



## **Surgical repair of a large shell injury in a loggerhead sea turtle *Caretta caretta* and the need for a wildlife recovery centre in the Cape Verde Islands**

**José Luis Crespo-Picazo<sup>1</sup>, Vanesa Martínez<sup>2</sup>, Samir Martins<sup>3</sup>, Elena Abella<sup>3</sup>, Pedro López<sup>3</sup>, Daniel García-Párraga<sup>1</sup> & Adolfo Marco<sup>3,4</sup>**

Keywords: fracture, shell, field surgery, sea turtle, *Caretta caretta*, *in situ* conservation, rehabilitation

### ABSTRACT

On 12 July 2013, an adult female loggerhead sea turtle *Caretta caretta* with an almost complete longitudinal carapace fracture was observed nesting and returning to sea at João Barrosa beach, Boa Vista, Cape Verde Islands. Due to the evident fracture instability and the likelihood of subsequent system infection development, an intervention was planned to prevent further health decline and eventual death. Beach surveillance was increased to raise recapture possibilities, based on the most likely nesting days for this individual. After 53 days, the animal hauled out again and was allowed to lay eggs before taken away for wound cleaning, stabilization, medication administration and surgery. An orthopaedic surgical intervention for shell repair was performed under field injectable general anaesthesia. The fracture was stabilised in six places by means of four marine resistant stainless steel plates and two orthopaedic wires screwed to the carapace. Finally, all implanted material was covered and protected with epoxy resin to maintain a smooth carapace surface and prevent potential entanglement.

### RESUMO

Em 12 de Julho de 2013, uma tartaruga comum *Caretta caretta* fêmea foi observada nidificando e regressando ao mar, com uma enorme fratura longitudinal na carapaça. A observação foi feita na praia de João Barrosa, ilha da Boa Vista, ilhas de Cabo Verde. Dada a instabilidade da fratura e a probabilidade de desenvolvimento de infeção sistémica, foi planeada uma intervenção para evitar a degradação da ferida e eventual morte do indivíduo. A vigilância da praia foi reforçada para aumentar a possibilidade da recaptura da fêmea, com base nos dias mais prováveis de nidificação. Após 53 dias, o indivíduo emergiu de novo para nidificar. Após a desova, foi transportado para um local onde foi feita a limpeza e estabilização da ferida, bem como a administração de fármacos. Foi depois realizada uma intervenção cirúrgica sob anestesia geral para reparação da carapaça. A fratura foi fixada em seis pontos diferentes por meio de quatro placas e dois arames de aço inoxidável presos à carapaça. Finalmente, todo o material implantado foi coberto e protegido com resina epóxi para manter a superfície da carapaça lisa e evitar potencial emaranhamento.

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<sup>1</sup> Veterinary Services, Oceanográfico, Ciudad de las Artes y las Ciencias, C/ Eduardo Primo Yúfera (Científico), 46013 Valencia, Spain

<sup>2</sup> Las Palomas, Veterinary Clinic, C/ Santo Justo y Pastor 145, 46022 Valencia, Spain

<sup>3</sup> BIOS.CV, Sal-Rei, Boa Vista, Republic of Cape Verde

<sup>4</sup> Estación Biológica de Doñana (CSIC), C. Américo Vespucio s/n, 41092 Sevilla, Spain; [amarco@ebd.csic.es](mailto:amarco@ebd.csic.es)

## INTRODUCTION

The International Union for the Conservation of Nature (IUCN) classifies the loggerhead sea turtle *Caretta caretta* as endangered (Marine Turtle Specialist Group 1996). The Cape Verde Islands have the third largest nesting population of this species in the world (Marco *et al.* 2010, 2012). The increasing pressure on this region due to the explosive growth of mass-tourism can have a large impact on the conservation status of the species. Indeed, the Cape Verde population represents one of the world's eleven most endangered populations considered as regional management units (Wallace *et al.* 2011).

Human activities (anthropogenic factors) are considered one of the major worldwide threats to sea turtle conservation (Mader 2005, Norton 2005). Human usage of the sea encompasses direct interaction with sea turtles (e.g. fisheries bycatch, poaching, nest destruction, boat strikes, etc), but also activities that indirectly lead to detrimental effects on sea turtle populations (e.g. environmental degradation, pollution, global warming) (Lutz & Musick 1997, Marco *et al.* 2010, 2011). For example, ship strikes present a life-threatening danger to sea turtles, especially when hit by keel or boat propellers, potentially causing multiple kinds of

injuries (Orós *et al.* 2005, Work *et al.* 2010). Natural factors can also contribute to adult female mortality. Several dozens of females are rescued every nesting season in Boa Vista as some animals become desorientated in wetlands adjacent to nesting beaches or have difficulty in passing small cliffs that they encounter on their way from the beach back to the sea. Turtles can also bump against rocks and suffer severe fractures of the carapace or can get stuck between rocks.

