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INTERNATIONAL WHALING COMMISSION

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## Summary

Between October 11 and 16, 2019, 5 flights were made off the coast of the province of Buenos Aires in meteorological conditions that allowed the sighting of various cetacean species. In particular, 41 sightings of Franciscan dolphins (*Pontoporia blainvillei*) were made, totaling 68 individuals. In addition, several herds of common dolphins were observed, some very numerous.

## Introduction

The first study in Argentine waters on the abundance of the threatened Franciscana dolphin, *Pontoporia blainvillei* was carried out in Buenos Aires Province and the northern coast of Golfo San Matías, Rio Negro Province during 2003–2004. We carried out 17 aerial surveys using line transect sampling methodology. We observed 101 Franciscanas in 71 sightings. A correction factor for submerged dolphins was applied to density and then extrapolated to the strip between the coastline and the 30-m isobath. In northern areas density was estimated at 0.377 individual/km2. Density was lower in southern areas (0.197/km2). Abundance in the northern area was estimated at 8,279 (4,904–13,960) individuals, while in the southern BA Province and Golfo San Matías it was estimated at 5,896 (1,928–17,999) individuals. Considering a potential annual mortality of about 500–800 individuals, about 3.5%–5.6% of the stock may be removed each year by the fishery and over the 2% recommended by the International Whaling Commission (IWC) and may not be sustainable by the population. Higher densities in coastal areas make Franciscanas more vulnerable to coastal fishing camps, which increased mortality in recent years (Corcuera, 1994)

Given all these facts there was a need of repeating the aerial surveys in order to see if the abundance of franciscana has sustained or has declined during the last 15 years. The opportunity came with financial support by FAO and IWC to carry out a new series of surveys in the same area with the same designs used in the 2003-2004 surveys, scheduled to be carried out between the months of February and March 2019, mainly for two reasons: a) so that they were comparable to the surveys performed in the period 2003 - 2004, b) so that they were carried out in the best meteorological conditions possible.

However, the delay in signing the Letter of Agreement between FAO and CONICET and in the arrival of funds precluded the flights to be carried out in the proposed time window. Given that the request for postponement until February - March 2020 was not authorized, said surveys were carried out in October. Therefore, the results achieved in this work will not be completely comparable with those obtained in the period 2003 - 2004.

**Material and Methods**

The data were obtained using population sampling through linear transects applied to animals that are observed in groups. The method assumes that all animals will be observed in the transect line (under the plane the probability of detection g (0) = 1) and less far from it. To estimate the density of animals in the area, it is first necessary to adjust the distance data to mathematical functions that represent the way in which the probability of detecting animals declines as the observations are further away from the line (Fig. 2). These are called detection functions. The method is flexible enough to allow modifications of these functions and incorporate covariates that allow for better adjustment and reduce the coefficient of variation of the estimates (Buckland et al. 2001).

*Correction for submerged animals*

Detection Probability (g0): considering the chance of missing submerged dolphins under the plane, the probability of detecting a Franciscana was estimated based on the equation used by Barlow et al. (1988) in abundance estimation of harbor porpoises (*Phocoena phocoena*). This equation was previously used for the abundance estimation of Franciscanas at Rio Grande do Sul (Secchi et al. 2001b):

$$g_0 = \Pr(\text{dolphin is visible} \mid \text{dolphin is on transect line}) = \frac{s+t}{s+d}$$

where *s* is the average time of a Franciscana being at the surface, *d* is the average time of a Franciscana being submerged, and *t* is the time window during which the Franciscana is within the visual range of an observer. Values of *s* and *d* were obtained in free-living behavioral studies in the wild during the summer season (Bordino et al. 1999, Bordino 2004), while *t* was measured directly on board the aircraft from seabirds, carcasses, or any other floating objects.

For completeness we define g0 = 1 if $t > d$. The variance of g0 was estimated by the delta method (Seber 1982) given by the following equation:

$$Var(g_0) = [Var(d)] \left[\frac{-s-t}{(s+d)^2}\right]^2 + [Var(t)] \left[\frac{1}{(s+d)}\right]^2 + [Var(s)] \left[\frac{d-t}{(s+d)^2}\right]^2$$

Parameters *s* and *d* were re-estimated by Bordino (2004) and *t* was estimated by the authors on board the aircraft. Even though the values of *s* and *d* are correlated, the information for each was taken independently in different events. Given that there was no chance of estimating the covariance, it was assumed to be 0 for the calculation of Var (g0) as in other previous articles (Secchi et al. 2001b).

