

POPULATION PARAMETERS ON RISSO'S DOLPHIN (*GRAMPUS GRISEUS*) IN FUERTEVENTURA, CANARY ISLANDS

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ABSTRACT

Risso's dolphin (*Grampus griseus*, Odontoceti) observations in the Canary Islands are common throughout the year. Information about the abundance and ecology of this species at the archipelago is scarce, although there are indications of a resident population at the eastern islands. Here we present data on the presence of this species at the north of Fuerteventura, gathered from an opportunistic platform, the whale watching vessel ICENAI, during six months (august 2016 to february 2017). The study area includes the Special Area of Conservation (SAC) Sebadales de Corralejo. Photo-identification was carried out to create a catalog of 130 individuals identified within the study area. A preliminary capture-recapture analysis provides a best estimate of 155 individuals (CI 95% 115 to 361) in the study area North of Fuerteventura; these are the first preliminary results on population density of Risso's dolphin in a local area of the Canary islands.

KEYWORDS: odontoceti, abundance estimation, *Grampus griseus*, photo-ID.

PARÁMETROS POBLACIONALES DEL CALDERÓN GRIS (*GRAMPUS GRISEUS*)
EN FUERTEVENTURA, ISLAS CANARIAS

RESUMEN

Las observaciones del calderón gris (*Grampus griseus*, Odontoceto) en las islas Canarias son comunes a lo largo del año. La información sobre su abundancia y ecología es escasa, sin embargo hay indicaciones de que existe una población residente en las islas del Este. Aquí presentamos datos sobre la presencia de esta especie en el norte de Fuerteventura, recogidos desde un punto de observación facilitado por el barco de observación de cetáceos ICENAI, durante seis meses (agosto de 2016 a febrero de 2017). El área de estudio incluye el Área de Especial Conservación, Sebadales de Corralejo. La fotoidentificación fue llevada a cabo para crear un catálogo de 130 individuos identificados dentro del área de estudio. Un análisis preliminar de captura recaptura generó unas buenas estimas de 155 individuos (CI 95% 115 de 361) en el área de estudio al norte de Fuerteventura; estos son los primeros resultados preliminares sobre la densidad poblacional de calderones grises en una zona de las islas Canarias.

PALABRAS CLAVE: odontocetos, estimación de abundancia, *Grampus griseus*, foto identificación.

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INTRODUCTION

Risso's dolphin (*Grampus griseus*) is an odontoceti (Fam. Delphinidae) recognized by its white scars and pronounced melon, although it does not exceed the vertical of the mouth anterior part. Size can reach between 3.2 and 4.3 meters and weigh up to 680 kilograms. Pectoral fins are long, falciform dorsal fin and narrow caudal peduncle. White scars are the result of combination of intraspecific battles, caused by other dolphins (Frantzis *et al.* 2002), by predators, such as some shark species, prey, such as cephalopods, and parasites (Kruse *et al.* 1998.).

They're found in continental-shelf waters and nearby areas. In coastal areas with short continental shelf or in the European Atlantic it seems to be associated with coastal waters and oceanic islands with abrupt seabed (Kruse *et al.* 1998). Feed is exclusively on cephalopods, especially mesopelagic squids (Fernández *et al.* 2009). Seasonal movements are unclear; however, some groups make north-south trips, both in the Atlantic and on the west coast of America (Leatherwood *et al.* 1980). Other places show Risso's dolphin high-fidelity groups like some Atlantic archipelagos such as the Azores (Hartman *et al.* 2008).

A few research campaigns in the Canary island eastern province waters confirms large number of recaptures on this species between the islands of Fuerteventura, and especially, Gran Canaria and Lanzarote (Ruiz *et al.* 2011), although a resident population have never been described.

There are cetaceans monitoring programs in Canary islands on resident species such as the beaked whale population on El Hierro island, composed of an adult population of 69 Blainville beaked whales (*Mesoplodon densirostris*) and 66 Cuvier beaked whales (*Ziphius cavirostris*) in a long-term study by the University of La Laguna (Reyes 2018). These programs have been successful due to large information amounts obtained from species with less knowledge.

