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# Bryde's whale *Balaenoptera edeni* occurrence and movements in coastal areas off Ecuador, Peru and Panama. A preliminary report

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## ABSTRACT

Bryde's whales are among the lesser-known of all the balaenopterids. In this paper, we present the results of our investigations into the occurrence, migration and behavior of Bryde's whales along the Ecuador, Peruvian and Panama coasts.

Five hundred seventy-three surveys were conducted for marine mammals from 2000 to 2017. We sighted 81 groups of Bryde's whales consisting of 102 individuals. Sixty-four individual were photo – identified. Of these, three were re-sighted: two in the same area and one in a different region, suggesting site fidelity within and between areas. The interval between re-sighting shows the first migration in the south east Pacific between Ecuador and northern Peru. The estimated distance between these two sightings is 294 km.

Data reported here, constitute the first contribution in Bryde's whale research efforts in Central and South America.

**KEY WORDS:** Bryde's whale, occurrence, distribution, migration patterns, Ecuador, Peru, Panama.

## INTRODUCTION

Bryde's whales (*Balaenoptera edeni*) are the least known of the large baleen whales. Their occurrence has been reported from all tropical and temperate waters in the North and South Pacific, Indian Ocean, and South and North Atlantic between 40°N and 40°S (Kato, 2002). There is little information describing their migratory patterns; however, early evidence suggests migration towards the equator during winter and to higher latitudes in summer (Rice, 1979).

In the eastern South Pacific, this species is distributed in coastal waters off South America from the equator to 37°S. Wade and Gerrodette (1995) reported Bryde's whales' sightings throughout the eastern Tropical Pacific in both inshore and offshore waters. Recently, there have been more frequent observations of Bryde's whales near coastal areas. Sightings, ship collisions and stranding data suggest that Bryde's whales, occur regularly along the coast off Ecuador, Peru and Panama. According to Kato (2002), the occurrence seems to be related somewhat to seasonal upwelling events.

Photo-identification (photo-ID) of individual whales is a well-established technique in aquatic mammal research. The use of natural markings and morphology to identify individuals to be monitored in photographic sighting and re-sighting events is the standard approach for addressing questions of movements and site fidelity (Wursig and Jefferson, 1990).

The aim of this paper is to present results of the first photographic research and summary of Bryde's whale sightings in the eastern tropical Pacific at low latitudes. In addition, we believe that this effort provide essential information about occurrence, habitat use and possible seasonal movements of Bryde's whales throughout neritic waters of Central and South America. These results are based on the individual identification of dorsal fin of these whales. Many researchers, NGO's, whale-watching tour operators in Ecuador, Peru and Panama achieved this effort.

## METHODS

In Ecuador, the research area was located in Machalilla National Park from 58°S - 63°S to 61° - 72° W and opportunisticly in the Galapagos Marine Reserve (0°40'N-1°23'S, 90°46' - 89°41'W). Surveys were conducted all year from 2000 to 2017. In northern Peru, the research effort was located at the coastal area located between Mancora and Cabo Blanco (ca. 04°10'38.78"S, 81°8'04.40"W; Fig. 1) from July to October 2009 - 2016. In Panama, surveys were conducted between July and September 2004-2015 in the Gulf of Chiriqui, bordered by the Azuero Peninsula to the east and Punta Burica to the west (7°18'-8°18'N, 82°54'-81°36'W; Fig. 1).

Sightings of Bryde's whales were made opportunisticly, during systematic trips from tourism boats and research vessels from 2000 to 2017. Data collected included GPS location, behavioral aspects and group composition. Photographs of individual whales were taken with a digital camera with a 75-300 mm lens.

Bryde's whales were photographed and identified through permanent, natural or acquired marks located in the right and left side of the dorsal fin (Katona *et al.*, 1979). For this study, the comparison of photographs of individually distinctive natural markings can provide direct evidence of whale movements. The clearest photograph of each individual (i.e., dorsal fin in focus and perpendicular to the camera) was included in the catalog. The photos taken at each sighting were compared with the photographs taken of previously identified individuals.

Only photographs with medium and high quality were considered in the present study. When a match between photographs was found, these were submitted to the co- authors for confirmation. We have considered three Bryde's whale catalogues: Pacific Whale Foundation - Ecuador (PWF), Pacific Adventure Catalogue – Peru (PAC) and Panacetacea Catalogue – Panama (PAN).

