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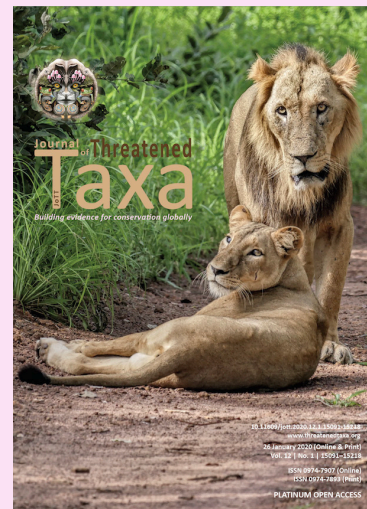
## COMMUNICATION

### STATUS, DISTRIBUTION, THREATS, AND CONSERVATION OF THE GANGES RIVER DOLPHIN *PLATANISTA GANGETICA* (MAMMALIA: ARTIODACTYLA: CETACEA) IN NEPAL

Deep Narayan Shah, Amit Poudyal, Gopal Sharma, Sarah Levine, Naresh Subedi & Maheshwar Dhakal

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## Status, distribution, threats, and conservation of the Ganges River Dolphin *Platanista gangetica* (Mammalia: Artiodactyla: Cetacea) in Nepal

Deep Narayan Shah<sup>1</sup> , Amit Poudyal<sup>2</sup> , Gopal Sharma<sup>3</sup> , Sarah Levine<sup>4</sup> ,  
Naresh Subedi<sup>5</sup> & Maheshwar Dhakal<sup>6</sup>

<sup>1</sup> Central Department of Environmental Science, Tribhuvan University, Kirtipur, P.O. Box 20791, Kathmandu, Nepal.

<sup>1,2</sup> International Union for Conservation of Nature, Kupondole, Lalitpur, P.O. Box 3923, Kathmandu, Nepal.

<sup>3</sup> Zoological Survey of India, Gangetic Plains Regional Centre, Sector-8, Bahadurpur Housing Colony, Patna, Bihar 800026, India.

<sup>4</sup> 25 HaKovshim Zichron Yaakov, 3094306 Israel.

<sup>5</sup> National Trust for Nature Conservation, Khumaltar, Lalitpur, Nepal.

<sup>6</sup> Biodiversity and Environment Division, Ministry of Forests and Environment, Government of Nepal, Kathmandu, Nepal.

<sup>1</sup> dnshah@cde.edu.np (corresponding author), <sup>2</sup> amit.poudyal@iucn.org, <sup>3</sup> gopal\_dolphinboy@rediffmail.com,

<sup>4</sup> lev.sarah1@gmail.com, <sup>5</sup> nareshsubedi@gmail.com, <sup>6</sup> maheshwar.dhakal@gmail.com

**Abstract:** The Ganges River Dolphin *Platanista gangetica* has been classified as Endangered in the IUCN Red List of Threatened Species. The IUCN changed its status from 'Vulnerable' to 'Endangered' in 1996 as the species population was declining in its entire distribution range. It is, however, classified as 'Critically Endangered' in Nepal. Historically, the freshwater cetacean has been documented in the Karnali, Koshi, Narayani, and Mahakali basins. With their population and distribution range in decline, the Ganges River Dolphin (GRD) is no longer found in the Mahakali River system, which demarcates and traverses the Western border of India and Nepal. This study examines the status and distribution of the GRD in the river systems of Nepal during the monsoon of 2016. The national dolphin population survey was conducted in the three largest river basins in Nepal—Karnali, Narayani, and Koshi. Each of the three basins represent the extreme upstream limit of the GRD distribution in Ganges River basin. The national population survey included both a boat-based survey and shore-based synchronized counting in each of the three river systems. Fifty-two (Best-High-Low: 52-61-50) dolphins were counted during the entire nationwide survey, conducted in July–August, 2016. Researchers gathered social-data from locals residing alongside the observed basin, giving priority to artisanal fishers and those subsisting to some degree from the rivers known to host the river dolphin. A questionnaire survey of ninety-two residents from riparian villages adjacent to the GRD hotspots sheds light on the local perspectives towards dolphin conservation coupled with an assessment of their socio-economic status; artisanal fishing practices; and their awareness of dolphin conservation. According to the survey, notable threats to dolphin conservation are prey depletion; non-availability of suitable habitat; habitat fragmentation and a low level of awareness. Based on the counting outcomes and social survey, recommendations have been put forward for the conservation of this species.