The loss of adult females can have a great impact on the future of sea turtle populations (Wyneken *et al.* 2008). On the one hand, the energy expense of reaching sexual maturity is considerable. On the other hand, the reproductive potential of one female sea turtle is exponential. For these reasons, a high pressure on adult females can be directly responsible for population decline and eventual extinction.

In this paper, the case of an adult female loggerhead sea turtle treated in order to repair a large carapace fracture is presented. The importance of this kind of rescue actions is evaluated, taking into account their contribution to the conservation of sea turtles by considering biological and educational aspects.

## CASE REPORT

On 12 July 2013, an adult female loggerhead turtle with an almost complete longitudinal parasagittal shell fracture was found at João Barrosa beach, Boa Vista Island (Fig. 1). Previously, the animal had been PIT-tagged by NGO Cabo Verde Natura 2000 with code 116524270A at Ervatão beach on 11 July 2003, ca. 5 km from the site where it was found in 2013.

The injury comprised the cranial aspect of the carapace, through the lateral right side of the spine, until three-quarters of the total curved carapace length (from the nuchal scute through all five right costal scutes). Additionally, a triangular piece of shell was loose, only attached by soft tissue, in the central area of the fracture. Fracture edges looked active and displaced significantly during normal animal movement. The female successfully dug a nest chamber, deposited 86 eggs and covered and camouflaged the nest. Because of the unusual finding and lack of material for treating the animal on location at

the time, the turtle was allowed to return to the sea in the hope of finding it again during the next beaching episode, with everything prepared on site to attempt surgical carapace cleaning and stabilization.



Fig. 1. The injured turtle during the first encounter on 12 July 2013 (Adolfo Marco).

Logistics put in place included a facility area to keep the animal calm, clean and safe until surgical intervention was possible. Additionally, veterinary advice was required to design an operation plan suitable to field work conditions and material availability. It was decided to perform a field orthopaedic surgery, aiming at a detailed examination of the fracture's extension and a permanent surgical solution to prevent further deteriorating and fracture progression and to allow proper wound healing.

Beach surveillance was increased during the most likely nesting days to maximize the possibility of detecting the female. Loggerheads of the Boa Vista population usually nest 4-6 times every 14-18 days. Eventually, the animal was found back on the same beach on 3 September 2013, 53 days after the first encounter (Fig. 2).



Fig. 2. The injured turtle immediately before surgery (Vanessa Martínez).

After nesting and laying 83 eggs, the turtle was placed in a large plastic container in a wet, calm and clean environment. Following veterinary advice, wound cleaning and medication administration was performed on a daily basis during 12 days. Physical examination of the sea turtle suggested that it was strong enough to overcome anaesthesia and sufficiently fit for surgical intervention. The procedure was carried out at NGO BIOS.CV's field camp at João Barrosa on 16 September 2013. To ensure the best medical assessment and dosage administration, the animal was weighted using a large field scale. The turtle's body weight was 67 kg and the straight carapace length was 88 cm.

General anaesthesia was achieved by intravenous injection of propofol (7 mg/kg; Propofol-Lipuro® 10 mg/kg, B. Braun Vet-Care SA, Barcelona, Spain). Meloxicam (0.2 mg/kg;

Metacam® 5 mg/ml, Boehringer Ingelheim Vetmedica GmbH, Ingelheim am Rhein, Germany) was used for pain relief and anti-inflammatory effect. Antibiotic coverage was achieved with intramuscular enrofloxacin (5 mg/kg; Baytril® 5%, Bayer Hispania SL Barcelona, Spain) prior to surgery and subcutaneous long acting ceftiofur (15mg/kg; Naxcel® 100 mg/ml, Pfizer Limited Puurs, Brussels, Belgium) postsurgery. During surgery, muscular tone and reflexes and cardiovascular performance monitoring by Doppler flow unit (Minidop ES-100VX, Hadeco, Japan) were used for anaesthesia plane follow up (McArthur *et al.* 2004) (Fig. 3). An intravenous catheter (Venofix® A, 21 G, Braun, Melsungen, Germany) was placed into the cervical dorsal sinus to allow adequate fluid therapy administration (1000ml saline FisiVet®, Braun



Fig. 3. Monitoring the turtle's vital functions (Vanessa Martínez).

