First record of orca predation on franciscana dolphins 
(*Pontoporia blainvillei*) in Argentina

Antonella D. Padula¹, Joaquín C.M. Gana¹, Gisela V. Giardino¹, M. Carolina De Leon¹, Andrea Elissamburu¹, Diego H. Rodriguez¹ and Pablo Denuncio¹,²

¹Instituto de Investigaciones Marinas y Costeras (IIMyC), Facultad de Ciencias Exactas y Naturales (FCEyN), Universidad Nacional de Mar del Plata (UNMdP), Consejo Nacional de Investigaciones Científicas y Tecnológicas (CONICET), Funes 3350, CC1260, 7600 Mar del Plata, Argentina
²Asociación de Naturalistas Geselinos, Villa Gesell, Argentina

*Corresponding author: antonellapadula@mdp.edu.ar*

The orca, or killer whale (*Orcinus Orca*), is a cosmopolitan cetacean species that is known as a predator of a wide range of prey, including bony fishes, sharks, sea birds, sea turtles, sea otters, pinnipeds, dolphins, and whales (Jefferson et al., 1991; Visser, 2005; Ford, 2017; Wright et al., 2021).

Previous reports of the orca diet off Argentina include broadnose sevengill sharks (*Notorynchus cepedianus*) (Reyes and Garcia-Borboroglu, 2004), birds (Copello et al., 2021) and marine mammals such as dusky (*Lagenorhynchus obscurus*) and common (*Delphinus delphis*) dolphins (Coscarella et al., 2015), southern right whales (*Eubalaena australis*) (Sironi et al., 2008), South American sea lions (*Otaria flavescens*) (López and López, 1985; Grandi et al., 2012), and southern elephant seals (*Mirounga leonina*) (Hoelzel, 1991). However, all these records came from observational studies in Patagonia.

In northern Argentina, the trophic ecology of orcas is poorly known. This may be related to the fact that historically orcas seemed to be sporadic visitors near the coast with only a few sightings per year, and that stranding events are very infrequent in this region. However, recent records of sightings suggest that there is an increasing trend in their occurrence in the area (Biología, Ecología y Conservación de Mamíferos Marinos, unpub. data). In the last few years, there were two orca mass strandings in northern Argentina, along the Buenos Aires coast. The first event occurred on 25 August 2018, where six females live stranded between Mar de Ajó (36°43′13″ S, 56°41′16″ W) and Mar del Plata (38°00′ S, 57°33′ W) (Fig. 1); three of them died, and the other three were released. Unfortunately, it was not possible to take samples of these individuals.

The second event took place on 16 September 2019, when seven orcas stranded alive in La Caleta (37°46′44″ S, 57°27′50″ W; Fig. 1). Following the morphometric relationships adopted by Best et al. (2010), there were four mature females (> 6 m total length), two calves (< 6 m) of unidentified sex, and a mature male (6.5 m of total length – TL, and a percentage height of dorsal fin to TL > 14.8%). Six of the seven individuals were released, whereas the male died on the beach (Fig. 2A) where a necropsy was performed.

The franciscana dolphin *Pontoporia blainvillei* is a small cetacean endemic to the Southwest Atlantic Ocean, from Itaúnas, Brazil (18°35′ S, 64°48′ W) to Peninsula Valdés, Argentina (42°35′ S, 64°35′ W) (Siciliano, 1994; Crespo et al., 1998; Bastida et al., 2007; Danilewicz et al., 2009). It is considered the most threatened small cetacean in the Southwest Atlantic Ocean, classified as ‘Vulnerable’ by the International Union for the Conservation of Nature (Zerbini et al., 2017) and the Society for Mammals in Argentina (Denuncio et al., 2019). The main threat to the species is incidental mortality in gillnet fisheries which has been observed since at least the mid-1960s (Van Erp, 1969). The latest mortality estimation ranged between 360-539 dolphins/year, representing > 2% of the species abundance (between 15,000 and19,000, Crespo et al., 2010; 2020) in Buenos Aires, Argentina (Negri et al., 2012). Herein, we report the first evidence of an orca predation on the franciscana dolphin in Argentina, from stomach content analysis.

