

Conservation and rehabilitation of sea turtles in the Maldives

Claire Lomas

Olive Ridley Project

Email: claire.lomas@oliveridleyproject.org

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Introduction

The Olive Ridley Project (ORP) is a UK based charity that works to protect turtles in the Indian Ocean through rescue and rehabilitation of injured sea turtles, and removal and recycling of ghost gear from the ocean. It also conducts various research projects and educational initiatives. In 2017 ORP set up the first veterinary clinic in the Maldives to provide care to injured sea turtles at the marine turtle rescue centre.

Sea turtle biology

Sea turtles are marine reptiles whose origins date back to the Mesozoic era, 120 million years ago (Motani 2009). Seven species are found globally, ranging in adult size from 40kg in the smaller ridley species (Conant 1975) to the largest, the leatherback, that reaches weights of up to 916kg (Eckert & Luginbuhl 1988). Sea turtles have a long lifespan and are estimated to live 50-100 years (NOS 2019). Depending on species, it can take 9-40 years to reach sexual maturity (Spotila 2004). Specialised salt glands located behind the eyes that secrete salt are an adaptation for living in the ocean. (Hudson et al. 1986). Sea turtles are also specially adapted for diving and can stay submerged for up to 7 hours at a time (Hochscheid et al. 2005).

Marine turtles in the Indian Ocean

Five species of sea turtle can be found in the Maldives and elsewhere throughout the Indian Ocean: leatherback (*Dermochelys coriacea*), loggerhead (*Caretta caretta*), green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*) and olive ridley (*Lepidochelys olivacea*) turtles (Hudgins et al. 2017). All species are on the IUCN red list of threatened species (IUCN 2020).

Olive ridley sea turtles

The olive ridley is one of the smallest species, reaching an adult weight of approximately 35-45kg and a carapace length of 62-70cm. They are a pelagic species distributed in tropical and subtropical waters of the Pacific, Indian and Atlantic Oceans. Ridley turtles can exhibit a unique nesting behaviour known by the Spanish term 'arribada', where thousands nest on the same beach

at the same time. Olive ridley turtles nest either in this synchronous way or individually (Hudgins et al. 2017). The conservation status of olive ridleys is classed as Vulnerable (IUCN 2020).

Threats to sea turtles

Sea turtles face many threats in the wild, the majority of which are caused by human activity (UN 2019). Poaching of turtles and eggs, pollution, loss of nesting and feeding habitat through human activities and interactions with fisheries all have large impacts on populations (NRC 1990; UN 2019). The most abundant species in the Indian Ocean, the olive ridley, is the turtle most likely to be found entangled in ghost gear (Stelfox et al. 2015).

Between 2016 and 2020, 651 injured sea turtles found in the Maldives were reported to the Olive Ridley Project. Of these turtles, 86.8% were injured due to entanglement in ghost gear or plastic. Most of the entangled turtles reported in the Maldives (87.7%) are olive ridleys. Over half of reported turtles (59.9%) were juvenile (J. Hudgins, pers. comm.).

Ghost gear in Maldivian waters

Ghost gear is a term that includes discarded, abandoned or lost fishing nets. It is harmful marine debris that has a major impact on many marine species, causing injury and death (Stelfox et al. 2016).

Maldivians predominantly fish using pole-and-line technique; the use of fishing nets is prohibited by law (General Fisheries Regulations 1987). Despite this regulation, many ghost nets are found in the Maldives each year (Stelfox 2015). Ocean currents, particularly during the Northeast Monsoon, cause entangled turtles and ghost gear to drift into the Maldives from neighbouring countries and international oceans (Stelfox et al. 2015). This causes a peak in reported entanglements from December to April; data collected by ORP (J. Hudgins, pers. comm.) since 2009 have shown that 68.5% of all entanglements were reported during these peak months.

Rescue and rehabilitation of sea turtles in the Maldives

The marine turtle rescue centre, located in Baa Atoll Maldives, consists of seven tanks for rehabilitating injured turtles as well as a dedicated clinic with radiography, ultrasonography and laboratory facilities. The centre was the first veterinary clinic set up in the country. Since opening in 2017, 125 sea turtles have been admitted to the centre, 97 of which were olive ridleys.