**Keywords:** Conservation, Ganges River Dolphin, large rivers, national survey, Nepal.

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## INTRODUCTION

The Ganges River Dolphin *Platanista gangetica gangetica* is one of the four obligate freshwater dolphin species found in the world. Of all the four obligate species, both the Ganges and Indus River Dolphin species hold the most ancient evolutionary lineage, separated from all other cetaceans by around 30 million years ago (Turvey 2009). The Ganges River Dolphin inhabits the Ganges-Brahmaputra-Meghna River (GBM) and the Karnaphuli-Sangu (KS) River systems of Nepal, India, and Bangladesh (Jones 1982; Mohan 1989; Reeves & Brownell 1989; Shrestha 1989; Reeves et al. 1993).

Historically, water development projects such as construction of over 50 dams and barrages within the historical range of the Ganges River Dolphin (Smith et al. 2000, 2012), toxic contamination (Kannan et al. 1993, 1994, 1997; Senthilkumar et al. 1999; Yeung et al. 2009) and incidental killings by fishing gear (Mohan 1995; Smith & Reeves 2000; Sinha 2002) are considered as the significant reasons for the decline of the species and ecological integrity of its habitats. Moreover, the reduction of prey along with alterations to the physical integrity of the GBM are contributing to the species' decline.

In Nepal, the Ganges River Dolphin is protected by Section 10 of the National Parks and Wildlife Conservation Act 1973 and is among 27 protected mammals in Schedule I (HMGN 1973). Despite the population concentrated in the Karnali and Koshi rivers being classified as Endangered (Baillie & Groombridge 1996), the freshwater cetacean species has received relatively less national attention in comparison to other megafauna casting a shadow over the works by conservation leaders in this specific ecozone (Paudel et al. 2015).

Regular assessments of the dolphin and its habitat by the scientific community are imperative for the implementation, monitoring and evaluation of future river dolphin conservation action plans (Smith & Reeves 2000). In this regard, the International Union for Conservation of Nature (IUCN Nepal), Department of National Parks and Wildlife Conservation (DNPWC) and National Trust for Nature Conservation (NTNC) jointly conducted a nationwide dolphin population survey in Nepal. The major objectives were: (1) to assess status and distribution of dolphins in Nepal during the monsoon season, (2) to assess conservation threats to dolphins, and (3) to assess the socio-economic status, local fishing practices, and awareness and perception on dolphin conservation of the people living in the vicinity

of dolphins. This study is unique and first of its kind as it uses standard methodologies and covers all possible dolphin habitats in Nepal during the monsoon season.

## MATERIALS AND METHODS

### Study sites

The dolphin population survey was conducted in the three largest river basins of Nepal (Figure 1), i.e., Karnali (Figure 2) and its tributary Mohana (Figure 3), Narayani (Figure 4), and Koshi (Figure 5) where the Ganges River Dolphin have been documented till date. These rivers represent the extreme upstream limits of the Gangetic Dolphin distribution in the Ganges basin. These river basins extend from the Tibetan Plateau to the lower Himalayas with rivers sourced from snow packs in the high Himalaya, glaciers, and glacial lakes; and from the Siwalik Hills. As the waters flow southward into the plains of the Terai region, residents of the shared watersheds greatly depend on agriculture and fishing, resulting in an increased spatial overlap between the dolphins and commercial as well as artisanal fishers (Paudel et al. 2015).

### Methods

We followed the survey methods recommended by Smith & Reeves (2000) that includes both a boat-based survey and a shore-based synchronized counting in each of the three river systems.

