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# ESTIMATES OF TURTLE BYCATCH IN FISHERIES OF CHITTAGONG DISTRICT, BANGLADESH

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## INTRODUCTION

Despite the coastal and offshore waters of Bangladesh being utilised by both industrial and artisanal fisheries (described in Hussain and Hoq, 2010), and fisheries bycatch identified as a major threat to sea turtles worldwide (Hamann *et al.*, 2010), the rate and fate of turtle bycatch in Bangladesh waters is still relatively unknown. Observations of sea turtle mortality presumed due to fisheries bycatch have been published for coastal areas in the Chittagong Division (southwestern coast) of Bangladesh, including St. Martin's Island, Cox's Bazar-Teknaf Peninsula, and Sonadia Island (Islam 2002, 2011). A three week survey of three boats fishing west of Cox's Bazar, setting 22 marine set bag nets in that time, found 95 trapped sea turtles, of which 48 drowned (Islam 2007). Alam (1996, in Rashid & Islam 2005) regard rates of turtle bycatch in fishing gear to be relatively low; however, Rashid & Alam (2005) suggest previously reported numbers may be conservative due to the US requirements for imported shrimp to be caught by fishing vessels employing TEDs. Therefore, the frequency and outcome of turtle-fisher interactions in Bangladesh waters requires more information to assess the potential threat of fisheries to nesting and feeding sea turtles.

## METHODS

We used the Standardised Dugong Bycatch Questionnaire (UNEP/CMS, 2010) to collect data about fishing practices and turtle bycatch. Participants for the study were recruited between January and March 2012 in Chittagong Division of Bangladesh by convenience sampling at the representative fishing sites of St. Martin's Island (Cox's Bazaar District), Sonadia Island (Cox's Bazaar District), and Bhatiary/North Bhatiary (Chittagong District) and interviewed by authors SSA, STS, TA and ZIK. Informed consent was obtained from all potential participants before interviews were conducted. The data presented are a sub-set of their responses to the survey, relevant to turtle-fisher interactions.

## RESULTS AND DISCUSSION

### Interviewee Background

We recruited 47 fishers (St Martin's Island n= 26, Sonadia Island n= 8 and Bhatiary/North Bhatiary n= 13), all of whom were male and the majority of whom were aged 26-50 (Table 1), to be interviewed. Interviewees acted as captain (57.5%), crew (38.3%) or in a variety of roles (4.3%) on their vessel. Fishing was the sole occupation of 44.7% of interviewees and the main occupation for 74.5%, and had been so for most of their life (Table 2).

**Table 1. Age distribution of fishers (n=47) in Chittagong Division, Bangladesh.**

| Age Group (years) | Respondents (%) |
|---|---|
| 15-25 | 23.1 |
| 26-50 | 65.4 |
| 51-75 | 7.7 |
| >75 | 3.8 |

**Table 2. Number of years fishing experience among fishers(n=47) in Chittagong Division, Bangladesh.**

| Number of Years | Respondents (%) |
|---|---|
| <=10 | 42.0 |
| 11-20 | 36.0 |
| 21-30 | 16.0 |
| 31-40 | 6.0 |

The survey participants fit within the recent demographic information known for fishers in Bangladesh (see FAO 2010), though are slightly younger than those interviewed by Hossain *et al.* (2014) as representative of South Kattoli in the Chittagong Division.

### Fishery Information

Using predominantly medium sized vessels (5-10m in length), with approximately equal numbers motorised and non-motorised (Figure 1), the majority of fishing in this region occurred after the early Summer monsoon and/or in the Winter months (Figure 2). The mean number of crew per boat was 7.5±4.4 st.dev. (range 3-20). Most fishers reported using longlines, traps and cast nets (the latter two gear included in 'Other') (Table 3) in unknown habitats (Table 4) to target mixed species (including fish and shrimp; Table 5). However, the reliability of this information is suspect as one participant was repairing a gill net during the interview, but identified it as a longline even after the interviewer verbally described the differences between the two and showed diagrams of each (see also Interviewer Perceptions of Interviewee Responses). Despite this anomaly, and paucity of information on fishing habitats, reported information about fishing gear, vessel length and motorisation fits within that known for Bangladesh coastal and marine fisheries. The FAO (2012) previously described the Bangladesh marine fisheries sector as dominated by an artisanal fleet fishing with set bag nets, gillnets and longlines utilizing motorised and non-motorised boats from 6-12m in length, operating in waters up to 10m deep (Table 4). The semi-industrial gill net fishing fleet uses motorised vessels up to 20m in length in water >10m deep (FAO, 2012). Hussain and Hoq (2010) report only 42 shrimp trawlers and >80 finfish trawlers that are supposed to operate in waters of 40m depth but

