

New insights into the distribution of the gharial *Gavialis gangeticus* in Bangladesh from the analysis of news reports

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The gharial *Gavialis gangeticus* Gmelin, 1789, is a fish-eating crocodile that is Critically Endangered and has already become extinct in Pakistan, Myanmar, and Bhutan (Lang, 2019; Uetz, 2021). The current distribution of this species includes some restricted localities in north India, the lowlands of Nepal, and in Bangladesh - the Padma-Brahmaputra basin (i.e. the major river system). Only 300–900 mature individuals of this species are surviving and its range in Bangladesh is very confined (Lang, 2019) where it is rare, but present in the rivers Padma, Jamuna and Brahmaputra (Khan, 2008; Chakma, 2009; Hasan et al., 2014; Jaman, 2015).

In Bangladesh, gharials are occasionally found as by-catch in fishing nets (IUCN Bangladesh, 2016). Limited information on gharials is available from the published literature (Sarker et al., 2003; 2008; Rashid et al., 2014; IUCN Bangladesh, 2016). The majority of these information sources used interviews

and questionnaire surveys for data collection, with little data coming from direct observation. Here, we assess news reports of gharial catch from 2016 to 2022 (until August) in Bangladesh, and investigate trends in catch by year and month, fate after catch, and identify the likely hotspots of occurrence.

We searched online news portals for news reports of gharials. We searched by keywords (e.g. gharial, river, fisherman) on Google using English and Bengali language (the official and native language of Bangladesh). We used combinations of the keywords to do this, such as ‘gharial’ + ‘rescue/dead’, ‘gharial’ + ‘river name’ + ‘district name’ and ‘gharial’ + ‘rescue/dead’ + ‘fisherman’ etc. We used information such as date and location of the incident to avoid duplicate records in the dataset. For each report, we recorded the following information: 1) day, 2) month, 3) year, 4) district, 5) river where caught, 6) condition which was ‘rescued and

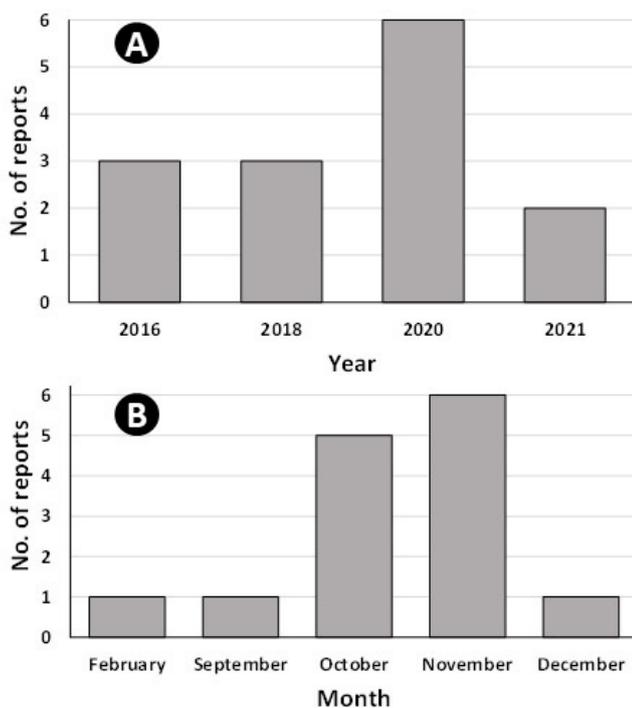


Figure 1. Number of reports of gharial catch in the river systems of Bangladesh from 2016 to August 2022 by - **A.** Year, and **B.** Month

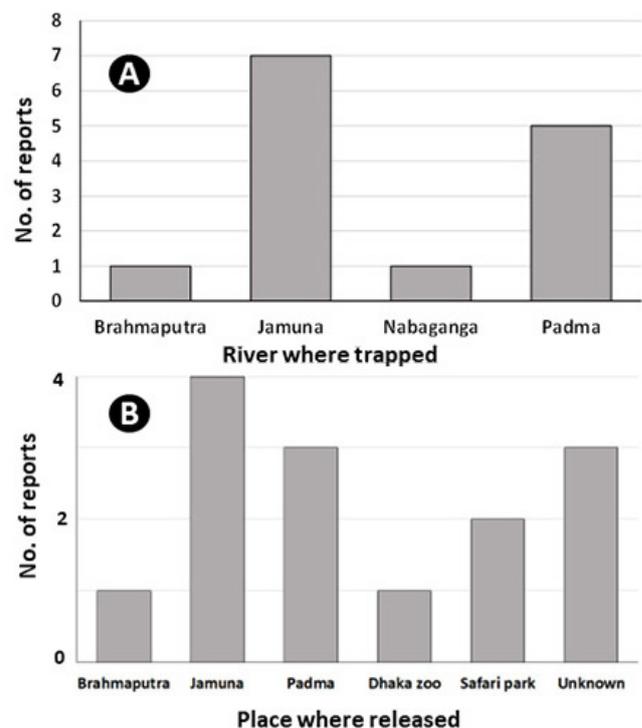


Figure 2. The number of reports of gharials in the river systems of Bangladesh from 2016 to August 2022 by - **A.** Where trapped, and **B.** Where released

