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Injury Recovery in a Juvenile Green Sea Turtle *Chelonia mydas* in a Foraging Ground in the Southwest Atlantic, Brazil

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Abstract.**—Sea turtles are often encountered showing signs of human interaction. Embedded fishing lines and hooks, plastic ingestion, and evidence of boat strikes are among the most common observed impacts. Considering their wide-ranging nature, it is a challenge to know how sea turtles in the wild can cope and sometimes recover from anthropic impacts, and to understand other secondary impacts to recovering turtles. Here we followed the recovery of a juvenile Green Sea Turtle (*Chelonia mydas*) for over 2 y in its natural environment. We captured the juvenile in a monitored foraging ground in the Right Whale Environmental Protection Area of southern Brazil, with wounds on its carapace, possibly caused by a boat collision. We captured the individual six times between July 2021 and July 2023, with an average 146 d interval between catches, allowing us to follow its wound healing, its body growth, and the epibionts colonizing it from which we identified barnacles of the species *Chelonibia testudinaria*, and for the first time in Brazilian Green Sea Turtles the titan acorn barnacles *Megabalanus coccopoma*, *M. tintinnabulum*, and *M. vesiculosus*. The gathering and development of these epibionts on the carapace seems to have been at least partially facilitated by the rest and permanence of the juvenile in the area while recovering from its wounds. Though a long-term (> 2 y) effects assessment of the trauma was not possible, the recapture events demonstrated the ability of the juvenile to recover naturally in the environment, and that its growth was likely compromised by human disturbances, evidencing the importance of continuous monitoring in the foraging areas for species conservation in the region.**

Key Words.—anthropic interaction; barnacles; carapace fracture; endangered species; environmental protection area; epibionts

Introduction

Sea turtles are vulnerable to numerous sources of injury throughout their lives. Motorboat traffic, ports, landfills, the dredging of navigation channels, and fishing activities are related to accidents and mortality of turtles throughout their distribution range in oceans, bays, and estuaries (Hazel and Gyuris 2006; Vélez-Rubio et al. 2013; Godoy and Stockin 2018; Lucchetti et al. 2018). Human occupation along coastal regions can be very harmful to their breeding areas (National Research Council 1990; Chaloupka et al. 2008) and impacts their foraging grounds (Goldberg et al. 2015; Godoy and Stockin 2018; Pulcinella et al. 2019).

In Brazil, the foraging areas of Green Sea Turtles (*Chelonia mydas*) are distributed between latitudes 3º–33ºS (Marcovaldi and Marcovaldi 1999; Proietti et al. 2012), with high abundance in some regions (Silva et al. 2017). On a global scale, Green Sea

Turtles are classified as Endangered (International Union for Conservation of Nature 2023); however, recent nesting estimates in the South Atlantic suggest a possible increase in this population (Broderick and Patricio 2019), prompting more interaction with humans and intensifying the occurrence of accidents due to human activities (Monteiro et al. 2016; Tagliolatto et al. 2020). Juvenile Green Sea Turtles can be prone to such accidents, as their foraging grounds occur in neritic environments close to rocky shores, bays, estuaries and around islands; the same areas are frequented and used by humans (Chaloupka et al. 2008; Reisser et al. 2013; Gama et al. 2016; López-Mendilaharsu et al. 2016; Foley et al. 2019). Chelonians are able to recover from serious injuries (Franchini et al. 2016; Archibald and James 2018; Ataman et al. 2021), however, and there are records of sea turtles rescued with serious physical damage that were successfully rehabilitated (Crespo-Picazo et al. 2013; Franchini et al. 2016; Cruciani et al. 2021). Damage, though, likely leads to future impairment of the health and biology of the turtle (Ataman et al. 2021).