**Shore Based Survey:** Similar to the methods applied in the past population surveys of the dolphin in Koshi River (Khatrri et al. 2010) and Karnali River (WWF 2006), the shore-based synchronized counting-hotspots were identified on the basis of literature reviews coupled with secondary data obtained from key informant interviews and local consultations. The total number of counting hotspots identified within each basin are the following: 15 hotspots in Mohana and its tributaries (Figure 3); 9 in Geruwa and Karnali (Figure 2); 4 in Narayani (Figure 4) and 11 in Koshi (Figure 5). To avoid double counting, the surveys were conducted simultaneously at all hotspots within each basin and lasted for a duration of three hours, sub-divided into six observation times with 30-minute duration each. The population survey took place for two days in each location allowing for greater robustness of data by decreasing error from other factors (including weather, water level/flow, double counting). Observations were repeated on 2016 July 25 and 26 in Mohana and its tributaries; 2016 July 27 and 28 in Geruwa and Karnali in parallel; 2016 August 19 and

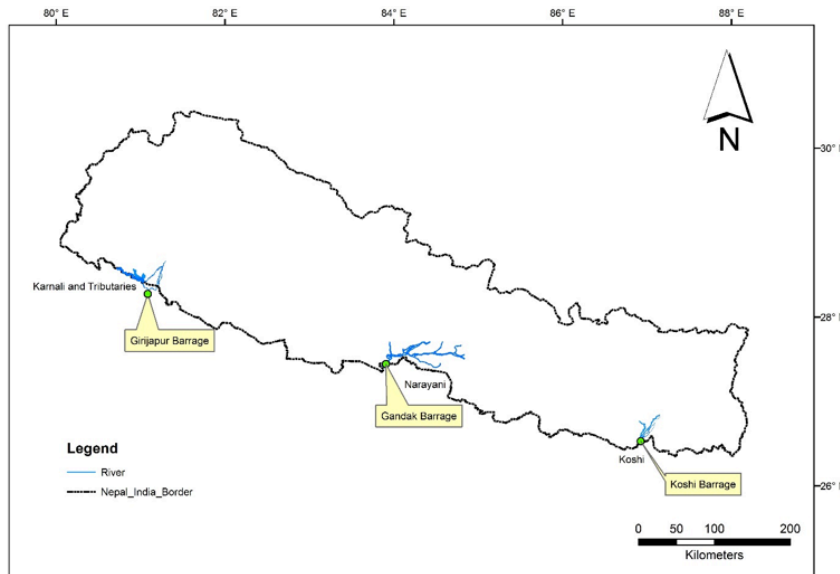


Figure 1. The studied rivers of Nepal namely (from left to right) Mohana, Karnali, Narayani, and Koshi.

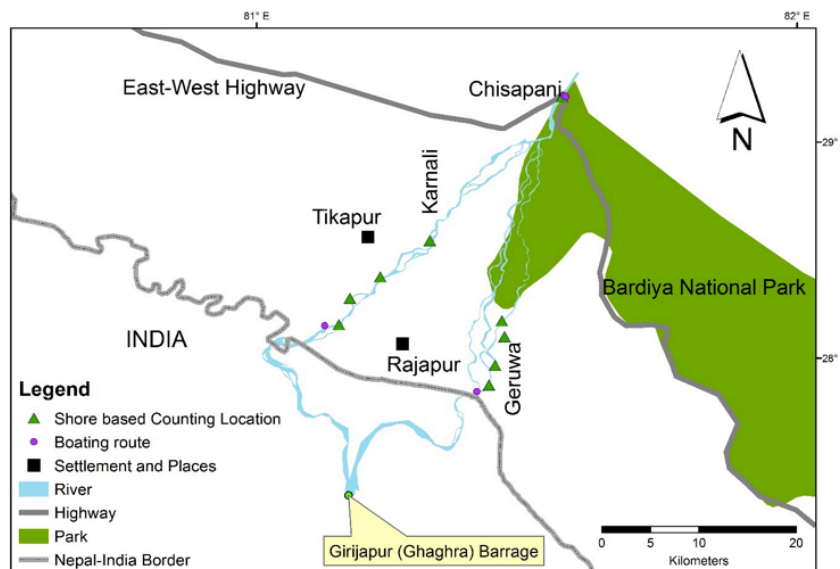


Figure 2. The surveyed areas in Karnali and Geruwa rivers, Nepal.

20 in Koshi; and 2016 August 22 and 23 in the Narayani River.