*Density estimation*

The density of the Franciscan dolphin (D = Du = uncorrected density) was estimated using the standard methods of distance sampling applied to groups of animals (Buckland et al. 1993, 2001). The data was analyzed using the DISTANCE 7.1 version 2 program (Thomas et al. 2004). Essentially, the program adjusts a detection function to the

distribution of perpendicular distances and this function is used to estimate the effective strip width (ESW). Then, the density is estimated using the following equation:

$$D = \frac{n * Es}{2l * ESW}$$

where *n* is the number of sightings, *l* is the total search effort and *Es* is the average group size. The quantity *n / l* is known as the encounter rate, which is the number of sightings per km traveled. This estimate does not include animals that are not observed in a blind strip on each side under the plane because the plane windows of the aircraft do not allow the detection of animals at angles closer to the transect line. Data were left truncated at 90m including the blind strip on each side below the plane. This is consequence of the flat windows in the aircraft that did not permit the detection of animals at angles closer to the transect line.

The aircraft used was a twin-wing Tecnam P2006T Twin MkII twin-engine (Fig. 1). The P2006T Twin MkII works with fuel savings and noise emissions much lower than other previously used aircraft, such as the Cessna 337. On flights made the dolphins, and in particular the Franciscana, did not react to engine noise, which happened with the Cessna 337.


Figure 1: Aircraft used for aerial surveys

The length of the transects was defined in 15 nautical miles, in accordance with the security restrictions of the owner of the private company of the rented aircraft. The basic plan was to follow the zigzag transects (Fig. 2) according to the same survey designs performed in 2003-2004. The surveys were carried out with a calm sea state on the Beaufort scale of 3 or less, which means that there are no waves that break that would lead to an underestimation of individuals.

