

Interactions of sea turtles with small-scale fisheries in the coastal waters of Maharashtra, India

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Introduction

Sea turtles are recognised in both the natural and sociocultural heritage of India. Five species – the green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), leatherback (*Dermochelys coriacea*), loggerhead (*Caretta caretta*), and olive ridley (*Lepidochelys olivacea*) turtle – forage in its waters and all except the loggerhead turtle nest on the mainland and island beaches (Shanker & Choudhury 2006). All species are regarded as endangered and hence are listed on Schedule I of the Indian Wildlife Protection Act of 1972 (Manohar Krishnan & Swaminathan 2021).

Sea turtles in India are vulnerable to a number of threats, including interaction with fisheries (Manohar Krishnan & Swaminathan 2021). Objective 1.1c of the National Marine Turtle Action Plan (2021-2026) for India is to “identify and document the threats to marine turtle populations and their habitats” (Ministry of Environment, Forest & Climate Change 2021) to inform initiatives to minimise bycatch. The cumulative contribution of coastal and small-scale fisheries to bycatch can exceed that of industrial fisheries (Peckham et al. 2007; Alfaro-Shigueta et al. 2011; López-Barrera et al. 2012). Hence, there is a project underway to compile data on sea turtle bycatch rates in small-scale fisheries in the coastal waters of Maharashtra and make observations of other interactions with fisheries.

Study Location

A state on the west coast of India, Maharashtra (Fig. 1) has a coastline of approximately 700 km and small but locally important nesting populations of olive ridley turtles. The current status of foraging populations is unknown but previous reports of sea turtle bycatch and observations include all five species found in Indian waters (Manohar Krishnan & Swaminathan 2021).

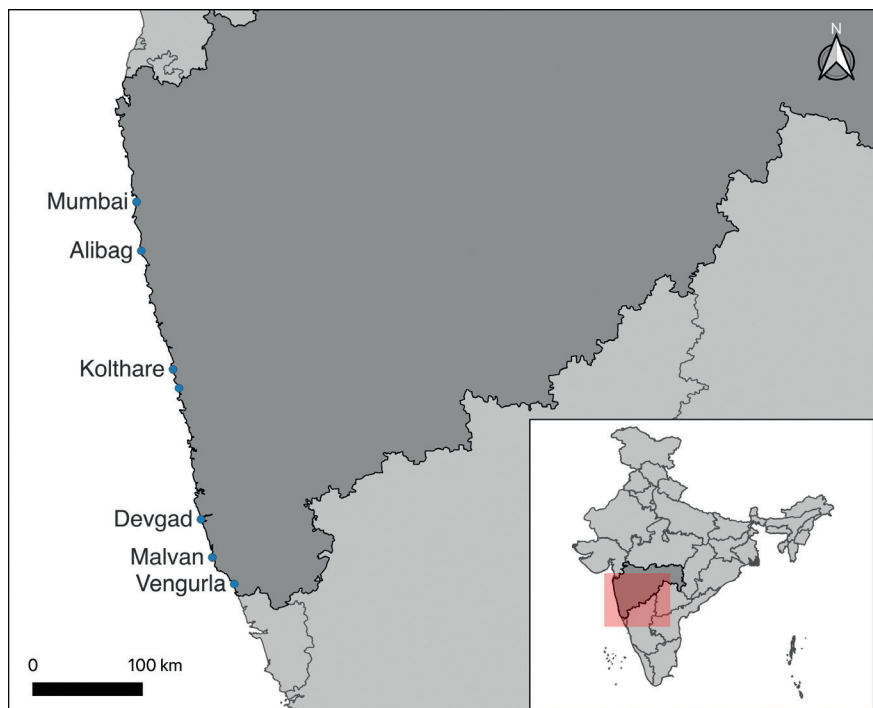


Fig 1. Study locations in Maharashtra, India.