Boat collisions and propeller lacerations are among the most common causes of carapace wounds reported (Godoy and Stockin 2018; Foley et al. 2019; Phu and Palaniappan 2019). Nevertheless, mortality and the inherent difficulty of following up on sea turtles in their natural environment result in few studies on trauma recovery. Using photo-identification, researchers have been able to follow the healing process of a juvenile Green Sea Turtle, which was also recaptured, allowing the monitoring of its annual carapace growth (1.3 cm/y curved carapace length, CCL; Ciccione et al. 2015), and found that its body growth was less than that of juveniles of similar size foraging in other habitats (Jardim et al. 2015; Lenz et al. 2017). Differences in growth are expected between individuals and populations, however, and are affected by complex environmental influences (Bjorndal et al. 2000; Balazs and Chaloupka 2004; Bjorndal et al. 2016), complicating the understanding of the cause-effect relationship.

Carapaces and soft parts of the body of sea turtles serve as a substrate to which meroplanktonic larvae of marine invertebrates like barnacles attach themselves (Frick and Pfaller 2013). Barnacle diversity in turtle foraging habitats, interspecific competitiveness, substrate availability, reproductive periods, and environmental conditions of temperature and salinity can influence this epibiosis (Severino and Resgalla Jr. 2005; Pfaller et al. 2008; Domènech et al. 2014; Zardus 2021). Furthermore, physio-biochemical differences in the host carapace and specific chemical signals may influence larval selectivity (Boyd et al. 2021), allowing for different interactive patterns. Interaction with epibionts is not indicative of disease in sea turtles (Pfaller et al. 2008; Frick and Pfaller 2013), but individuals who are immunosuppressed and lethargic may be susceptible to rapid colonization (Deem et al. 2009; Fernandez et al. 2015), as it occurs with nesting female sea turtles, which are possibly more sedentary, and have been shown to host more complex epibiont communities (Pfaller et al. 2008; Frick and Pfaller 2013). An extensively registered epibiotic relationship is that of turtle barnacles of the genus *Chelonibia* with sea turtles (Ross 1963), which has been reported in populations in the Mediterranean Sea and the Pacific, Atlantic, and Indian oceans (Fernandez et al. 2015; Lim et al. 2020; Boyd et al. 2021; Zardus 2021). In Brazil, turtle barnacles like *Chelonibia testudinaria* (no common name), *Platylepas hexastylos* (no common name) and acorn barnacles of the genus *Amphibalanus* have already been recorded as epibionts of Green Sea Turtles in their foraging areas (Bugoni et al. 2001; Pereira et al. 2006; de Loreto and Bondiolo 2007), and their presence can be used as indicators of sea turtle habitat use and behavior. For instance, migratory movements between oceanic and neritic habitats alter the epibiont species found on Loggerhead Sea Turtles (*Caretta caretta*; Reich et al. 2010). The epibiont removal services carried out by reef fish (Sazima et al. 2010), and the self-cleaning behavior of Green Sea Turtles also curb their successful settlement (Boyd et al. 2021) and contribute to individual and environmental differences.

A foraging ground of juvenile Green Sea Turtles has been monitored by personnel of the Caminho Marinho Project in an Environmental Protection Area (EPA) in the subtropical zone of the Southwest Atlantic since 2010. During one of the periodic monitoring activities conducted in the area, we captured a juvenile Green Sea Turtle that had external lesions with exposed internal tissue on the carapace. We describe the recovery of this Green Sea Turtle over a 2-y period in its natural environment and the benthic species that colonized its carapace during the convalescence process.

Materials and Methods

Study area.—We carried out capture and monitoring activities with Green Sea Turtles that were subjects