**Table 3. Fishing gear used by fishers (n=47) in the Chittagong Division, Bangladesh.**

| | | Frequency of Use | | |
|---|---|---|---|---|
| Type of Fishing Gear | #Fishermen Using Gear | Only | Mostly | Sometimes |
| Gill or Trammell Net | 12 | 16.7% | 41.7% | 41.7% |
| Purse Seine | 0 | 0.0% | 0.0% | 0.0% |
| Beach Seine | 5 | 0.0% | 0.0% | 100.0% |
| Trawl Net | 9 | 0.0% | 44.4% | 55.6% |
| Longline | 29 | 31.0% | 37.9% | 31.0% |
| Bottom Longline | 1 | 0.0% | 0.0% | 100.0% |
| Hook and Line | 4 | 25.0% | 0.0% | 75.0% |
| Other (trap, cast net) | 21 | 14.3% | 47.6% | 38.1% |

**Table 4. Fishing habitat used fishermen (n=47) in the Chittagong Division, Bangladesh.**

| | | Fishing Habitat | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Type of Fishing Gear | # Fishermen | Deepwater | Coral | Seagrass | Mangrove | Rock | Estuaries | Fine Sediments | Unknown |
| Gill/Trammell Net | 12 | 11.1% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 11.1% | 77.8% |
| Purse Seine | 0 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Beach Seine | 5 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% |
| Trawl Net | 9 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% |
| Longline | 29 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% |
| Bottom Longline | 1 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% |
| Hook and Line | 4 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% |
| Other (trap, cast net) | 21 | 4.5% | 0.0% | 0.0% | 9.1% | 0.0% | 9.1% | 0.0% | 77.3% |

**Table 5. Target species of fishermen (n=47) in the Chittagong Division, Bangladesh.**

| | | Target Species | | | | |
|---|---|---|---|---|---|---|
| Type of Fishing Gear | #Fishermen Using Gear | Fish | Squid | Crab | Shrimp | Mix |
| Gill/Trammell Net | 12 | 11.1% | 01.0% | 0.0% | 0.0% | 88.9% |
| Purse Seine | 0 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Beach Seine | 5 | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% |
| Trawl Net | 9 | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% |
| Longline | 29 | 18.5% | 0.0% | 0.0% | 0.0% | 81.5% |
| Bottom Longline | 1 | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% |
| Hook and Line | 4 | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% |
| Other (trap, cast net) | 21 | 28.6% | 0.0% | 0.0% | 9.1% | 71.4% |

may be found trawling at 10m. These fishing practices, and seine nets set in arrays parallel to the shore, entangling nesting females (Islam *et al.*, 2011), may contribute to turtle mortality.

**Sea Turtle Observations and Bycatch**

Turtles had been seen by 95.6% of respondents (n=45). Of those, approximately 63.2% identified the turtles they regularly see as green, hawksbill, olive ridley, loggerhead, leatherback or flatback (Figure 3) when asked about their encounters with each species. However the most abundant turtle in Bangladesh waters are most likely to be nesting olive and green turtles, and foraging green turtles (Rashid & Islam, 2005) with leatherback and loggerhead turtles rarely reported. In addition, flatback sea turtles are endemic to Australia. These discrepancies, combined with only 45.9% of respondents indicating they really know the difference among sea turtles, suggests the likelihood of correct species identification by this cohort is low. Responses also suggest participants may be responding affirmatively because they believe a response is expected or desired by the interviewer; such responses would confound results of the study.

