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A healed propeller wound on a wild loggerhead turtle, *Caretta caretta* (Testudines, Cheloniidae), occupied by a pelagic crab, *Planes minutus*, in the Azores Islands, Portugal

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The consequences of negative interspecific interactions have been the object of intense conservation studies, especially those resulting from anthropogenic activities. Among some of these are non-biodegradable waste as well as the use of certain predatory equipment that compromises not only the fishery resources but also the associated fauna (Byard et al., 2012). The real impact of accidents involving marine fauna with fishing equipment (ingestion of material and injuries caused by nets, hooks, nylon threads, boat propellers, among others) is likely underestimated.

Some of the most affected animals include cetaceans, pinnipeds, birds, and sea turtles, in addition to the fish themselves (Barreiros and Guerreiro, 2014). Injuries range from minor lesions to limb amputation and death of the animal, which are the most often reported incidents (Barreiros and Raykov, 2014). Sea turtles are often involved in this type of accident with fishing equipment and boats. In the case of *Caretta caretta* (Linnaeus, 1758), its highly opportunistic foraging strategy and attraction to floating items makes accidental ingestion of foreign materials frequent (Nicolau et al., 2015; Martin et al., 2019). When evaluating accidents caused by boat propellers in *C. caretta*, these are known to occur frequently but are underreported or difficult to identify and document (Witherington, 2003). The total impact of these accidents is not known well around the world, and only a small number of turtles are found alive after being seriously injured (Barreiros, 2015).

It has not been possible to find accurate descriptions of propeller-induced injuries in sea turtles in the literature, although there are reports for marine mammals (Wells and Scott, 1997; Visser, 1999; Rommel et al., 2007; Byard et al., 2012). This paper details and discusses a helix-induced injury to the right anterior shell of a seemingly healthy subadult loggerhead turtle.

On 10 September 2018, two of the authors (JBB and JPB) located a loggerhead sea turtle resting on the rocky reef bottom at a depth of about 10 m (Fig. 1) while freediving off the southeastern coast of Terceira Island, Azores, Portugal; 38.6711°N, 27.0742°W; Fig. 2). Observing an anomaly on the turtle's carapace, they hand-grabbed the turtle to take a closer look. The whole process was filmed using a GoPRO 8 camera. The turtle was swimming and strongly moving its flippers, when we noticed a deep wound on the right anterior part of the carapace. Inside the cicatrised wound were at least two epibionts, pelagic crabs of the species *Planes minutus* (Linnaeus, 1758) (Fig. 3). These crabs are epipelagic and often found associated with floating debris, and they are commonly seen with sea turtles, especially in the space between the ventral part of the carapace and the tail.

The turtle's wound was fully healed and did not appear to affect either its lungs or its backbone, since the turtle swam fast and straight after being released; it did not show any symptoms of a possible pathology. The right mid-section of the carapace was covered with algae, which we attribute to a period of floating with that part submerged, something that might have occurred right after the wound was received.

Discarded or lost fishing gear is part of a serious pollution problem that affects all the world's oceans. In addition, in places where boating is common, fatal, and serious injuries caused by propellers in marine animals occur regularly. The real effects of this impact are likely to remain poorly studied because not all affected animals

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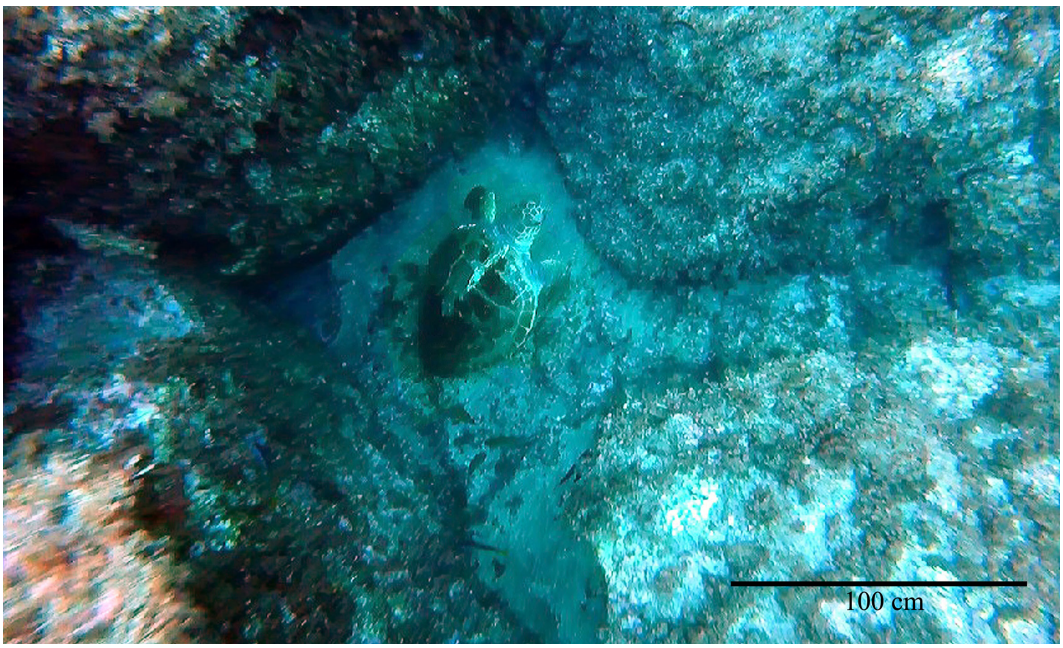

