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OBSERVATIONS ON THE ENTANGLEMENT OF PLASTIC DEBRIS IN SEABIRDS OF THE FAMILY LARIDAE ALONG KERALA COAST, INDIA

Nisanth, H.P.* and Biju Kumar, A.

Dept. of Aquatic Biology and Fisheries,
University of Kerala, Thiruvananthapuram 695 581, India
**Email: nisanthhp@gmail.com*

Abstract: Marine plastic pollution has become an emerging issue in the recent past and it impacts sea birds by way of entanglement, ingestion and chemical contamination. This may also affect their normal behaviour including feeding, preening and movement, besides poisoning and mortality. This paper reports few cases of plastic entanglements in migratory sea birds of the family Laridae (Lesser Black-backed Gull *Larus fuscus*, Brown-headed Gull *Chroicocephalus brunnicephalus*, and Lesser Crested Tern *Thalasseus bengalensis*) from Kerala coast of India and comments on the impacts of plastic entanglement in their behaviour.

Key words: Seabirds, Marine debris, Plastic pollution, Charadriiforms, Laridae

INTRODUCTION

Marine debris in the ocean is an emerging global environmental concern (Bergmann *et al.*, 2015) and the recent surveys in India also reported the increasing marine debris all along the coasts (Kaladharan *et al.*, 2017; Maharana *et al.*, 2019). Marine debris has been found in the pelagic environment worldwide and their quantity is increasing at an alarming rate, posing many threats to the coastal and marine environment (Galgani *et al.*, 2010). Among these marine debris, plastic debris (including microplastics) is one of the serious issues in the coastal, marine and freshwater environments (Li *et al.*, 2016). Seabirds are one of the severely impacted marine fauna due to plastic debris and Wilcox *et al.* (2015) estimated that 99 per cent of the seabird species would consume at least a plastic item. There are mounting amounts of information on the impacts of plastic pollution on marine birds of the western Indian Ocean, and the impacts recorded primarily include entanglement, ingestion, and chemical contamination (Cartrauda *et al*., 2019). Entanglement is one of the serious environmental concerns for marine vertebrates, specifically for the avian fauna (Ryan, 1987, 2018; Kuhn *et al.*, 2015). Recent studies indicate that at least one-quarter of all sea birds are entangled in plastics (Kuhn *et al*., 2015; Ryan, 2016). The impacts of entanglement are much more pronounced and may lead to many complications, from injury to death of the birds (Laist, 1997; Kuhn *et al.*, 2015; Riyan, 2018). In general, there are lesser number on observations of entanglements of sea birds, as the plastic-entangled birds often stay away from the flocks, and they may die far off from the land (Laist, 1997; Kuhn *et al.*, 2015). The only report of plastic entanglement in sea birds of India was by Veena *et al.* (2014), who reported a Brown-headed gull entangled in a gillnet. This paper reports few observations on the entanglement of plastics in gulls and terns from Kerala coast.

METHODOLOGY

The observations were made as part of the on-going study on sea birds of Kerala and Lakshadweep coast of India. During the survey, line transect method and point count methods were used (Gregory *et al*., 2004). The birds were observed using binoculars (Olympus 10X 50 DPS I) and were photographed using DSLR camera (Nikon D500; Nikkor 200 -500mm lens). The locations were also recorded using GPS device (Garmin 12H). The feeding and foraging behavior of the birds were also recorded during the survey.

RESULTS AND DISCUSSION

The survey of seabirds along Kerala coast recorded 22 species during the year 2019. Among these seabirds, three species, the Lesser Black-backed Gull (*Larus fuscus* Linnaeus 1758), the Brown-headed Gull [*Chroicocephalus brunnicephalus* (Jerdon, 1840)], and the Lesser Crested Tern [*Thalasseus bengalensis* (Lesson, 1831)], were found to be entangled with plastics. All these plastic entanglements were observed in migratory seabirds belonging to the family *Laridae*. Lesser Black-backed Gull *Larus fuscus*, a winter visitor to south-west coast of India, was reported from the Ponnani fishing harbour in Malappuram district, Kerala on 8th February 2019, with a plastic bottle ring (tamper-evident band/ security ring) trapped in its beak (Fig. 1 A-C). The ring has pierced the lower mandible and formed a hindrance for feeding and for preening. It remained over its eyes, which results in obstruction of long-range vision, ultimately impacting the normal flight of the bird. The ring-- might have trapped while the bird was feeding from the sea or during the search of food among the trashes and discarded waste. After two months, on 06th April 2019, the bird was again spotted from the same region with severely impaired plumage (Fig. 1C). Another individual of *L. fuscus* in its breeding plumage was observed from the Ponnani harbour (Fig. 2) on 09th February 2019, with remnants of monofilament nylon net in its leg.

On 13th February 2019 a Lesser Crested Tern *Thalasseus bengalensis* (Fig. 3 A, B) was documented from Alappuzha (=Alleppey), Kerala, with discarded nylon gill net strangled around its beak, legs and wings (Fig. 3 A). The net created issues for feeding as the beak and the legs were entangled with the net. As a result, it cannot maintain streamline posture during flight (Fig. 3 B).

