

# First documented record of cookie-cutter shark (*Isistius* spp.) bite marks on a killer whale (*Orcinus orca*) in the Southwestern Atlantic Ocean

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Cookie-cutter sharks of the genus *Isistius* are small (< 60 cm) pelagic squaliform sharks with a global distribution across tropical and subtropical seas (Papastamatiou et al., 2010; Dwyer & Visser, 2011). These sharks are known for causing distinctive oval-to-elliptical wounds on a wide range of marine vertebrates, including teleost fishes, elasmobranchs, pinnipeds, and cetaceans. The micropredatory feeding strategy, coupled with a highly specialized feeding apparatus, enables these sharks to exploit much larger animals as a food source (Shirai & Nakaya, 1992; Papastamatiou et al., 2010; Niella et al., 2018). Bite marks of cookie-cutter sharks have been reported in several cetacean species, mysticetes, and odontocetes, mainly in offshore and deep-water environments (Dwyer & Visser, 2011; Best & Photopoulou, 2016). Killer whales (*Orcinus orca*) are wide-ranging apex predators that occupy both pelagic and coastal habitats (Ford, 2009) and are sporadically recorded in Argentine waters, including the Buenos Aires province (Bastida et al., 2007; Coscarella et al., 2019). However, documented interactions between killer whales and cookie-cutter sharks remain

scarce, and no such interactions have previously been reported for the Southwestern Atlantic Ocean. This study documents skin lesions consistent with cookie-cutter shark bites on a stranded killer whale off the coast of Argentina, contributing to the limited regional documentation of these interspecific interactions in temperate coastal waters.

The study is based on photographic documentation obtained during a mass stranding event on 16 September 2019 at La Caleta, Buenos Aires province, Argentina (37°46' S, 57°27' W). The event involved seven individuals: four adult females and two calves of undetermined sex, which were successfully reintroduced to the sea, and one adult male (6.5 m total length) that died shortly after the stranding (Padula et al., 2022). Bite-mark lesions on the deceased male were photographed and qualitatively analyzed, focusing on their anatomical distribution, morphology, depth, and healing stage, following the criteria established by Dwyer & Visser (2011) for orca. Multiple bite-mark lesions were found distributed across the body surfaces. In the cephalic region, two active, round, deep crater wounds were identified: one adjacent to the blowhole (approximately 5 cm in diameter) and another on the lower jaw (4 cm in diameter; Fig. 1). On the left lateral side, two depressed round lesions were observed on the pectoral fin, one open and the other in an intermediate state of healing (Fig. 2). Three additional lesions were recorded on the flank: one was an oval, smooth scar, while the other two were depressed, oval-shaped, in an intermediate state of healing, and with estimated lengths of 4 and 6 cm, respectively (Fig. 3). Two additional bite-mark wounds were recorded in the ventral region: one oval-shaped lesion to the right of the genital slit and one round-shaped lesion, both of which were depressed and in an intermediate state of healing (Fig. 4). Although the stranded individual was examined through standard necropsy procedures, including morphometric measurements and stomach content analysis (Padula et al., 2022), the bite marks consistent with cookie-cutter sharks were documented exclusively through external photographic examination following diagnostic criteria described by Dwyer & Visser (2011).

