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Abundance estimation of franciscana dolphins by means of aerial surveys in Buenos Aires Province, Argentina

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Abundance estimation of franciscana dolphins by means of aerial surveys in Buenos Aires Province, Argentina

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Report to the International Whaling Commission

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Objectives

Abundance estimates in two selected areas of the Province of Buenos Aires, Argentina, will be obtained by means of aerial surveys, where incidental mortality continued to occur during the last decade. Surveys will be undertaken by the Marine Mammal Laboratory of the Centro Nacional Patagónico (CENPAT-CONICET) and Fundación Aquamarina.

Summary

Between October 11 and 16, 2019, and March 12 and 14, 2022, 9 flights were made on the coast of the province of Buenos Aires in meteorological conditions that allowed the sighting of several species of cetaceans. The two series of surveys (2019-2022) were carried out separately due to the covid-19 pandemic. In particular for 2019, 41 sightings of Franciscana dolphins (*Pontoporia blainvillei*) were made, totaling 68 individuals. For the 2022 survey, 55 sightings were made comprising 80 franciscanas. In addition, several herds of common and dusky dolphins were observed, some very numerous. The abundance of Franciscana would preliminary give a figure of 19252 dolphins if we consider the estimation obtained in 2022 plus 5896 dolphins estimated in 2004 for the southern areas, roughly 20000 individuals considering those in deeper waters beyond the 30 meters isobath.

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, Río 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 Buenos Aires Province and Golfo San Matias 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. They were scheduled to be carried out between the months of February and March 2019, mainly for two reasons: a) that they were comparable to the surveys performed in the period 2003 - 2004, b) 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, the surveys were carried out in October 2019. Therefore, the results achieved in this work would 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 decline 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 (g_0): 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):

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

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 behavioural 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 $g_0 = 1$ if $t > d$. The variance of g_0 was estimated by the delta method (Seber 1982) given by the following equation:

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

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 $\text{Var}(g_0)$ as in other previous articles (Secchi et al. 2001b).

Density estimation

The density of the Franciscan dolphin ($D = D_u =$ uncorrected density) was estimated using the standard methods of distance sampling applied to groups of animals (Buckland et al. 1993, 2001). The data was analysed 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:

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

where n is the number of sightings, l is the total search effort and E_s 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 (Crespo et al. 2010).



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.