Highly digested prey items were identified in the stomach contents of an adult male orca, including beaks of four long-finned squids (*Loligo sanpaulensis*) (Class: Cephalopoda), a partially digested cetacean rib, and 14 odontocete teeth (Fig. 2B and 2C). The size and the shape of the teeth found in the stomach contents of the adult male orca were consistent with those of orca teeth reported previously (Jefferson et al., 1991). The first evidence of orca predation on franciscana dolphins in the Southwest Atlantic Ocean is described in this report.
revealed that they belonged to a franciscana dolphin. Kasuya and Brownell (1979) described decades ago that franciscana dolphin teeth range between 7 and 10 mm (length of teeth found: 8.41 mm ± 1.27), with a crown antero-posteriorly compressed, and a root of L or J-shape, and lingual-buccally flattened, characteristic particularly notorious in older specimens. Two measurements were taken at the external surface of each tooth, following Ramos et al. (2000): (1) tooth length (L-mm), measured from the apical extremity of the crown to the end of the root; and (2) cingulum width (CW-mm), measured in the maximum width in the intersection of the crown with the root (Fig. 2D). These measurements were compared to a reference teeth collection of $P$. blainvillei of known age (Table 1; Denuncio et al., 2013).

Significant differences were found for cingulum width between the year class 1 and 2 of the reference collection and the ones found in the stomach (K-W: CW: $\chi^2 = 40.764$, d.f. = 3, p ≤ 0.01), but there were no significant differences between the year class 0 and the ones found in the present study (p = 0.69) (Fig. 2D). These findings indicate that the teeth found seem to belong to a young specimen less than one year of age (up to 108 cm TL; Denuncio et al., 2013).

Orca predation on franciscana dolphins has been previously reported in Brazilian waters. The first record was found in the stomach content of a stranded orca in Rio Grande do Sul (38°48'15" S, 50°32'45" W; Ott and Danilewicz, 1998; Franciscana Management Area III (FMA III; Secchi et al., 2003)). The second record was an observational study in Paraná (25°20' S, 48°05' W; Santos and Netto 2005; FMA II) (Table 2). In Argentina, orcas have only been documented preying on two species of dolphins before ($L$. obscurus and $D$. delphis; Coscarella et al., 2015). To our knowledge, and despite a previous observational record of this behavior in Mar del Plata (Buenos Aires) during the late 1970s to early 1980s (Bastida et al., 2007), this is the first report of a confirmed franciscana dolphin consumed by an orca in Argentina. Only broadnose sevengill shark was known to be a franciscana predator in the area (Lucifora et al., 2005; Table 2).

Very scarce data on natural mortality is available for franciscana, and therefore orca predation could be an underrepresented source of natural mortality in coastal areas of northern Argentina. However, franciscana dolphins may constitute a profitable prey for orcas, as the franciscana has a predicted occurrence with limited home ranges (Bordino, 2002; Wells et al., 2013), confined to shallow waters (up to 30 m; Danilewicz et al., 2009). Furthermore, from the viewpoint of the predator, franciscana’s average blubber layer represents 25-31% of body weight (Caon et al., 2007; Denuncio, 2012), and could therefore satisfy the energetic demands of an

Table 1. Measurements (in mm) of the total length and cingulum width of franciscana ($P$. blainvillei) teeth (n = 14) found in the stomach content of the orca ($O$. orca) and those from a reference collection (ID) with known ages (0, 1, and 2 years old, respectively).

| ID    | Age | Range | Average | SD   | Range | Average | SD   |
|-------|-----|-------|---------|------|-------|---------|------|
| Pb11  | 0   | 7.42-  | 8.84    | 8.15 | 1.4-   | 1.58    | 0.1  |
|       |     | 9.84   |         |      | 1.3-1.73| 1.58    |      |
| 9496  | 1   | 8.54-  | 9.67    | 9.11 | 0.3   | 2.08-    | 2.4  |
|       |     | 9.67   |         |      | 3.4   | 2.4     |      |
| Pb60/09| 2   | 7.68-  | 8.67    | 8.31 | 0.25  | 2.33-    | 2.54 |
|       |     | 8.67   |         |      | 2.68  | 2.54    |      |
| Orca  | ?   | 5.45-  | 10.48   | 8.01 | 1.53  | 0.91-    | 1.65 |
|       |     | 10.48  |         |      | 2.4   | 1.65    | 0.37 |