Study Methods

We have been conducting a cross-section study using structured, face-to-face interviews with small-scale fishers operating in the coastal waters of Maharashtra (Figs 2 & 3) since 2018 (interrupted from 2020-2022 by the COVID pandemic). Interviews are conducted after fishers give prior informed consent and in a language (Marathi, Hindi, Konkani, Kannada, or English) of their choice. Participants are not compensated, and can decline to answer any questions and are free to end the interview at any time. To date, interviews have been conducted in fishing communities at (from north to south) Mumbai, Alibag, Kolthare, Guhagar, Devgad, Malvan, and Vengurla (Fig.1).

The 50-question survey tool is a modified version of that designed and validated by Pilcher et al. (2017). Additional questions are among those from the Olive Ridley Project – Ghost Net Data protocol (www.oliveridleyproject.org). While interviews are ongoing, a sub-set of responses about bycatch rates are presented below.



Fig. 2. Local fishers and their vessels. Photo by Andrea Phillott.

Results

Fishing Gear and Practices

Across all locations, we have interviewed 163 fishers to date (March 2023) about their fishing practices, sea turtle bycatch rates, and observations of other interactions with fisheries.

Fishing activities by the majority of respondents occur in small (mean = 8.9m, SD = 3.0m), motorised (85.5%) vessels, within a mean of 14.2km (SD = 9.9km) or 84.9 min (SD = 9.9 min) travel from shore, and throughout the year except for a seasonal closure in June-July. Monofilament (73.0%) gillnets (91.6%) are the most common gear used by the fishers we interviewed. Close to equal proportions (17.8 - 22.6%) of gillnets are set at different positions (surface, mid-water, bottom, full-depth) in the water column, with a mean soak time of 1.6 hr (SD = 1.0 hr). Nets are commonly (84.5%) tended by fishers while set.



Fig. 3. Nets used by local fishers. Photo by Andrea Phillott.

Interactions with Fisheries

The majority of fishers have seen sea turtles while fishing (75.0%) and report accidental bycatch of turtles (68.9%) at any time. More than half report sea turtle bycatch in the last year (59.6%), usually in the range of 1-2 turtles (55.7%). Fishers describe this number as the typical bycatch rate per year (66.7%) at present, and the same (25.3%) or less (48.0%) than in previous years. All bycatch turtles are released.

Other evidence of bycatch includes fishers finding sea turtles floating dead at sea (62.6%) or stranded on shore (53.5%). Indicative of interactions with ghost gear, all fishers had found turtles at sea which were entangled in fishing gear.

Discussion

Gillnetting is the dominant coastal fishery in Maharashtra and approximately 4,000 vessels operate along the state coastline (CMFRI 2010). Fishers in coastal waters use some practices that place entangled sea turtles at risk, including soak times position of nets in the water column. Self-reported annual bycatch per vessel is low, but the number of vessels in the state potentially scales this to an annual loss of thousands of turtles from coastal, small-scale gill net fisheries in Maharashtra. In addition, sea turtles caught by fishers in this study potentially contribute to regional management units (Wallace et al. 2010) or distinct population segments (Seminoff et al. 2015), four of which are categorised as threatened by the IUCN and six of which are regarded as high-risk/high threat (Wallace et al. 2011).

Future Work

We continue to conduct interviews with fishers along the Maharashtra coastline to document ecological knowledge about observation of sea turtles, bycatch rates, and other threats. Bycatch data will complement that being collected in another study from commercial fishers.

Any potential mitigation actions, such as seasonal closures, net illumination etc., must take into account fishers' livelihoods when being considered to avoid human-turtle conflict (see Kale 2022). More precise quantification of bycatch rates, mortality after bycatch, and entanglement in ghost gear through documented self-reports, observer programs, and systematic in-water study could inform schemes to compensate fishers for the safe release of bycatch turtles, initiatives to safely dispose of unwanted and/or abandoned, lost or otherwise discarded fishing gear, and other management and conservation actions.

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