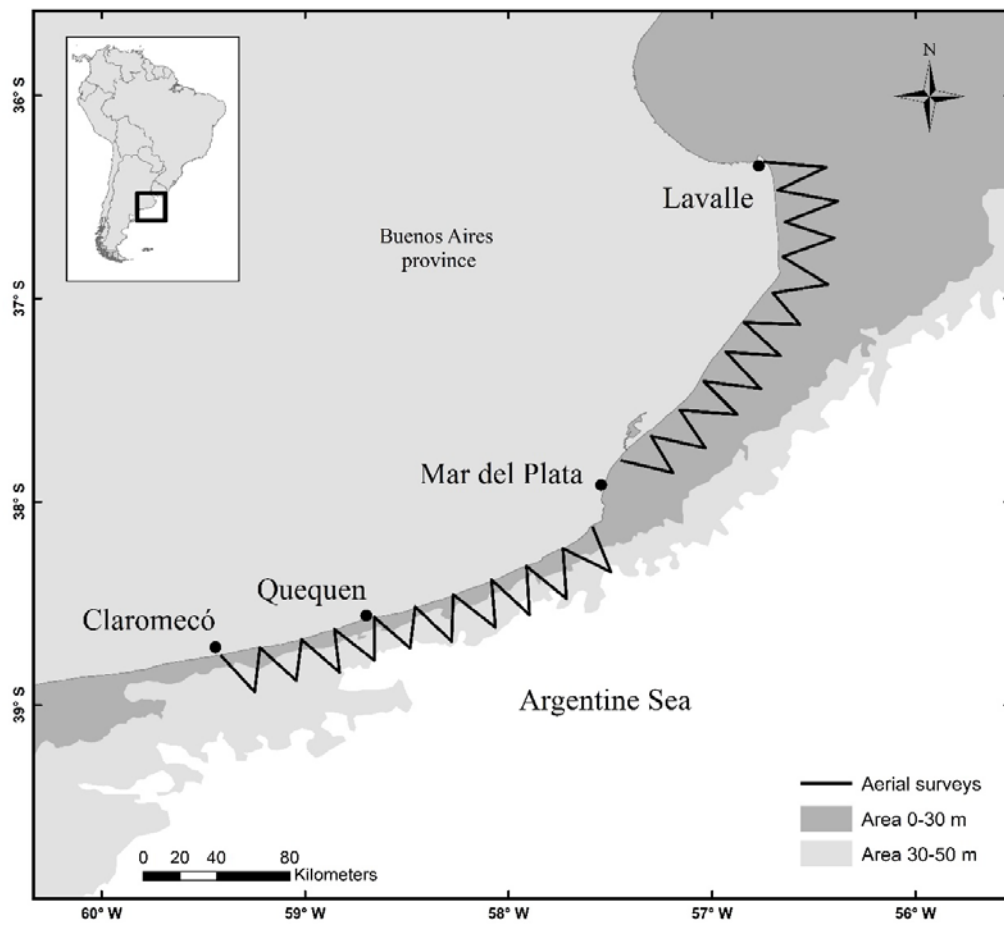


Figure 2: Map of Buenos Aires Province with survey designs and isobaths

Results

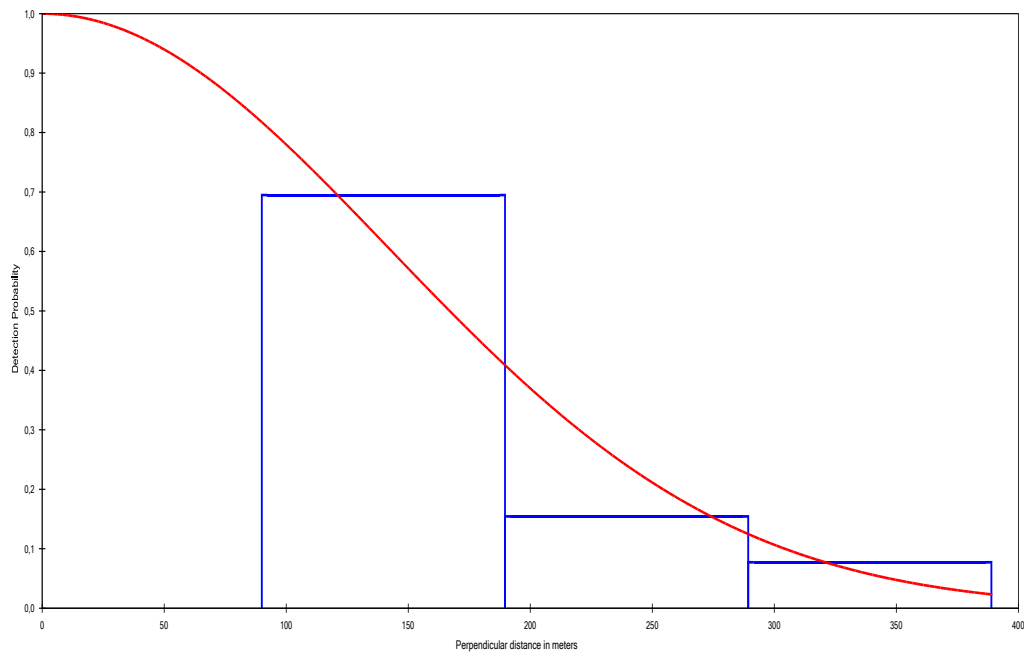
Between October 11 and 16, 2019, and March 12 and 14, 2022, 9 flights were made on the coast of the province of Buenos Aires in meteorological conditions that allowed the sighting of several species of cetaceans. In particular for 2019, 41 sightings of Franciscana dolphins (*Pontoporia blainvillei*) were made, totaling 68 individuals (Table 1). For the 2022 survey, 55 sightings were made comprising 80 franciscanas.

In addition, in 2019, 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. In 2022, besides common dolphins and bottlenose dolphins and South American sea lions, leatherback turtles (*Dermochelys coriacea*), green (*Chelonia mydas*) and/or loggerhead (*Caretta caretta*) and hammerhead sharks (*Sphyrna zigaena*) were spotted. It was not possible to distinguish between green and loggerhead turtles.