**Boat-based Survey:** The boat-based counting was performed in a single rowing boat, travelling approximately 8km/h following a mid-channel route with multiple observers on board (at least two primary observers in the front, two observers in the back and two observers on each side). This allowed counting the dolphins that surfaced at least once within the range of detection and avoided double counting. To minimize the risks of perception-bias, the observers' positions were rotated every two hours.

During boat-based surveys, there are inherent risks

of missing a proportion of animals in the observed basin when dolphins are submerged and out of view, resulting in a negative-bias due to the lack of correction factors for availability and perception.

There are also inherent losses of data when national surveys are performed on species that transcend political boundaries. The authors recommend the results be integrated with concurrent data from other survey methods to estimate the abundance of river dolphin in Nepal during the monsoon season as well as those during the dry season. These data will greatly improve our understanding of dolphin populations whose summer home ranges extend across international boundaries



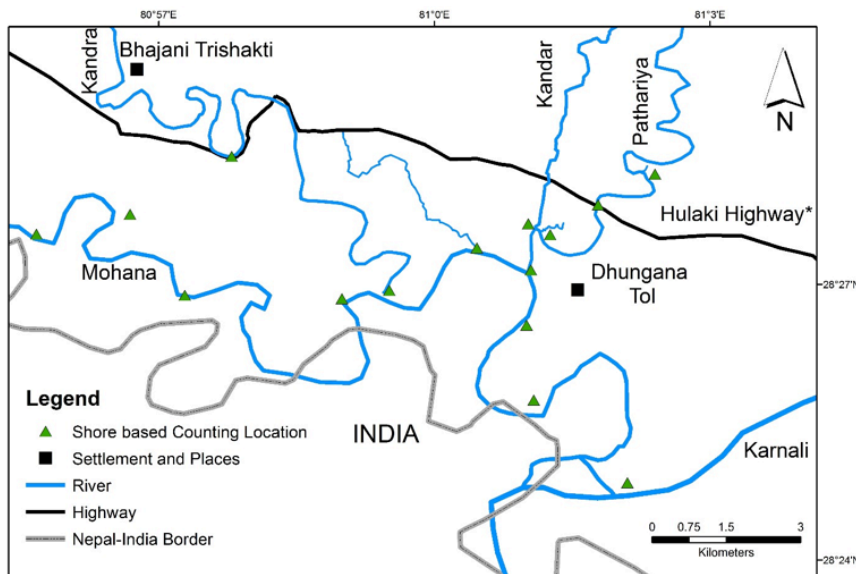


Figure 3. The surveyed areas in Mohana and its tributaries. Mohana is a right tributary of Karnali River. The Nepal-India border shown in this figure is not in scale.

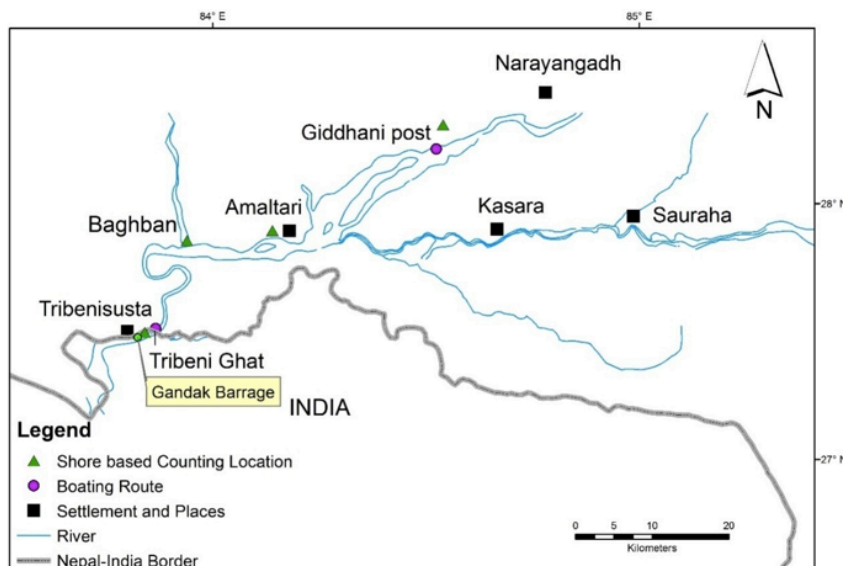


Figure 4. The surveyed areas in Narayani River, Nepal.

into Nepal and improve our ability to provide advice for conservation within Nepal, specifically with regards to proposed development projects in and alongside the rivers.