W.; Santos and Netto 2005; FMA II (Table 2). In Argentina, orcas have only been documented preying on two species of dolphins before ($L$. obscurus and $D$. delphis; Coscarella et al., 2015). To our knowledge, and despite a previous observational record of this behavior in Mar del Plata (Buenos Aires) during the late 1970s to early 1980s (Bastida et al., 2007), this is the first report of a confirmed franciscana dolphin consumed by an orca in Argentina. Only broadnose sevengill shark was known to be a franciscana predator in the area (Lucifora et al., 2005; Table 2).

Figure 1. Location of two orca ($O$. orca) strandings (and the number of individuals stranded) in the Buenos Aires Province of Argentina: 25 August 2018 (n = 6, black diamonds), between Mar de Ajó and Mar del Plata; 16 September 2019 (n = 7, white diamond), at La Caleta.

Figure 2. (A) Orca ($O$. orca) male specimen stranded at La Caleta, Buenos Aires, Argentina. (B) Partially digested rib found in the stomach content analysis. (C) Comparison of the teeth found in the orca stomach (*) to the reference collection of franciscana ($P$. blainvillei) sorted by year class (0, 1 and 2 years old, respectively). (D) Scheme indicating the measurements taken. Total Length (L), and cingulum width (CW). Photos: this study.

Table 1. Measurements (in mm) of the total length and cingulum width of franciscana ($P$. blainvillei) teeth (n = 14) found in the stomach content of the orca ($O$. orca) and those from a reference collection (ID) with known ages (0, 1, and 2 years old, respectively).
orca (Kriete, 1995; Noren, 2011). Conversely, these characteristics, along with the existence of breeding areas reported near Bahía Samborombón (Denuncio et al., 2013) and their small size (< 150 cm TL and 25-30 kg of body weight, Denuncio et al., 2018), make franciscanas potentially vulnerable for active foraging of orcas. This note presents three valuable contributions to the trophic ecology of marine mammals in the waters of Argentina: (i) along with previous records in Brazil, it confirms orca predation of the franciscana dolphin in almost the entire distribution range of franciscana’s, increasing to at least three the number of natural predators of this endangered small dolphin (Table 2); (ii) it provides valuable information on the previously poorly known diet of orca, this apex predator, from the analysis of stomach contents of a stranded animal; and (iii) it highlights the importance of conducting necropies to provide insights to the ecology of understudied orca populations on the coast of Buenos Aires, Argentina.

### Acknowledgments

The authors would like to thank the reviewers for their comments on an earlier version of the manuscript. Special thanks to Ingrid Visser for the helpful suggestions for improving the manuscript. Also, we would like to thank Alan Rosenthal and staff of Asociación Naturalistas Geselinos, of Fundación Mundo Marino, and of Fundación Aquarium, Faro Querandi Park Rangers, OPDS Park Rangers, Pablo Galíndez, Municipality of Mar Chiquita, Juan Timi and Ana Lanfranchi (IIMYC). Special thanks to the other members of Marine Mammals Lab (IIMYC) and volunteers of the Universidad Nacional de Mar del Plata (UNMDP, Salomé López, Ludmila Barrionuevo, Julieta Auciello) who helped us during necropsy in the field. This contribution was part of the ADP bachelor thesis for the UNMDP.

### References

Bastida, R., Rodríguez, D., Secchi, E. and da Silva, V. (2007) *Mamíferos Marinos Sudamericanos*. Vázquez Manzini Editores, Buenos Aires. 345 pp.