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

Survey	Flight number	Direction	Number of sightings	Number of individuals
2019	1	south	13	22
	2	south	6	11
	3	north	0	0
	4	south	8	11
	5	north	14	24
	total		41	68
2022	1	south	4	6
	2	north	27	37
	3	south	1	3
	4	north	23	34
	total		55	80

Regarding the parameter estimation, the encounter rate, the expected cluster size and density were either analysed by stratum or for all data combined for each survey. The best fitted model was a Half-normal/Cosine without expansion series (Fig. 3). The total combined effort for 2019 was 1531.98km, and the model used an effective strip with of 389 m. For the 2022 survey the effort was 1641.79km with an effective strip with of 231m. The estimates obtained are shown in Table 2.



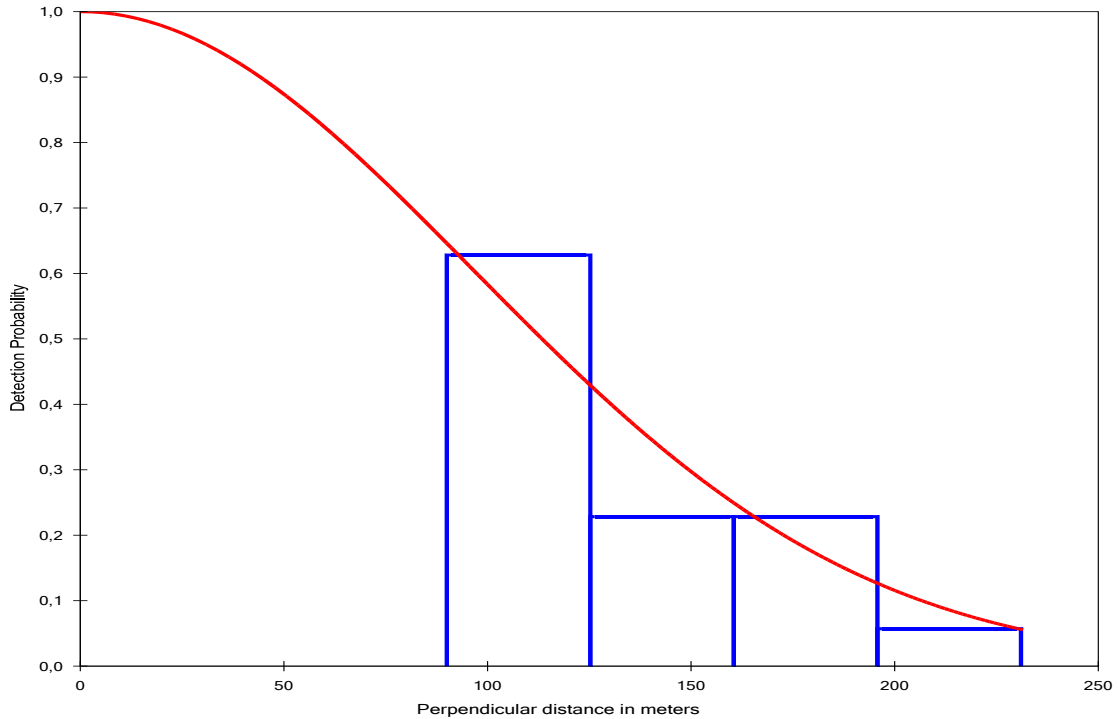


Figure 3: Detection probability function of Franciscana sightings for 2019 (upper plot) and 2022 (lower plot) surveys

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).

Survey	Parameter	Point Estimate	Standard Error	CV%	95% CI	
2019	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
2022	DS	0.151	0.068	45.22	0.062	0.366
	E(S)	1.478	0.146	12.74	1.00	1.49
	D	0.174	0.082	46.98	0.069	0.431

Preliminary estimation of Franciscana abundance

The preliminary density estimate obtained using the DISTANCE 7.3 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 19252 dolphins if we sum the 2004 and 2022 estimates (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

Survey	Dens Unc	Corr. Fact.	Corr Dens	Area Extrapol	Abundance	95% CI	
2019	0.171	0.281	0.608	21961	13356	7737	22821
2022	0.174	0.281	0.619	21961	13598	5392	33683
2004	0.055	0.281	0.197	29927	5896*	1928	17999

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 (0.377 individuals / km² for 2003-2004, Crespo et al. 2010 to 0.608 individuals / km², 2019; 0.619 individuals / km², 2022). However, 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. Nevertheless, the two surveys completed in this study rendered a similar abundance estimation, making the estimates of 0.6 individuals /km² plausible.

