



Orient BlackSwan



# **Nature** **without** **Borders**



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## Two RESTORING THE GANGA FOR ITS FAUNA AND FISHERIES

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### Blind Dolphins and Murky Waters

Across the Gangetic floodplains in North India, local people are familiar with the folklore of the mysterious 'Soons', a dark creature that materialises from the murky river and disappears instantly. Everyone knows it is not a fish, but very few know that it is a river dolphin, a mammal. This animal is the oldest cetacean species alive in evolutionary time, representing an ancient lineage of dolphin-like creatures living in the Tethys Sea, later uplifted during the formation of the Himalayan mountain range. Two species of 'true' river dolphins, today found only in the Amazon and the Indus-Ganges-Brahmaputra systems, are unique freshwater mammals entirely dependent on river habitats for their survival. Of these, the Ganges river dolphin<sup>1</sup> (*Platanista gangetica*—including its subspecies, the Indus river dolphin, *P.g. minor*) is found in India, Nepal, Pakistan and Bangladesh. Owing to millions of years of evolutionary adaptation in the murky, sediment-loaded Indo-Gangetic river systems, Ganges river dolphins are almost totally blind, having lost their eyes to disuse. With only rudimentary slits for eyes, completely lacking a crystalline lens, they navigate in the turbid waters with the aid of highly effective echolocation.<sup>2</sup>

Freshwater biodiversity and riverine ecosystem services are highly threatened.<sup>3</sup> The rivers that the endangered Ganges river dolphin occurs in happen to be among the most severely human impacted freshwater ecosystems in the world. Conservation of

unique riverine species is thus an urgent need and also a major challenge in the face of declining resources, water diversion, excessive pollution and over-exploitation.

Despite this, the Gangetic basin feeds over 500 million people even today. The Ganga was declared India's national river recently in 2008 and the Ganges river dolphin made India's national aquatic animal.<sup>4</sup> Such concern about conduct with living creatures is not new even if this particular kind of conservation consciousness is a phenomenon of the modern era. Imperial protection for the animals of the Ganges river (including some fish species) was an important aspect of Emperor Asoka's wider policy of *Dhamma* (third century BCE), which made an attempt to define sensitive conduct even towards common species that would not be eaten or used otherwise, as revealed in Pillar Edict V.<sup>5</sup> The significance of this regulation is undeniable, as it extended from total prohibition of hunting or slaughter to imposing temporal bans on the exploitation and sacrifice of several common species. Asoka's policy remains resoundingly relevant, especially as we assess the current state of the Gangetic basin and its wildlife.

The river dolphin has become a prime candidate for conservation efforts in recent times.<sup>6</sup> First, it has the enigma and charisma associated with dolphins in general. Second, it is locally common and identified easily by many inhabitants of the riverbanks, but is perceived as a threat by almost nobody. Third and perhaps most important, the river dolphin's ecology and future is strongly connected with that of the people of the Ganges in many ways.

Dolphins cannot be seen in isolation from their riverine landscape, the complex texture of which is knit together from different social, political, economic, geological, hydrological, historical and ethical strands. Be it inside the river or on the banks, the world of the endangered Ganges river dolphin is a complex, diverse aggregation of social and ecological collisions and conflicts. The species is thus more than a symbol of the river: its presence in healthy populations could be considered an index of the ecological integrity of the river system as a whole. More immediately, the species could also be a rallying symbol for an approach to conservation that goes beyond the mere protection of individual

animals to a more holistic set of arrangements that ensures that human use (or rather abuse) does not endanger the integrity of the riverine system and freshwater ecology. How does one save an iconic endangered species and aquatic emblem in such an iconic river? Here, there is a bitter irony. The Ganga is perhaps the most intensively used river in the world, and sadly, the most abused as well. Conservationists often argue for the ideal of 'coexistence' of wildlife and human needs that depend extensively on biodiversity and ecosystem services.<sup>7</sup> But how can we rise to the challenge of reconciling the diverse needs of millions of people with socially just conservation in a fractured society? These are the larger questions we hope to unpack. For now, it is best to start with the river itself.

