The Gangetic dolphins plead for mercy

The Ganges river dolphins (*Platinista gangetica* Roxb. subsp. *gangetica*) are endangered, obligate freshwater cetacean species, endemic to Ganges–Brahmaputra–Megna and Karnaphuli–Sangu river systems in India, Nepal and Bangladesh[1]. There were about 4000–5000 individuals in 1982, but in a short span of 15 years, their number has declined abysmally by 50% and further to less than 2000 with annual mortality of 130–160 individuals[2–4]. This resulted in the declaration of their IUCN status from vulnerable to endangered[5,6].

Causes for decline in the population of dolphins were explored, mainly in the tributaries of River Ganga within the states of Uttar Pradesh (UP) and Bihar – the Burhi Gandak, Gandak, Ghagra, Gomti, Kosi, Saryu, Rapti, Yamuna and their tributaries. Till 1982 numerous dolphins were sighted from July to September during the rainy season in almost all these rivers, but slowly their numbers started decreasing with every passing year. By 2005, the sight of even a single dolphin, once a part of our natural aquatic heritage, became rare and a subject of great curiosity, as they vanished from these tributaries.

At the zenith of the aquatic food chain, the Gangetic dolphins epitomize the life and wealth of biodiversity in the River Ganga and play a vital role in maintaining the essential balance of the river ecosystem. Their approximate life-span is 30–35 years; they attain reproductive maturity at 10–12 years of age when they weigh about 100–150 kg. Breeding season extends from January to June. Each female gives birth to only one calf in 2–3 years, with a gestation period of 9–11 months. Therefore, one female rears only 4–6 calves in its lifetime. The slow multiplication rate is therefore dependent on female survival ratio compared to that of the males.

Figure 1. A gestating female dolphin trapped in fishing net and drowned.

A dolphin measuring 1 m in length is considered as calf, 1–1.8 m as an adolescent and more than 1.8 m as an adult. The adult females grow up to 2.7 m in length (larger than males which grow up to 2.15 m) and can easily be identified by their size and conspicuous upward curve of snout. The Gangetic river dolphin is not a selective feeder, but is a catholic feeder eating whatever fish species is locally available. They feed on crustaceans, insect larva, molluscs, small fishes, small soft-celled turtles and zooplanktons.

Although dolphins enjoy high level of legal protection nationally as well as internationally, their numbers are continuously declining at an alarming rate in the absence of coordinated conservation planning, lack of awareness, etc. Development pressures in the form of construction of various dams and barrages, and diversion and extraction of large quantities of water have reduced the flow in rivers. As a result, the rivers have become shallow, obstructing local movement and migratory routes of the dolphins, which prefer 1.5–4.5 m water depth with availability of temperature gradient and food at different trophic levels of the river system. Further, the shallow waters adversely affect their breeding activities[7]. River water pollution in the form of factory effluents, garbage and dead body disposal, coupled with sand mining and fishing activities, alters the substrate composition as well as fish spawning and rearing habitats causing habitat fragmentation for these priceless keystone species of the Ganga river ecosystem.

Anthropogenic pressures pose additional threats to the Gangetic dolphins. Dolphin hunting and slaughter was common in UP and Bihar till 1985, for meat and extraction of dolphin oil from the blubber used chiefly as fish bait, and lantern oil as it has 8–10 times more longevity, aphrodisiac, massage oil and for relief from joint pains, as well as for making soaps and in tanning industry. However, in subsequent decades due to scarcity and drastic population collapse of the dolphins, these activities declined automatically, but indiscriminate fishing still continued erratically. The shrunken, small population of dolphins is currently restricted to short patches in the Ganga and Gandak in UP and Bihar. During rainy season when the rivers get flooded, some dolphins often get disoriented from their main course and stray into the tributaries and sometimes in narrower streams where fishing nets generally spread out at nights, become severe death traps for them. One such instance occurred recently in River Yamuna at Allahabad, where a pregnant female dolphin got trapped in a fishing net and drowned (Figure 1).

In the above context we draw attention towards conservation of our national aquatic animal – the Ganges dolphin, as its population is currently exposed to various threats. The species might even face extinction in near future if all these demographic pressures continue to operate. The most essential need is to save the River Ganga and its tributaries from pollutant influx through strict implementation of effluent treatment measures of various factories and city sewage. A check on sand mining is also essential to conserve the dolphin habitat, coupled with reforestation of river banks for preventing soil erosion and siltation of the river-beds. Further, the seasonal alteration in river water levels with resultant change in its flow impedes the movement of dolphins. This can best be checked if water management through dams, barrages and canals is regulated sustainably for continuous, steady water flow round the year in the river.

It is also urged strongly that spreading out ‘fish nets’ for long hours overnight needs to be discontinued during the rainy season from June to September as well as January to June, which is the potential gestation period of the females. Further, protection and conservation of other small fishes is also vital during this period to offer healthy food to the gestating dolphin females, which tend to wander-off from their normal tracks and groups into the laterally dichotomizing tributaries and narrower streams. The method of fishing through nets may be replaced by more refined alternative means aimed at trapping only target

fishes. While the dolphin awareness programmes are already at work along Ganga river, we appeal to the Government and other concerned agencies to extend the programmes to tributaries of the Ganges in order to save the dolphins in these regions as well. Saving the life of a single dolphin, if it happens to be a female, can increase their numbers by 4–5 individuals.

