

ARTICLES



OLIVE RIDLEY TURTLE ENTANGLEMENT IN GHOST NETS IN KAVARATTI LAGOON, LAKSHADWEEP ISLANDS, INDIA

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Marine megafauna such as sea turtles face multiple threats as they occupy different habitats at their breeding and foraging grounds (Lascelles *et al.*, 2014; Read *et al.*, 2014;), increasing their exposure to dangers across different life stages (Read *et al.*, 2006; Dulvy *et al.*, 2008; Wallace *et al.*, 2010). Of these, ghost nets have emerged as a severe threat, affecting marine life disproportionately (Richardson *et al.*, 2019a). Ghost nets are defined as discarded or accidentally abandoned fishing gear that are lost to the sea (Wilcox *et al.*, 2014), and which continue to 'fish' indiscriminately thereafter. According to Wilcox *et al.* (2014), nearly 6.4 million tonnes of ghost nets make their way into the oceans annually. Richardson *et al.* (2019a) estimated that about 6% of all fishing nets, 9% of all traps, and 29% of all lines are lost every year. Ghost nets get carried over long distances across different oceans (Stelfox *et al.*, 2014; Sayer & Williams, 2015), forming floating conglomerates and trapping large-bodied marine animals such as marine mammals, elasmobranchs, and sea turtles (Stelfox *et al.*, 2015).

Sea turtle species such as the olive ridley (*Lepidochelys olivacea*) turtles are prone to entrapment in ghost nets due to their attraction to smaller organisms caught in such nets (Stelfox *et al.*, 2016). For instance, olive ridleys are associated with flotsam in the eastern tropical Pacific Ocean (Pitman, 1990) and are known to bask at the sea surface, increasing their vulnerability to ghost nets (Pitman, 1993). Juveniles tend to utilise floating algal mats for basking, and could potentially be using floating ghost net conglomerates for the same (Boyle & Limpus, 2008). Where these overlap, olive ridleys are at great risk of being caught in ghost net conglomerates drifting in the sea.

In India, olive ridleys mass nest synchronously in Odisha (Pandav *et al.*, 1994) and the Andaman and Nicobar Islands (Namboothri *et al.*, 2015), and nest solitarily elsewhere along the Indian coastline and in the Lakshadweep islands. The Lakshadweep islands are an offshore territory located between 8°-12°N and 71°-74°E in the Arabian Sea that serve as breeding and feeding grounds for olive ridleys, with nesting observed on some islands

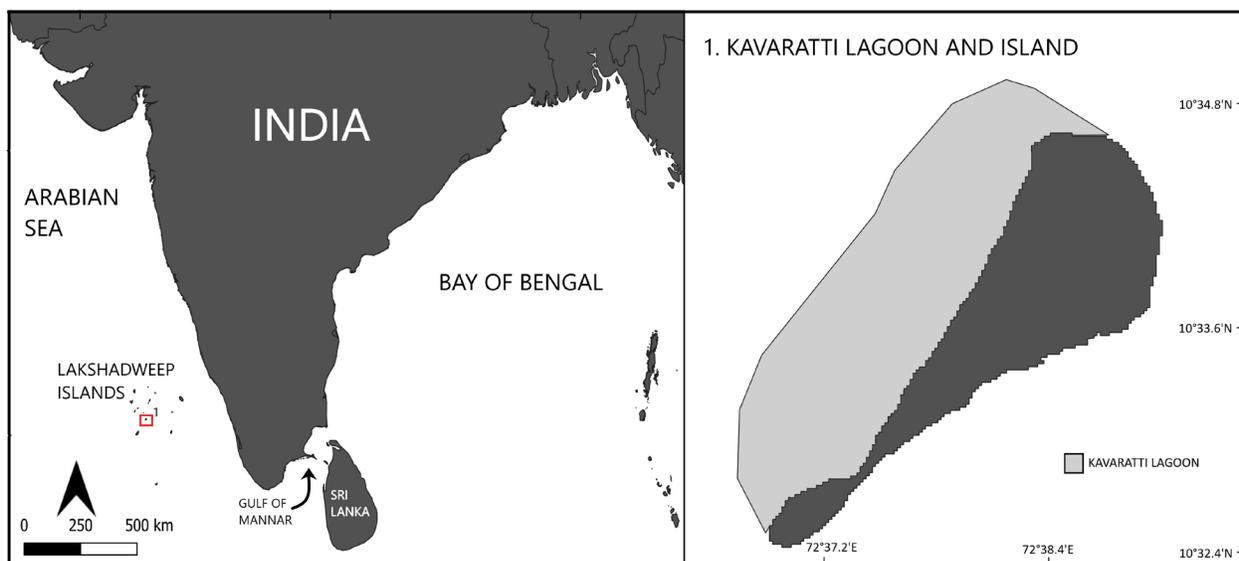


Figure 1. Map of peninsular India depicting the Lakshadweep Islands (red inset box), Gulf of Mannar, Sri Lanka and the Arabian Sea; 1) Kavaratti lagoon (light grey) where entangled Olive Ridley turtles were observed in 2019 and 2021.



Figure 2. Olive ridley turtle was observed to be in distress after getting entangled in a floating ghost net in April 2021. (Photo credit: Nupur Kale)

(Tripathy *et al.*, 2006). However, there is little information on the threats faced by olive ridleys, specifically the impact of their interactions with ghost nets in the islands.

