

Head injuries in Loggerheads (*Caretta caretta*): new threat in the Gulf of Taranto?

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Abstract –Among the anthropogenic threats to *Caretta caretta*, fishing is one of the most impactful.

Boating and fishing can cause traumatic injuries to sea turtles, moreover some fishermen can deliberately injure turtles which are supposed to reduce the catch and damage gear.

The present study synthesizes the skull injuries treatments provided to loggerhead turtles rescued from 2013 to 2019 in the Gulf of Taranto in the Northern Ionian Sea (Central Mediterranean Sea). The type and localization of injury were analyzed in order to evaluate clinical signs, recovery times and healing rates. The timeliness of hospitalization after catch, the application of correct wound treatment and good management practices in the early stages of care have been crucial to increase the chances of clinical recovery and ensure subsequent release to the sea.

I. INTRODUCTION

The loggerhead turtle *Caretta caretta* (Linnaeus, 1758) is the most common sea turtle species in the Mediterranean and worldwide. In the IUCN Red List its global population is considered "Vulnerable" [1], while the Mediterranean sub-population is classified "Least Concern" [2]. Sea turtle rescue centres are acknowledged to reduce mortality in bycatch hotspots, provide a wealth of scientific data, and raise public awareness [3].

A list of the most impactful threats on the conservation of sea turtles has been drawn up. This is called 'Five Hazards to Marine Turtles' established during BI-3: fisheries bycatch, take, coastal development, pollution and pathogens and climate change.

One of the major threats for sea turtle conservation is the incidental capture by fishing gears, particularly by bottom trawling [4] and drifting longline [5]. In Italy, the interaction between sea turtles and fisheries were documented in the North Adriatic Sea, the Ionian Sea and surrounding the Strait of Sicily [6,7,8].

Nautical and fishing activities can be associated with traumatic injuries to sea turtles including propeller wounds and blunt force trauma from impact with watercraft or fishing gear. Turtles with boat-strike injuries present severe fractures of the carapace, plastron and skull and flipper lacerations [9]. In addition, reckless fishermen may deliberately traumatize sea turtles presumed to have diminished the fishing catch or damaged gear [10,11]. Among traumatic lesions, those involving the skull, if complicated by brain exposure, are often life-threatening. In these cases, death could be the outcome of direct trauma of the cerebral tissue or of secondary meningoencephalitis [12]. If the sea turtle survives, weakness, disorientation and irreversible deficits may ensue, hindering the turtle's ability to feed or escape from natural predators [13].

The present study synthesizes the skull injuries treatments provided to loggerhead turtles rescued from 2013 to 2019 in the Gulf of Taranto in the Northern Ionian Sea (Central Mediterranean Sea), in order to warn the management system about a possible new threat to their conservation.

II. MATERIALS AND METHODS

A. Study area

The WWF Sea Turtle Rescue Centre located in Policoro (MT), coordinates the Sea Turtles Project in the area of the Gulf of Taranto (from Punta Prosciutto (TA) to Punta Fiume Nicà (CS), with the collaboration between MATTM, WWF Italy, Sea Turtle Clinic of the Department of Veterinary Medicine of the University of Bari, Department of Ecology of the University of Calabria and the University of Rome "La Sapienza". As already reported the Gulf of Taranto in the Northern Ionian Sea (Central Mediterranean Sea) represents a suitable habitat for the loggerhead turtle due to eco-physiographic features of the basin [14, 15,16,17].

B. Data collection

Study design was conducted at Sea Turtle Rescue Centre WWF Policoro and (1) the species, (2) type of discovery, (3) the GPS capture coordinates, (4) the reason for hospitalization, (5) the possible presence of epibionts, were assessed, (6) presence of external injuries, fishing lines or hooks have been considered. After clinical, radiographic and other diagnostic investigation methods diagnosis, therapy and prognosis have been reported. Biometric parameters, coordinates of capture, biological samples of sea turtles found stranded dead, were also collected. The alive sea turtles have been carrying to the Policoro Rescue Centre where clinical and neurological examination were performed. Level of consciousness (LOC), flippers movements, and pupillary, eyelid, flippers and cloacal reflexes were evaluated. Each sea turtle was evaluated in the tank to detect any anomalies in the movement of the flippers, diving ability or abnormal buoyancy.

C. Veterinary protocol

The veterinary protocol used belongs to the Sea Turtle Clinic (DVM UniBa) resulting from multiple studies [9,18,19,20,21]. Initial treatments included rehydration, antibiotic therapy, analgesic therapy and wound cleaning with sterile saline [18,19,20].

At the Sea Turtle Clinic of the University of Bari, a radiographic study of the sea turtles' skulls was performed. A computed tomography (CT) scan of the head as performed to better characterize the lesion and evaluate the full extent of the damage.