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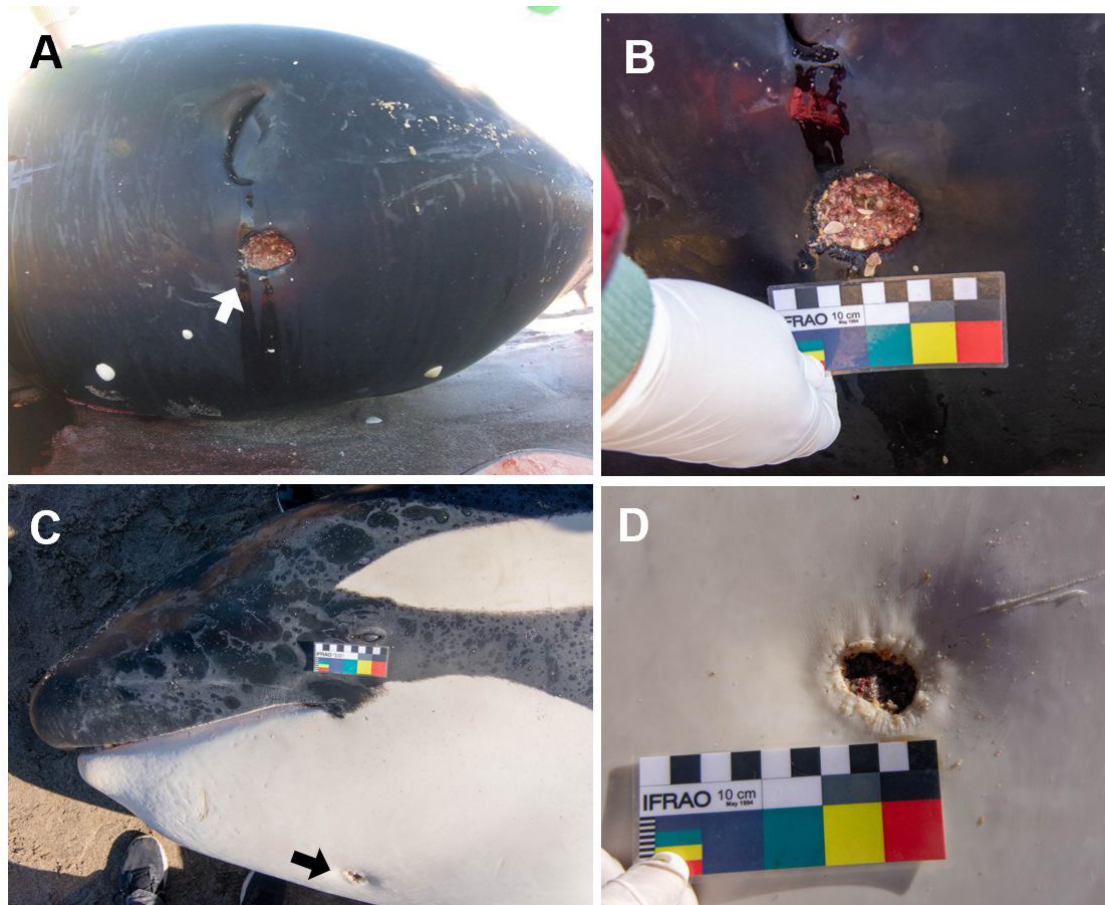
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**Figure 1.** Cookie-cutter shark (*Isistius* spp.) bites localized in the cephalic region of a stranded killer whale (*Orcinus orca*). A) Bite-mark next to the blowhole (white arrow). B) Detail of mark A; note the round, active crater characteristics of the wound. C) Bite-mark localized on the lower jaw (black arrow). D) Detail of the active, round, deep crater wound on the lower jaw. Scale bar (colored ruler) = 10 cm.

As no tissue samples from the lesions were collected for histological or genetic analyses, species-level identification within the genus *Isistius* was not attempted.

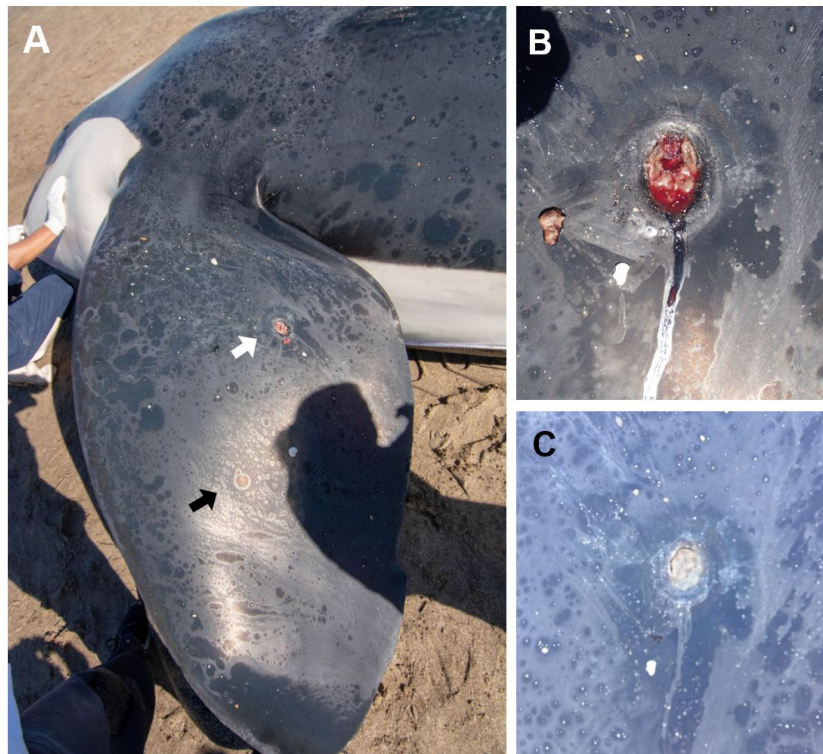
The skin lesions described herein are morphologically and metrically consistent with wounds produced by cookie-cutter sharks (*Isistius* spp.). These sharks typically leave distinctive circular or subcircular wounds with well-defined margins and localized tissue loss, a direct result of their specialized “plug-feeding” behavior (Shirai & Nakaya, 1992). In this study, the observed lesion dimensions (4 - 6 cm) align closely with the diagnostic ranges established for the genus. Specifically, our findings fall within the recorded diameters for *I. brasiliensis* (up to 5 - 7 cm) in large pelagic teleosts (Shirai & Nakaya, 1992) and *I. plutodus* (2,5 - 8 cm) across 13 cetacean species off the coast of Bahia, Brazil (Souto et al., 2007). Furthermore, the wounds observed on the killer whale are consistent with the 4–6 cm marks recently documented by Barcelos et al. (2024) in other delphinids (Atlantic spotted dolphin *S. frontalis* and common dolphin *D. delphis*).