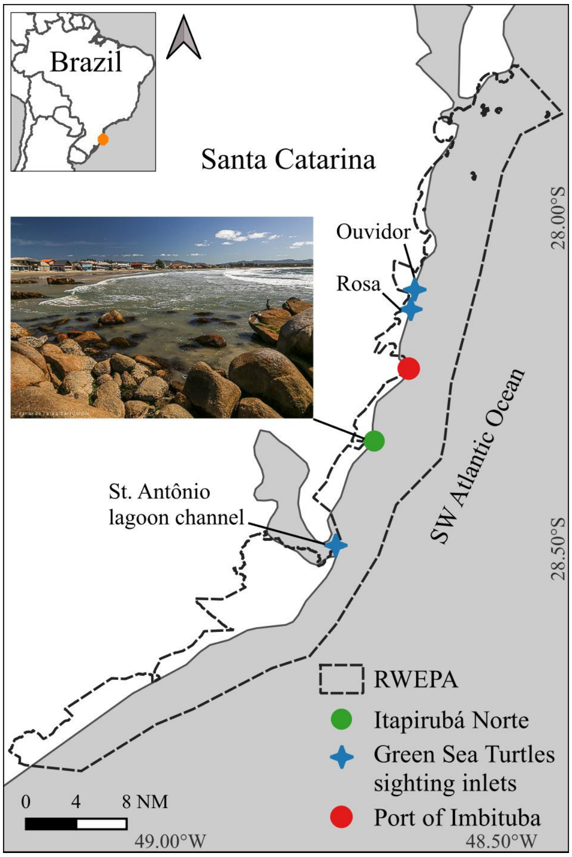

Figure 1. Green Sea Turtle (*Chelonia mydas*) monitoring area at the Right Whale Environmental Protection Area (RWEPA), Santa Catarina, Brazil. (Itapirubá Norte inlet photographed by Fernando Tatagiba/ICMBio).

of incidental captures during artisanal fishing in the Itapirubá Norte cove (28º18'S, 48º41'W), in the Right Whale Environmental Protection Area (RWEPA), Santa Catarina, Brazil (Fig. 1). This inlet borders a rocky coast to the south (about 530 m long) where there are macroalgae such as the green alga *Codium* sp. and *Ulva* sp., characteristic of Green Sea Turtle foraging grounds, and the water depth is < 20 m. The average sea surface temperature is approximately 24º C in the Southern Hemisphere summer, and to 16º C in the winter, and may occasionally be lower than 18º C in the summer, due to cold water intrusion events near the Santa Marta Cape (Campos et al. 2013). The area is close to the Port of Imbituba (about 7 nm) and overlaps with small-scale amateur and large commercial fisheries. The Port of Imbituba is small, with only three berths, totaling approximately 660 m in length, and is used mainly to export grains and oil products (García-Onetti et al. 2021). Fishing is carried out by artisanal and industrial fleets throughout the year in a seasonal schedule and with the use of gillnets, longlines, lines, and trawls (Capellesso and Cazella 2011; Zappes et al. 2013; Port et al. 2016). The state of Santa Catarina is the largest producer of industrial fish (mainly bony-fish, and some sharks and rays) in Brazil (Universidade do Vale de Itajaí, Centro de Ciências Tecnológicas da Terra e do Mar 2013), and fishing is allowed in the EPA in accordance with national legislation, which allows fishing in sustainable use protected area (Freitas et al. 2022).

Green Sea Turtle monitoring.—Between 2021 and 2023, we performed periodic captures at 30 to 60 d intervals, with either gill nets or trawl nets measuring 50 m long and 3.2 m tall, with 0.30 m mesh, near the rocky coast at a depth of 2–3 m (Fig. 1). Caminho Marinho team reported previous sightings of Green Sea Turtles along the rocky coast, which we used to select the capture site. For capture, we either pulled or kept in place the nets by a diver with a sinker, without the presence of a boat, for approximately 1 h and only on days with favorable oceanographic conditions. Water and land teams monitored the nets and juvenile turtles were removed immediately after entanglement, while the gear was kept in place. We determined the CCL of the Green Sea Turtles using a flexible measuring tape (precision of 0.1 cm) and the weight with a digital scale (precision of 0.01 kg). We used Inconel tags, style 681, provided by TAMAR/ICMBio (National Center for Research and Conservation of Sea Turtles and Eastern Marine Biodiversity of the Chico Mendes Institute for Biodiversity Conservation, Vitória, Brazil), for tagging on both fore flippers.

