



Scarface shortfin makos, a tale of resilience

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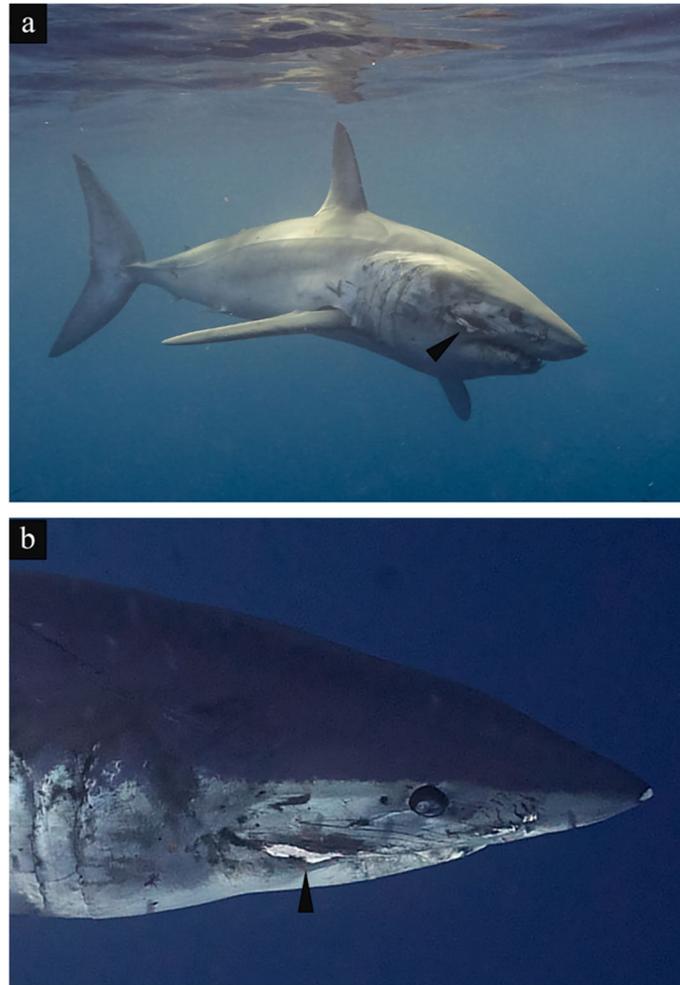


Fig. 1 Shortfin mako (*Isurus oxyrinchus*) adult female photographed off the coast of Bermeo (Euskadi, Spain). **a** The female presented many scars on the right side of the body and a healing wound above

the mouth (arrow) likely produced by a fishing hook. **b** Detail of the head showing the healing wound that resulted from a releasing action from a longline vessel

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Citizen science projects are based on collaborations between scientists and interested members of the public to generate scientific research. Shark watching in the wild, which is a booming touristic activity, can provide valuable observations for scientific purposes and act as a citizen science program.

On July 31, 2023, off the north coast of Spain (8 miles north of Bermeo city, Euskadi, Spain), during a sighting trip for blue sharks (*Prionace glauca*), a group of recreational divers was surprised by

an unusual visitor. A female shortfin mako (*Isurus oxyrinchus*), which was an estimated 2.8 m in length, was filmed calmly swimming around the sighting team. Although this unexpected encounter lasted only a few minutes, there was sufficient opportunity to observe striking marks on her body: teeth or beak impressions in the skin (close to the eye and nose), wounding and scarring on the upper part of the pectoral fins, around the gills and on the body, an eroded tip to the snout, and a noticeable, longitudinal wound (healed) on the right side of the head, close to the mouth (Fig. 1a, b).

The striking longitudinal wound could have been caused by an interaction with a billfish (Istiophoridae) or swordfish (*Xiphias gladius*), since several cases of this have been reported (Penadés-Suay et al. 2019; Romeo et al. 2020), and a clash with such a fish can result in such wounding. Nonetheless, considering the shape, location, and apparent shallow depth of the wound, it seems more likely that it was produced by a hook and the unhooking process before releasing the shark back into the water, potentially by a commercial longline vessel or recreational fisherman.

Shortfin mako is an oceanic and epipelagic shark distributed in tropical and warm temperate oceans around the world. Historically, shortfin mako was targeted by international longline fisheries for their valuable meat and fins. Recent stock assessments conducted by ICCAT (International Commission for the Conservation of Atlantic Tunas, <https://www.iccat.int/>) confirmed that this species has been overfished in the Atlantic Ocean. Consequently, an intensive recovery plan was established in 2021, including a recommendation of prohibition on retaining on board, transshipping, and landing of shortfin mako for 2022 and 2023, as a first step to recover the stock.

At present, pelagic longline fisheries target blue sharks, swordfish, and tunas (*Thunnus* spp.) with a range of other species taken incidentally, including black marlin (*Makaira nigricans*), Atlantic sailfish (*Istiophorus albicans*), and various oceanic sharks. Accidental bycatch of shortfin mako still keeps happening in large numbers (Mucientes 2023), and they must be released (when captured alive) or discarded (when captured dead) during fishing operations in the sea. When captured alive, the crew must directly release the shark from the hook, or may inadvertently cut the skin/muscle if the hook is too entrenched, leaving the shark injured. In the second case, such handling would leave an open wound in the muscle of the released sharks that can be potentially sublethal or fatal (Borucinska et al. 2002; Adams et al. 2015).

Hook damage and the presence of retained hooks in sharks are relatively frequent in oceanic sharks under fishing pressure. Based on data obtained from fisheries surveys, in the North Atlantic Ocean, 0.4% of blue sharks and 0.8% of shortfin makos were observed with retained hooks (Mucientes and Queiroz 2019); while in the South Pacific, 1.8% and 4.9%, respectively, were recorded with retained hooks on the body (Mucientes and Queiroz 2019). Cases of healing have been described (Mucientes and Queiroz 2019; Borucinska et al. 2020), which highlight the extraordinary healing capacity of this top predator from external injuries. The photograph shown here proves that shortfin mako can survive interactions with hook and line gears, and provides important anecdotal observations to support scientific studies on discard survival

(Mucientes et al. 2022). While the effectiveness of the current protection measures is uncertain, improved handling of incidentally caught sharks should, with the goodwill and skill of the fishers, enhance discard survival and enable the stock to recover.

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Declarations

Conflict of interest The authors declare no competing interests.

Ethical approval No animal testing was performed during this study.

Sampling and field studies The authors have obtained all necessary permits for observational field studies from the Spanish competent authorities. The study is compliant with CBD and Nagoya protocols.

Data availability Data are available upon request.

Author contributions All authors contributed to the conceptualization, design, methodology, and writing of the study. IC conducted field observation and photographs.

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