in other parts of the world have well documented the potential detrimental effects of disturbance by vessels on dolphins (Nowacek 2001, Constantine 2001; 2004, Hastie et al. 2003, Lusseau 2003; 2004). Constantine (2001) reported a decrease from 48% to 34% in success of swim with the dolphin attempts and an increase in avoidance responses to swimmers in a four year period. Dolphin response was found to vary according to swimmer placement. The greatest increase in avoidance occurred when swimmers were placed in the dolphins' path of travel. Cumulative experience of exposure to swimmers by individual dolphins causes them to become sensitized to swim attempts.

Lemon et al. (2006) found that powerboats are a significant source of disturbance to coastal cetaceans and determined that travelling dolphins responded to approaches by a powerboat by altering their surface behavior. In the author's experience, boat-based approaches on dolphins (if they cannot be avoided) should be done at a speed that matches the speed of the animals (5-6 knots on average), with the boat traveling parallel to the dolphins without dividing the school and without cutting off animals from their direction of travel. There should be no zig-zagging, circling, or sudden acceleration around the animals.

Constantine (2004) reported that multiple boats on dolphins at the same time contribute more to behavioral changes. In Shark Bay, Australia, an increase in dolphin-watching tour operators resulted in a decrease in the number of dolphins present (Bejder et al. 2006). Such results supports limiting the number of boats dedicated to dolphin watching in a particular area. Around Bonaire, boat operators often put divers or snorkelers in the water with the dolphins. This activity should be discouraged. However, if this activity is permitted, the best approach for the boat captain is to drop off people quietly way ahead of the animals in a place along their perceived direction of travel but not directly in it. People should move with caution and never flail their arms, slap the water or pursue single animals or try to touch them.

### **ACKNOWLEDGEMENTS**

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## TABLES

Table 1 - List of cetaceans recorded in the Netherland Antilles

<b>Common Name</b>	<b>Species</b>	<b>Source</b>
Bryde's Whale	<i>Balenoptera edeni</i>	Soot-Ryen, 1961
Common Dolphin	<i>Delphinus delphis</i>	Halewijn, 1972
Short-fin Pilot Whale	<i>Globicephala macrorhyncus</i>	Unpublished data
Dwarf Sperm Whale	<i>Kogia simus</i>	DeBrot and Barros, 1992
Humpback Whale	<i>Megaptera novaeangliae</i>	Bree, 1975
Gervais' Beaked Whale	<i>Mesoplodon europaeus</i>	DeBrot and Barros, 1992
Sperm Whale	<i>Physeter macrocephalus</i>	Bree, 1975
Pantropical Spotted Dolphin	<i>Stenella attenuate</i>	Bree, 1975
Striped Dolphin	<i>Stenella coeruleoalba</i>	Kristensen, 1979
Atlantic Spotted Dolphin	<i>Stenella frontalis</i>	Bree, 1975
Long-Snouted Spinner Dolphin	<i>Stenella longirostris</i>	Bree, 1975
Bottlenose Dolphin	<i>Tursiops truncatus</i>	Bree, 1975
Cuvier's Beaked Whale	<i>Ziphius cavirostris</i>	Bree <i>et al.</i> , 1973