The turtles underwent a total intravenous anesthesia [22] before performing surgical curettage of the skull. Swabs for microbiological evaluation were performed on each wound. The inability to feed on debilitated patients was overcome by inserting an esophagogastric tube feeding [23].

Sea turtles were hospitalized in water at a controlled temperature (ranged from 25 to 28°C), the neurological examination was repeated every week during

hospitalization, healing times and any adverse reactions were monitored [9,24].

The hospitalization protocol included topical wound treatment [20]. Vaseline impregnated gauzes were applied in the depression of the injuries to obtain a waterproof environment and allow the medicament to act without being washed off once the animal was put into the water [9].

Parameters such as the initial wound area and time to heal were recorded.

III.RESULTS

From 2013 to 2019, a total of 335 loggerhead turtles were conferred to the Policoro Rescue Centre, 14 of these with skull injuries, representing 4% of the sea turtle.

Figure 1 shows distribution and the method of discovery of the 14 loggerhead turtles.

Sea turtles analyzed were n.12 sub-adults (30 cm <CCL <70) and n.2 adults (CCL > 70cm).

Three turtles (n.4, n.7, n.12 see Tab1) were found dead along the Lucanian coast, they were in poor condition, emaciated and malnourished.

At the time of admission, four loggerhead turtles (n.1, n.9, n.13, n.14) presented a recent injury, they did not show an altered level of consciousness (LOC), in two cases (n.1 and n.2) alteration of the ocular reflexes was detected. One turtle (n.14) showed altered reflexes of front flipper and in attitudes of stress and pain, in the tank. No neurological alteration was observed in the sea turtle n.13 (fig.2), that however showed static buoyancy for 15-20 minutes after handling necessary for therapeutic treatment, probably by stress [25]. Two turtles (n.1 and n.14) showed anorexia and needed to insert an esophagogastric tube feeding. For all these turtles, neurological reflexes returned to normal range after 10-15 days from surgery curettage and topical treatment. After 2 months the turtle n.13 began to make diving attempts and after another 3 weeks it was able to swim for long apneas on the bottom of the tank.

The other seven animals have a not recent injury and neurological examination revealed an alteration of reflexes in all cases. Five turtles (n.2, n.3, n.6, n.10, n.11) died after 1-11 days of hospitalization, instead two turtles (n.5 and n.8) were hospitalized for 7 and 17 months. These two turtles showed slightly extensive lesions without loss of tissues, level of consciousness (LOC) excited and in the tank they showed anomalous attitudes: hyperextension of the anterior limbs and of the neck, crossing of the posterior limbs and immersion inability; it was probably by strong algic symptomatology and by stress [26].

During hospitalization, all turtles showed a progressive worsening of neurological symptoms.

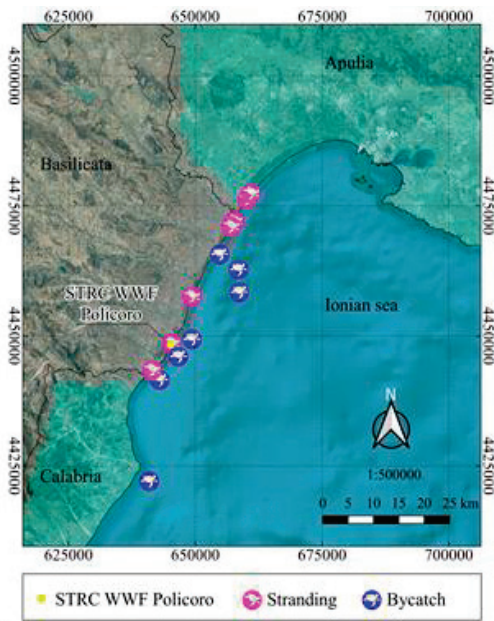


Fig.1. *C. caretta* with skull injuries recovery map

Of the 11 turtles rescued, only 4 turtles (n.1, n.9, n.13, n.14) with recent injury have been reintroduced in nature after long hospitalization period ranging from a minimum of 37 days to a maximum of 145 days.

IV.DISCUSSION

In the present study, although the small number of cases, release success of sea turtles with skull injuries is low (fig.3). This places attention on the case studies, making it essential to develop clinical and conservation solutions.

Fishing activities in the area under study are attributable to artisanal fishing with the use mostly of set nets. Medium-large size sea turtles, are captured by fishing gears typically deployed in neritic area (bottom trawls, set nets, demersal longlines) where large turtles are supposed to spend most of their time [27]. The sizes of sea turtles with skull injuries confirms that there is a relationship between the traumatic event and artisanal fishing.

