Supplementary material from:
Copello, J. M., Visser, I. N., Bellazzi, G., Cazenave, J., Coscarella, M., Enarson, M., Henderson, C. H., Lopez, J. C., Marchesi, M. C., & Trom, A. S. (2026). Lesions on the jaws of an adult male orca (*Orcinus orca*) from Punta Norte, Argentina. *Latin American Journal of Aquatic Mammals*, *21*(2), 55-69.
https://doi.org/10.5597/lajam00376

Supplementary Material 4.

Six rejected hypotheses, and some of the reasonings as to why we believe these are less likely to have been the cause of the lesions on the adult male orca (*Orcinus orca*) known as Mel, are presented here. See the main body of text for an additional three hypotheses which have merit(s).

Rejected Hypothesis One

The lesions may have been caused by conspecifics, as observed on orca in other locations (Scheffer 1969, Hoyt 1984, Visser 1998).

Evidence.

Although conspecific scars are present on the orca frequenting the Península Valdés area (PNOR unpublished data) these are generally limited in number and all appear to be superficial. Between 2005-2025 no physical altercations (i.e., what we would determine as aggression) were recorded between the orca, during more than 1,180 days of observations. The consistency of the location of the lesions on Mel, each time they reoccurred over a period of more than 10 years, is also suggestive that these lesions are not from conspecifics. If so, we would expect there to be lesions in other locations based on rake marks and lesions on other orca populations from conspecifics (e.g., Visser 1998) and potentially similar lesions on more other orca from the same population as Mel (if they were aggression related).

Rejected Hypothesis Two

The taking of high-risk prey such as sharks (south of Peninsula Valdés, see Reyes and García-Borboroglu 2004), adult male elephant seals (Copello, Cazenave et al. 2019) and potentially rays (PNOR unpublished data), may result in perforating injuries. Perforating injuries have been reported on a dolphin from the jaw of a needlefish (Arronte, Pis-Millán et al. 2005) and from ray spines in dolphins and orca (Walsh, Beusse et al. 1988, McFee 1997, Duignan, Hunter et al. 2000).

Evidence.

It is doubtful that the lesions reported here are the result of such injuries, given the manifestations on both sides of the skull and on both the upper and lower jaws, frequently all at the same time. Additionally, we could find no other orca in the population, who presumably feed on the same prey as Mel, exhibiting lesions to the same extent as those observed on Mel (PNOR, unpublished data). However, we do note that one male orca had some degree of discolouration on one mandible (see main text for details). Furthermore, comparison to the New Zealand Coastal orca, who feed predominantly on elasmobranchs (e.g., see (Visser 2005) including references therein) has confirmed that they do not exhibit any lesions on their faces such as those described on Mel (Visser & Orca Research Trust, unpublished data). Additionally, despite elasmobranchs inflicting lesions on cetaceans (Duignan, Hunter et al. 2000, Castelblanco-Martínez, Ramos et al. 2022), including on orca (Dwyer and Visser 2011), these lesions are not similar to those documented on Mel.

Rejected Hypothesis Three

Lesions from the two main prey species taken during intentional stranding i.e., southern sea-lions (*Otaria flavescens*) and southern elephant seals *(Mirounga leonina*), may be substantial, especially when considering the adult dentition of

these pinnipeds (King 1983, Riedman 1990). Such injuries could result in the observed lesions and/or subsequent bacterial infection could result in abscesses, which can form if the lesion does not drain (Vlasman and Campbell 2003). Complications can also arise, such as tetanus, which can affect the central nervous system and can cause stiffness of the jaw muscles (Fernandez 2000), giving rise to the common name of 'lock-jaw disease'.

Evidence.

Evidence against these prey species causing the lesions described here includes the lack of similar lesions (pre- and post-possible infection) on any of the other orca who regularly intentionally strand at Punta Norte and who also successfully capture these prey (N=21 individuals in 2025, PNOR ID Catalogue data). Additionally, the typical prey handling of sea-lion pups indicates that they are grasped mid-body, minimizing the chances that the orca can be clawed or bitten (*e.g.,* see (Enarson, Copello et al. 2024) which shows the small size of the prey compared to the head of an orca). Furthermore, the relatively small claws (less than 1 cm) as well as the relatively small milk teeth of these sea-lion pups (less than 2 cm for the canines and less than 1 cm protruding for the rest of the teeth) (Crespo 1988), along with the small mouth gape (less than 10 cm) suggests that any lesions inflicted would likely be predominantly superficial. Of note is that great white sharks (*Carcharodon carcharias*) who feed extensively on pinnipeds off the coast of False Bay, South Africa exhibit lesions on their faces from their prey, but these are distinct in they are either paired puncture marks or closely spaced claw/teeth rake marks, are from both adults and pups and, these injuries do not result in lesions such as those described herein (Enarson, pers. obs.). Similarly, lesions on great white sharks which predate on pinnipeds off the coast of North America have been described and documented with puncture and claw/rake injuries (Anderson, Kanive et al. 2025, see their Figure 1E & 1F),. none of which apparently developed into the types of lesions see on Mel.