**Social Survey:** Altogether 92 respondents were selected at random, based on their dependence on the observed basins that host river dolphin hotspots. In addition, an informal discussion was conducted with the officials of Bardia National Park, Chitwan National Park, Koshi Tappu Wildlife Reserve and with the members of respective buffer zone committees. Respondents were inquired about local fishing practices; their attitudes toward dolphin conservation; historical accounts of dolphin abundance; perceived threats to the dolphins;

potential pollution in the area, and basic socioeconomic demographics.

### Data Analysis

The dolphin population survey results were made at best, high and low estimates. High and low estimates are used to reflect the confidence of observers coupled with the accuracy of the best estimate. Identical best, high, and low estimates indicate a high level of confidence in the best estimate. The direct count and local sightings of dolphins were mapped using GPS points taken during the survey. Multiple counting of the same individuals was avoided by recording the location and time of sightings and by noting distinctive physical characteristics such as length of the rostrum and body size.

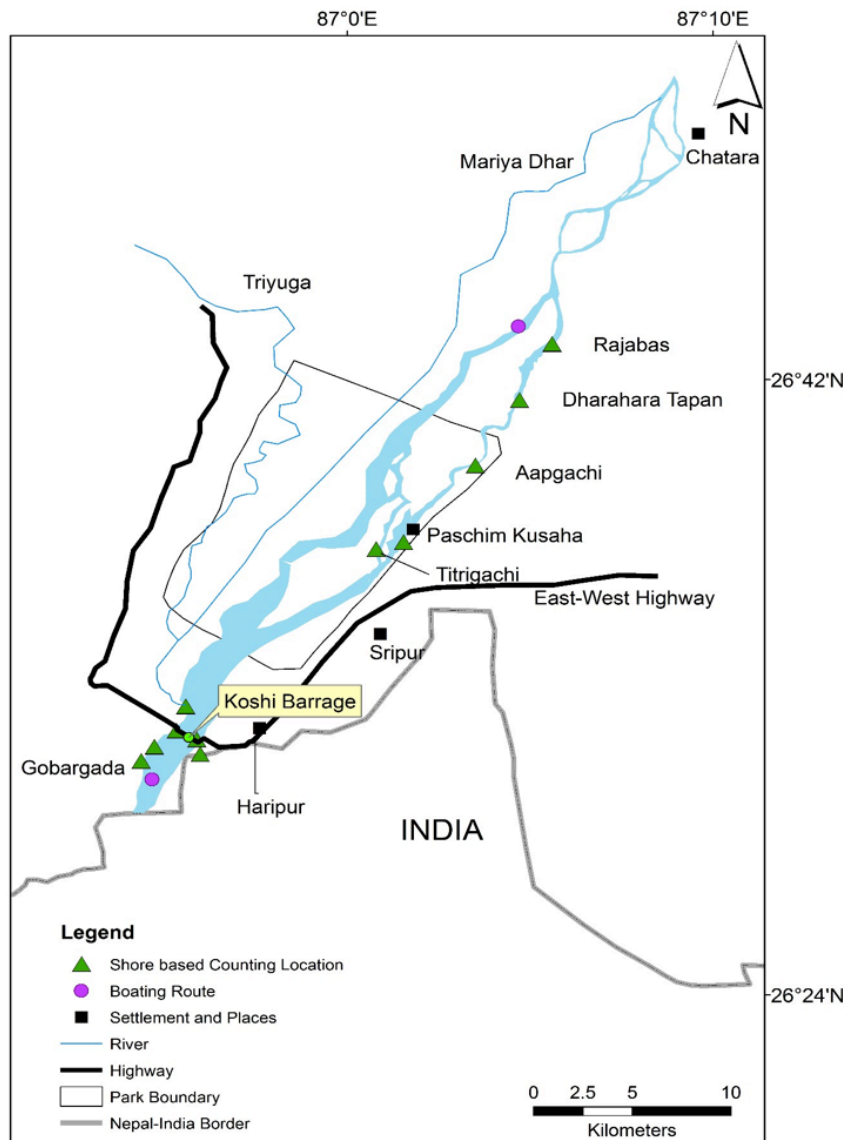


Figure 5. The surveyed areas in Koshi River, Nepal.