VetCare SA, Barcelona, Spain) to improve anaesthesia recovery and acupuncture point GV26 was used to decrease recovery time (Canion & Rogers 2006).

Deep debridement of the wound and tissue and bone necrotic removal (Fig. 4) was performed before complete fracture reduction. For fracture reduction and stabilization, marine stainless steel plates with 5 mm screws were chosen to ensure permanent shell stability (Piermattei *et al.* 2006). To complete fracture

repair, cerclage orthopaedic wire was used to fix the detached central shell piece (Fig. 5). In order to prevent entanglement with marine debris and to minimize epibiont adhesion to or around implanted material, bone plates, wire and bone screws were covered with an epoxy layer (Fig.

6). Once the turtle was fully recovered from two hours anaesthesia, it was released on the beach (Fig. 7). The animal responded quickly by approaching the water and entered the sea as normally observed in females after egg laying.



Fig. 4. Fracture cleaning and debridement. Fig. 5. Orthopedical fixation of the carapace fracture (Rosa García Cerdá).



Fig. 6. Protective epoxy application to the fixed carapace. Fig. 7. The sea turtle named Laura, painted for easier resighting, is released on the beach (Rosa García Cerdá).

## DISCUSSION

Several conclusions can be drawn from this case. First of all, the singular biological value of a breeding female sea turtle of an endangered population (Wallace *et al.* 2011) justified the performance of this exercise. In Cape Verde, many sea turtles are severely injured every year by both anthropogenic and natural causes. Up to 20% of nesting females are found to have injuries on their bodies and other injured turtles are found dead on the beaches and at sea. The present study case is a good example of the utility and efficacy that a well-organized programme of rescue and rehabilitation of sea turtles could have in Cape Verde. In this

particular case, a rehabilitation facility would have helped in conducting an adequate health assessment of the animal prior to surgery. Moreover, the procedure would have been executed in a well-equipped surgery room and follow up controls could have been made after the surgery to ensure correct recovery of the wound. In addition, a rescue center could serve as a supporting unit for conservation management and scientific research. It can also be used to bring local people, especially the youth, into contact with sea turtles through educational activities.

Another important point to consider is the social upshot of this kind of actions involving charismatic animals such as sea turtles and the possibility to increase (or create) public awareness or even fundraising for conservation. The use of current means of communication, such as social networks, to spread the word about actions and international interest will ensure better local and international reach and, at the same time, are effective tools for getting feedback. In the example described here, the amazing response received from social networks and the follow-up and interest shown by the general public (e.g. <http://youtu.be/-rBpKIKfiV0>, <http://tinyurl.com/q7cnxwo>), reflect the potential of this kind of events for raising interest in

wildlife conservation. National media also gave attention to this case and the news was released on national television and radio and in newspapers, even arguing for local political involvement in sea turtle conservation.

Apart from these public awareness aspects, valuable clinical information was obtained from surgery and anaesthesia, to the benefit of future field technical work. Finally, but not less important, taking the opportunity for experience exchange with technical personnel, perform practical *in situ* work and share experiences and materials, significantly promoted knowledge diffusion and improved surgical skills and interest among local staff.



Fig. 8. Part of the staff involved in the turtle's rehabilitation at the João Barroso field camp (Pedro López).

#### ACKNOWLEDGEMENTS

The authors wish to thank all the staff and volunteers of BIOS.CV based at the turtle camp of João Barrosa who collaborated in the rescue and surgery of the injured turtle. Thanks as well to the Direcção Geral do Ambiente of Cape Verde and the Departamento das Áreas Protegidas da Boa Vista for their support and authorization for the handling and treatment of the turtle. Support was also provided by the

Associação de Animais de Boa Vista and Hotel Riu Tuareg (Boa Vista). NOAA (USA), AECID (Spain), BirdLife International (U.K.), the Oceanográfico of the City of Arts and Science of Valencia (Spain) and the Environmental Office of Andalusia (Spain) generously funded the activities. Comments by Ana Belén Casal, Juan Daniel Hernández and an anonymous reviewer helped improve the manuscript.

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Received 13 January 2014

Revision received 21 March 2014

Accepted 10 April 2014