Most of the interviewees observed turtles while travelling to, or at, their fishing areas (Figure 4), with reported overall frequent observations (Figure 5) including several times in the last year (Figure 6). Despite seeing turtles while fishing, the majority of fishermen (~80%) reported catching no turtles in the last year, last 5 years, or in their lifetime, while the remaining ~20% indicated they had caught up

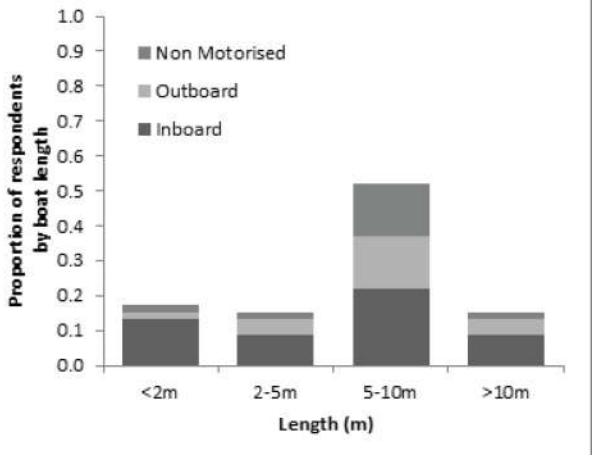


**Figure 1. Length (n=47 respondents) and motorisation(n=34 respondents) of boats used by fishers in Chittagong Division, Bangladesh.**

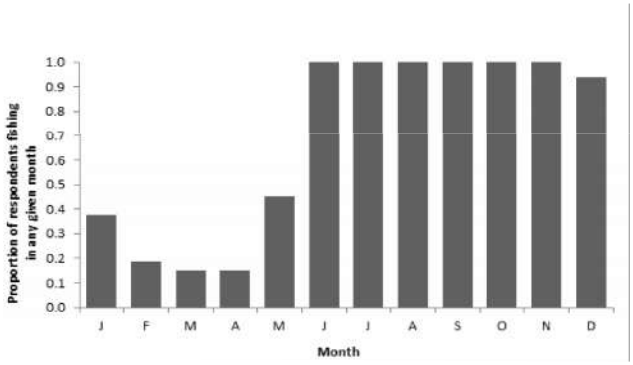


**Figure 2. Seasonality of fishing in Chittagong Division, Bangladesh (n= 47 respondents).**

to 10 turtles in the same time periods (Table 6). However, 44 of the 47 interviewees responded to a question asking what they did with turtles that were captured; 45.5% of the responses indicated that dead turtles were discarded and 81.8% of responses indicated that live turtles are released. There were no reports of bycatch turtles, live or dead, being eaten, sold, or used as bait, despite previous reports of superstition within the fishing community resulting in entangled turtles being viewed as a poor omen and often killed (Islam 2002). Sea turtles were only added to the protected list of the Bangladesh Wildlife (Preservation and Protection) Act in 2012 and should not be hunted or deliberately killed, but it is unknown if the participant responses are reflection of their real actions or xavoidance of potential prosecution as interviewers were often asked several times if they were 'from the government'.

When asked to indicate trends in the overall number of turtles and number of turtles they caught, most fishermen (~65%) thought both numbers had declined, with approximately equal proportions (~10%) indicating turtle numbers had increased or remained the same, or did not know the trend (Table 7). There are currently not enough data on nesting or feeding populations of sea turtles in Bangladesh to determine if fishers perspectives of population trends are accurate. Approximately equal numbers of respondents (n=37) to a question about the importance of turtles believed they were important (45.9%; reasons including they are a natural part of the environment, and eat jellyfish) as not important (54.1%; reasons including they were of no use, and ate target fish species). Awareness programs at St Martin's and Sonadia Islands may have contributed to the knowledge among some fishers about the ecological role and importance of

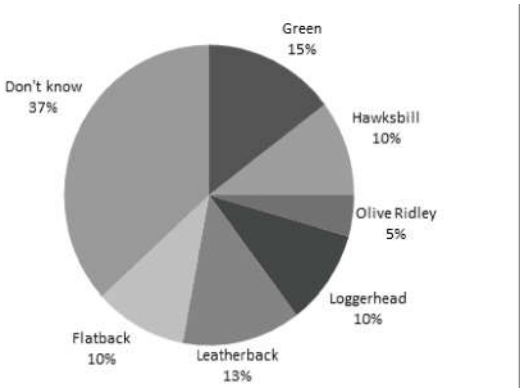


**Figure 3. Sea turtles species observed by fishermen (n=45) in Chittagong Division, Bangladesh. 66.7% of respondents said they had observed one species of sea turtle, 17.8% had encountered two species, 13.3% reported three species, and 2.2% identified four species.**