Recapture and assessment of injured Green Sea Turtle.—At each capture, we photographed the injured juvenile turtle and measured the injuries found in the first capture with the aid of ImageJ software (available at https://imagej.net/). We cleaned the wounds with Chlorhexidine to prevent bacterial infections and, exclusively on the first capture (Recapture Event 0; Fig. 2), we kept the turtle under observation for 2 d at the Research Center of Caminho Marinho, in Itapirubá, before being released back to the same cove. In the first recapture (Recapture Event 1; Fig. 3B), we scraped off the barnacles that densely colonized the region of the carapace and the largest wound with the aid of a spatula and stored the barnacles in 70% alcohol. Using millimetric paper and a stereoscope microscope (40× zoom), we measured the base length (mm) of the barnacles that were collected from inside

Figure 2. Wounds on the carapace of the juvenile Green Sea Turtle (*Chelonia mydas*) when first captured (Recapture Event 0). (A) Major wound to the lateral and central scutes; (B) Minor injury to marginal scutes. (Photographed by Caminho Marinho Project).

the wound and from the rest of the carapace (n = 70 for each area) and identified them using a specific key and identification catalog for Cirripedia (Henry and McLaughlin 1986; Young 1999). We only registered and quantified but did not measure the presence of Turtle Barnacles (*Chelonibia testudinaria*).

Results

Over a 2-y period, we captured a juvenile Green Sea Turtle, BRA31516 fore left flipper, BRA31518 fore right flipper (from here on called BRA315, CCL = 32.1 cm; weight = 3.60 kg), six times with an average interval of 146 d between captures (Table 1). At Recapture Event 0, on 28 July 2021, BRA315 had two wounds on its carapace: a deep, curved, Y-shaped wound, which reached the first and second left lateral scutes and the second central scute, and a second smaller wound that reached the fifth and sixth left marginal scutes (Fig. 2). The first wound measured 12.3 cm long and the second 3.6 cm long. There was no hemorrhage or fluid leaking, as the coelomic cavity was not perforated; however, internal tissues were visible in the first wound. Only one Turtle Barnacle was present on the carapace during Recapture Event 0 (Fig. 3). Small superficial abrasions were found on the plastron and there were no lesions on the neck and flippers.

At Recapture Event 1 of the juvenile (CCL = 32.2 cm; weight = 3.69 kg), on 2 November 2021 approximately three months later, the wounds were partially healed, and the carapace was densely colonized by non-pedunculated barnacles and green algae filaments (Fig. 3). The barnacles present exclusively inside the larger carapace wound were species of titan acorn barnacles, including 70 *Megabalanus coccopoma* (mean base length = 7.6 ± 2.1 [standard deviation] mm; range of values 4–11 mm), and one individual of *M. vesiculosus* (base length = 5 mm), while another titan acorn barnacle *M. tintinnabulum* occurred in high density on the rest of the carapace (mean base length = 5 ± 1.2 mm; range of values 2–9 mm, n = 70). A colonial bryozoan *Membranipora* sp. was also found attached to that *M. tintinnabulum* individual. At Recapture Event 2 (CCL = 32.7 cm; weight = 4.02 kg), on 17 March 2022, there was an evident reduction of titan acorn barnacles, while 10 Turtle Barnacles were present on the carapace (Fig. 3). Turtle BRA315 had a slight weight gain, and healing of the dermis was apparent in the larger wound. At Recapture Event 3 (CCL = 32.6 cm; weight = 3.85 kg) 25 May 2022, the wound in the marginal scute had healed and, in the largest lesion, we saw the process of keratinization (keratin production by epidermal cells, demonstrated by the sealing and impermeabilization of the wound; Ackermann 2013; Hargis and Ginn 2013) of the epidermis, besides a slight loss of body mass in relation to Recapture Event 2 (Table 1); as to barnacle epibionts, only one Turtle Barnacle was found on the carapace (Fig. 3). At Recapture Event 4 (CCL = 32.6 cm; weight = 3.86 kg) 6 July 2022, the keratinization of the largest wound was practically complete; one Turtle Barnacle and few titan acorn barnacles (fewer than 10 individuals) were present on the third and fourth central scutes of the carapace (Fig. 3). After 2 y, on 24 July 2023, we recaptured BRA315 for the fifth time (Recapture Event 5) in the same foraging area. The individual had increased in size and weight (CCL = 35.2 cm; weight = 5.02 kg), with an annual carapace growth of 2.6 cm CCL (Table 1), and only the scar of the largest wound remained (Fig. 3). Only