Figure 1. Dorsal view of the loggerhead sea turtle *Caretta caretta* observed in the present study. Photo by J.B. Barreiros.

are reported or reach researchers, and certainly a large number will die without being reported (Barreiros and Raykov, 2014).

Considering accidents involving aquatic animals and boat propellers, air-breathing marine organisms such as sea turtles and some mammals are at high risk of being struck by boats because they must surface to obtain oxygen. In addition, activities such as basking, mating, and resting at the surface make the animals susceptible to boat strikes. Sick or injured turtles may spend significant amounts of time on the surface and may be incapable of diving quickly to avoid approaching boats (Lenhardt et al., 1983; Bresette et al., 1998). Despite the specialized capability of loggerheads of hearing low frequency sounds, the time available between a turtle detecting an oncoming boat and diving to escape being struck by the hull or propeller may be insufficient even for turtles in healthy condition (Moein et al., 1999). Although propeller protectors have been developed for some vessels, they are not used very often. A boat's propeller shocks can result in lacerations, fractures, paralysis, buoyancy problems, breathing difficulties, amputations, and death (Walsh, 1999; Byard et al., 2012).

Planes minutus crabs have previously been reported as epibionts of sea turtles in the Atlantic Ocean (Frick et al., 1998). Three species of sea turtles in the Atlantic are reported as hosts of *P. minutus*: *C. caretta*, *Chelonia mydas* (Linnaeus, 1758), and *Eretmochelys imbricata* (Linnaeus, 1766). The crabs are commonly found clinging onto the underside of the turtle near the tail, cloaca, and hind limbs using their walking legs (Caine, 1986).

Studies with analysis of the stomach contents of *P. minutus* reveal that, in addition to being coprophagous, they feed within and upon a turtle's epibiotic community. Davenport (1994) found several organisms reported to be epibionts of *C. caretta* (barnacle cyprids, commensal amphipods, nocturnal euphausids, other *P. minutus*) in the stomachs of these crabs. In addition, turtles also act as an important breeding substratum for *P. minutus* (Dellinger et al., 1997). Together with other epibiotic crabs, *P. minutus* aid in cleaning epibiota from *C. caretta*. However, colonization by epibionts in sea turtles can also have adverse effects. Epibiotic drag drastically alters the hydrodynamic characteristics of the turtle carapace and in turn increases the amount of energy needed for a turtle to swim. Thus, it is assumed that any activity or organism that rids a turtle of its epibiota would be beneficial to the host turtle. By removing small epibionts and epibiont larvae, epibiotic crabs could be considered "beneficial symbionts" of the sea turtles they are associated with (Logan and Morreale, 1994).