### Sanctuary for the Ganga?

This journey can begin with a boat ride on the Ganga. Ochre-buff agricultural floodplains with remnants of tamarisk scrub, industrial belts and brick kilns stretch as far as the eye can see. Boats overloaded with people, bales of hay, cattle, motorbikes and metal trunks noisily dash across the river. The grey waters glare and gradually fall silent again. Dolphins sense the boats through the opaque grey curtains and swim away, turning and surfacing again. They are effectively blind and must rely on sound to evade an array of fine-meshed gill nets successfully. Untreated sewage flows into the river from the ghats. Suddenly there are gunshots in the distance, and fisher folk, staging a protest march, run helter skelter.

The scene described here was and is an adequate sketch of any river stretch in the Gangetic floodplains and depicts the daily life of an imperiled freshwater cetacean species, and the precarious human condition around it.

A good place to find answers to the riddle of coexistence is the Vikramshila Gangetic Dolphin Sanctuary (VGDS) in Bhagalpur, Bihar, the only existing sanctuary specially designated to protect the Ganges river dolphin. Named after an ancient Buddhist university, it was notified in 1991 due to the high abundance of river dolphins in a 60–67 km long stretch of the Ganga between the towns of Sultanganj and Kahalgaon.<sup>8</sup> The sanctuary riverscape

has a diversity of riverine habitats such as meanders, countercurrent pools, sandbars and imposing granite outcrops in deep channels. In many reaches, the river course changes year to year, often shifting northward over large distances, a consequence of sediment loads from the Himalayas. This region is unique in having an almost intact assemblage of India's riverine vertebrate megafauna, including dolphins, smooth-coated otters, turtles, the occasional gharial or mugger, fish and numerous resident and migratory bird species. This makes it a unique aquatic equivalent of well known reserves of surviving terrestrial megafauna, no less important than Kaziranga in Assam or Bandipur in Karnataka. That it is not as well known is evidence of the marginality of aquatic ecology and wildlife among the general public, policy-makers and even ecologists. Terrestrial systems, even now, get the lion's share of conservationists' attention. The Vikramshila sanctuary has largely been without monitoring or management interventions by concerned government departments. After the dolphin became the national aquatic animal and the state animal of Bihar, awareness increased, but this has not translated into much significant on-ground action.

### Shifting Boundaries

Vikramshila may well be designated a Protected Area, but even here, there seems no respite for the dolphin. A fundamental need of conservation planning is the presence of a fixed spatial or temporal domain within which interactions, whether of conflict or of cooperation, may be expected to take place. Limits to resource exploitation can be realistic only as per the clear definition of boundaries, ownership and tenures. Terrestrial Protected Areas or protected lakes have definite boundaries that need enforcement and maintenance for effective conservation. In open access, linear and highly dynamic systems such as rivers, conservation often has to be achieved through cultural or behavioural fences on human conduct and regulated use—rather than guns, well defined physical boundaries and fences.<sup>9</sup>

And therein lies the problem, for riverine Protected Areas cannot be fenced by boundaries.<sup>10</sup> It is not that fences do not work or

are porous: they are simply not feasible. These imaginary, symbolic fences may only wobble around the central tendency of the river's dynamic and ever changing course. They pose every difficulty of definition: boundaries, rights of usage, management authorities.