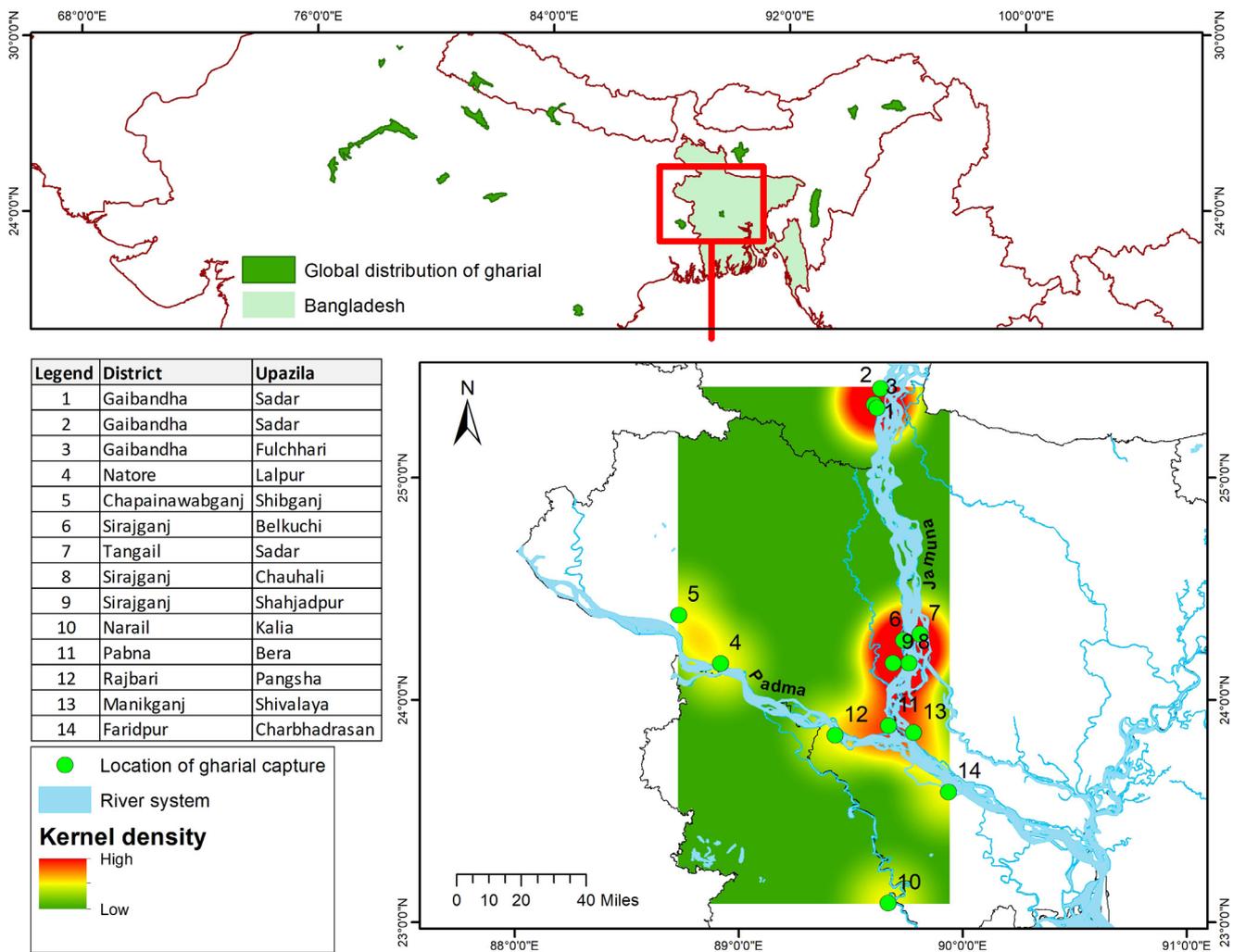


Figure 3. Map showing the full range of the gharial at the top, below the records of gharial captures in Bangladesh collected in the present study and the gharial hotspots inferred from them

released’, ‘rescued for captive breeding’, or ‘unknown’, 7) place of release, 8) exact location of gharial catch with GPS, 9) number of individual, and 10) cause of capture/trap. We extracted location data (GPS) using Google Maps from the centre of the area, if not specified clearly in the report. We produced a map showing hotspots with the Kernel Density function by ArcMap (version 10.3). We used chi-square test to examine the significant differences in the categorised data among years and months. All plots and analyses were done in R version 3.4.4 (R Core Team, 2018).