1. Wakid, A., *Curr. Sci.*, 2009, **97**, 1143–1151.
2. Jones, S., *FAO Fish. Ser.*, 1982, **5**, 97–115.
3. Mohan, R. S. L., In *Biology and Conservation of the River Dolphins* (eds Perrin, W. F. *et al.*), IUCN, Gland, Switzerland, 1989, pp. 64–69.
4. Sinha, R. K. *et al.*, In *Biology and Conservation of Freshwater Cetaceans in Asia* (eds Reeves, R. R., Smith, B. D. and Kasuya, T.), IUCN, Gland, Switzerland, 2000, pp. 54–61.
5. Klinowska, M., *The IUCN Cetacean Red Data Book*, IUCN, Gland, Switzerland and Cambridge, UK, 1991, p. 429.
6. IUCN, *IUCN Red List of Threatened Animals*, IUCN, Gland, Switzerland and Cambridge, UK, 1996, p. 448.
7. Behera, S. K. and Rao, R. J., *J. Bombay Nat. Hist. Soc*., 1999, **96**, 43–47.

ACKNOWLEDGEMENTS. We thank the Director, Botanical Survey of India, Kolkata for facilities, and the villagers of Bihar and Uttar Pradesh for support during this study.

ARTI GARG
R. KR. SINGH*
S. L. GUPTA
VINEET SINGH
Y. A. SIDDIQUI

Botanical Survey of India,
Central Regional Centre,
10, Chatham Lines,
Allahabad 211 002, India
**e-mail: rksbsiadsingh@yahoo.co.in*

Sarasvati II

Current Science published an article by Valdiya[1] that is a long rebuttal of our study[2] published in *PNAS* in 2012 on the 'Fluvial landscapes of the Harappan civilization'. We will respond nevertheless to the challenge and its follow-up[3], although we were surprised that Valdiya did not submit his rebuttal to *PNAS* and would have preferred that his contributions focused on scientific issues only[4,5].

We thank Valdiya for his apology for his misattributions of text and opinion, but find his reply[3] to be insufficient as it is mostly dedicated to the perpetuation of an error, namely that we somehow ignored Indian contributions to the topic. Keeping in mind publication space restrictions, we did select relevant work but the selection criteria did not include the nationality of the authors! For the record, where Valdiya[3] finds only 3 papers by Indian authors we count 11 and these include a collection of 27 studies by Indian scientists.

In this letter we assess if Valdiya's article provides new and/or uncovers old evidence to seriously challenge our scholarship (Table 1). His critique primarily addresses one of the problems pursued in our original work: Did a glacier-fed Himalayan river, identified by some with the mythical Sarasvati, flow along the interfluve between the modern courses of Sutlej and Yamuna and, if yes, when?

For the sake of this discussion let us call the large perennial river system that was once active on the Sutlej–Yamuna (S–Y) interfluve Sarasvati, as we agree that this is the most likely location for the mythical river. Nobody would disagree with the need for more studies on the hydrogeology, eolian activity, tectonics, near-surface geology and geophysics, mineralogy, etc. of the S–Y interfluve and adjacent regions, as suggested by Valdiya, provided that such studies would have solid spatial and temporal information. For example, we see the high value of hydrogeological studies to expand pioneering work by, for example, Rao[6], and Geyh and Ploethner[7], which suggests that old groundwater on the S–Y interfluve and under the dunes of the Thar Desert has a probable lowland pluvial origin rather than Himalayan.

We also agree with Valdiya that climate is not the only forcing factor affecting rivers and people living along them, nor is it always dominant. However, for now, climate change provides a full and relatively well-supported explanation for disappearance of the Sarasvati, while no proposed theory for its capture that is based on either tectonic or morphodynamic causes has gathered enough evidence to be credible. Most importantly, these theories lack precise chronologies on well-documented outcrops and/or cores. So far there are no studies to link Himalayan rivers to their purported extension on the S–Y interfluve that have a reliable chronology for the time of interest (Holocene). References provided by Valdiya that we already consulted for our study do not unfortunately seem to change this state of affairs. Furthermore, where such chronologies exist or are being developed, downstream along the former palaeochannels of the S–Y interfluve, results are consistent with our data and interpretation. For example, luminescence dates presented by Gupta and colleagues indicate that the palaeochannel traced to the Sutlej[8,9] is much older than the Harappan era. New provenance work[10] supports our previous contention[11] that the other possible Himalayan source for Sarasvati, the Yamuna, has flown to the east during the Holocene. This is in accordance with our Cholistan data and upstream data from Saini *et al.*[12] and Saini and Mujtaba[13], which indicate that the river activity changed drastically on the S–Y interfluve well before Harappan times.

Our main geomorphological argument for a non-Himalayan Sarasvati is simple: the lack of wide incised valleys on the S–Y interfluve similar to the valleys of the Indus, Ganga, Yamuna and all Himalayan tributaries of the Indus, including Ravi, which is the smallest (see also Maemoku *et al.*[14]). Such large-scale features cannot be completely covered by wind along their entire course as argued by Valdiya; in fact, the much narrower Ghaggar incision (see figure 1 in our *PNAS* paper[2]) is still easily recognizable even at the edge of the Thar Desert. New data on dunes on both sides on the Ghaggar and Chautang courses show that they started to develop well before Harappan times, are continuing to do so today[14] and yet they leave intact channel traces visible on satellite imagery. A multitude of papers use interpretations of