In April 2019 and April 2021, we had two single-day chance encounters of three (two alive and one dead) and one (alive) olive ridley turtles respectively, trapped in ghost net conglomerates in the lagoon at Kavaratti Is. (Figure 1). We recorded the events photographically while freeing the turtles from the nets (Figure 2). We were unable to take morphometric measurements or determine the sex of the turtles as their removal from the water was not feasible. Based on the photographs, we estimated the curved carapace length (CCL) of the entangled turtles to be between 40-60cm. There were no signs of external injuries on their carapace, plastron and neck; however, we noticed some lacerations on the flippers during the removal, probably caused by the nets. After release, the live turtles swam away without apparent injury or fatigue.

In the last few years, the number of reports on marine turtles found entangled in ghost nets along the west coast of India has been on the rise (Tiwari, 2021; Kumar, 2022). Similarly, the Maldives also reported increasing incidents of marine turtles entangled in ghost nets, especially olive ridleys (Anderson *et al.*, 2009). Stelfox *et al.* (2020) noted that most olive ridleys found entangled in ghost nets in the Maldives belonged to the east Indian and Sri Lankan nesting populations. The origin of our turtles is unknown, but the Gulf of Mannar and Sri Lanka are known foraging sites for olive ridley turtles (Kannan, 2008; Rees *et al.*, 2012; Behera *et al.*, 2018), and it is possible that the turtles we found belonged to the Sri Lankan nesting population, or small nesting population of olive ridleys from the

Lakshadweep islands. Given the low nesting numbers of olive ridleys in the Lakshadweep islands, any loss of turtles from this stock might impact the genetic diversity of this species in India. Improved monitoring and genetic assessment of individuals entangled in ghost nets in the north-western Indian Ocean will help understand the impact of ghost nets on olive ridley populations.

There has been an increase in marine litter found on the beaches and in the lagoons of the Lakshadweep Islands (Kaladharan & Anasukoya, 2020). In 2017, Kaladharan *et al.* (2017) surveyed ten islands in the Archipelago, recording an average of 1.61g/m² of litter on the beach, chiefly nylon threads and pieces of fishing net. In 2020, Kaviarasan *et al.* (2020) reported that nearly 45% of marine debris on three remote beaches of the Lakshadweep was discarded fishing gear. Even though tuna fishing using pole and line gear is the predominant form of fisheries in the Lakshadweep islands, nets and long-lines are also used to catch bait and lagoon fishes, and sharks respectively. Moreover, the commonly practiced fisheries in the Indian Ocean region and India are trawling, gill netting and seine nets, all of which rely heavily on different types of nets (Stelfox *et al.*, 2014). Therefore, while it is likely that some nets in ghost net conglomerates observed in the Lakshadweep islands may have originated from mainland India, the diversity of nets used at local and regional scales make it difficult to ascertain the exact origins of the nets (Stelfox *et al.*, 2019).

Ghost nets pose a significant threat to all marine life. It is imperative that activities that improve net disposal and reduce plastic pollution and other forms of waste from the waters at both regional and global scales are implemented.

Tackling this issue will require a multi-faceted approach combining research, awareness, and preventive action. It is essential to determine the type of gear that is lost and find ways to minimise its disposal through dialogue with fishers and fisher unions (Stelfox *et al.*, 2019). Other measures include engaging with coastal enforcement agencies, fishers and other marine vessels in activities, and engaging them in rescue of sea turtles and other marine megafauna from ghost net entanglements. This will help in understanding how the distribution of floating nets along the coast is correlated to fishing practices at regional scales. While regular cleaning up of beaches, lagoons and retrieval of nets is important to tackle the threat of ghost nets, innovative measures such as regular monitoring and removal, incentivising fishers to practice recycling or reusing damaged nets and encouraging proper disposal of the gear in waste facilities on shore or ports will considerably reduce the threat of ghost nets (Richardson *et al.*, 2019a, b; Stelfox *et al.*, 2019). Fishers play a pivotal role in any initiative that aims to mitigate the threats of ghost nets. Therefore, creating awareness amongst the coastal communities and initiating collaborative efforts will drive a change in behaviour towards implementing sustainable practices in ghost net reduction and removal.

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CONSERVATION OF SEA TURTLES ALONG THE PUDUCHERRY COAST OF INDIA

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INTRODUCTION

Of the five species of sea turtle reported from Indian waters, *Caretta caretta* (loggerhead turtle), *Chelonia mydas* (green turtle), *Dermochelys coriacea* (leatherback turtle), *Eretmochelys imbricata* (hawksbill turtle), and *Lepidochelys olivacea* (olive ridley turtle) (Tikedar & Sharma, 1985; Rajagopalan *et al.*, 1996) all except the leatherback have been reported offshore from the

Union Territory of Puducherry (Kar & Bhaskar, 1982) on the east coast of India. Approximately 16km of the Puducherry coast is also utilised by nesting olive ridley (81.6%) and green turtles (16%) (Abraham, 1990; Bhupathy & Saravanan, 2006; Saravanan *et al.*, 2013).

Puducherry (11.882°-11.998° N, 79.750°-79.879° E), the regional capital and the second largest town of Puducherry Union Territory, is located along the Coromandel Coast