While *I. brasiliensis* is a recognized component of the chondrichthyan fauna in the Southwestern Atlantic Ocean—ranging from southern Brazil to the northern Argentine coast (Sabadin et al., 2020)—most documented interactions in this region are concentrated at lower latitudes. Previously, the only recorded interaction at these latitudes was documented by Fundación Mundo Marino in 1999, involving a stranded sperm

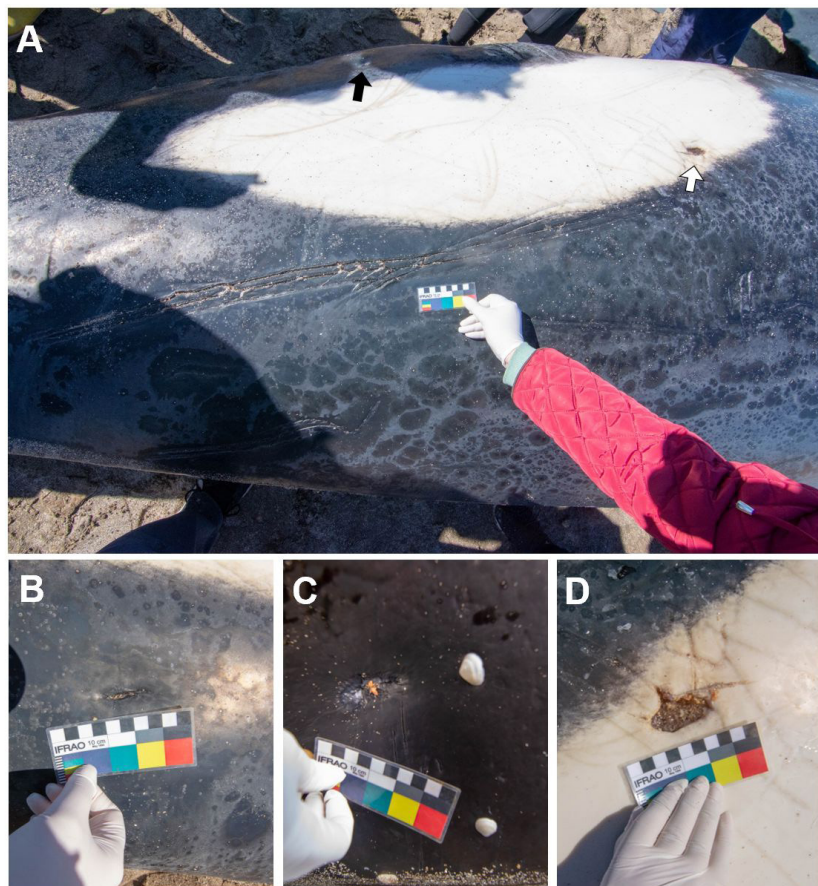
whale (*Physeter macrocephalus*) on the coast of Mar del Tuyú (approx. 36°35' S, 56°41' W; unpub. data). Our present report from La Caleta (37°47' S) represents one of the southernmost documented records of such interactions in the Southwestern Atlantic, situating the interaction near the southernmost limit previously reported for the genus in this region (Mar del Plata, 38°00' S; Cappozzo et al., 2005). Furthermore, while the prior record at these latitudes involved a Hector's beaked whale (*Mesoplodon hectori*), our study provides the first documentation of an interaction with a large delphinid (*Orcinus orca*) in these temperate waters, thereby expanding the known host range for the genus *Isistius* in the Southwestern Atlantic.

The occurrence of these lesions in a coastal stranding context does not necessarily imply that the interaction took place in shallow, neritic waters. Orcas are highly mobile apex predators capable of extensive movements between offshore and coastal habitats (Ford, 2009). The presence of wounds at different stages of healing may suggest multiple interactions with cookie-cutter sharks during offshore excursions. This aligns with the known oceanic distribution and vertical migration patterns of these sharks (Papastamatiou et al., 2010).