Immediately after the declaration of the Vikramshila sanctuary, the fisheries department came into conflict with the directives of the forest department. The fisheries department still recognises fishing as a legitimate activity, whereas forest and wildlife protection laws do not. So the former department refused to 'recognise' the sanctuary and continued to provide permits and identity cards for 'free-for-all' fishing. Such interdepartmental conflict left fisher folk highly confused and many readily, and obviously, disregarded the existence of either the sanctuary or the nationwide hunting ban on species such as river dolphins. Many fishers regularly hunted river dolphins for oil from their blubber, commonly used as bait to catch a species of catfish. Both authorities, ignorant of each other's priorities and situations, played blame games, neither managing fisheries well nor protecting river dolphins. Given a difficult law and order situation (the area was susceptible to dacoit gangs patrolling the *diara* (islands formed between a main river and its tributaries) lands and maintaining territorial boundaries through fights to protect their villages as well as other criminal gangs running illegal operations for powerful politicians and erstwhile zamindars), the forest department never dared to step inside the river's open, fluid, flooding, receding boundaries much less monitor the river stretch or bring turtle and dolphin poachers or bird hunters to book. It is, therefore, easy to understand why, for most of its initial years, the sanctuary existed only on paper. The neglect was compounded by policy choices, as the state governments of the 1990s seem to have largely ignored the issue in Bhagalpur District where the sanctuary is located. It is commonplace to label this as the absence of political will. The law and order situation worsened over this period, leading to the Vikramshila sanctuary becoming a 'punishment posting' for forest officials, compared to other lucrative opportunities in the state. Until very recently, Bhagalpur was not even a separate Forest Division (lacking a Conservator of Forests posting), and the sanctuary's headquarters were in the deciduous forest-dominated

district of Banka. The problems were compounded by the inadequacy of the forest department, which was more familiar with forests and plantations than with rivers and their ecosystems. The usual tool kit: silviculture, pug mark counts, fire control and cutting game trails was of little relevance on the water front.

### Conservation Efforts

There are several fisher families in this region, living in extremely poor socioeconomic conditions and all heavily dependent on the river. Although fishing was technically illegal in the sanctuary, it formed the main, and often the only, livelihood for thousands of marginalised fisher folk. In 1999, a significant civil society initiative led by Professor Sunil Choudhary through a small team called the Vikramshila Biodiversity Research and Education Centre (VBREC) launched a mass awareness campaign for fishers in the region. Believing that protecting river dolphins while also sustaining the fishers' livelihood needs was crucial to obtaining support of local fishers for river conservation, the team worked hard to put a stop to the intentional killing of river dolphins in the sanctuary area. In 2001, the Patna high court directed both the Union and Bihar state governments to allocate funds to support river dolphin conservation in the state.<sup>11</sup> This intervention helped, and the team's continued presence and persistent monitoring of threats to dolphins and other wildlife, socioeconomic surveys and awareness campaigns, resulted in a considerable reduction in the killing of dolphins in Vikramshila. The team developed a network with key fishers to get reports of accidental entanglement of dolphins and illegal activities in the sanctuary area. They also chose local spokespersons for dolphin conservation from among the fishers, using the community's respect for their traditional knowledge. Preserving an open attitude to integrated research, the team has successfully collaborated with local fisher folk, river dolphin conservationists, sociologists, wildlife scientists, cetacean experts, filmmakers and fisheries biologists across the world to enhance the conservation focus on this riverscape.

The Vikramshila sanctuary today has the highest known density of Ganges river dolphins across their distribution range.<sup>12</sup> As dolphin hunting is negligible here, the place offers an excellent platform for robust conservation biology research to estimate effects of other threats to dolphin abundance and distribution. Together with the VBREC team, we have been conducting ecological research on dolphins for improving population sampling methods and assessing long-term distribution of river dolphins in the sanctuary with the background theme of river dolphin-fisheries interactions at multiple scales. We have been trying to identify in detail the ecological factors and mechanisms to help estimate the extent and the nature of conflict and competition between dolphins and fishermen.