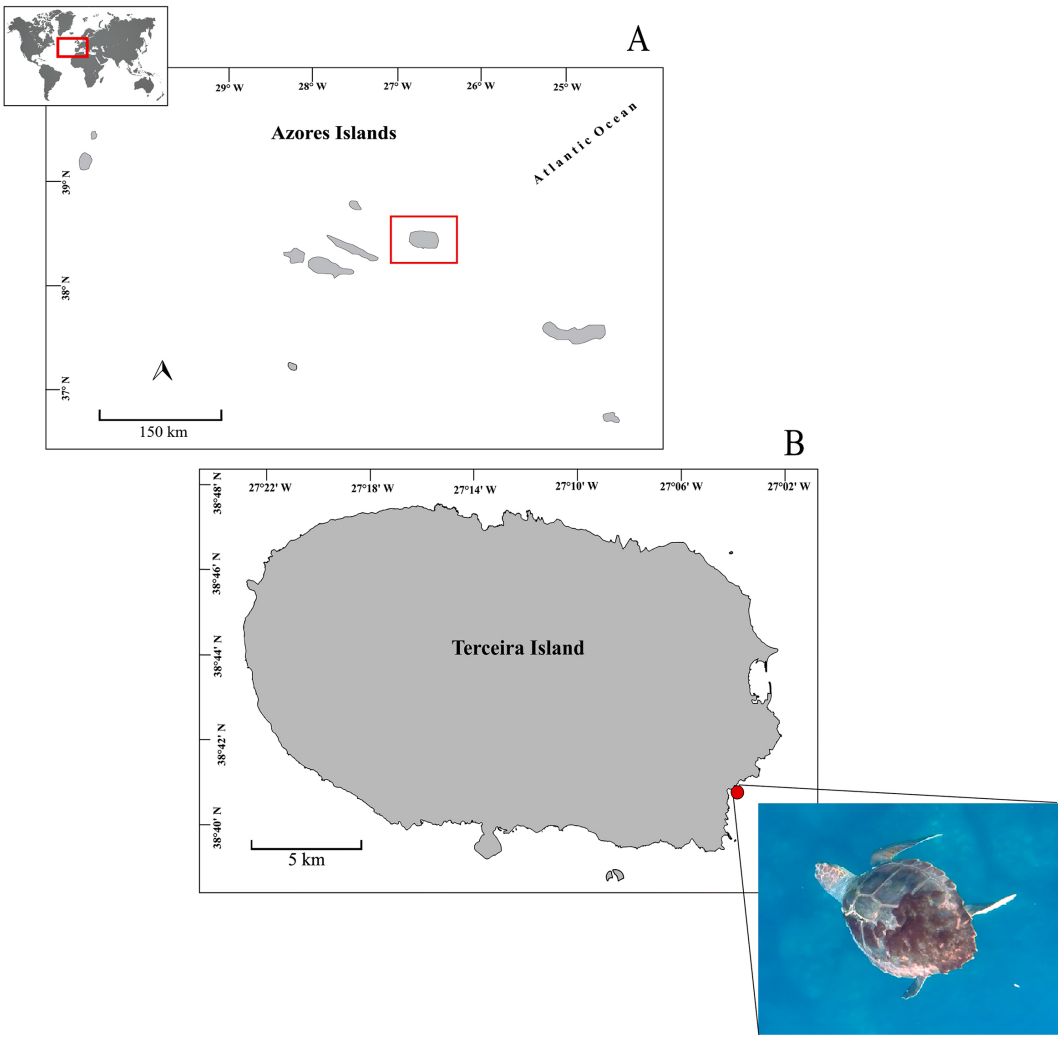

Figure 2. Location of the sighting of *Caretta caretta* (Linnaeus, 1758) in the Azores Archipelago, Portugal. (A) The Azores Islands are shown and the red rectangle marks Terceira Island. (B) Close-up of Terceira Island, with the specific locality of the *C. caretta* sighting marked by a red dot.

Although being apparently healed, wounds such as the one observed in the loggerhead in this study can negatively influence the animal's reproductive success, its foraging capacity, and may still be a gateway for opportunistic infections, which impair the turtle's survival.

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References

Barreiros, J.P. (2015): Hook removal from a loggerhead sea turtle (*Caretta caretta*): Report of a tricky surgery under difficult conditions. Journal of Coastal Life Medicine **3**(8): 671–672.

Barreiros, J.P., Guerreiro, O. (2014): Notes on a plastic debris collar on a juvenile *Pagellus acarne* (Perciformes: Sparidae) from Terceira Island, Azores, NE Atlantic. Bothalia Journal **44**(4): 2–5.

Barreiros, J.P., Raykov, V.S. (2014): Lethal lesions and amputation caused by plastic debris and fishing gear on the loggerhead turtle *Caretta caretta* (Linnaeus, 1758). Three case reports from Terceira Island, Azores (NE Atlantic). Marine Pollution Bulletin