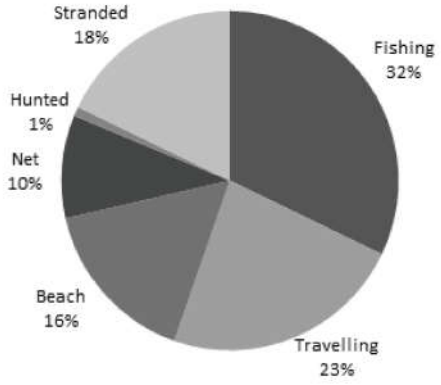


**Figure 4.Activities during which turtles are observed by fishermen (n=45) in Chittagong Division, Bangladesh**

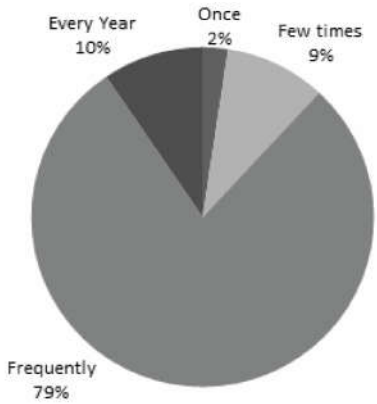


**Figure 5. Overall frequency of turtle observations by fishermen (n=42) in Chittagong Division, Bangladesh.**

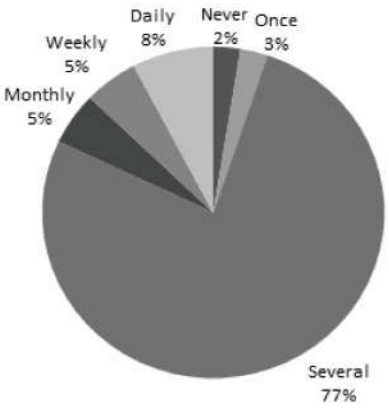


**Figure 6. Observations of turtles in the last year by fishermen (n=42) in Chittagong Division, Bangladesh.**

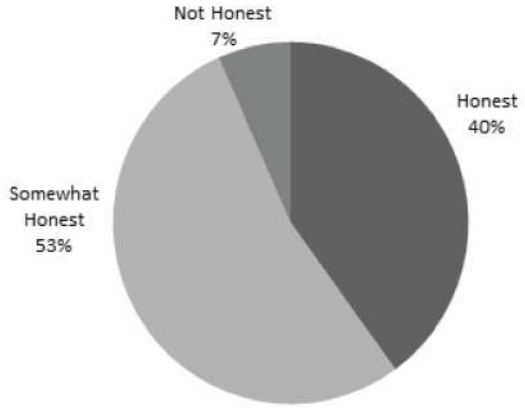


**Figure 7. Interviewers perceptions of fishers openness and honesty when responding to questions about bycatch.**

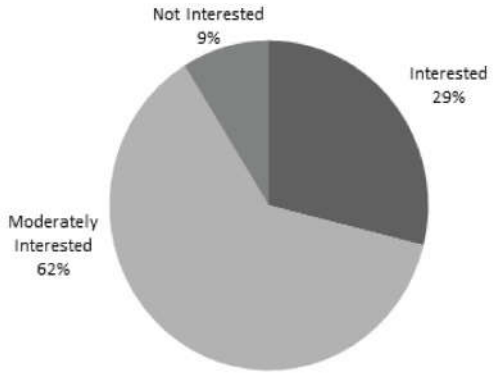


**Figure 8. Interviewers perceptions of fishers interest and engagement during the interview.**

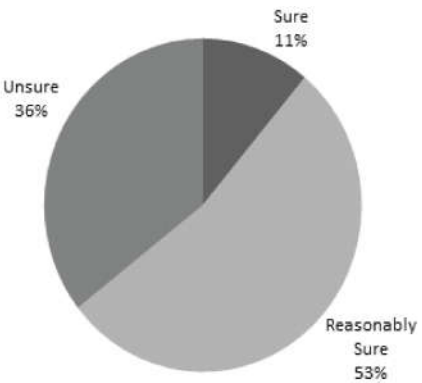


**Figure 9. Interviewers perceptions of fishers certainty about answers to numerical questions.**

sea turtles (Islam 2002).