### Knowing the River Dolphin Better

Over the years there has been intense and increasing competition for use of foraging space and for fish prey, aggravated both by local fishing practices and landscape-level factors, such as flow reduction in tributaries from upstream diversion of water for irrigation.<sup>13</sup> As a result, by May 2008, the seasonal flow significantly reduced with the progress of the dry season, much of it attributable not to natural flow dynamics but clearly to impacts via human agency. Due to reduction in flows, the dolphins tend to concentrate in the main channel of the river in the peak of summer. The depleted flow leads to congregation of both fishers and dolphins in the main channel, causing intense competition over the concentrated fish resources at specific locations. The high spatial and temporal overlap has led to an increased fatal risk of accidental entanglement of dolphins in gillnets.<sup>14</sup> It is easy to wrongly interpret the observed spatial and temporal overlap of dolphins and humans as 'harmonious coexistence'. It is actually the outcome of a shared resource or ecological function that attracts both wild species and humans, drawing them into severe competition and negatively affecting both entities. Further, loss of fish prey from preferred areas caused by excessive fishing pressure in more productive river reaches might force dolphins to forage in suboptimal habitats. Based on our

quantification of overlap and impact of fishing on river dolphins, it may be possible to clearly identify reference sites for dolphin-fisher coexistence and to maintain both dolphins and fishers in mutually tolerable states. Our prolonged observations in the sanctuary have revealed long-term persistence of Ganges river dolphin populations at certain specific areas or hotspots. The persistence of such habitats despite changes in river morphology each year suggests the need for creation of 'no-fishing zones' at these sites, with buffer areas where fishers can be allowed to fish in compliance with some regulations, including dolphin-friendly use of fishing gear, thereby causing low disturbance or danger to local dolphin populations.<sup>15</sup>

With respect to robust scientific research, many areas in river dolphin ecology need to be investigated in detail. Unfortunately, in most river dolphin projects in India, research activity does not go beyond the initial documentation of threats and routine, crude, count-based surveys.<sup>16</sup> Modern techniques of estimating dolphin abundance, such as independent double-observer surveys, need to be improved and made suitable for having robust estimates with associated uncertainty, using statistical sampling and modeling to avoid undercounting of dolphins due to their diving behavior. There are many interesting questions about the trophic and behavioural ecology of dolphins that could be tied strongly to their conservation. These include, in particular, research on dolphin acoustics from an ecological point of view, dolphin mating systems, site fidelity and distributional dynamics in relation to riverine productivity patterns, dolphins' trophic position in river food webs, prey selection and strategies of foraging and feeding.<sup>17</sup> Many new interfaces of such research are being explored in the Vikramshila sanctuary through diverse scientific collaborations by the VBREC. These ongoing research studies show a lot of promise for enriching understanding of the elusive Ganges river dolphin in the coming years.

Despite these contributions, the full realisation of Vikramshila as a meaningful sanctuary is still far off in the future. The Ganges river dolphins and the fisher folk of the sanctuary both continue to be victims of much larger problems. Going deeper, one finds that conflicting relationships have been shaped by diverse local and

landscape-level social dynamics, the complex textures of which often cannot enter any statistical models as parameters in explaining the causes of endangerment of dolphins directly. A detailed analysis of social, economic and historical changes that have affected the riverscape becomes imperative.

### Beyond Ecology: Social, Economic and Historical Aspects

The feudal *panidari* (Jalkar) system of river fishing contracts prevalent in this region was abolished between the years 1987 and 1991. *Panidari* was the riverine counterpart of the oppressive zamindari system, where powerful *panidars* or waterlords laid claim to stretches of the Ganga river and 'owned' all fishing and movement rights within that stretch,<sup>18</sup> thereby grabbing a large chunk of whatever fishers would fish there and demanding that they pay tax. Needless to say, the *panidars* would harass, beat up, or even kill, fishermen and their families who refused to work on the Jalkar contracts in this area (from Sultanganj downstream to Pirpainti) or pay up the fish tax.