Rejected Hypothesis Four

The lesions may have been from an anthropogenic source, as it is known that two adult male orca (including Mel) were shot on 27 May 1976 by personnel from the Argentinean Coast Guard, Police of the Rio Negro region and by sea-lion hunters (Iñíguez 1993, López 2000).

Evidence.

The other male orca who had lesions was Bernard, was observed with a red open lesion on the left caudal peduncle on 9 March 1977. That wound appeared to heal and re-open at least three times after the original observation (López, unpublished data). Additionally, during May 1976, Mel was shot through the dorsal fin. This caused a projectile wound on the right side of his dorsal fin, and although it was still upright on 28 October 1976, by 30 October 1976 it was inclined at a 90° angle to the animal's right side. By 10 December 1976 the fin had partially recovered but still remained inclined at an angle of 20° to the animal's right side (López, unpublished data). This resulted in a bend midway up the fin, however by 2008 the bend was at less than 5° (see Fig. 2 main text). We acknowledged that the lesions on the jaws of both adult male orca may be an indirect result of the shootings through systemic infections, although we believe this is unlikely given that both orca were first documented with lesions on their jaws on 12 August 1989, i.e., 13 years after they were first shot.

Rejected Hypothesis Five

Infection by parasites, which are known to cause lesions when they erupt from subdermal tissue, e.g., those found on a Cuvier's beaked whale (*Ziphius*

cavirostris) (Gomerčić, Gomerčić et al. 2006).

Evidence.

No external parts of a parasite could be observed in the lesions of Mel, even with high-resolution images. Although these were only a proxy (via photograph) examination of the lesions, one would expect that at some point over the extended period that the lesions were documented, that if parasites were the cause, some part of the parasites would be visible. Furthermore, the lesions did not show any graduation / concentration of tissue damage when they were *Open (raw or granulated)*, which could be expected if a parasite infection was the cause of the lesions.

Rejected Hypothesis Six

These lesions may be simply a result of natural tooth wear, as teeth in the upper and lower jaws of orca alternate and when the jaws are closed the teeth inter-digitate. Hence in an aged animal they are typically worn at their tips and also may develop deep groves worn in their anterior-posterior sides from interlocking.

Evidence.

Although orca have been known to loose teeth from abscesses (Wellings 1944) all evidence collected from the orca in the Punta Norte area (*i.e.,* skulls, photographs, observations) do not indicate any tooth losses. However, perhaps of note is that of the six records in the literature, describing abscess / disease on the jaws of orca, five are known to be adult males (Ulmer 1941, Mead 1961, Gormley 1990, the two presented here).

References

Anderson, S. D., P. E. Kanive, T. K. Chapple, S. Andrzejaczek, B. A. Block and S. J. orgensen (2025). A classification system for wounds and scars observed on white sharks (*Carcharodon carcharias*). *Frontiers in Marine Science 12*, e1520348.

Arronte, J. C., J. A. Pis-Millán and C. Pérez (2005). Injury to an Atlantic white-sided dolphin (*Lagenorhynchus acutus*) caused by needlefish impalement " *Aquatic Mammals* **31**(2): 184-186.

Castelblanco-Martínez, E. A. Ramos, J. Kiszka, M. P. Blanco-Parra, J. A. Padilla-Saldívar, J. García and C. A. Niño-Torres (2022). "Spatial patterns of shark-inflicted injuries on coastal bottlenose dolphins in the Mesoamerican Reef System." *Studies on Neotropical Fauna and Environment* **57**(3): 332-338.

Copello, J. M., J. Cazenave and I. N. Visser (2019). Fifteen years of data reveals insights into some of the most internationally recognised orca (*Orcinus orca*) in the world (Poster ID #1098). 9-12 December. *2nd World Marine Mammal Conference.* Barcelona, Spain.