On 4th April 2019 another case of entanglement was documented from the same locality (Alappuzha) in a Brown-headed Gull *Chroicocephalus brunnicephalus* (Fig. 4), which was entangled with bit of nylon fishing net. Yet another case was documented on 05th December 2019, from the northern Kerala in *Larus fuscus* where one of its wings was entangled in nylon gill net (Fig. 5); even though the bird was entangled, in this case the bird could able to manage its movements and maintain the wing posture.

Fig. 1A-C. Plastic bottle ring trapped in the beak of Lesser Black-backed Gull *Larus fuscus* from Ponnani, Kerala

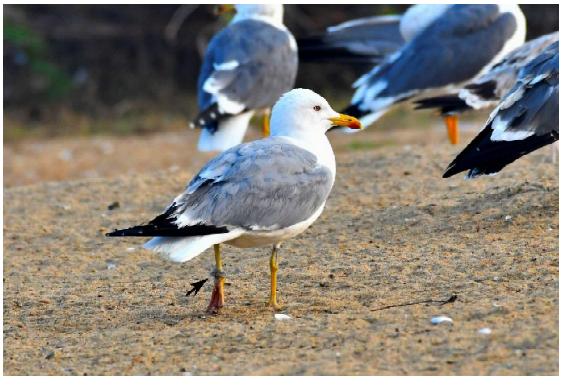

Fig. 2. *Larus fuscus* with monofilament nylon net in its leg, located from Ponnani, Kerala

Fig. 3A. *Thalasseus bengalensis* with monofilament net entangled around its beak and legs, recorded from Alappuzha, Kerala

Fig. 3B. *Thalasseus bengalensis*- entangled nets impacting normal flight of the bird

Fig. 4. *Chroicocephalus brunnicephalus* with monofilament net entangled around its legs, observed from Alappuzha, Kerala

Fig. 5. *Larus fuscus* with monofilament net tangled around its wing, recorded from Ponnani Kerala

In all these cases the plastics entangled in the body seems to impact the behaviour of birds. We have observed that the feeding of the *Larus fuscus* with plastic bottle ring trapped in its beak resorts to depend on other birds for their share of food. This bird was also observed to feed on the discards of food from other birds in the flock or resorts to feed from the discards from the fishing boats. These kinds of feeding restrictions and the resultant possible nutritional deficiency may also affect the moulting process of the bird, as was evident from the impaired plumage observed in the bird after two months since our first observation (Fig. 1B, C). Derraik (2002) showed that entanglement impacts behavioural patterns of sea birds and the surface foraging species are more vulnerable to both floating plastic entanglement and ingestion (Ryan, 1987). The plastic entanglements also impact the preening behaviour, which is important for maintaining the integrity of feathers. According to Moreno-Rueda (2017), preening with the secretions from the uropygial gland is essential for reducing the feather degradation and it helps in improving the thermoregulation, waterproofing and flight capacity. Therefore, in the present case, the inefficiency in the preening behaviour in turn may affect the migration of the species after the season.

Savoca *et al.* (2016) suggest that the plastic materials in the ocean release Dimethyl Sulphide (DMS), which act as the foraging cue for many seabird species and be probably one of the reasons for the consumption of plastics. Roman *et al.* (2018) found that seabird flocks forage at the surface and those with a crustacean dominant diet are at highest risk of debris ingestion. The entangled birds seem to heavily reliant on the movements of other members of the same species or even different species in the flock for getting their share of food and to escape from the predator. Santos *et al.* (2016) observed that plastic ingestion is commonly attributed to visual similarities of plastic fragments to animal prey items. The chemical contaminants in floating plastic pieces, specifically microplastics, may also induce toxicity to the marine organisms (Arthur *et al.*, 2009; Maharana *et al.*, 2019).

The discarded fishing gears, often referred as 'ghost nets', including the nylon nets and cut lines with hooks, often cause lethal damages to the seabirds (Good *et al.*, 2009). This study also reveals that the abandoned plastic (nylon) gill nets cause serious threats to seabirds which forage around the coastal areas of India, which often remain unnoticed due to the limited number of seabird studies in the area, not to speak of the lesser number of research on marine debris in India (Arun Kumar and Siva Kumar, 2016). From India entanglement of Brown-headed Gull *Chroicocephalus brunnicephalus* with gill net was reported from Vishakhapatnam, India (Veena *et al.*, 2014). While the plastic debris entanglement impacts the foraging activity of seabirds, they seem to resort to feeding on trash fish and the discards from the fishing boats. Kuhn *et al.* (2015) and Ryan (2018) suggest that entanglement of birds is more noticeable than ingestion as its impact includes injury, impeded mobility and drowning. It also reduces the ability to prey and an increased chance of predation (Li *et al.*, 2016). Reduced prey abundance also could be a reason for the higher consumption of plastic materials by seabirds. (Tanaka *et al.*, 2013).

Seabirds, as top predators, are exposed to all threats affecting the ocean and this makes them ideal organisms for monitoring changes within the marine ecosystem. Therefore, by monitoring the incidence of plastic entanglement, ingestion and type of plastics ingested by the sea birds, long term trends in plastic pollution could be ascertained, and further, it may serve as a cost-effective method for monitoring plastic pollution levels in the oceans (Ryan *et al.*, 2009; Lescroel *et al.*, 2016).

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