The 2019 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. The 2022 surveys were carried out in the same period (end of the summer) to make them comparable to the 2003-2004 estimates. Again, the global density rendered a higher figure, very similar to the one from 2019 survey. 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 Buenos Aires 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 based on 22 % of the fleet with an average of 78 dolphins/year. When extrapolated to the whole area the total number of Franciscanas caught is around 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 with a minimum of 400 dolphins / year (based on interviews with cooperative fishermen). Negri et al. (2012) estimated 107 dolphins/year in southern Buenos Aires Province and 360-539 for whole 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 on-board to the whole fleet. It is clear that not all fishermen of a given locality behave 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 decrease. 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 a trend in abundance and trustable mortality estimations as well.

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Literature Cited

- Bordino, P. 2004. Diving behavior. Pages 18-23 in: Key Aspects of the biology and ecology of the franciscana dolphin (*Pontoporia blainvillei*). Final Report to CMS compiled by E.A. Crespo. 43 pp.
- Bordino & Albareda 2004. Incidental mortality of Franciscana dolphin *Pontoporia blainvillei* in coastal gillnet fisheries in northern Buenos Aires, Argentina. Document SC56/SM11 presented at the 56th IWC Meeting, Sorrento, Italy
- Bordino, P., G. Thompson, and M. Iñiguez. 1999. Ecology and behaviour of the franciscana (*Pontoporia blainvillei*) in Bahía Anegada, Argentina. *Journal of Cetacean Research and Management* 1:213-222.
- Cappozzo, H.L., M.F. Negri, F.H. Pérez, D. Albareda, F. Monzón & J.F. Corcuera 2007. Incidental Mortality Of Franciscana Dolphin (*Pontoporia Blainvillei*) In Argentina. *LAJAM* 6(2): 127-137.
- Corcuera, J. 1994. Incidental mortality of franciscanas in Argentine waters: the threat of small fishing camps. Gillnets and Cetaceans. *International Whaling Commission, Special Issue* 15: 291-294.
- Corcuera, J., F. Monzon, E.A. Crespo, A. Aguilar & J.A. Raga. 1994. Interactions between marine mammals and coastal fisheries of Necochea and Claromecó (Buenos Aires Province, Argentina). *Gillnets and Cetaceans. International Whaling Commission, Special Issue* 15: 269-281.

- Crespo, E.A., S.N. Pedraza, M.F. Grandi, S.L. Dans & G. Garaffo. 2010. Abundance estimation of Franciscana dolphins (*Pontoporia blainvillei*) in argentine waters and implications for the conservation of the species. *Marine Mammal Science*, 26(1):17-35.
- International Whaling Commission. 1991. Report on the scientific committee. Report of the International Whaling Commission 42:75–81.
- International Whaling Commission. 1996. Report of the subcommittee on small cetaceans, Anexo H. Report of the International Whaling Commission 46:160–179.
- Negri M.F., Denuncio P., Panebianco M.V. and Cappozzo H.L. 2012. Bycatch of franciscana dolphins *Pontoporia blainvillei* and the dynamic of artisanal fisheries in the species' southernmost area of dis-tribution. *Brazilian Journal of Oceanography* 60, 151–160.
- Perez Macri G. & E.A. Crespo 1989. Survey of the franciscana dolphin (*Pontoporia blainvillei*) along the Argentine coast with a preliminary evaluation of incidental mortality in coastal fisheries. En: *Biology and Conservation of the River Dolphins. Occasional papers of the IUCN Species Survival Commission (SSC) No. 3.* pp:57-63. Ed. W.F. Perrin, R.L. Brownell Jr., Liu Jiankang y Zhou Kaiya.
- Secchi, E.R., P.H. Ott, E.A. Crespo, P.G. Kinas, S.N. Pedraza, and P. Bordino. 2001. Abundance estimation of franciscana dolphin, *Pontoporia blainvillei*, stock from aerial surveys. *Journal of Cetacean Research and Management* 3(1):95-100.
- Thomas, L., J. L. Laake, S. Strindberg, F. F. C. Marques, S. T. Buckland, D. L. Borchers, D. R. Anderson, K. P. Burnham, S. L. Hedley, J. H. Pollard and J. R. B. Bishop. 2004. Distance 4.1. Release2. Research Unit for Wildlife Population Assessment, University of St. Andrews, St. Andrews, U.K. Available at <http://www.ruwpa.st-and.ac.uk/distance/>.