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Short Note

Record of a Dugong Feeding Trail with a Note on Recent Dugong-Related Incidents Along the Coast of Tamil Nadu, India

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The Gulf of Mannar (GoM) and Palk Bay (PB) together encompass an Important Marine Mammal Area (IMMA) supporting a breeding population of dugongs (*Dugong dugon*; Müller, 1776). Commonly called sea cows, they are among the most elusive marine mammals (Order: Sirenia); and in India, their numbers are limited and have been dwindling over the years. *Dugong dugon* is listed as "Vulnerable" on the International Union for Conservation of Nature's (IUCN) *Red List of Threatened Species* (Marsh & Sobtzick, 2019). They are protected in India under Schedule I of the Wild Life (Protection) Act (1972). Habitat destruction, hunting, fisheries interactions, and pollution are the key reasons for their continuous decline (Vivekanandan & Jeyabaskaran, 2012). It is estimated that there are only around 200 dugongs left in the wild habitats of India (Sivakumar, 2013).

Dugongs are present in four regions throughout Indian coastal waters: (1) GoM, (2) PB, (3) Gulf of Kutch, and (4) Andaman & Nicobar Islands (Vivekanandan & Jeyabaskaran, 2012). The Tamil Nadu Forest Department (TNFD) and Wildlife Institute of India (WII), Dehradun play a key role in promoting initiatives for dugong conservation in Tamil Nadu. Other organisations/institutions undertaking conservation efforts in the GoM and PB include the Organization for Marine Conservation, Awareness and Research (OMCAR) Foundation and the Suganthi Devadason Marine Research Institute (SDMRI). The GoM and PB are located in the southern part of Tamil Nadu, and both areas are known for having large seagrass meadows. The GoM and PB, with certain areas in India and Sri Lanka, have been designated as IMMAs, primarily due to the presence of dugongs. IMMAs are defined as "discrete portions of habitat, important to marine mammal species, that have the potential to be delineated and managed for conservation" (Marine Mammal Protected Areas Task Force, n.d.). The IMMA Initiative is a major activity of the Marine Mammal Protected Areas Task Force under the IUCN. Being a flagship species in its range, the Government of India has constituted a Task Force for Conservation of Dugong in India to conserve and manage the declining population of dugongs within its territory (Sivakumar, 2013).

Several strandings (mostly specimens killed by fishing gears or boat propellers) and accidental catches of dugongs have been reported from the GoM and PB in recent years. The WII (www.wii.gov.in/dugong_field_sites_tamil_nadu) and the OMCAR Foundation (www.omcar.org/dugongs) have been maintaining open-source data of all sightings and casualty incidents related to dugongs from the GoM and PB on their respective websites.

In this short note, we report a typical dugong feeding trail (Figure 1A) at ~120 m from the beach off Periyapattinam in the GoM during a regular seagrass monitoring survey on 7 January 2021 (09° 14' 57.90" N, 78° 54' 10.39" E). Only a single feeding trail was observed during the survey. The length of the trail was ~5 m, recorded at a depth of 3 m. It is highly probable that more feeding trails were present in the area, but due to poor visibility (~2 m), detecting other trails was not possible. The trail was slightly curved. According to D'Souza & Patankar (2011), characteristic dugong feeding trails are serpentine with cleared patches of seagrass along the edges. Since there are no other organisms or any anthropogenic disturbances that can create such a trail, it was confirmed to be a dugong feeding trail. Photo and videographic records of the trail were made during the survey. This observation is very similar to other such reports in India (Anand, 2012; Apte et al., 2019). A dense seagrass bed (Figure 1B) was recorded in