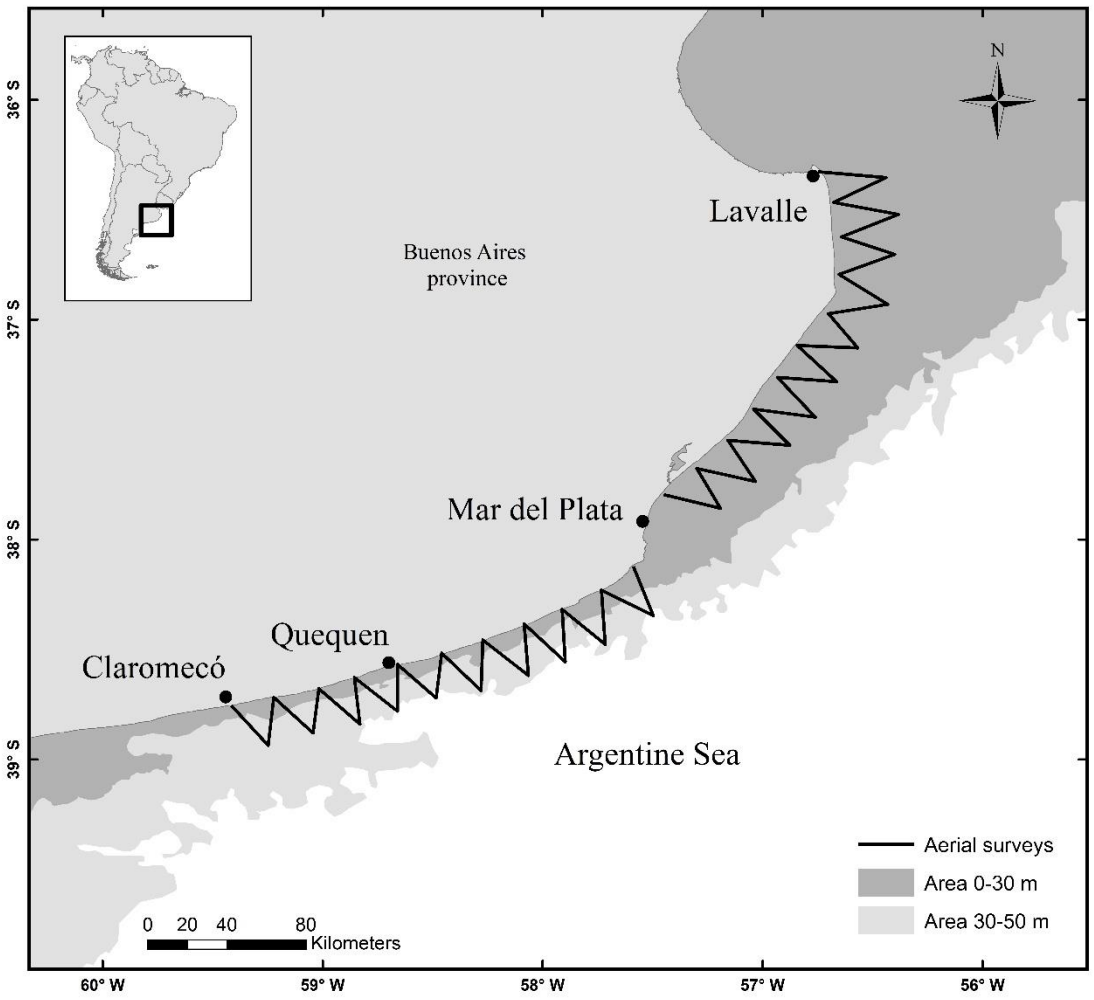


Figure 2: Map of Buenos Aires Province with survey designs and isobaths

## Results

Between October 11 and 16, 2019, 5 flights were made on the coast of the province of Buenos Aires in meteorological conditions that allowed the sighting of several species of cetaceans. In particular, 41 sightings of Franciscana dolphins (*Pontoporia blainvillei*) were made, totaling 68 individuals (Table 1).

In addition, several herds of common dolphins (*Delphinus delphis*) were observed, some very numerous. Individual sightings were also made of dusky dolphins *(Lagenorhynchus obscurus*), bottlenose dolphins (*Tursiops truncatus*), killer whales (*Orcinus orca*), unidentified rorquals (*Balaenoptera spp.*), South American sea lions (*Otaria flavescens*) and seabirds such as seagulls and shearwaters.

Table 1. Sightings and number of Franciscana dolphins recorded on flights

| Flight number | Direction | Number of sightings | Number of individuals |
|---|---|---|---|
| 1 | south | 13 | 22 |
| 2 | south | 6 | 11 |
| 3 | north | 0 | 0 |
| 4 | south | 8 | 11 |
| 5 | north | 14 | 24 |
| total | | 41 | 68 |

Regarding the parameter estimation, the encounter rate, the expected cluster size and density were either analyzed by stratum or for all data combined. The best fitted model was a Half-normal/Cosine without expansion series (Fig. 3). The total combined effort was 1531.98km, and the model used an effective strip with of 389 m. The estimates obtained are shown in Table 2.

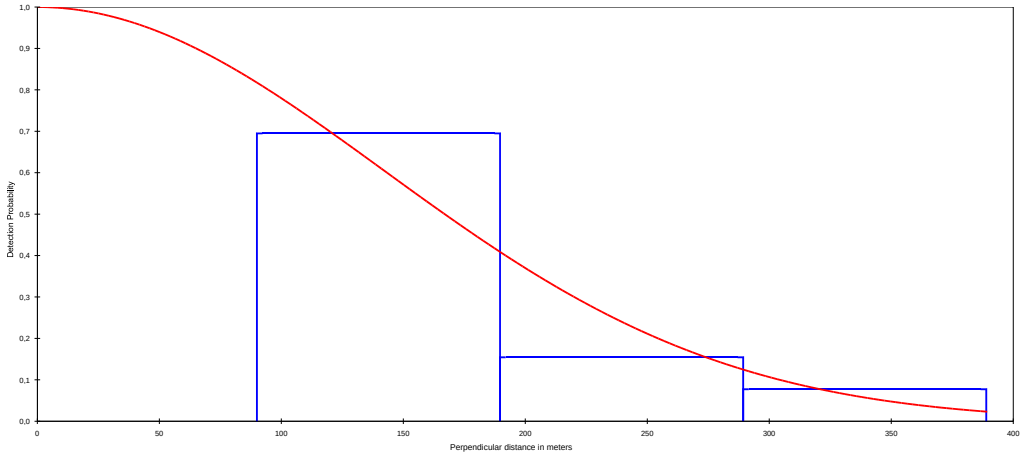


Figure 3: Detection probability function of Franciscana sightings

Table 2: Analysis of the single stratum for Franciscana dolphin. DS = estimate of density of clusters (dolphins/km2); E(S) = Expected cluster size; D = estimate of density of animals (dolphins/km2).