## RESULTS AND DISCUSSION

The population of Ganges River Dolphin (Image 1) in the Karnali, Narayani, and Koshi rivers of Nepal was estimated at best 52 individuals. The high estimation was 61 and the low was 50 individuals in the three basins observed in Nepal's monsoon season (Table 1). Local sightings of the dolphins have also been made apart from the official population survey. Two local sightings in Mohana at Helauna Baba Ghat, two local sightings in Geruwa, and two local sightings in Narayani were made apart from the official population survey. In Mohana and its tributaries, mostly the mother and calf were observed.

The number of dolphins varied seasonally in relation

to the water levels in Mohana and its tributaries. During monsoon the dolphins ascend into the tributaries of Karnali River (Sinha & Kannan 2014). Notably it was seen in Mohana and its tributaries but during dry periods, most of its tributaries dry out causing the dolphins to reside in deeper water of the main channel. In Karnali and Geruwa rivers no dolphins were counted within the surveyed area, however, there were local sightings of two dolphins in Geruwa prior to our population survey. We attributed this to the possibilities of high water levels and turbulent flows to the absence of dolphins in Geruwa as well as Karnali River. Hence, it is important to ensure that threats to dolphins are minimized in the larger main rivers (Karnali and Geruwa) during the dry-season, but for Mohana threats need to be addressed mainly during the monsoon season. No dolphin was



Image 1. Ganges River Dolphin *Platanista gangetica* in Mohana River, Nepal. © Amit Poudyal/ IUCN.

sighted in Narayani River during our survey, however, two dolphins were spotted by other surveyors during April 2016. In Koshi, dolphins were observed both in the upstream and downstream of the Koshi Barrage.

Among the respondents of our household-based survey, about 44 percent were engaged in fishing practices. Indigenous groups such as the Tharu and Magars were mostly engaged in fishing but not the non-ethnic groups like Brahmin and Chettri. A majority of the artisanal fishers used traditional fishing nets like tiyari, balchi (hooks), Chatijaal, Khepnijaal, Haatajaal, Khokrijaal for fishing. About 66 percent of the respondents had a prior knowledge of Mahajaal (large seines). It was, however, not in practice in any of the surveyed areas.

In Karnali, fishing is for both domestic consumption and commercial purpose. While fishing is prohibited within the Bardia National Park boundary and certain sections of Chisapani areas, licenses are provided by the District Development Committee (DDC) for fishing in the river falling outside the national park's jurisdiction. Generally, one person acquires the contract and grants permit to other fishermen by levying a nominal amount. Likewise in Narayani, fishers use a traditional net for catching fish for domestic consumption though fishing is prohibited inside Chitwan National Park. Similarly, in Koshi River, both commercial and domestic fishing is practiced. While fishing is prohibited within the core area of Koshi Tappu Wildlife Reserve, licenses are provided by the Koshi Tappu Wildlife Reserve Office to fish in the river falling within the buffer zone.

Fishing is intense in all the studied rivers. There remains a paucity of scientific evidence with regards to competition between fishers and dolphins for fish, however, there are known negative impacts on dolphins due to specific fishing methods when river depth decreases. Following the flood (2012–2015) of the

Table 1. Dolphin counts in different rivers of Nepal during July–August 2016.

	Name of the river	Length of river surveyed (km)	No. of dolphins sighted/best estimate
1	Mohana and its tributaries	26	43
2	Karnali	35	NS
3	Geruwa	37	NS
4	Narayani	57	NS
5	Koshi	49	9

\*NS – Not Sighted during the official dolphin population survey, could be due to perception bias and high water levels as the surveys were done during the monsoon season.