For the Bihar state governments at the time of abolition of *panidari*, especially between the period of the fall of the Karpoori Thakur government (1979) and the dominance of Lalu Prasad Yadav (1990–2005), freeing all rivers, or 'flowing water bodies', from contract systems for everyone to fish in was a major political advantage to the socialist ruling party.<sup>19</sup> But the abolition also meant that fishing in the river now became free for all. After the abolition, criminal gangs came in and illegally continued to extort fish catch from these fishermen at gunpoint, killing anyone who refused or defied them. A fishing mafia ring soon developed, illegally seeking monopoly over fishing areas through force and brutality. They continue to use highly destructive fishing practices to capture the smallest of fish in the river to cater to the huge market for small fish at Siliguri in northern West Bengal. Mosquito nets (*kapda jal*) and beach seines (*kachaal jal*) are excessively operated by criminals in the vicinity of highly productive confluence habitats and in floodplain wetlands marginally connected to the main river

channel. These highly destructive nets set off longstanding conflicts between traditional fishermen and the fishing mafia. Criminals and local fishers often spar with each other over the issue of ownership and fishing rights for confluence channels (*kol*) and floodplain wetlands (*dhab*). The problem stems from ambiguous definition in the Fishing Act: the *dhab* is cut off from the main river in the dry season and the *kol* 'may or may not' get cut off. The *dhab* may be leased out to private contractors, but not the *kol* if it is wider than 100 m at the confluence. On the ground, such a definition is difficult to make sense of. There have been shootouts, murders and even organised massacres of fishers over fishing territories and rights to fishing areas. Furthermore, multiple traditionally non-fishing castes have also plunged into the free-for-all fishing, from dominant classes of landholders such as Bhumihars and Rajputs to marginalised people such as Gangotas or Muslims. In a state where caste plays an important role in determining almost any action, free fishing has thus led to serious caste based conflicts. Interestingly, our recent surveys show that fishing villages 'outside' the sanctuary (upstream of the river at Sultanganj) are mentioning that they seldom fish inside the Protected Area, for criminal activity is higher inside than outside. This validates impacts of historically contested claims over ill defined rules and rights, which is a failure of fisheries management.

Confluence habitats are highly preferred by both fishers and river dolphins, owing to the aggregation of fish in these areas. Destructive netting practices (such as barricading of confluences with mosquito nets) cause mass mortality of larval and juvenile fishes, reducing recruitment to the main river and suppressing viability of fish populations. Indiscriminate destruction of fish stocks by criminals along with social threats has ousted both traditional fishermen and river dolphins from their preferred fishing locations. Strict enforcement is needed to ban such destructive fishing practices.<sup>20</sup> But who will control them? There has been no real change with regards to riverfront protection, despite a general perception of improved administrative efficiency in the state of Bihar, especially with reduction in road and highway robbery, murder rate and theft. According to local fishers, regular patrolling and the mere 'presence'

of police along riverbanks can control fishing mafia activity. With severely diminishing returns even from fishing of small fry, the current status of the fisheries is also endangered and on the verge of large scale collapse. The change in institutional control, from the formal tender-based private contract system with inbuilt exploitation to an open access free-for-all situation of harassment and lawlessness, has now forced fishers to rethink. Recent surveys indicate that many fishers, lacking knowledge of any other system, now perceive even the days of Jalkars as better than the present state, and mention that the panidari at least afforded some protection to them because of 'bonded' labor. This vicious cycle reveals that both private and open access arrangements have failed to work, and opens doors to consideration of co-management of common pool resources.<sup>21</sup>

### The Decay of a Socio-ecological System

Kahalgaon is the central site of the fisher folk movement against the administration, the fishing mafia, and also the sanctuary. Their outcry against the oppression of criminal gangs and mafia is genuine. However, the fishers' own use of resources also needs critical scrutiny. The Ganga Mukti Andolan, a fisher community-led movement, is agitating for the denotification of the sanctuary, which it alleges has blocked access of traditional fishers to the river's resources. People dependent on Protected Areas for their livelihoods often seek denotification of these areas because of both restricted access and criminalisation of their means of livelihood. But in reality, no stretch of the sanctuary is devoid of fishermen or fishing activity. Even after the declaration of the sanctuary, fishers have continued to fish in whatever way and at whatever magnitude they like, using old identity cards issued by the fisheries department to fish freely anywhere in the Ganga river and the lack of monitoring by the forest department as an escape route. Legally, the very legitimacy of 'traditional fishing rights' is questionable, as the tradition itself has a dubious existence now. These traditional fishermen worked as labourers in the panidari jalkars for several generations.

