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REPORT ON THE STATUS OF MORTALITY

DUE TO GAS EMBOLISM

ACTION C2

15 JULY 2024

Collective actions for improving the conservation status of the EU sea turtle populations: bordering areas (LIFE18NAT/IT/000103). Project is carried out with the assistance of LIFE financial instrument of the European Union / **info@medturtles.eu**

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BACKGROUND

One of the greatest threats to marine megafauna (e.g., cetaceans, elasmobranchs, sea turtles, seabirds) worldwide is incidental captures in fishing gears (Lewison et al. 2014). Several mitigation measures have been explored over the years, such as implementing gear modifications, creating no-take zones, and regulating fishing practices (Squires et al. 2021). Additionally, efforts to raise awareness among fishers and involve them in conservation initiatives has also shown promise in reducing bycatch (Hall et al. 2017; Jenkins et al. 2023).

The Mediterranean Sea is one of the areas with very high interaction of sea turtles with fisheries (Wallace et al. 2011). Latest estimates report that approximately 44,000 turtles are incidentally captured annually by various fishing gears (Casale et al. 2018). Loggerhead sea turtles (*Caretta caretta*) are the most abundant species in the Mediterranean region (Casale et al. 2018). Their conservation status is currently considered as conservation-dependent, meaning sustained and ongoing conservation efforts are crucial to preserve the species' population and preventing its decline (Casale and Tucker 2015).

A significant portion of turtle bycatch occurs in bottom trawl fisheries, where mortality is caused by drowning and decompression sickness following gas embolism (García-Párraga et al. 2014; Parga et al. 2020). These conditions frequently co-occur in varying degrees within a turtle, leading to immediate or delayed mortality (Wilson et al. 2014). The effects of these conditions and frequency of delayed mortality are still not fully understood, as are the possible countermeasures to reduce or prevent them. For instance, current best practices, which state that turtles in a comatose state should be left onboard to recover (FAO 2009), were conceived to counter drowning, but could be counterproductive for decompression sickness.

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Bottom trawls are intensely used in the shallow waters of the Adriatic Sea (Lucchetti et al. 2017), which is one of the most important neritic foraging areas for Mediterranean loggerhead turtles (*Caretta caretta*) (Casale et al. 2018). The Adriatic Sea predominantly hosts turtles from Greek rookeries, and to a lesser extent from Cyprus, Libya and Turkey (Splendiani et al. 2017; Tolve et al. 2018) (Bertuccio et al. 2019), which are the most important for the Mediterranean population. Therefore, finding and implementing effective conservation measures to reduce bycatch impact is critical for the survival and health of this population.

In contrast to the northern Adriatic, the Gulf of Manfredonia (GoM), in the southern Adriatic, is less studied although evidence indicates high bycatch rates and mortality in this area as well (Casale et al. 2015; Baldi et al. 2022). A recent study reported on a significant problem of gas embolism in turtle caught by bottom trawlers in this area (Franchini et al. 2021).

The current best practice, promoted to fishers, of keeping the turtle on the boat for a while until it recovers aims to reduce mortality caused by drowning, However, it might increase mortality due to gas embolism, if it could be reduced by returning soon to depths where high pressure can mitigate it. This possibility is extremely concerning and needs to be investigated in order to understand if the best practices currently promoted need to be adjusted. The objective of this module of the Action C2 is to assess if the current best practices are detrimental regarding the decompression sickness.

METHODS

A total of 20 loggerhead turtles incidentally captured by trawlers in the waters of the Gulf of Manfredonia (GoM) were tagged with satellite tags to monitor their fate

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after release. Turtles were measured (curved carapace length, CCLnt) (Bolten 1999) and flipper tags were applied to both front flippers to avoid resampling the same individuals (in case of recapture after loss of the satellite tag).

For the objective of this module, it was key to detect emergences of the turtle at sea surface and its movements in the few hours following the release. Therefore, satellite tags connected to the Iridium satellite network were used (SeaTrkr-4370 or 4375, Telonics, Mesa, AZ, United States), because this network has complete daily coverage in contrast to the Argos network. After cleaning and sanding the carapace, the transmitters were applied to the second vertebral scute, using a two-part epoxy resin (De-Walt AC100 Nordic) (Fig. 1). To avoid any thermal stress on the animal caused by the exothermic reaction of this fast-hardening resin (<10 minutes at temperatures below 15°C), cold water was continuously poured over the attachment site.