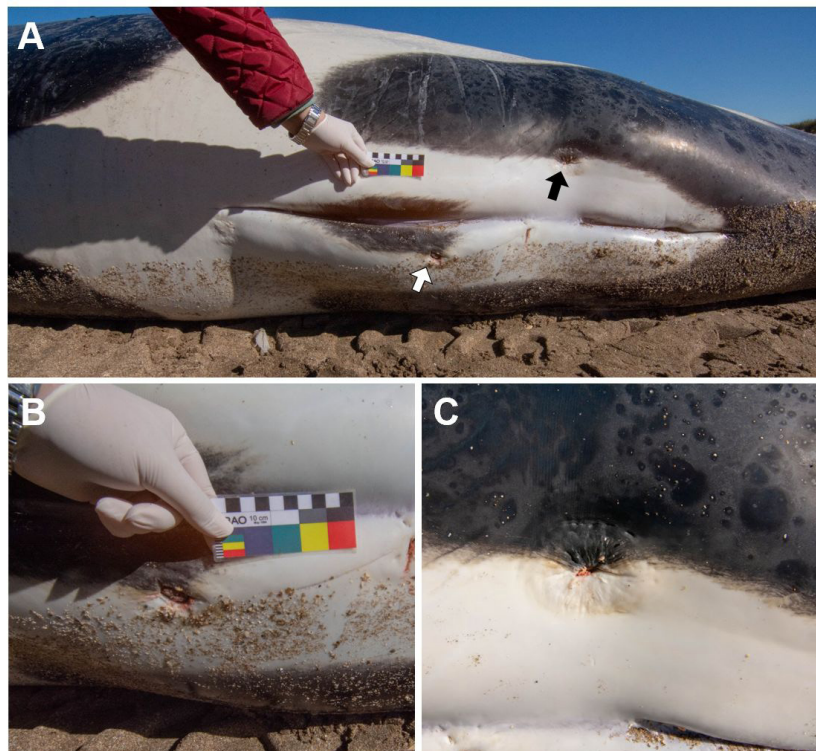
Globally, such interactions are well-documented for orca. In Oceania, records date back to 1955 in New Zealand, with further sightings in Australia and the Solomon Sea (Dwyer & Visser, 2011). In the North Pacific, evidence is highly prevalent, with over 150 individuals identified off Russia, alongside records



**Figure 2.** Cookie-cutter shark (*Isistius* spp.) bite-marks on a stranded killer whale (*Orcinus orca*). A) Depressed round lesions (arrows) on the left pectoral fin. B) Detail of the white arrow in A; note the round, open crater wound. C) Detail of the black arrow in A; round, crater wound in an intermediate state of healing.



**Figure 3.** Cookie-cutter shark (*Isistius* spp.) bite-marks on left flank of a stranded killer whale (*Orcinus orca*). A) Lateral view of the left flank, arrows indicate the bite-mark wounds. B) Oval, smooth scar, approximately 4 cm in length (black arrow in A). C) Depressed, oval-shaped wound in an intermediate state of healing, measuring approximately 4 cm. D) Depressed, oval-shaped wound in an intermediate state of healing on the dorsal edge of the white ventral patch, measuring approximately 6 cm (white arrow in A). Scale bar (colored ruler) = 10 cm.



**Figure 4.** Cookie-cutter shark (*Isistius* spp.) bite-marks on the ventral region of a stranded killer whale (*Orcinus orca*). A) Ventral view; arrows indicate the bite-mark wounds. B) Detail of the oval, depressed lesion in an intermediate state of healing, located to the right of the genital slit (white arrow in A). C) Round, depressed lesion in an intermediate state of healing (black arrow in A). Scale bar (colored ruler) = 10 cm.

from Hawaii, Alaska, and the Canadian High Arctic (Dwyer & Visser, 2011). Similarly, in Antarctic waters, many orcas exhibit healed scars acquired during mid-latitude migrations (Dwyer & Visser, 2011; Best & Photopoulou, 2016). In contrast, regional reports in the Southwestern Atlantic remain scarce; although *I. brasiliensis* is common in deep-sea ecoregions (Sabadin et al., 2020), documented interactions with cetaceans are largely limited to lower latitudes, such as those reported off Bahia, Brazil (Souto et al., 2007). In conclusion, although based on photographic evidence and without species-level confirmation of the shark involved, the record contributes to the limited regional documentation of such interactions and highlights the occurrence of these lesions in temperate waters. The findings should be interpreted cautiously, and primarily as descriptive evidence derived from a single event. Nevertheless, the documentation of these marks in the context of a well-documented stranding provides useful baseline information for future comparative studies on host–parasite interactions involving large odontocetes in the region.

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