In the cases analysed, death was not an immediate consequence of the trauma, confirmed by the state of malnutrition of turtles found deceased and the not recent injuries of hospitalized and subsequently deceased turtles.

TABLE 1- Sea turtles with skull injuries both found deceased or hospitalized. LOC is the level of consciousness: ↓ lethargic, ↑ excited. Reflexes were evaluated by assigning a value from 0 to 5: 0 absent, 3 normal, 5 increased. FB (*C.caretta* n.2) is foreign body.

<i>Caretta caretta</i> (n)	Recovery date	CCL	Days of recovery	Release/ Death	Injury site	LOC	Eyelid, pupillary reflexes	Flippers reflexes	Diving ability
1	15-06-2013	58	137	R	frontoparietal		2	3	
2	02-04-2015	56	3	D	FB in right eye, cranial cavities	↓	1	3	
3	14-07-2015	71	3	D	frontoparietal, supraocular	↓	0 left	3	
4	14-08-2015	47.5				↑			
5	19-08-2015	55	519	D	frontoparietal	↑	1	4	absent
6	04-09-2015	39.5	4	D	frontoparietal, supraocular	↓	0 right	1	
7	12-06-2016	56.5							
8	02-11-2016	50	228	D	frontoparietal	↑	2	4	absent
9	03-06-2017	57	37	R	supraocular		1	3	
10	07-06-2017	71.5	11	D	frontoparietal, supraocular	↓	2	2	
11	13-06-2017	64	1	D	frontoparietal, temporal	↓	1	1	
12	14-06-2017	59							
13	19-06-2019	58	67	R	frontoparietal		3	3	
14	28-10-2019	60	145	R	frontoparietal, prefrontal		3	2	absent

Probably the reason for death are infections and meningoencephalitis or irreversible deficits that hinder the turtle's ability to feed [12,13]. It is evident that the prognosis is influenced by the rapidity of the rescue [28]. Euthanasia often appears to be the most ethical choice if it is not possible to avoid animal pain, but appropriate treatment can increase life expectancy and may minimize brain injuries [13].

In this study, no relation has been found between prognosis and extent of the lesion. The simultaneous presence of altered reflexes both ocular and front flippers, the assumption of abnormal attitudes and inability to swim have been associated with poor prognosis [26,29].

Given the high mortality and the importance of intervening quickly, awareness of the fishermen is necessary.

A compromise needed between the conservation of protected species and the interests of professional fishing, mitigation devices have become a priority in fishing research [30,31] to reduce bycatch and net damage. In recent years, different approaches have been tried to avoid bycatch in different fishing techniques; for example, a new type of flexible TED has proven itself a practical and valuable solution to reduce turtle bycatch in coastal Mediterranean demersal multispecies fisheries [31]. A potential bycatch reduction strategy for set nets fisheries has been connected to alteration of visual cues with lights, LED lamps and light sticks attached to gillnet float lines have proven to be effective in decreasing turtle bycatch rates while preserving target species catch rates [32,33].

If fishermen have no problem with nets and turtles, will reduce violence towards these animals. In Italy, the economic compensation system for damage from wild animals to agriculture and livestock is not functional. Late payments or lower figures than requests, increase the satisfaction of the citizens involved. Therefore, awareness raising is fundamental, together with the use of bollards for damage to fishermen's nets.

V. CONCLUSION

Despite the few number of cases analysed, the high mortality of loggerhead turtles with head injuries warning against this threat. Therefore, it is essential to reduce the contact between fishermen and sea turtles by creating new deterrent tools and increasing awareness-raising activities.



Fig.2 Loggerhead turtle n.13 at the admission (left) and before release (right) (courtesy of Antonio Di Bello STC).

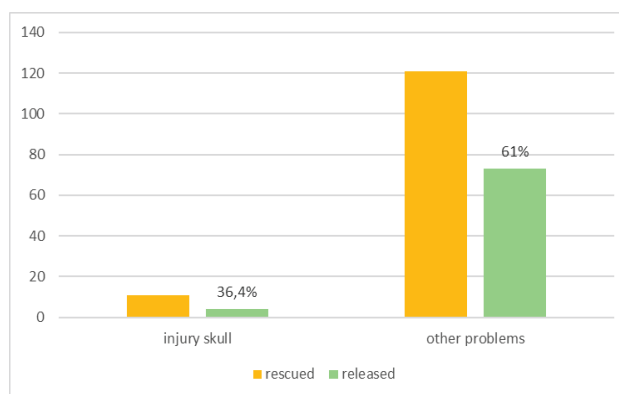


Fig.3 Success rate of recoveries for skull injuries and for other diagnoses (hook ingestion, line constrictions, plastic ingestion, drowning, flipper and carapace injuries).

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