On the other hand, there are short-period studies with a lot of information collected, such as in short finned pilot whale (*Globicephala macrorhynchus*) populations on the southwest and north of Tenerife. Researchers used photo-identification techniques and *capture-recapture* methods determining 391 animals (95% CI = 325-470) with a standard error of 26.03 on the southwest of Tenerife (Marrero *et al.* 2016).

Due to the above, this study presents the following general objectives: I.- Elaboration of standard monitoring program on *Grampus griseus* population on Fuerteventura island through an opportunistic platform (Whale-Watching). II.- Create a photo-ID catalog of Risso's dolphin. III.- Data analysis using *capture-recapture* techniques for abundance estimation of Risso's dolphin in the north of Fuerteventura.

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MATERIAL AND METHODS

2.1. STUDY AREA AND EXPERIMENTAL DESIGN

Data collection was done from August 2016 until February 2017 as part of a research grant program of the insular government Fuerteventura Cabildo, on one opportunistic platform (*Whale-watching*), in the northern waters of Fuerteventura. The platform, called ICENAI allow the data collection through an agreement. The following information was collected every journey: I.- Effort data. II.- Environmental parameters. III.- Groups information: Start and end time, GPS position, species, number of individuals, offspring presence, and surface behavior (standardized). IV.- Photo-ID: Nikon D5100; 55-200 mm., and Canon EOS 5D Mark III; 70-300 mm. were used in this study.

Photo-identification in cetaceans is used to obtain information on population parameters such as population size and how it varies seasonally, rate of residence and social structure analysis (Hammond *et al.* 1990). For *capture-recapture* method a encounters matrix was developed with values 0 (not observed) and 1, indicating if the animal was observed or not in the study period. As a short study period (6 months), the matrix has been prepared using the different sightings (time scale per day) instead of a longer time scale, as applied in a short-term study about short finned pilot whale population in Tenerife (Marrero *et al.* 2016).

Photographs of *Grampus griseus* were selected according to standard criteria Q (scale 1-4) and M (scale 1-4), where Q1 / M1 indicates low quality or few recognizable marks respectively, and Q4 / M4, high quality and numerous marks. Identification was made by hand with the supervision of two researchers, according to the marks, scars and notches of the dorsal fin, being easy to differentiate each individual due to permanent scars. (Hammond *et al.* 1990). Sightings were discarded from analysis in which there was no capacity to take high quality photographs, but to confirm the species.

Pictures in Q1 or Q2 category of marked animals (M3 or M4) were included. A code was established for each animal under criteria: INITIALS_AREA_SIDE_NUMBER following short-finned pilot whale (*Globicephala macrorhynchus*) catalog on Tenerife island (Marrero *et al.* 2016).

2.2. STATISTICAL ANALYSIS

Homogeneity and photography coverage was calculated from the number of individuals included in the catalog in relation to the total group (recognized individuals plus unidentified individuals). The capture-recapture method often provides more precise population size estimations than those obtained in linear transects, excepting when assumptions are violated, for example due to: I.- Heterogeneity in the probability of capturing individuals. II.- Loss of marks, due to the indiscriminate use of non-permanent marks or inappropriate periods between sampling (Hammond 1990).

The software used to analyze the photo-ID database and for density estimate calculation by capture-recapture techniques was *Program Mark* (White 1999). A



closed-populations model was selected. Correction factor (1 / Photographic coverage) was applied to include non recognized animals. An abundance estimation was calculated for the recaptures obtained from fins on the right side, on the left side, and for the total number of individuals.

A comparative analysis of the closed population models (M0, Mt, Mh, Mb, Mth, Mtb, Mbh and Mtbh) was performed with *Program Mark: Capture* tool. *Goodness of Fit* test (GOF) was applied to determine (scale 0 to 1) the model with better statistical fit to the data (closets to 1). An estimate was calculated for the north of Fuerteventura, confidence interval (95% CI) and standard deviation.