Figure 3. Condition of the carapace of the injured juvenile Green Sea Turtle (*Chelonia mydas*) on (A) Recapture Event 0 with Turtle Barnacle (*Chelonibia testudinaria*) in the black circle; (B) Recapture Event 1, largest wound in the carapace, which was covered by titan acorn barnacles: *Megabalanus coccopoma* on the wound, and *M. tintinnabulum* over the carapace; (C) Recapture Event 2, Turtle Barnacles visible on the carapace; (D) Recapture Event 3, Turtle Barnacle in the circle; (E) Recapture Event 4, titan acorn barnacles in the rectangle, Turtle Barnacle in the circle; (F) Recapture Event 5, Turtle Barnacle not visible because it was on the fifth marginal scute of the carapace. (Photographed by Caminho Marinho Project).

one Turtle Barnacle was present on the fifth marginal scute of the carapace, with no other epibiont species observed.

Discussion

Sea turtles face several anthropogenic threats throughout their lives, and collisions with boats and vessels are one of the most recorded (Hazel and Gyuris 2006; Foley et al. 2019; Ataman et al. 2021), including dredging operations (Goldberg et al. 2015). We saw the recovery of a juvenile Green Sea Turtle whose injuries were almost certainly caused by humans, given the characteristics of the wound. The curved fracture on the back of the carapace is like that of sea turtles struck by boat propellers (Work et al. 2010; Godoy and Stockin 2018; Phu and Palaniappan 2019), characterized by a single linear or parallel slicing wound, which can be fatal when they compromise the coelomic cavity (Work et al. 2010). We could not determine how much time had passed between the incident and Recapture Event 0, however. The fact that the juvenile turtle was captured when it still had the largest wound open, with small bone fragments, suggests that the impact had been recent, and that the incident had probably

Table 1. Interval between successive captures, curved carapace length (CCL), weight, and description of wounds and epibionts for BRA315, the injured Green Sea Turtle (*Chelonia mydas*) over a 2-y period in a natural environment. Abbreviations RI = recapture interval (consecutive days) and W = weight in kilograms.

Recapture Event	Date	RI	CCL (cm)	W	Carapace Condition	Epibionts on carapace
0	28 July 2021	-	32.1	3.60	Wound on carapace of 1st to 2nd left lateral scute and exposure of internal tissue on 2nd central scute; wound on 5th and 6th left marginal scutes	Turtle Barnacle *Chelonibia testudinaria* (n = 1)
1	2 November 2021	98	32.2	3.69	Exposed wound in the process of healing on carapace	Green algae and high density of titan acorn barnacles *M. coccopoma* and *M. tintinnabulum*; one barnacle *M. vesiculosus* and one bryozoan *Membranipora* sp.
2	17 March 2022	235	32.7	4.02	Carapace wound with healed dermis	Absence of titan acorn barnacles, only Turtle Barnacle (n = 10)
3	25 May 2022	304	32.6	3.85	Keratinization of epidermis in carapace wound	Turtle Barnacle (n = 1)
4	6 July 2022	344	32.6	3.86	Wound reduction with increased keratinization	Titan acorn barnacles (<10), and Turtle Barnacle (n = 1)
5	24 July 2023	728	35.2	5.02	Wound fully healed	Absence of titan acorn barnacles, only Turtle Barnacle (n = 1)

occurred in the vicinity of the monitored foraging area. Within this larger foraging area, the individual could have already been foraging in the cove where it was found before the injury event, or the cover may be the place where it found favorable environmental conditions to shelter and recover from injuries.