Karnali Basin, dolphins were seldom seen in the Geruwa channel but one fatality was recorded in 2013. Given that fishing intensity is greater in the Karnali Channel, the population estimated by our team is seen to be in an ecological trap (Khanal et al. 2016). To boost the abundance of dolphin, fishing in preferred channels and hotspots should be restricted or confined to limited periods with respect to river depths. For sustainable conservation practice, the concerned authorities are encouraged to demotivate fishing by supporting alternative livelihood enhancement programs with consideration to the cultural and ethnic needs of the targeted communities.

As stated in the beginning of the paper, this study is unique as this is a nation-wide survey performed during the monsoon season. Flagship species tourism has the potential to raise funds for conservation and improve the economic conditions surrounding the dolphin habitats according to local and conservationists' opinion. Bardia National Park visitation has grown nearly three-fold within two decades (BNP 2018/ 2019).

Collaboration between scientific bodies and federal government to survey dolphins in the monsoon allows the government to realize the potential in investing in the ecological resilience of such charismatic megafauna during a season that otherwise experiences a decline in tourism throughout the year.

The population reduction of the species' geographical range due to habitat fragmentation (Khanal et al. 2016) and ecological degradation is one of the indispensable characteristics of river dolphin population decline and extinction (Turvey et al. 2010). Anthropogenic activities such as construction of dams/ barrages, irrigation schemes, and intensive and unregulated fishing have invariably harmed aquatic organisms (Smith 1993; Kelkar et al. 2010).

The dearth of riverine conservation policy, its enforcement and local stewardship allows the species' population to continue its decline. Therefore, we see both the formulation and active enforcement of National and Trans-boundary Dolphin Conservation Strategy and Action Plans as imperative for the survival of the species.

The environmental stress affecting the studied basins is not expected to abate in the immediate future. At present, there is no single transboundary, national or inter-province based agreement to regulate basin volume which is threatened by increased agricultural demand for irrigation (Khanal et al. 2016), proposed hydropower in the Karnali Chisapani (10,800 MW); and pollution, rapid sand and rock mining, and fishing practices.

Further investigation into banning the use of chemical fertilizers and pesticides which might negatively affect the aquatic life by way of bioaccumulation is suggested. This coupled with localized enforcement of fishing methods with respect to locations, quantities and season may help conserve the species. With consideration to indigenous subsistence artisanal fishers, the pressure on the shared basins must be monitored and managed by locals, who are incentivized by the notion of co-management or alternative livelihood enhancement programs.

Inter-province collaboration must take place for the enforcement of laws with consideration to the watersheds divided by the provinces of Nepal. Both Koshi and Karnali basins are divided into two separate provinces. The known habitats for the Ganges River Dolphin are provinces one and two of Koshi and six and seven of Karnali.

Lastly, we propose the Government of Nepal to establish a sanctuary for the Ganges River Dolphin for its conservation. The creation of the Vikramshila Sanctuary

of Bihar, India has proven beneficial for the survival of the species.

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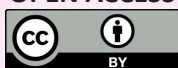
**Author details:** DR. DEEP NARAYAN SHAH has expertise in freshwater science, biogeography, restoration ecology, environment management tools and water governance. MR. AMIT POUDYAL has an experience of more than 12 years in broadcast, print and online media. DR. GOPAL SHARMA is currently involved in the Gangetic Dolphin Data analysis and he recently conducted a survey in the main stream of Ganga in Bihar apart from his original taxonomic study of aquatic macroinvertebrates of the Gangetic Plains in India. MS. SARAH LEVINE is the founder of the Himalayan Outdoor Center, a partnership with the WILD Foundation's Project Coalition Wild that leads the country in watershed expeditions to further support conservation initiatives in Nepal. DR. NARESH SUBEDI works as Conservation Program Manager at National Trust for Nature Conservation in Nepal. He is specialized on large mammals' conservation and research. DR. MAHESHWAR DHAKAL is serving as the chief of the climate change management division in the ministry. He has a strong background on biodiversity and climate change policy issues in Nepal.

**Author contributions:** DNS conceived the project, led the field study and wrote up the paper. DNS and GS designed the field methods. AP and GS joined the survey team in the Karnali River basin. SL edited the manuscript. All authors read and approved the manuscript. The authors declare no conflict of interest.





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