## RESULTS

Five hundred seventy-three surveys were conducted from 2000 to 2017. We sighted 81 groups of with a total of 102 individuals. A total of 64 Bryde's whales were identified by the dorsal fin and form part of the three catalogues (PWF, PAC AND PAN) in the Pacific East (Table 1).

Table 1 Effort and Results of photographic identification of Bryde's whales in South America between 2000-2017. Total IDs is the number of identifications including re-sights in the same area and between areas.

	# Surveys	# of Sightings	# of individ	Total Id's	Year	# Resighted animals in the same area	# Resighted animals PWF-PAC	# Resighted animals PWF-PAN
Ecuador Continental EC	284	36	46	32	2012-2017	2		
Ecuador Galápagos* GAL	-	15	16	14	2000-2016			
Peru PER	106	12	16	5	2016		1	
Panama PAN	183	18	24	13	2004-2015	1		
<b>Total</b>	<b>573</b>	<b>81</b>	<b>102</b>	<b>64</b>		<b>3</b>	<b>1</b>	<b>0</b>

\* Tourist contribution

### *Ecuador*

Forty-six whales were identified by the dorsal fin from 2000 to 2017. Two individual were re-sighted (Table 1). The distances between these matches were approximately 10 – 20 km. One individual (ECB022) was photographed opportunistically in front of Salango Island (1°33' S -81°50'W) on 07 September 2016 and 12 days later was re-sighted on 19 September 2016 off Puerto Lopez. Whale ECB024 was sighted off Puerto Lopez on 19 September 2016 and was re-sighted opportunistically three months later in front of Machalilla town. During the months of October and November, one observation is recorded without obtaining the individual identification. In December, Bryde's whales are again registered more frequently.

### *Peru*

Five whales were identified during 2016 season. No matches are observed in the same area.

### *Panama*

Thirteen Bryde's whales were identified by the dorsal fin from 2004 to 2015. One match was made during comparison (Table 1). Whale ID 009 was sighted on 6 Sept 2014 near the Contreras Islands, and was re-sighted again on 3 September 2015 in between the Contreras and Secas Islands. The estimated distance between these two sightings is 11.87 km.

### *Resight between Ecuador and Peru*

One whale was resighted between Ecuador and Peru. The whale #01PA21Jul16\_DD - ECB036DI was sighted on 21 July 2016 in Los Organos, Peru (04°15'S, 81°14'W) and was re-sighted opportunistically seven months later in Machalilla National Park in front to Puerto Lopez (01°15'S, 58°14'W) on February 22, 2017. The estimated distance between these two sightings is 294 km.



### *Monthly encounter*

We sighted 81 groups consisting of 102 individuals. In Peru and Panama, the majority of sightings were during August and September, whereas in Ecuador the whales were sighted over five months: January, February, June, September and December (Table 2).

Table 2. Monthly encounter in Ecuador, Peru and Panama

	January	February	March	April	May	June	July	August	September	October	November	December	# of Sightings
Ecuador Continental	13	8	1	0	0	5	0	1	3	1	0	4	36
Ecuador Galápagos*	1	0	1	3	3	2	4	1	0	0	0	0	15
Peru	0	0	0	0	0	0	2	5	3	2	0	0	12
Panama	0	0	0	0	0	0	0	10	8	0	0	0	18
<b>TOTAL PER MONTH</b>	<b>14</b>	<b>8</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>7</b>	<b>6</b>	<b>17</b>	<b>14</b>	<b>3</b>	<b>0</b>	<b>4</b>	<b>81</b>

### *Behavior and composition*

In Ecuador, a total of 36 whales were observed in Machalilla National Park. Bryde's whales were most frequently observed alone ( $n = 18$ , 52,9%), aggregations of two to four adult individuals (including the same adult-calf pair, typically swimming close together) were observed ( $n = 15$ , 44%) and of which four pods were mother and calf. Three times the number of animals in the group is not certain. Traveling and feeding were the most common behavior recorded. Galapagos Islands, tourist's contribution made all records and no data of composition or behavior are available.