**Table 6. Temporal variation in frequency of turtle captured by fishermen (n=42) in Chittagong Division, Bangladesh.**

| | Number of Turtles | | | |
|---|---|---|---|---|
| Time Period | 0 | 3-10 | 1-2 | >10 |
| Last year | 83.3% | 2.4% | 4.9% | 7.3% |
| Last 5 years | 78.0% | 2.4% | 2.4% | 17.1% |
| Lifetime | 78.0% | 0.0% | 0.0% | 22.0% |

**Table 7. Perceived trends in number of turtles and number of turtles caught by fishermen (n=42) in Chittagong Division, Bangladesh.**

| | Perceived Number of Turtles | | | |
|---|---|---|---|---|
| | More | Less | Same | Don't Know |
| # Turtles Caught | 11.9% | 66.7% | 11.9% | 9.5% |
| # Turtles Overall | 12.2% | 63.4% | 14.6% | 9.8% |

**Interviewer Perceptions of Interviewee Responses**

The four interviewers answered a series of confidential questions at the end of each individual interview, indicating their self-perception of participant's openness and honesty (Figure 7), interest and engagement (Figure 8), and certainty in answering numerical questions (Figure 9).The results indicate only moderate to low confidence among interviewers about most responses.

## CONCLUSION AND RECOMMENDATIONS

The current study suggests a low rate of sea turtle capture by fishers in the Chittagong Division of Bangladesh, but inconsistent responses among participants- for example, only ~20% of all respondents reported they had caught turtles while fishing during their lifetime, while ~93% responded to a question about disposal of turtles caught while fishing- and only low to moderate confidence among interviewers about the engagement of fishers during the interviews raise questions about the reliability of responses to the questions. Further research is required to better understand the practices of fishers in Bangladesh, including gear type and characteristics, fishing habitat, soak times, and capture rates. We suggest an onboard observer program is more likely to capture accurate information about turtle bycatch in coastal fisheries than interviews. However, if interviews are the only means by which information can be gathered, using the randomized response technique (RRT; see Keane *et al*., 2015) may help reduce problems due to non-response bias (e.g. unknown fishing habitat) and socially-desirable responses (e.g. naming a sea turtle species without confidence).

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# A SURVEY OF MARINE TURTLE BYCATCH AND FISHERFOLK ATTITUDE AT KALPITIYA, SRI LANKA

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Bycatch is a major threat to all five species of marine turtles that nest and/or forage in Sri Lankan territories (Ekanayake *et al.*, 2015). Fishing communities on the north-west coast of Sri Lanka depend on seasonal, artisanal gill net fisheries targeting pelagic shoaling fish. Previous studies have revealed that these fisheries experience unwanted and expensive interactions with olive ridley turtles (Kapurusinghe & Cooray, 2002; Rajakaruna *et al.*, 2009. The turtles actively seek and feed from gill nets containing captured fish, but in the process often become entangled, causing additional damage with each entanglement. Once turtles are entangled they may drown, but are more often hauled aboard fishing vessels alive and extremely aggressive. In response, fishers either beat the turtles' heads until they are rendered unconscious, or hack off the turtles' flippers to make disentanglement easier. The turtles are then either discarded at sea, or brought back to shore for illegal processing for their meat for local consumption. Harming and killing the turtles, or possessing their body parts, is prohibited under the 1972 Fauna and Flora Protection Ordinance of Sri Lanka (FFPO, 1972; amendment 1993 and 2009). Through these unwanted turtle interactions, fishing families are therefore compromised through the significant costs incurred in repairing damaged gear, as well as at risk of illegal activity under national legislation. Marine turtles are also endangered animals and play a key role as coastal biodiversity. Therefore, it is necessary to reduce unwanted interaction between fisher folk and marine turtles.

The overall objective of the study summarized in this report was to reduce turtle bycatch and mortality due to interactions with fishers and fishing gear, and promote marine turtle conservation among fishing communities in the Gulf of Mannar, off the Northwestern Province (NWP) of Sri Lanka. The activities described below took place between August 2014 and July 2015.

1. A beach survey was conducted along the coast from Chilaw to Kalpitya, to count both the number of dead turtles washed ashore and any remains of turtles killed for consumption, in order to assess the geographic range and frequency of turtle bycatch. Based on initial results, the