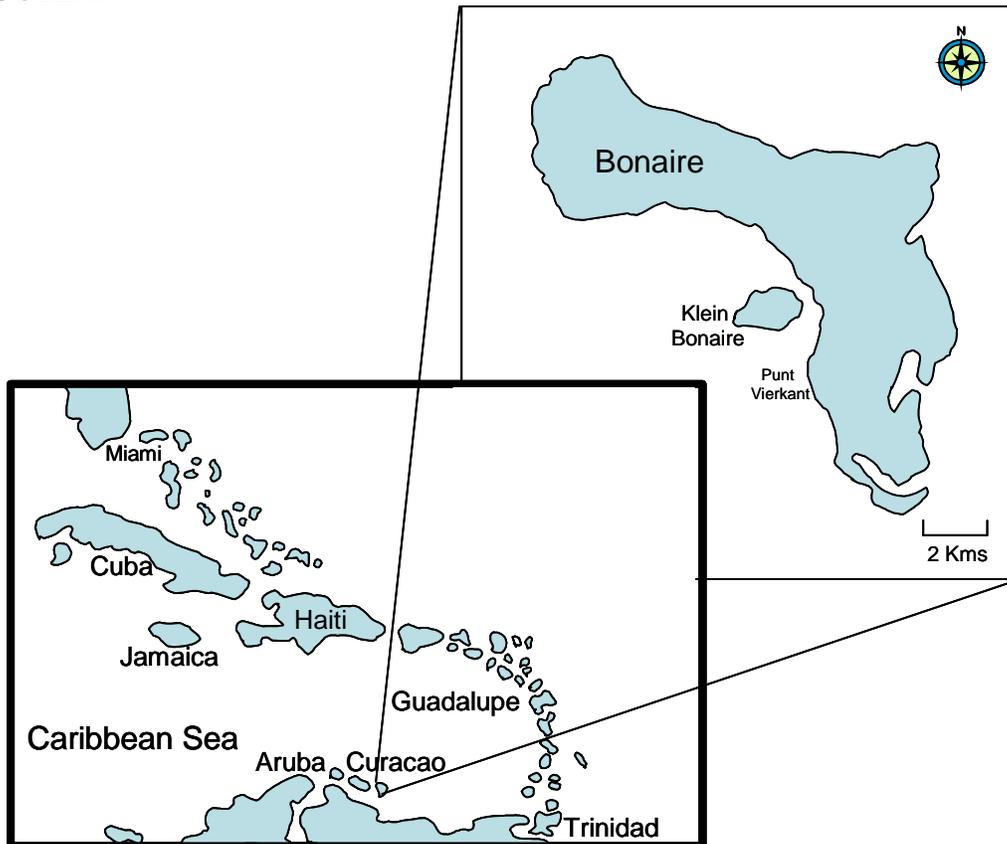
## FIGURE LEGENDS

Figure 1 – Map of the study area and of relevant observation area (in grey) from the shore-based site.

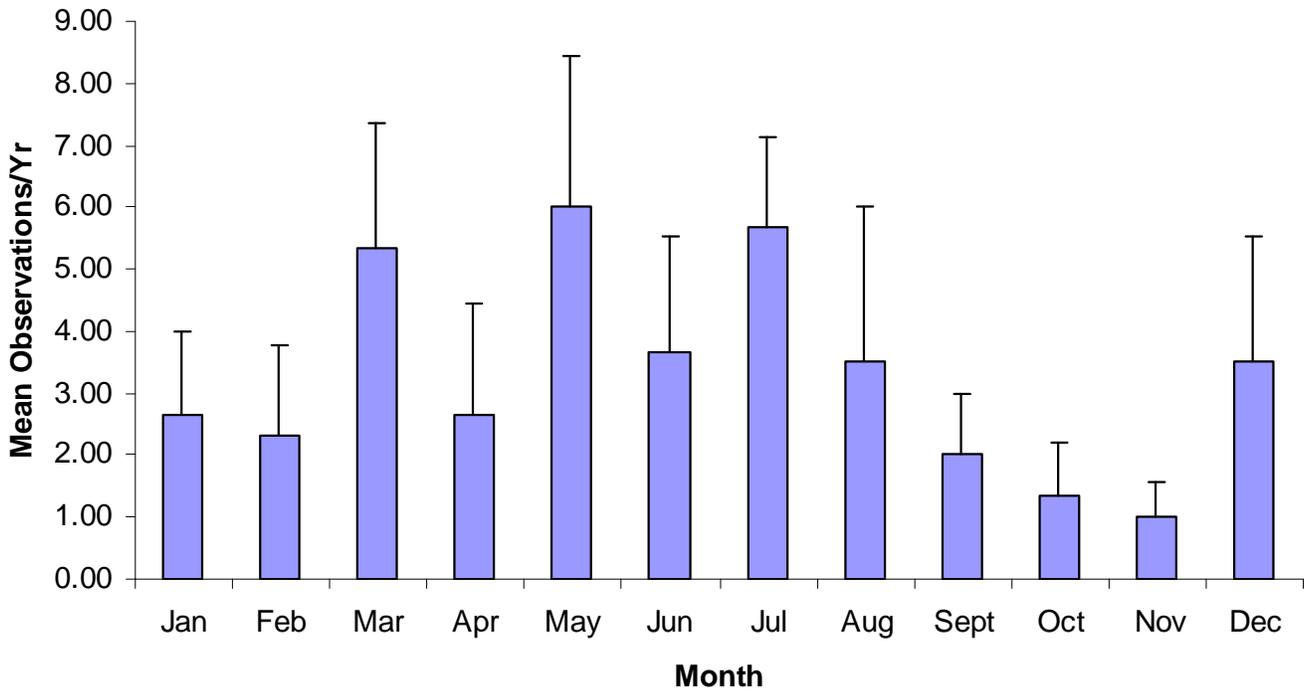
Figure 2 – Average number of opportunistic bottlenose dolphin observations recorded between January 2005 and December 2007 from the Punt Vierkant shore site.

Figure 3 – Time of day distribution of opportunistic bottlenose dolphin observations recorded between January 2005 and December 2007 from the Punt Vierkant shore site.

### FIGURE 1



**FIGURE 2**



**FIGURE 3**