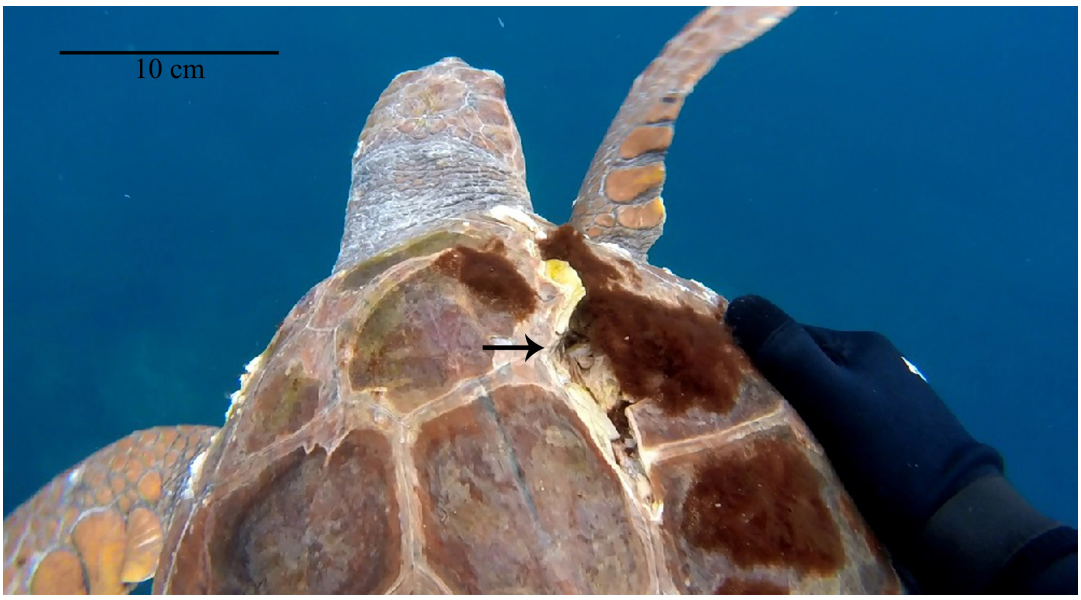

Figure 3. A loggerhead sea turtle, *Caretta caretta*, sighted in the Azores Archipelago, Portugal. The black arrow indicates the location of the healed wound, showing a crab, *Planes minutus* (Decapoda: Grapsidae) near the arrow's tip inside the scar. Photo by J.B. Barreiros.

86(1–2): 518–522.

Bresette, M., Gorham, J., Peery, B. (1998): Site fidelity and size frequencies of juvenile green turtles (*Chelonia mydas*) utilizing near shore reefs in St. Lucie County, Florida. Marine Turtle Newsletter **82**: 5–7.

Byard, R.W., Winskog, C., Machado, A., Boardman, W. (2012): The assessment of lethal propeller strike injuries in sea mammals. Journal of Forensic and Legal Medicine **19**(3): 158–161.

Caine, E.A. (1986): Carapace epibionts of nesting loggerhead sea turtles: Atlantic Coast of U.S.A. Journal of Experimental Marine Biology and Ecology **95**(1): 15–26.

Davenport, J. (1994): A cleaning association between the oceanic crab *Planes minutus* and the loggerhead sea turtle *Caretta caretta.* Journal of the Marine Biological Society of the United Kingdom **74**(3): 735–737.

Dellinger, T., Davenport, J., Wirtz, P. (1997): Comparisons of social structure of Columbus crabs living on loggerhead sea turtles and inanimate flotsam. Journal of the Marine Biological Association of the United Kingdom **77**(1): 185–194.

Frick, M.G., Williams, K.L., Robinson, M. (1998): Epibionts associated with nesting loggerhead sea turtles (*Caretta caretta*) in Georgia, USA. Herpetological Review **29**(4): 211–214.

Lenhardt, M.L., Bellmund, S., Byles, R.A., Harkins, S.W., Musick, J.A. (1983): Marine turtle reception of bone-conducted sound. The Journal of Auditory Research **23**(2): 119–126.

Logan, P., Morreale, S.J. (1994): Hydrodynamic drag characteristics of juvenile *L. kempi*, *C. mydas*, and *C. caretta*. In: Proceedings of the Thirteenth Annual Symposium on Sea Turtle Biology and Conservation, p. 248–252. Schroeder, B.A., Witherington, B.E., Eds., NOAA Technical Memorandum NMFS-SEFSC-341.

Martin, J.M., Jambeck, J.R., Ondich, B.L., Norton, T.M. (2019): Comparing quantity of marine debris to loggerhead sea turtle (*Caretta caretta*) nesting and non-nesting emergence activity on Jekyll Island, Georgia, USA. Marine Pollution Bulletin **139**: 1–5.

Moein, B.S., Musick, J.A., Lenhardt, M.L. (1999): Auditory evoked potentials of the loggerhead sea turtle (*Caretta caretta*). Copeia **1999**(3): 836–840.

Nicolau, L., Marçalo, A., Ferreira, M., Sá, S., Vingada, J., Eira, C. (2016): Ingestion of marine litter by loggerhead sea turtles, *Caretta caretta*, in Portuguese continental waters. Marine Pollution Bulletin **103**(1–2): 179–185.

Rommel, S.A., Costidis, A.M., Pitchford, T.D., Lightsey, J.E.M. (2007): Forensic methods for characterizing watercraft from watercraft-induced wounds on the Florida Manatee (*Trichechus manatus latirostris).* Marine Mammal Science **23**(1): 110–132.

Visser, I.N. (1999): Propeller scars on and known home range of two orca (*Orcinus orca*) in New Zealand waters. New Zealand Journal of Marine and Freshwater Research **33**(4): 635–642.

Wells, R.S., Scott, M.D. (1997): Seasonal incidence of boat strikes on Bottlenose Dolphins near Sarasota, Florida. Marine Mammal Science **13**(3): 475–480.

Witherington, B.E. (2003): Biological conservation of loggerheads: challenges and opportunities. In: Loggerhead Sea Turtles, p. 295–312. Bolten, A.B., Witherington, B.E., Eds., Washington, DC, USA, Smithsonian Institution Press.

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