Juvenile Green Sea Turtles, with carapace size between 25 and 40 cm CCL, globally are known to gather in benthic environments with seagrass meadows and macroalgae near the coast (Limpus et al. 2005; Guebert-Bartholo et al. 2011; Silva et al. 2017). In this case, BRA315 could have recently migrated from an oceanic environment, ending its pelagic life stage (Carr 1987), or could have come from nearby foraging sites, such as the Arvoredo Marine Biological Reserve, on the coast of Santa Catarina (Reisser et al. 2013), or the Paranaguá estuary complex, on the coast of Paraná (Gama et al. 2016). Green Sea Turtle individuals also migrate from Argentina and Uruguay to the southern coast of Brazil where the seawater temperature is warmer during the Southern Hemisphere autumn and winter, expanding the range of occurrence of the species during the juvenile stage (González Carman et al. 2012; Vélez-Rubio et al. 2018). Furthermore, in the RWEPA region, there are inlets and rocky shores (Fig. 1) next to Itapirubá where only juvenile Green Sea Turtles are seen foraging (Gustavo Martinez-Souza, pers. comm.). Regardless their routes, juveniles are at risk of boat-related accidents (Godoy and Stockin 2018; Lucchetti et al. 2018) and possible collisions in the RWEPA region, as boat and ship traffic are relatively constant due to commercial fishing (Capellesso and Cazella 2011; Zappes et al. 2013; Port et al. 2016) and port activities (García-Onetti et al. 2021).

With the frequency of successive catches, we were able to assess the physical condition of the individual and monitor the progress of its recovery. In Recapture Event 1, due to the high density of titan acorn barnacles on the carapace, we considered it prudent to remove them, especially those inside the fracture, to assist the healing of the largest wound. In doing so, we found that *M. coccopoma* predominated in the wound region, while *M. tintinnabulum* was largely distributed over the rest of the carapace. These two titan acorn barnacles naturally occur on rocky shore regions of southeast-south Brazil, from the state of Espírito Santo to the state of Rio Grande do Sul (Young 1999; Klôh et al. 2013). The presence of harbors, breakwaters and other artificial structures in the marine environment also facilitate their natural occurrence (Severino and Resgalla Jr. 2005; Ignacio et al. 2010; Abreu et al. 2016). *Megabalanus vesiculosus*, which is endemic to the Brazilian coast and commonly found in northeastern Brazil (Farrapeira 2010; Abreu et al. 2016), also occurs in Santa Catarina (Boss et al. 2012). The presence of titan acorn barnacles on the carapace of BRA315 thus increases the list of epibionts species able to colonize juvenile Green Sea Turtles over the Brazilian coast, since the Turtle Barnacle *C. testudinaria* is a common epibiont of sea turtles in Brazil (Bugoni et al. 2001; Pereira et al. 2006; de Loreto and Bondiolo 2007) and worldwide (Frick and Pfaller 2013; Zardus 2021).

Juvenile Green Sea Turtles are less active during the cold season of the year, resting longer and foraging less frequently (Reisser et al. 2013), and this also seems to be the behavior of sea turtles experiencing severely debilitating trauma (Fernandez et al. 2015). Thus, the low mobility and lethargy of traumatized juveniles likely allows the settlement and development of epibionts, which may have arbitrarily embedded themselves in the wound region (Zardus 2021), also facilitating the colonial bryozoan *Membranipora* sp. settlement over the barnacles (Frazier et al. 1992; Pfaller et al. 2008). The increased availability of *M. coccopoma* larvae from spring onwards (Severino and Resgalla Jr. 2005), coinciding with the post-incident period, also favored the dense colonization of these epibionts over the carapace at that time. Other juvenile Green Sea Turtles were also colonized by titan acorn barnacles in the foraging area, but mostly on the metal tags used for marking (Caminho Marinho Project, unpubl. data). As suspension feeders, these barnacles can benefit from the feeding habit of turtles, which resuspend sediments as they forage (Boyd et al. 2021). To fully understand these associations, however, further studies in the foraging grounds are needed.