Best, P.B., Meyer, M.A. and Lockyer, C. (2010) Killer whales in South African waters – a review of their biology. *African Journal of Marine Science* 32(2): 171-188. https://doi.org/10.2989/1814232X.2010.501544

Bordino, P. (2002) Movement patterns of franciscana dolphins (*Pontoporia blainvillei*) in Bahía Aneagada, Buenos Aires, Argentina. *Latin American Journal of Aquatic Mammals* 1(1): 71-76. https://doi.org/10.5997/laiam.00011

Caon, G., Fialho, C.B. and Danilewicz, D. (2007) Body fat condition in franciscanas (*Pontoporia blainvillei*) in Rio Grande do Sul, Southern Brazil. *Journal of Mammalogy* 88(5): 1335-1341. https://doi.org/10.1644/06-MAMM-A-364R.1

Copello, J.M., Bellazzi, G., Cazenave, J. and Visser, I.N. (2021) Argentinean orca (*Orcinus orca*) as an umbrella species: Conservation & management benefits. Pages 1-27 in Visser, I.N. and Cazenave, J. (orgs) *Contributions to the global management and conservation of marine mammals*. Editora Artemis, Curitiba, Brazil. https://doi.org/10.37577/EdArt_1003212861

Coscarella, M.A., Bellazzi, G., Gaffet, L., Berzano, M. and Degrati, M. (2015) Technique used by killer whales (*Orcinus orca*) when hunting for dolphins in Patagonia, Argentina. *Aquatic Mammals* 41: 192-197. https://doi.org/10.1578/AM.41.2.2015.192

Crespo, E.A., Harris, G. and Gonzalez, R. (1998) Group size and distributional range of the Franciscana *Pontoporia blainvillei*. *Marine Mammal Science* 14: 845-849. https://doi.org/10.1111/j.1748-7692.1998.tb00768.x

Crespo, E.A., Pedraza, S.N., Grandi, M.F., Dans, S.L., and Garaffo, G.V. (2000) Abundance and distribution of endangered Franciscana dolphins in Argentine waters and conservation implications. *Marine Mammal Science* 26(1): 17-35. https://doi.org/10.1111/j.1748-7692.2009.00313.x

Crespo, E.A., Coscarella, M., Arias, M. and Suyero, N. (2020) Abundance estimation of franciscana dolphins by means of aerial surveys in Buenos Aires Province, Argentina. Paper SC/68B/ASI/03Rev1 presented to the Scientific Committee, International Whaling Commission, May 2020. [Available from the Office of the International Whaling Commission, The Red House, 135 Station Road, Impington, Cambridge, Cambridgeshire CB4 9NP, UK, <http://iwcoffice.org/>].

Danilewicz, D., Secchi, E.R., Prado, P.B., Moreno, I.B., Bassoi, M. and Borges-Martins, M. (2009) Habitat use patterns of Franciscana dolphins (*Pontoporia blainvillei*) off southern Brazil in relation to water depth. *Journal of the Marine Biological Association of the United Kingdom* 89: 943-949. https://doi.org/10.1017/S002531540900054X

Denuncio, P. (2012) *Biología y conservación del delfín del Plata* (*Pontoporia blainvillei*) en el sector costero bonaerense. Ph.D. Thesis. Universidad Nacional de Mar Del Plata. Mar del Plata, Argentina. 208 pp.
Denuncio, P., Bastida, R., Danilewicz, D., Morón, S., Rodríguez Heredia, S. and Rodríguez, D. (2013) Calf chronology of the franciscana dolphin: birth, lactation and onset on feeding ecology in coastal waters of Argentina. *Aquatic Mammals* 39: 73-80. [https://doi.org/10.1578/AM.39.1.2013.73](https://doi.org/10.1578/AM.39.1.2013.73)

Denuncio, P., Negri, M.F., Bastida, R. and Rodríguez, D. (2018) Age and growth of Franciscana dolphins in northern Argentina. *Journal of the Marine Biological Association of United Kingdom* 98(5): 1197-1203. [https://doi.org/10.1017/S0025315417000765](https://doi.org/10.1017/S0025315417000765)