In Peru, a total of 16 whales were observed. Bryde's whales were most frequently observed alone ( $N = 10$ , 75%), aggregations of two individuals (mother and calf) were observed ( $n = 2$ , 25%). Traveling and milling were the most common behavior recorded.

## **DISCUSSION**

Most observations are opportunistic and made from whale watching boats. The use of whale watch vessels can provide a cost-effective "platform of opportunity" to assess cetacean distribution and abundance (Evans and Hammond, 2004).

In the case of Ecuador, the daily Tour Isla de la Plata in Puerto Lopez, is carried out all year, it is logical to think that has been possible to register other cetaceans such as Bryde's whales, when there is no presence of humpback whales. According to Clarke & Aguayo (1965), the first Bryde's whale reported for the whaling manager named Ingebrigtsen in the Pacific Coast were in Colombia (Gorgona) and Isla de la Plata (Ecuador) in the summer of 1914.

Galapagos Islands, tourist's contribution made all records and no data of composition or social structure are available. However, the Bryde's whale is considered common on the islands (Day, 1994).

Because surveys off Peru and Panama were only conducted between July and September, no inferences can be made about seasonality of Bryde's whale sightings in these locations.

Although the number of individuals identified and re-sighted is low, the results suggest that some Bryde's whales are using most frequently the coastal waters off Ecuador, Peru and Panama in the last years.

The whale ECB022, who was photographed in front of Salango Island – Ecuador (1°33' S -81°50'W) on 07 September 2016 was re-sighted on 19 September 2016 off Puerto Lopez – Ecuador. Whale ECB024 was sighted off Puerto Lopez – Ecuador on 19 September 2016 and was re-sighted on 30 December 2016 in front of Machalilla – Ecuador. Whale ID 009 was sighted on 6 Sept 2014 near the Contreras Islands – Panama, and was re-sighted on 3 September 2015 in between the Contreras and Secas Islands (Panama).

The intervals between re-sightings indicate Bryde's whales may stay in an area for several days and return to it after months (ECB022, ECB024) or years (ID 009). This suggests site fidelity at least for some individuals, as reported for Bahia La Paz in Mexico (Urban *et al.*, 1996); Cabo Frio in Brazil (Figueiredo *et al.*, 2014).

Unlike most other large balaenopterids, Bryde's whales do not undertake long distance migrations between low latitude breeding areas and higher latitude feeding areas (Kato, 2002). Whale #01PA21Jul16\_DD - ECB036DI was sighted on 21 July 2016 in Los Organos, Peru (04°15'S, 81°14'W) and was re-sighted opportunistically in front to Puerto Lopez (01°15'S, 58°14'W) on February 22, 2017. The interval between re-sighting shows the first migration in the south east Pacific, between Ecuador and northern Peru. The estimated distance between these two sightings is 294 km.

Previously, changes of distribution and movements of Bryde's whales have already been observed in Ecuador (Clarke & Aguayo, 1965) and Peru (Clarke & Aguayo, 1965; Valdivia, 1981). According to Clarke & Aguayo (1965), the distribution between the north of Chile and Ecuador, across Peruvian seas, is presumably continuously. The re-sighted between Ecuador and Peru, affirms the distribution, presence of migratory patterns for the Bryde's whale and possible migratory corridors and connection between low and high latitudes. The sightings in Machalilla National Park suggest a high presence of Bryde's whales certain months of the year, during the months of December-February, May-June and September-October.

The data we collected is one of the first attempts to identify individual Bryde's whale in the South and Central East Pacific, allowing for an assessment of Bryde's whale movements in coastal waters off Ecuador, Peru and Panama. We provide the first information on Bryde's whales sighting history and habitat use around Machalilla National Park, Mancora, Cabo Blanco and Gulf Chiriqui.

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ANNEX



Dorsal Fin of the Bryde's Whale with ID, part of the Ecuadorian Catalogue.



Photo of the Bryde's whale feeding close to Isla de la Plata, Ecuador. Photo: Silvano Quimiz, PWF 2013.





Mother and calf traveled close to Puerto Lopez, Ecuador. Photo: Cristina Castro, PWF 2015



Head of the Bryde's whale. Photo: Galo Echeverria, PWF 2017.



Bryde's whale in Panama. Photo: Kristin Rasmussen PANACETACEA.



Bryde's whale in Peru. Photo: Pacific Adventures 2016