Even if a claim for fishing rights in the name of tradition<sup>22</sup> is entertained, the negative ecological impacts of existing fishing practices, even the relatively non-destructive techniques, are very high, not just on dolphins but on the fishery itself. The Andolan's persistent claim is that fishers have always lived in harmony with river dolphins and other wildlife, blaming all illegal killing and poaching on criminals. But the evidence paints a different picture. Some Kahalgaon fishers continue to kill turtles in a clandestine fashion, sometimes hunt dolphins for oil, kill the occasional gharial and predate on wild birds. The fisheries department rules specify that fishing with gillnets less than 40 mm in diameter is illegal anywhere in the Ganga's main channel, even outside the sanctuary. Thus, almost eighty per cent of the existing fishing in the sanctuary is illegal and destructive to river dolphins and fish populations, be it by the mafia or traditional fishermen. Irrespective of who fishes, current levels of fishing activity can seriously aggravate resource depletion rates. This is a qualitatively new situation and may not have past precedent: so harking back to 'traditional' practices, however laudable a goal, does not have an ecologically sound basis.

### In the Shadow of Farakka

It is true that these fishers are a highly marginalised people, affected not just by degraded socioeconomic conditions but also by ecological destruction. But the sanctuary is clearly not the sole or even major reason for their marginalisation. In fact, the Protected Area has been a worthwhile venture for securing their interests. It is part of a relatively more productive segment than many other river stretches in the Ganga. Still, the mesh sizes of fishers have kept shrinking year after year, with many already much below the lower restricted limit. But overfishing, pollution, local factors, and poverty explain only a small fraction of this decline. There are larger, landscape-level historical reasons for the severely depleted state of the entire floodplain river system.

The proverbial rug has been pulled from under our feet by the successive river engineering projects that have adversely affected riverine ecosystems.<sup>23</sup> The Farakka Barrage built in 1972-73 almost

entirely destroyed the commercial hilsa (*Tenualosa ilisha*) fishery in the upstream reaches of the river, within which Vikramshila is situated.<sup>24</sup> The hilsa is an anadromous fish that migrates upriver at the start of the monsoons to breed and then returns to the estuary and sea for its adult life. The barrage physically obstructed the species, along with many others, from migrating to reproduce, causing its extinction further upriver, and leading to cascading declines downstream as well. The hilsa, highly valued across the region (which bears a significant imprint of Bengali culture, where hilsa is a culinary cultural symbol) for its taste and as a seasonal delicacy, had been an important commercial resource for the fisher populations and a crucial seasonal prey-base for wildlife. But today, the fish can be regarded extinct in this region, playing hardly any ecological or commercial function. Studies have estimated ninety-nine per cent reductions in availability of hilsa upriver, since the barrage was built.<sup>25</sup> This decline is a shocking example of the collapse of an important fishery of India's inland waters. Many other economically valued fish species have also met with the same fate: *Anguilla benghalensis*, a once common catadromous eel, the freshwater stingray *Patinachus sephen*, and a bagrid catfish *Mystus menoda* have also disappeared.

Barriers to movement imposed by dams, pollutant loads, degradation of spawning habitat and overfishing have led to declines in other native commercial carp species (such as rohu and katla), and catches are gradually being replaced by 'trash' species, mainly small catfish, barbs and gobies.<sup>26</sup> Average fish sizes available and caught in fishing in these reaches indicate the presence of mostly juveniles and small-sized adults, which is another stark indication of ecosystem-level fisheries collapse.<sup>27</sup> Fishermen lift up their empty nets to find only tiny fish caught after over fourteen hours of painstaking effort. The resource base of the Ganga is so degraded today that fishermen are scrounging for scraps. Fishing has also shifted to shallower areas. Owing to their feeding morphology, river dolphins tend to forage in shallow river areas and feed mostly on small schooling fish. As fishers are now compelled to target only small fish, resource competition and conflict with dolphins has likely intensified over the years. This is evident in the increased cases

of accidental entanglement and death of dolphins in small mesh gill nets.<sup>28</sup> It is an example of the far reaching, negative landscape-level impacts of large barrages: in many ways the ecological and economic consequences of such projects intensify fisher-dolphin conflicts.