| Parameter | Point Estimate | Standard Error | CV% | 95% CI | |
|---|---|---|---|---|---|
| DS | 0.127 | 0.032 | 25.49 | 0.077 | 0.210 |
| E(S) | 1.343 | 0.142 | 10.59 | 1.084 | 1.664 |
| D | 0.171 | 0.047 | 27.60 | 0.099 | 0.292 |

*Preliminary estimation of Franciscana abundance*

The preliminary density estimate obtained using the DISTANCE 7.1 version 2 program (Thomas et al. 2004) was applied only to the area between the coast and the 30-meter isobath and that corresponds to the surveys carried out in October 2019. In addition, we add in a second row of Table 3, the number of franciscana dolphins that could be in the southern region of Buenos Aires province and northern coast of Golfo San Matías according to the paper by Crespo et al. (2010). This would give us the total number of franciscanas in the whole area of distribution in Argentina, not considering the animals beyond the 30-meter isobath.

This would preliminary give about 19214 dolphins (Table 3). The correction factor for submerged animals was taken from Bordino (2004), Bordino et al. (1999), Secchi et al. (2001) and Crespo et al. (2010).

Table 3: Density and abundance of dolphins in the province of Buenos Aires

| Dens Unc | Corr. Fact. | Corr Dens | Area Extrapol | Abundance | 95% CI | |
|---|---|---|---|---|---|---|
| 0,171 | 0,281 | 0,608 | 21961 | 13356 | 7737 | 22821 |
| 0,055 | 0,281 | 0,197 | 29927 | 5896* | 1928 | 17999 |
| | | | | 19214 | | |

Ref: Dens Unc: Uncorrected density; Corr Fact: Correction factor applied; Corr Dens: Corrected Density; Extrapol Area: Extrapolation Area. Density is expressed in individuals / km2; the extrapolation area is expressed in km2 and abundance is expressed in number of individuals. * Numbers taken from Crespo et al. 2010.

**Discussion and some preliminary conclusions**

The results achieved indicated the existence of a higher abundance of Franciscana compared to what was previously available (0.377individuals / km2 for 2003-2004, Crespo et al. 2010 to 0.608 individuals / km2, this study). However, since the data are not completely comparable, a greater abundance or a positive population trend from the period cited to the present cannot be considered as credited.

The current estimated abundance could have been the product of the time of the year in which the surveys were made, since mid-spring is the time when it is possible (unsafe,

without empirical evidence) that animals are grouped for reproduction. The censuses of the period 2003 - 2004 were carried out at the end of the summer - beginning of autumn, with which the reproductive biology could be indicating another hormonal state in the individuals, manifesting a greater dispersion and hence the observed differences. Since this is a hypothesis, it would be necessary to continue monitoring abundance in the future, as well as obtaining more accurate estimates of mortality.

Regarding mortality rates published along the last 3 or 4 decades all of them are beyond the 2% recommended by the IWC. During the 80´s Perez Macri & Crespo (1989) estimated 340-350 dolphins/year for whole BA Province (based on interviews with cooperative fishermen). Corcuera et al. (1994) estimated 303 dolphins/year for 1984-1990, 41% of the fleet was monitored (mainly based on interviews). Bordino & Albareda (2004) recorded in total, 312 dolphins caught on board of vessels during four consecutive fishing seasons. 22 % of the fleet. Average: 78 dolphins/year. Extrapolated to the whole área: 651 indiv/year for northern BA prov. Cappozzo et al. (2007) estimated 354 dolphins/year for 1997-2000 and 307 dolphins/year for 2002-2003. Minimum of 400 dolphins / year (interviews with cooperative fishermen). Negri et al. 2012 estimated 107 dolphins/year in southern BA Prov. and 360-539 for whole BA Province (interviews with cooperative fishermen). The common features of all these estimations are that all of them extrapolated the sample of a small group of fishermen (interviewed or onboard) to the whole fleet. It is clear that not all fishermen of a given locality behaved in the same way. Therefore, these estimations could be severely biased upward.

Our problem is that these mortalities would have driven the franciscana near to local extinction in a short time if our abundance estimations are realistic. The estimates obtained both in 2004 and during this study have shown that the abundance did not decreased. This poses a conflict: we may be underestimating abundance and/or overestimating mortality, but this conflict will not be solved until we have better estimations of trend in abundance and a creditable mortality estimations as well.

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