Common cases: injuries

Seventy six percent of sea turtle patients admitted to the rescue centre have wounds from ghost gear or plastic entanglement. Of these patients, 47% require surgery to amputate one or more flippers due to the severity

of wounds inflicted by ghost net entanglement. Turtles with a single flipper amputation have the potential for rehabilitation and release, as turtles with missing flippers have been observed nesting in the wild (Deem et al. 2006). Some turtles present with wounds to flippers that are able to be salvaged through a combination of repair surgery and topical treatment with iodine disinfection and silver sulfadiazine cream. Many cases also require injectable antibiotics. Aside from wounds to flippers, many turtles also have neck wounds from ghost gear entanglement. Some turtles require surgery to repair the oesophagus and other structures after deep cuts are inflicted from nets.

Common cases: buoyancy syndrome

Buoyancy syndrome is a very common condition seen in injured olive ridley sea turtles and can also occur in all species. Fifty five percent of sea turtles admitted to the rescue centre are buoyant on admission, following ghost net entanglement or after boat strike injury (which can also occur as a result of entanglement due to becoming trapped at the surface). Some, 10.4%, of admitted turtles present with buoyancy without any external injuries that would indicate entanglement or trauma. Some of these cases are diagnosed with pneumonia or have severe generalized disease such as septicaemia.

Buoyancy syndrome can occur with traumatic injuries or diseases that cause spinal damage or a build-up of gas within viscera or the coelomic cavity (Manire et al. 2017). Gas build-up can occur within the intestine, for example due to an obstruction. Gas can also become trapped in the lungs subsequent to pneumonia or injury. Gas can leak out into the coelomic cavity (the term given to the abdominal space in chelonia) from lung tears subsequent to trauma, or intestinal leakage leading to pneumocoelom (terminology meaning gas in coelomic cavity). Finally, tumours such as fibropapillomas can also cause buoyancy issues; however, this is not a disease that has been encountered in the Maldives so far. Some cases of buoyancy syndrome seen at the centre have normal radiographic findings and a cause of excessive buoyancy cannot be determined. Many of these cases show intermittent buoyancy problems that worsened following a stressful event. They have periods of recovering diving ability and relapsing into buoyancy syndrome. One hypothesis is that stress and behavioural factors can influence buoyancy syndrome. However, without access to advanced testing and imaging such as MRI, it is not possible to completely rule out a pathological cause in these cases.

Common cases: rescued pets

Hatchlings and juvenile turtles are sometimes handed over to the centre after being kept as pets on local islands. They are mostly green sea turtles as this species commonly nests in the Maldives. One case of a loggerhead

hatchling presented after being kept in a plastic bottle as a pet. Some of these hatchlings are kept in fresh water so need a period of slow acclimatisation to salt water before release. They often show signs of disease related to poor husbandry conditions; for example, soft shells are likely to be due to a combination of insufficient calcium intake from a poor diet and lack of UV light which is required for calcium metabolism (Gregory et al. 2019).

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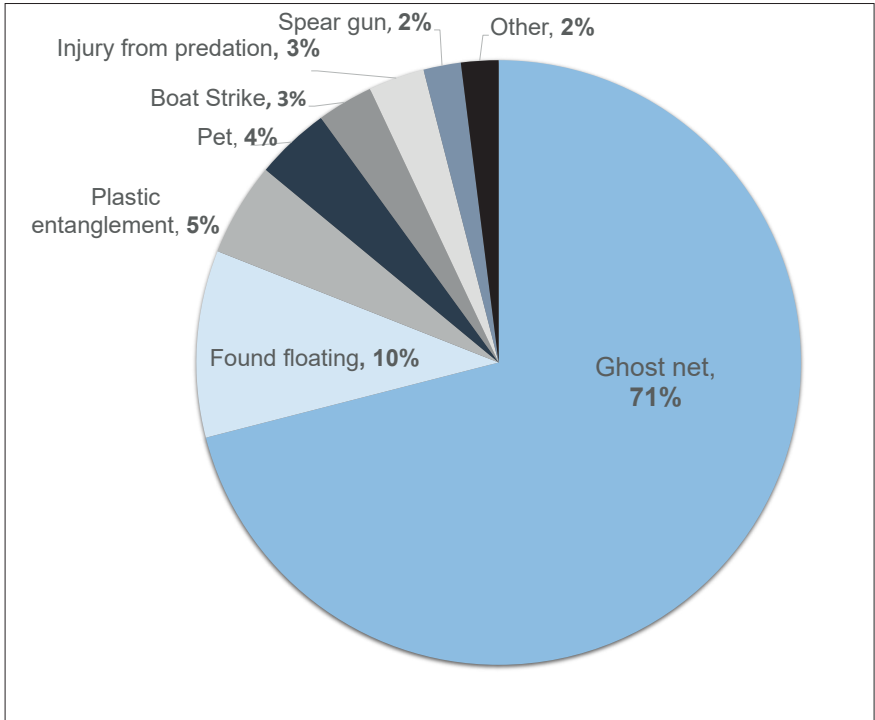
Author performs surgery to remove plastic from intestines of olive ridley turtle. Photo by Claire Lomas.