### India, China and Mindless River Development

India's record on rivers does not show any deeper appreciation of the immediate, painful lessons to learn from other Asian nation states. In China, the Yangtze River dolphin or baiji was declared extinct in 2006. It was deemed the first human-caused extinction of a cetacean species.<sup>29</sup> The species was not actively targeted or hunted out, but was 'accidentally' killed by destructive fishing techniques (rolling hooks) and extensive degradation of its habitat. The story of the baiji's demise, poignantly told by Samuel Turvey,<sup>30</sup> could well be repeated in the Indian subcontinent as a result of large scale water development projects and resource exploitation practices.<sup>31</sup> The baiji was lost recently and several unique and endemic species in the highly diverse Yangtze ecosystem are also extinct already, or critically endangered or alive only in captivity: the Yangtze Softshell Turtle, Chinese Alligator, Paddlefish and Chinese Sturgeon.<sup>32</sup> The health of the people dependent on the Yangtze has been declining and all indicators of river health are already critical. The Yangtze is sometimes called the largest open sewer in the world but are India's rivers far behind?<sup>33</sup> While there is increasing awareness and appreciation of the threats to river species in India, macroeconomic developmental forces, such as industrial demand on rivers have become drivers in many a 'developing country' or emerging economy. Such secular trends seem to prevail despite significant political differences and 'nature tolerant' Asian cultural and social values, reflecting in the massive depletion of river production systems (fisheries, farming) in China and India alike.

Economic cost-benefit analyses suggest that large river development projects are highly unsustainable and often ecologically destructive.<sup>34</sup> They are based on profound belief in technologically grand design but not on ecological reason. A few voluntary

organisations may not be able to do much to question this dominant paradigm when ideas such as river interlinking still hold fast with India's educated middleclass.<sup>35</sup> Large-scale public opinion is a must at all levels (as in the case of urban forests taken up by Agarwal, this volume),<sup>36</sup> to critically consider the potential impacts of river interlinking and associated water developments.

Declines and irregularities in river flows have wiped out many species from large reaches. Dolphins and gharials have undergone substantial range reductions in most of the upper Ganges, Yamuna, Chambal and the Ken-Berwa-Sone rivers.<sup>37</sup> In addition, large dams might have genetically isolated river dolphin populations within the Ganges basin.<sup>38</sup> Rivers originating in the peninsula, which are not fed by snowmelt and are further exploited by dams and irrigation projects have been receiving less and less water each year. Most rivers in the distribution range of the dolphin have heavily altered flow regimes, degrading river habitats and reduced fish abundance.<sup>39</sup> Even the Brahmaputra river system is under threat from a series of major run-of-the-river dam projects, and from seismic surveys for oil exploration. Several towns on the Ganges do not have efficient working treatment systems for sewage and solid wastes. Interlinking and dam projects, diversions, embankments, irrigation projects, agricultural land use changes and sand mining are extremely serious emerging challenges to ecologically sustainable use of water resources. The extent of degradation in some sites is of some concern for both biodiversity and fisheries, if inaction continues alongside reckless technological interventions.<sup>40</sup>

The quest for meaningful, achievable coexistence means that scientific criteria, and socio-ecological realities must inform tradeoff decisions in order to benefit wildlife conservation and human welfare. Our work illustrates the many challenges that ecologists and wildlife biologists, elected representatives, administrators and social scientists face in evolving a framework for coexistence. This is especially complex where species conservation has to be achieved in human-dominated landscapes. The dominant conservation (or rather, preservation) paradigms that stress exclusion of humans are of little relevance here.<sup>41</sup> Coexistence essentially implies the sustainability of different levels and kinds of human extraction and

activities if viable populations of endangered species are also to be conserved, for the sake of the entire ecosystem. What, then, is the basis for coexistence, when the river itself has become ecologically impoverished?