Denuncio, P., Paso Viola, N., Cáceres-Saez, I., Cappozzo, H.L., Rodríguez, D. and Mandiola, A. (2019) *Pontoporia blainvillei*. In SAyDS–SAREM (eds) *Categorización 2019 de los mamíferos de Argentina según su riesgo de extinción. Lista Roja de los mamíferos de Argentina*. Versión digital: [http://cma.sarem.org.ar](http://cma.sarem.org.ar)

Di Benedetto, A.P.M. (2004) Presence of franciscana dolphin (*Pontoporia blainvillei*) remains in the stomach of a tiger shark (*Galeocerdo cuvier*) captured in Southeastern Brazil. *Aquatic Mammals* 30(3): 311-314. [https://doi.org/10.1578/AM.30.2.2004.311](https://doi.org/10.1578/AM.30.2.2004.311)

Ford, J.K.B. (2017) Killer whale *Orcinus orca*. Pages 531-537 in Würsig, B., Thewissen, J.G.M. and Kovacs, K.M. (Eds) *Encyclopedia of marine mammals*. 3.ed. Academic Press, San Diego.

Grandi, M.F., Loizaga de Castro, R. and Crespo, E.A. (2012) Killer whales attack on South American sea lion associated with a fishing vessel: predator and prey tactics. *Latin American Journal of Aquatic Research* 40(4): 1072-1076. [https://doi.org/10.3856/vol40-issue4-fulltext-22](https://doi.org/10.3856/vol40-issue4-fulltext-22)

Hoelzel, A.R. (1991) Killer whale predation on marine mammals at Punta Norte, Argentina; food sharing, provisioning and foraging strategy. *Behavioral Ecology and Sociobiology* 29: 197–204. [https://doi.org/10.1007/BF00166401](https://doi.org/10.1007/BF00166401)

Jefferson, T.A., Stacey, P.J. and Baird, R.W. (1991) A review of killer whale interactions with other marine mammals: predation and co-existence. *Mammal Review* 21(4): 151-180. [https://doi.org/10.1111/j.1365-2907.1991.tb00291.x](https://doi.org/10.1111/j.1365-2907.1991.tb00291.x)

Kasuya, T. and Brownell Jr, R.L. (1979) Age determination, reproduction, and growth of the Franciscana dolphin, *Pontoporia blainvillei*. *The Scientific Reports of the Whales Research Institute Tokyo* 31: 45-67.

Kriete, B. (1995) *Bioenergetics in the killer whale*, *Orcinus orca*. Orca Ph.D. Thesis. The University of British Columbia, Vancouver, Canada. 137 pp.

López, J.C. and López, D. (1985) Killer whales (*Orcinus orca*) off Patagonia, and their behavior of intentional stranding while hunting nearshore. *Journal of Mammalogy* 66(1): 181-183. [https://doi.org/10.2307/1380981](https://doi.org/10.2307/1380981)

Lucifora, L.O., Menni, R.C. and Escalante, A.H. (2005) Reproduction, abundance and feeding habits of the broadnose sevengill shark *Notorynchus cepedianus* in North Patagonia, Argentina. *Marine Ecology Progress Series* 289: 237-244. [https://doi.org/10.3354/meps289237](https://doi.org/10.3354/meps289237)

Negri, M.F., Denuncio, P., Panebianco, M.V. and Cappozzo, H.L. (2012) Bycatch of franciscana dolphins *Pontoporia blainvillei* and the dynamics of artisanal fisheries in the species Southernmost area of distribution. *Brazilian Journal of Oceanography* 60(2): 149-158. [https://doi.org/10.1590/S1679-87592012000200005](https://doi.org/10.1590/S1679-87592012000200005)

Noren, D.P. (2011) Estimated field metabolic rates and prey requirements of resident killer whales. *Marine Mammal Science* 27(1): 60–77. [https://doi.org/10.1111/j.1748-7692.2010.00386.x](https://doi.org/10.1111/j.1748-7692.2010.00386.x)

Ott, P.H. and Danilewicz, D. (1998) Presence of franciscana dolphins (*Pontoporia blainvillei*) in the stomach of a killer whale (*Orcinus orca*) stranded in southern Brazil. *Mammalia* 62(4): 605-609.