To assess a potential negative effect of current on-board best practices, due to gas embolism, turtles were assigned to two treatments: immediate release after capture or delayed release, i.e. be kept on board as per the best practices adopted by the fishers. The hypothesis to test was that the turtles kept longer at surface experienced a higher mortality than those immediately released and able to gain depth with higher pressure. Since the mortality due to decompression sickness typically occurs within 20 hours from capture (when the turtle arrives on the deck of the fishing boat) (Franchini et al. 2021), mortality was here defined as definitive interruption of transmissions from the turtle in the first 24h since capture.

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RESULTS AND CONCLUSIONS

Turtles ranged between 60.5 and 84.2 cm CCL (Table 1). One tag malfunctioned and never transmitted. No interruption of GPS position (Fig. 2) was observed in any of the other 19 turtles for the first few days after release.

In spite of the serious problem of decompression sickness reported from the same area (Franchini et al. 2021), an immediate release does not seem to provide significant benefits in comparison to the current best practices of keeping the turtle onboard.

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Turtle	Release date	Last transmission	CCL (cm)
MT01	01/12/2021	06/07/2022	66.0
MT02	17/01/2022	17/07/2022	68.0
MT03	19/01/2022	23/01/2022	73.5
MT04	03/03/2022	11/07/2022	63.0
MT05	16/03/2022	25/07/2023	76.5
MT06	16/03/2022	26/06/2022	68.0
MT07	21/03/2022	07/08/2022	60.5
MT08	25/03/2022	29/06/2022	74.3
MT09	24/03/2022	29/06/2022	72.0
MT10	20/04/2022	22/08/2022	72.0
MT11	28/02/2023	23/06/2023	73.0
MT12	01/03/2023	21/07/2023	76.0
MT13	07/03/2023	01/07/2023	69.2
MT14	08/03/2023	03/06/2023	77.2
MT15	13/05/2024	02/06/2024	84.2
MT16	16/06/2024	ongoing	75.2
MT17	16/06/2024	ongoing	76.1
MT18	16/06/2024	21/06/2024	82.0
MT20	28/06/2024	ongoing	75.0

Table 1. Loggerhead turtles monitored for investigating best practices (n=19). The tag of turtle #MT19 malfunctioned and never transmitted. Three turtles were still transmitting at the time of this report.

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Fig. 1. A loggerhead turtle with a satellite tag attached on the carapace just after its capture, on the deck of the fishing boat.

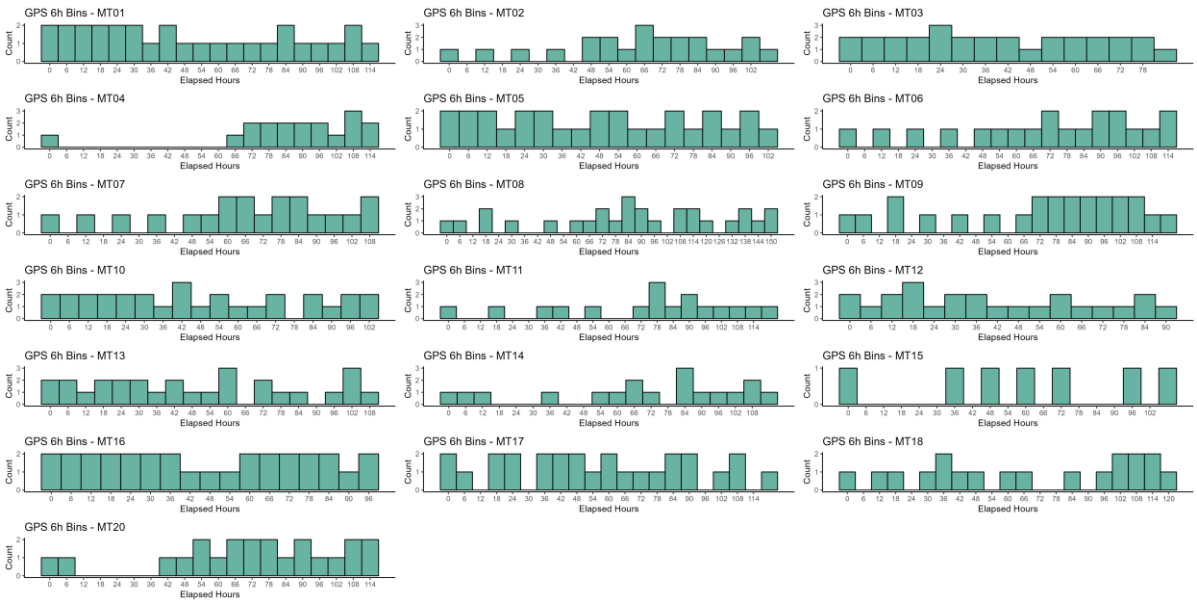

Fig. 2. Frequency of GPS positions recorded by satellite transmitters attached to 19 loggerhead turtles.

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