RESULTS

A total of 103 trips were performed between august 2016 and february 2017 (Table 1), summing 141 cetacean sightings of which Risso's dolphin (Figure 1) was the third most sighted species (Table 2).

Out of 31 *Grampus griseus* sightings, 27 were included in the analysis (Table 1). Most of it were found between 300 and 700 meters deep. The average group size was 7 individuals (min 2, max 14).

Grampus griseus groups have been found either in navigation or in a determined point. Surface behaviour have been recorded (feeding, socializing or resting), also during feeding events some cephalopod pieces (*Octopus* sp.) have been recorded on the sea surface.

A total of 2648 images were analyzed. Marked individuals and included in the photoID catalog are higher than unidentified individuals (Figure 2). A digital catalog with 130 individuals was made, including 98 right-side (R) and 63 left-side (L) dorsal fins.

Recaptured individuals proportion increases over time surpassing the newly registered animals in the catalog (Figure 2). Cumulative curve (Figure 2) shows there is not stability and just an increase tendency due to newly recorded animals.

Photography coverage (Figure 3) shows there are not enough number of photographs on unidentified animals. Photography coverage (Figure 3) determine heterogeneity on the number of photographs by individual following a closed population model.

Abundance estimation obtained from fins on the right side is 155 individuals [CI 95% 115 - 361] standard deviation 50.15 in the north of Fuerteventura. Abundance estimation obtained from left side fins is 132 individuals [CI95% 105-180] standard deviation 18.64.

DISCUSSION

This study shows most sightings of *Grampus griseus* between 300 and 700 meters deep. This result coincides, as explained by Kruse *et al.* (1998) in the species description, with habitat between 400 and 1000 meters deep. The bathymetric zone corresponding to the end of the insular platform seems an interesting area for this species ecology.

Sightings have not been standardized due to this study was made in an opportunistic platform, during real censuses sightings can be related to environmental variables, which are independent of the particular moment (Buckland *et al.* 2001). However, through opportunistic platforms there are windward areas on the island have not been frequented enough allowing this study to make new effort on those places from the north. It is also a useful tool in data collection due to constancy and gives very accurate abundance estimation by capture-recapture techniques (Marrero *et al.* 2016).

Results of photographic effort analysis and the cumulative photo-ID curve shows there's no tendency to stability in the number of recaptured animals due to the appearance of newly registered individuals. This study has been carried out for 6 months, a very short time to register all the individuals in the population. Studies with a longer period, and combination of both methodologies (linear transects and opportunistic platforms data) are necessary.

Results of photographic effort analysis shows some of the animals could not be identified due to few number of photographs. A first hypothesis raises during foraging animals are very segregated with a successive dive pattern, which makes difficult to take photographs, unlike other moments of navigation or surface resting. This behaviour has been observed in other areas, where animals feed in solitary (Cockroft 1993), breaking during those moments groups well structured by classes, as it has been studied in other places like azores (Hartman *et al.* 2018). It suggests a foraging strategy about a bigger use of the area, however, further studies on social structure and ecology are necessary.

On the other hand, this study allowed to begin the monitoring of *Grampus griseus* on this island continuously, also the creation of a photo-ID catalog with fins of 130 animals, and the first abundance estimation on waters from the north of Fuerteventura.

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AUTHORS CONTRIBUTION

Both authors contributed equally to the data acquisition, analysis and writing.