A total of 14 reports on gharial catch have been recorded, of which 42.86 % (n = 6) were from 2020. No reports have been found for 2017 or 2019 (Fig. 1). The number of reports between years did not differ significantly ($\chi^2 = 2.571$, df = 3, p = 0.463). All the reports stated that gharials were caught in fishing nets, all of them were entangled in the dry season, and all gharials reported in the news were 70 to 165 cm long which is the typical size range of sub-adult gharials. The highest catch was found in the month of November (n = 6, 42.86 %) followed by October (n = 5, 35.71 %) but the monthly reports did not differ significantly ($\chi^2 = 8.857$, df = 4, p = 0.064) (Fig. 1).

The fourteen gharials were trapped in four rivers of Bangladesh. Among them, the maximum was recorded for

Jamuna (n = 7, 50 %) followed by Padma (n = 5, 35.71 %) and single individuals were found for the rivers Brahmaputra and Nabaganga. The variation in gharial capture rate was not significantly different for the four rivers ($\chi^2 = 7.714$, df = 3, p = 0.052). Eight of the 14 gharials captured were rescued and released on-site, three were collected for captive breeding and kept in safari park (n = 2) and zoo (n = 1) (Fig. 2). The other three individuals were entangled in fishing nets but their subsequent fate was not reported.

The trapped gharials in the reports came from ten districts and all of these districts are situated adjacent to waterbodies. Among them, three reports were from upstream of the Jamuna river (Gaibandha) and formed a small hotspot. While five were from downstream of the Jamuna river (Sirajganj, Tangail and Manikganj) and two at the junction of Padma-Jamuna (Pabna and Rajbari) forming the largest hotspot (Fig. 3). The other records from upstream and downstream of Padma along with Nabaganga showed a lower density.

It is evident from the reports that gharials have been using the major rivers as well as their tributaries and distributaries. People living in these areas are principally dependent on the agro-fisheries sector for their livelihood. All the records we obtained of the gharials were caught in fishing nets, which

Table 1. Number of records of gharials from different time periods in different rivers according to IUCN Bangladesh (2016) and the current study*, which is based on news reports, all other studies used questionnaire surveys

Time period	Padma	Jamuna	Brahmaputra	Nabaganga	Teesta	Mahananda	Total
2016–2022*	5	7	1	1	0	0	14
2000–2015	39	17	1	0	0	1	58
1980–1999	16	24	0	0	0	0	40
1955–1979	9	15	0	0	1	0	25

are a serious threat to the gharial throughout its range (IUCN Bangladesh, 2016). Rashid et al. (2014) collected gharial catch reports which documented the trapping of 21 gharials in fishing nets from 2009 to 2012. This indicates that the gharial population may have been much higher previously, compared to the present time. In the case of these 21 gharials, 17 were released on-site and 4 were taken for breeding purposes (two in Dhaka zoo and Rajshahi zoo, both died later, and two in Bhawal National Park). We documented three cases of gharials taken into captivity, where two individuals caught in the Padma river were sent to a safari park and one caught in the Jamuna river was sent to Dhaka zoo. None of the individuals that were released on-site were injured and we found no incidents of killing or death in captivity.

Until the late 1980s, gharials were known to nest regularly in Bangladesh at sites including - Char Khidirpur (Padma river); Pechakhola, Pabna district and Baladuba Char, Kurigram district (Jamuna river) (Rashid et al., 2014). The present study did not find any records of nesting or breeding gharials. The gharials reported in the news were sub-adults and from this we assume the likely occurrence of breeding or adult individual near the hotspots identified.

The full range of the species shown in the upper portion of Figure 3 suggests that gharial is present specifically at the junction of the Jamuna-Padma river (Fig. 3). However, we found a greater number of records of the species elsewhere. Most records were from the Jamuna river and the hotspot analysis highlights this area. The previous surveys in different rivers suggested a relatively high population in both the Padma and Jamuna rivers (Table 1). No individual was previously recorded from Nabaganga river and the present study found no records of any gharials in the Teesta and Mahananda rivers (Table 1).

Based on the previous data (Table 1), IUCN Bangladesh (2016) identified four hotspots in the Padma and one in the Jamuna river. The Kajla hotspot of the Jamuna river, located in Sariakandi, Bogura, is near to the hotspot of Gaibandha recognised in this study. The four hotspots identified in the Padma river are located in Chapainawabganj and Rajshahi districts. From the current analysis, we found a large hotspot downstream of the Jamuna at its junction of the Padma river.

We recommend initiating an immediate monitoring programme for released gharial individuals as well as a rigorous systematic survey of the gharial population in the Padma-Jamuna river system to record abundance, distribution and the identification of potential breeding

grounds. Once identified these should be declared as protected areas and supported with an awareness campaign for fishermen.

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