Adult olive ridley with buoyancy syndrome after ghost net entanglement, at the ORP rescue centre. Photo by Claire Lomas.



Olive ridley turtle entangled in ghost gear. Photo by Claire Petros.



Case Pie Chart

■ Percentage of turtles with ghost net wounds

■ Percentage of turtles found floating; buoyancy syndrome

■ Percentage of turtles entangled in plastic

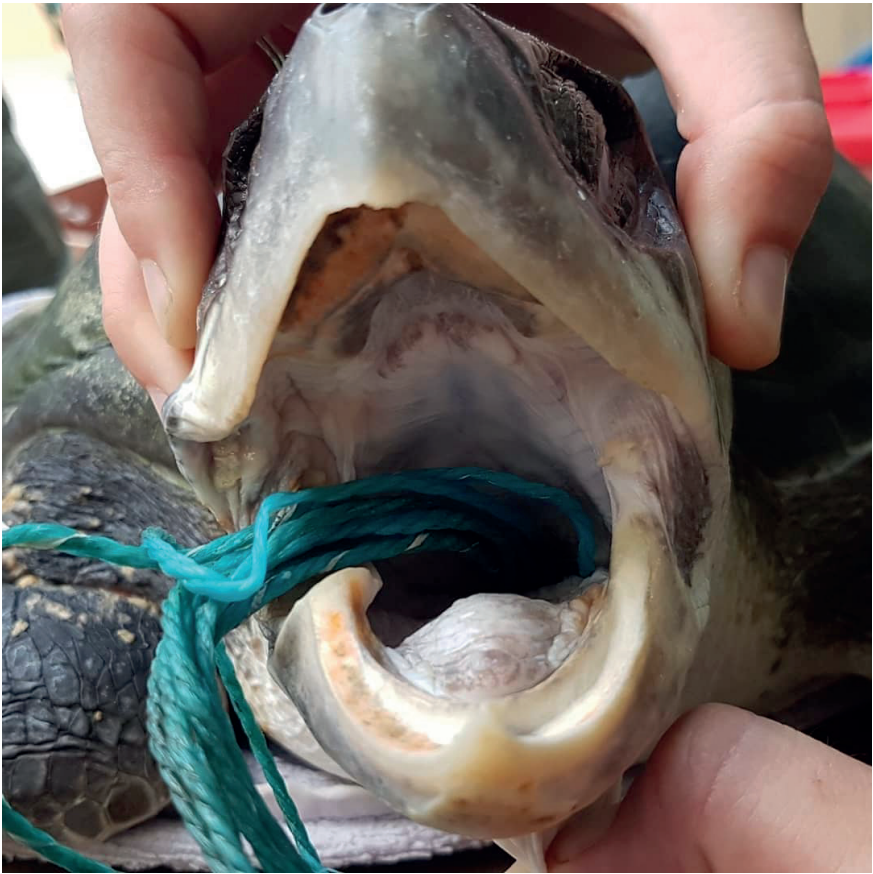
■ Percentage of turtles that were kept as pets

■ Percentage of turtles with Boat strike wounds

■ Percentage of turtles injured by natural predators

■ Percentage of turtles with wounds from spear guns

■ Percentage of turtles admitted for other reasons



Juvenile olive ridley presenting with ghost net ingestion. A large quantity of net had to be surgically removed from the stomach. Photo by Claire Lomas.



Nesting green sea turtle on Coco Palm, Maldives. Photo by Claire Lomas.



Recovering plastic debris and entangled turtle from ocean in Maldives. Photo by Claire Lomas.



Turtle patient at ORP marine turtle rescue centre with amputation following ghost gear entanglement. Photo by Claire Lomas.