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TABLES & FIGURES

TABLE 1: SUMMARY OF RESULTS DURING DATA COLLECTION PERIOD

Number of trips	Average duration (hours)	Total hours	Average effort per trip (nautical miles)	Number of sightings (mean per trip/ total)	<i>Grampus griseus</i> sightings	<i>Grampus griseus</i> sightings included in mark recapture analysis
103	3:36 ± 0:47	363:36	24,2 ± 7	Mean per trip: 141	31	27

TABLE 2: GROUPS NUMBER FOUNDED

SPECIES	SIGHTINGS NUMBER
<i>Balaenoptera sp.</i>	5
<i>Balaenoptera edeni</i>	34
<i>Grampus griseus</i>	31
<i>Stenella coeruleoalba</i>	7
<i>Stenella frontalis</i>	53
<i>Tursiops truncatus</i>	3
<i>Physeter macrocephalus</i>	2
<i>Feresa attenuata</i>	1
<i>Ziphiidae</i>	2
<i>Steno bredanensis</i>	1
<i>Delphinus delphis</i>	2



Figure 1: Morphology of *Grampus griseus* in photographs taken during the study and general aspect of the unpigmented scars presence.



Cumulative photographic effort

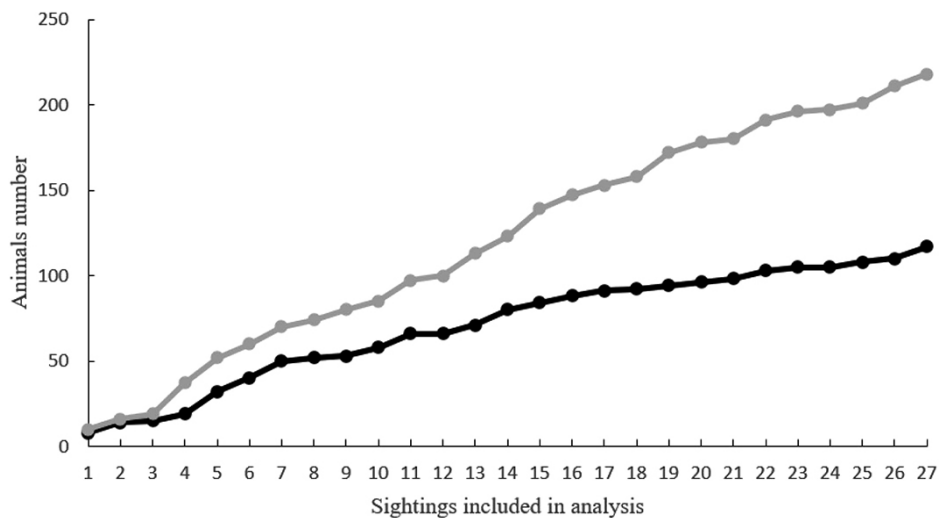


Figure 2: Cumulative new animals (black) versus cumulative total animals (new plus recaptured) (grey).

Pictures per animal and day

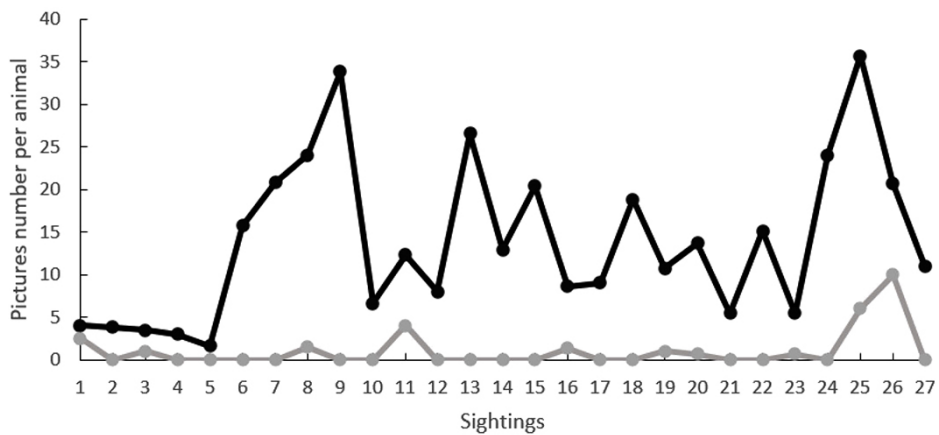


Figure 3: Pictures per animal (black) versus unidentified animals (grey).