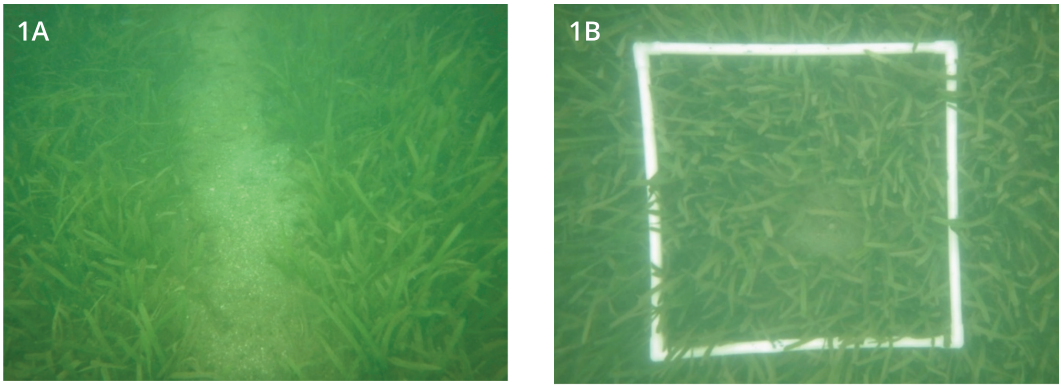

Figure 1. (A) Photograph showing the dugongs' (*Dugong dugon*) feeding trail along a seagrass bed at ~120 m from the beach off Periyapattinam, Gulf of Mannar (GoM), India; and (B) dense cover of seagrass (e.g., *Cymodocea serrulata* and *Syringodium isoetifolium*) at Periyapattinam, GoM, India; the white square frame represents a random quadrat (0.5 × 0.5 m^2) survey for seagrass.

the area based on a random quadrat survey (0.5 × 0.5 m^2), and the percentage cover was estimated to be 90% following the method of Orth et al. (1999). Two seagrass species, namely, *Cymodocea serrulata* and *Syringodium isoetifolium*, were recorded in the area and also along the grazing trail. Jeyabaskaran et al. (2013) recorded *C. serrulata*, *S. isoetifolium*, *Halodule uninervis*, *Halophila ovalis*, *Halophila beccarii*, *Halodule pinifolia*, and *Enhalus acoroides* in PB and also observed fresh dugong feeding scars in *C. serrulata* and *S. isotifolium* beds at Sethupavachatram and Manamelkudi. Dugong feeding grounds are very important sites to strategise conservation efforts (D'Souza et al., 2011). Locating and documenting these feeding grounds aid in confirming their presence and estimating their population numbers.

From the present observation, it is clear that dugongs do feed close to the shore (120 m from shore) where there is dense seagrass cover even if water depth is low (3 m). Observing dugong feeding trails is only an indicative method of determining their presence, while the primary method is direct visual confirmation. Based on the open-source information from the WII and OMCAR Foundation websites, a GIS map (Figure 2) was prepared by plotting the coastal sites where dugong-related incidents have been reported. These incidents were further divided into stranding, entanglement, boat hit, rescue, sighting, and poaching categories and marked on the map. The feeding trail reported herein along with the IMMA boundary (Figure 2C) have also been indicated on the map.

Based on the historical data (Figure 2), it is evident that more incidents have been recorded in PB when compared to GoM in the last 10 y. The northern part of PB (Ammapattinam, Kottaipattinam, etc.; Figure 2B) seems to be a hotspot of dugong-related incidents and, in fact, the PB is known for its more extensive seagrass beds when compared to the GoM. The National Centre for Sustainable Coastal Management (NCSCM) has mapped the extent of seagrass beds in the GoM and PB as 69.11 and 329.70 km^2, respectively, through geospatial assessment (Geevarghese et al., 2018). A total of four incidents from the GoM and 29 incidents from PB (Table 1) were recorded (including the present record) in the last 10 y. Stranding and entanglement were the two most common dugong-related incidents in the IMMA boundary. A greater number of incidents in PB may be attributed to the presence of more extensive foraging grounds. Other than strandings, most of the incidents are the result of fishing activities such as entanglements in nets and boat hits. Incidents of shocked and distressed individuals released after entanglements in fishing gears mostly go unreported, and their fate post-entanglement is never known. Three incidents of poaching of dugongs for meat have also been reported during the last 10 y. Also, four rescues (from fishing gears) and one report of a sighting in the sea (Thondi in PB) have been documented during the same period. There are no reported sightings of a dugong feeding trail from the GoM during this period.