Recapture events during and after the months of warmer sea surface temperature (late summer and autumn) showed gradual improvement in the body condition of BRA315 and the removal of the titan acorn barnacles may have favored the healing of the dermis in the largest wound. By interfering in its recovery process, we probably also affected epibiotic associations that occur over time, because the presence of epibionts alters the carapace substratum, allowing the settlement of other epibionts, which happened with the colonial bryozoan. During each release following a recapture event, the strong raised head and ease of diving of BRA315 led us to presume it was in good health condition to return to the marine environment. One year after the incident (Recapture Event 4), the small portion of the second central scute was still not keratinized and the low load of epibionts (fewer than 10) was indicative of recovery. Its growth appeared to have been impaired, however, with its size and weight remaining practically unchanged over the course of a year. It was only in Recapture Event 5, 2 y after the incident, that there was an annual growth of 2.6 cm CCL, quite similar to those already documented for juvenile Green Sea Turtles within the same size class (30–39.9 cm CCL) at the nearby foraging area (3.9 cm/y; Lenz et al. 2017), and in tropical shallow reefs in Northeastern Brazil (2.4 cm/y; Jardim et al. 2015). Environmental, demographic, and individual factors can contribute to growth differences between development areas (Bjorndal et al. 2000; Balazs and Chaloupka 2004), and it is possible that BRA315 may have benefited from the high primary productivity characteristic of the region (Acha et al. 2014), investing in somatic growth one year after the human disturbance it suffered. The timely cleaning of the wound, with infection prevention and removal of epibionts, very likely aided in recovery also.

Our study indicated that the recovery time, in the wild and with early human assistance (removal of epibionts in the wound) of juvenile Green Sea Turtles with lesions on the carapace is < 1 y and probably varies according to life stage, to the severity of the lesion, and to geographic location. In Malaysia, Phu and Palaniappan (2019) showed a different healing time in the wild, for lesions from boat collisions in juvenile and adult Green Sea Turtle carapaces, and a possible relation between the severity of the wound and the healing time was established, though records came from only four individuals. Unfortunately, the authors did not report the size of the individuals at recaptures, so a direct comparison cannot be made. Fidelity to foraging areas over a few years seems to be common in juvenile Green Sea Turtles (Seminoff et al. 2003; González Carman et al. 2012; Proietti et al. 2012; López-Mendilaharsu et al. 2016; Silva et al. 2017), and this residency behavior enabled our study to follow the recovery of this turtle in the wild. Our study showed the importance of maintaining regular monitoring in sea turtle foraging grounds, especially in areas indicating a tendency of populational growth.

Though we did not quantify all the epibionts, we suspect that the improved health (human-mediated) of BRA315 and the increase in foraging were contributing factors for the absence of dense colonization by titan acorn barnacles. In addition, by removing such barnacles, we possibly allowed the settlement of Turtle Barnacle larvae by decreasing interspecific competition for space. Ecological relationships between the epibiont fauna and their debilitated host sea turtles should be further investigated elsewhere, including studies on how human-mediated interventions may affect the process of epibiont colonization and ecological succession over a wounded carapace.

In addition to recording the presence of new barnacle epibionts on Green Sea Turtles in Brazil, our study showed that weakened sea turtles may function as substrates for rapid colonization by epibionts in coastal foraging areas. We also evidenced the potential threat of boat traffic to juveniles that feed in the neritic zone of the RWEPA. Other consequences, besides the possibility of death, include reduced somatic growth after accidents, which can result in long-term negative effects, considering the late sexual maturity in sea turtles, and possible increased risk of predation and infection. Activities geared toward the maintenance and expansion of monitoring other inlets where turtles may have a presence, the monitoring of dredging activities in the Port of Imbituba and fisheries with on-board observers should be discussed and put into practice to contribute to the conservation of the species in the Southwest Atlantic.

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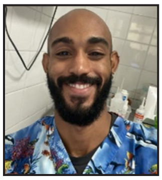

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