Praderi, R. (1985) *Relaciones entre Pontoporia blainvillei* (Mamífera: Cetacea) y tiburones (Selachii) de aguas uruguayas. *Comunicaciones Zoológicas del Museo de Historia Natural de Montevideo* 11: 1-19.

Ramos, R.M.A., Di Benedetto, A.P.M. and Lima, N.R.W. (2000) Relationship between dental morphology, sex, body length and age in *Pontoporia blainvillei* and *Sotalia fluviatilis* (*Cetacea*) in northern Rio de Janeiro, Brazil. *Revista Brasileira de Biologia* 60(2): 283-290. [https://doi.org/10.1590/s0034-71082000000200012](https://doi.org/10.1590/s0034-71082000000200012)

Reyes, L.M. and García-Borboroglu, P. (2004) Killer whale (*Orcinus orca*) predation on sharks in Patagonia, Argentina: a first report. *Aquatic Mammals* 30: 376-379. [https://doi.org/10.1578/AM.30.3.2004.376](https://doi.org/10.1578/AM.30.3.2004.376)

Santos, M. and Netto, D. (2005) Killer whale (*Orcinus orca*) predation on a franciscana dolphin (*Pontoporia blainvillei*) in Brazilian waters. *Latin American Journal of Aquatic Mammals* 4(1): 69-72. [https://doi.org/10.5597/lajam00072](https://doi.org/10.5597/lajam00072)

Secchi, E.R., Danilewicz, D. and Ott, P.H. (2003) Applying the phylogeographic concept to identify franciscana dolphin stocks: implications to meet management objectives. *Journal of Cetacean Research and Management* 5: 61-68.

Siciliano, S. (1994) Review of small cetaceans and fishery interactions in coastal waters of Brazil. *Reports of the International Whaling Commission* (Special Issue 15): 241-250.

Sironi, M., López, J.C., Bubas, R., Carribero, A., García, C., Harris, G., Intieri, E., Illiguez, M. and Payne, R. (2008) Predation by killer whales (*Orcinus orca*) on southern right whales (*Eubalaena australis*) off Patagonia, Argentina: effects on behavior and habitat choice. *Paper SC/60/BRG29* presented to the IWC Scientific Committee, June 2008 [Available from the Office of the International Whaling Commission, The Red House, 135 Station Road, Impington, Cambridge, Cambridgeshire CB4 9NP, UK, <http://iwcoffice.org/>].

Van Erp, I. (1969) In quest of the La Plata dolphin. *Pacific Discovery* 22: 18-24.

Visser, I.N. (2005) First observations of feeding on thresher (*Alopias vulpinus*) and hammerhead (*Sphyra zygaena*) sharks by killer whales (*Orcinus orca*) specialising on elasmobranch prey. *Aquatic Mammals* 31(1): 83-88. [https://doi.org/10.1578/AM.31.1.2005.83](https://doi.org/10.1578/AM.31.1.2005.83)

Wells, R.S., Bordoño, P and Douglas, D.C. (2013) Patterns of social association in the franciscana, *Pontoporia blainvillei*. *Marine Mammal Science* 29(4): E520-E528. [https://doi.org/10.1111/mms.12010](https://doi.org/10.1111/mms.12010)

Wright, B.M., Deecke, V.B., Ellis, G.M., Tristes, A.W. and Ford, J.K.B. (2021) Behavioral context of echolocation and prey-handling sounds produced by killer whales (*Orcinus orca*) during...
pursuit and capture of Pacific salmon (Oncorhynchus spp.). *Marine Mammal Science* 2021: 1-26. [https://doi.org/10.1111/mms.12836](https://doi.org/10.1111/mms.12836)

Zerbini, A.N., Secchi, E., Crespo, E., Danilewicz, D. and Reeves, R. (2017) *Pontoporia blainvillei* (errata version published in 2018). *The IUCN Red List of Threatened Species* 2017: e.T17978A123792204