Anand et al. (2015) estimated the dugong population in the GoM to be 80 individuals and in PB to be around 78 individuals. However, compiled secondary data from recent years (Figure 2A; Table 1) indicate that dugong numbers might be higher in PB than in the GoM. Geevarghese et al. (2018) indicate that except in a few locations, seagrass meadows exist within a distance of about 300 m from the coast in PB. The contiguous seagrass meadows in PB provide ideal habitats for the endangered dugong species. Seagrass monitoring is vital for the conservation and management of

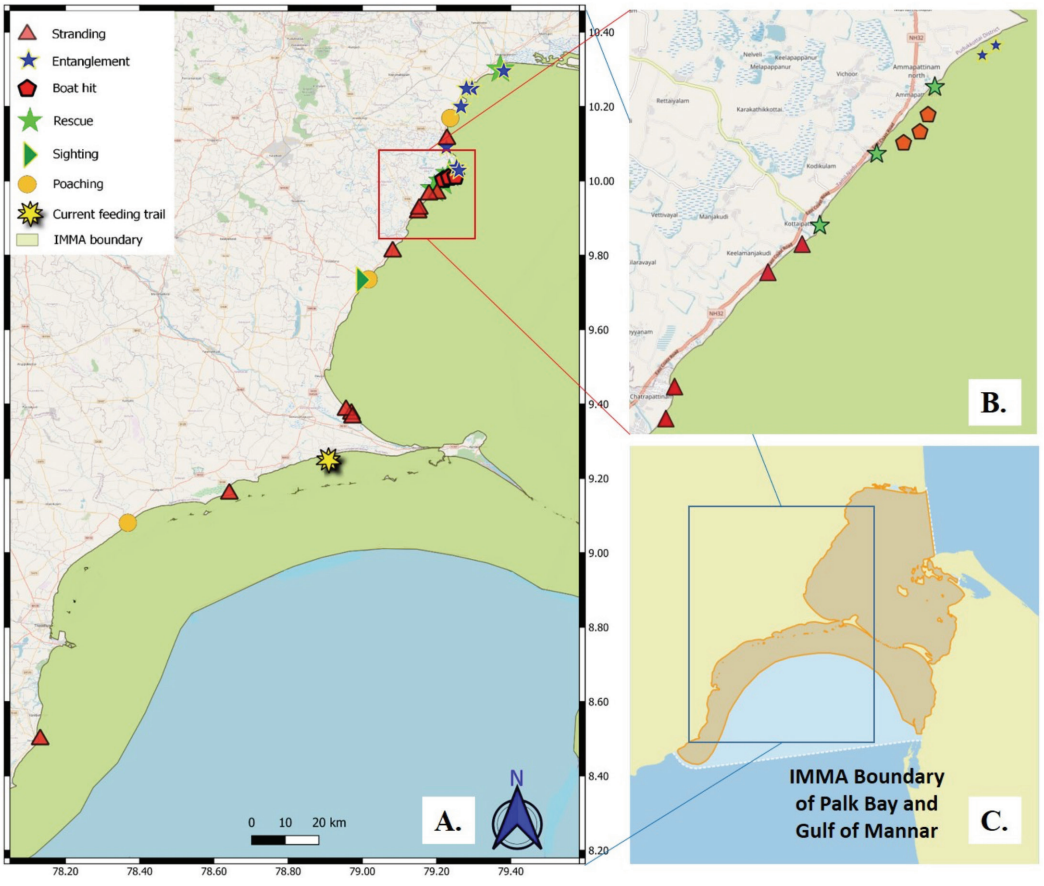

Figure 2. Dugong records from the GoM and Palk Bay (PB), India: (A) mapped area based on historical data and the present record; (B) zoomed area with congested records from PB; and (C) IMMA boundary (as per Marine Mammal Protected Areas Task Force, n.d.) with the present area of reference.

Table 1. Dugong-related incidents as recorded from the Gulf of Mannar and Palk Bay. * = taken from present record; ** = taken from Jeyabaskaran et al. (2013).

Incidents	Gulf of Mannar	Palk Bay
Stranding	2	9
Entanglement	--	8
Boat hit	--	3
Rescue	--	4
Sighting	--	1
Poaching	1	2
Feeding trail	1*	2**
Total	4	29

dugong habitats (D'Souza et al., 2013). Protection of seagrass meadows from anthropogenic driven impacts is vital for the survival of the dugong population in India. Records of feeding trails are important for conservation efforts considering that dugong sightings are rare due to their shy nature, unlike other coastal mammals such as dolphins who are sighted often. Under the CRZ 2019 Notification, seagrass is categorized as CRZ 1A – Ecologically Sensitive Areas (ESAs) and has been delineated and demarcated in the GoM and PB regions. The areas thus identified as ESAs have been approved by the Tamil Nadu Coastal Zone Management Authority (TNCZMA) under the Coastal Zone Management Plans (CZMP). Along with this, strict implementation of the Wildlife (Protection) Act (1972) is equally important to put an effective end to the incidents of disturbing dugong habitats and poaching.

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