Crespo, E. A. (1988). *Dinámica poblacional del lobo marino de un pelo Otaris flavescens, (SHAW), 1800, en el norte del litoral patagónico.* PhD Doctoral, Universidad de Buenos Aires.

Duignan, P. J., J. E. B. Hunter, I. N. Visser, G. W. Jones and A. Nutman (2000). "Stingray spines: A potential cause of killer whale mortality in New Zealand." *Aquatic Mammals* **26**(2), 143-147.

Dwyer, S. L. and I. N. Visser (2011). "Cookie cutter shark (*Isistius* sp.) bites on cetaceans, with particular reference to killer whales (orca) (*Orcinus orca*)." *Aquatic Mammals* **37**(2), 111-138.

Enarson, M., J. M. Copello and I. N. Visser (2024). *The Hunters of Punta Norte.* Península Valdés, Argentina, Punta Norte Orca Research / Blurb.

Fernandez, E. (2000). "*Clostridium perfringens* as a cause of death during the recovery of stranded dolphins." *European Research on Cetaceans* **14**, 268.

Gomerčić, H., M. Đ. Gomerčić, T. Gomerčić, H. Lucić, M. L. Dalebout, A. Galov, D. Škrtić, S. Ćurković, S.

Vuković and Đ. Huber (2006). "Biological aspects of Cuvier's beaked whale (*Ziphius cavirostris*) recorded in the Croatian part of the Adriatic Sea." *European Journal of Wildlife Research* **online only**: 1-6.

Gormley, G. (1990). *Orcas of the Gulf.* San Francisco, Sierra Club Books.

Hoyt, E. (1984). *Orca: The whale called killer.* Ontario, Camden House Publishing Ltd.

Iñíguez, M. A. (1993). *Orcas de la Patagonia, Argentina.* Buenos Aires, Probucsora Literaria.

King, J. E. (1983). *Seals of the world.* St Lucia, Queensland, Australia, University of Queensland Press.

López, J. C. (2000). *Orcas. Entre el mito y la realidad. (Orcas. Between the myth and the reality).* Buenos Aires, Editorial Sudamericana.

McFee (1997). "A stingray spine in the scapula of a bottlenose dolphin." *Journal of Wildlife Diseases* **33**(4): 921-924.

Mead, T. (1961). *Killers of Eden: The killer whales of Twofold Bay*. Sydney Australia, Angus & Robertson.

Reyes, L. M. and P. García-Borboroglu (2004). "Killer whale (*Orcinus orca*) predation on sharks in Patagonia, Argentina: a first report." *Aquatic Mammals* **30**(3): 376-379.

Riedman, M. (1990). *The Pinnipeds: Seals, sea lions, and walruses.* Los Angeles, University of California Press.

Scheffer, V. B. (1969). "Marks on the skin of a killer whale." *Journal of Mammalogy* **50**: 151.

Ulmer, F. A. J. (1941). "Notes on a killer whale (*Grampus orca*) from the coast of New Jersey." *Notulae Nature of the Academy of Natural Sciences of Philadelphia* **83**: 1-5.

Visser, I. N. (1998). "Prolific body scars and collapsing dorsal fins on killer whales (*Orcinus orca*) in New Zealand waters." *Aquatic Mammals* **24**(2): 71-81.

Visser, I. N. (1998). "Prolific body scars and collapsing dorsal fins on killer whales in New Zealand waters." *Aquatic Mammals* **24**(2): 71-81.

Visser, I. N. (2005). "First observations of feeding on thresher (*Alopias vulpinus*) and hammerhead (*Sphyrna zygaena*) sharks by killer whales (*Orcinus orca*), which specialise on elasmobranchs as prey." *Aquatic Mammals* **31**(1): 83-88.

Vlasman, K. L. and G. D. Campbell (2003). *Diseases and parasites of marine mammals of the Eastern Arctic.* Guelph, Ontario, Canadian Cooperative Wildlife Health Centre, University of Guelph.

Walsh, M. T., D. Beusse, G. D. Bossart, G. W. Young, D. K. Odell and G. W. Patton (1988). "Ray encounters as a mortality factor in Atlantic bottlenose dolphins (*Tursiops truncatus*)." *Marine Mammal Science* **4**(2): 154-162.

Wellings, C. E. (1944). "The killer whales of Twofold Bay, N.S.W., Australia, *Grampus orca*." *Australian Zoologist* **10**: 291-293 + plate.