### Alternatives for Overcoming Destitution

It is tragic that Bihar, a land of three large fertile floodplains, has to import more than seventy-five per cent of its fish from pond culture farms in Andhra Pradesh today. Moreover, these imports virtually sustain fish market economic turnover, according to local fishers. This unfortunate state of affairs reminds us that immediate and strong steps are urgently needed. First and foremost, it is necessary to enforce strict bans on destructive fishing techniques used by fishing mafia and 'traditional' fishers alike. Ecological restoration of all major and minor rivers in India needs to be undertaken urgently to ensure natural and adequate flow regimes, multi-objective habitat maintenance, protection of hydrological dynamics and services, natural flooding regimes and pollution control.<sup>42</sup> Dam reoperations to ensure adequate flows and variability in river discharge remain a neglected aspect of river management in most regions today.<sup>43</sup> Regulated and non-destructive fishing sustained over a long term could itself lead to restoration of collapsed fish stocks and needs to be the foremost goal for the management of the Ganges basin fisheries. The restoration should lead to improved health, numbers and availability of native commercial carps and preponderance of larger fish sizes through improved juvenile recruitment. Despite being regulated, restorations will enhance and not depress fisher livelihoods. Large scale scientific monitoring programs for fisheries need to be instituted to assess restoration programs critically.<sup>44</sup> The material dignity of fishers and the restoration of the river system are closely interlinked. There have been episodes of mass exodus of fisher families from the Gangetic plains (as high as forty to eighty per cent of the male workforce) to work as construction laborers in cities, because 'nothing is left to fish' and the perennial threat of criminal gangs. Given the failure of market-oriented private control systems and subsistence-oriented free fishing, cooperatively

managed alternative livelihoods from common pool resources hold promise to achieving the twin ends of river dolphin conservation and enhancement of commercial gains for fishers.<sup>45</sup> However, the current state in which cooperatives exist is abysmal.<sup>46</sup> If carried out with ecologically sensitive and sound methods, even co-managed commerce may not be antithetical to dolphin conservation.<sup>47</sup> Alternative fisheries could be developed, providing small-scale, species-specific gear that could be 'dolphin-friendly' in terms of reduced entanglement and sizes caught.<sup>48</sup> While reducing pressure on the already depleted river fish resource base, these options could also improve the local economy through involvement of fishers' knowledge and enterprise. An example that has been gathering positive reviews for its income generation potential across rural Andhra Pradesh, Assam and West Bengal is the creation of community-based, lease owned pond carp aquaculture through fishing cooperatives.<sup>49</sup> Fisher compliance towards biodiversity conservation also needs to be ensured in the process,<sup>50</sup> so that fishers who own leased ponds can also monitor adjoining river stretches and help sanctuary authorities in regulating illegal, destructive fishing. The recent Food Security Act and rural labour programs could enhance both nutrition and wage rates of fishers, providing some protection to livelihoods without adverse impacts on fisheries.

### Bringing Back Dignity to the River

Recent political changes in Bihar have led to some improvements in governance, and these can help secure such conservation initiatives. Improved social security could help create opportunities for involving fishers in small-scale ecotourism around the Vikramshila Sanctuary, making them important stakeholders in sanctuary management. The sanctuary's proximity to Kolkata offers a good opportunity for such initiatives. River dolphin tourism has started in a few locations along the Chambal River on a small scale. Planning ecotourism ventures in Vikramshila would also require assessing their benefits to fishers as against other commercial interests, as well as critically evaluating the ecological impacts of tourism itself. But

if well planned, these measures can help conservation efforts, as they utilise and preserve traditional skills and ecological knowledge for conservation. The Mahatma Gandhi National Rural Employment Guarantee Scheme (MNREGS) too can be effectively used towards this end, on a cooperative, open and equal footing. The importance of sustained monitoring and action in all these initiatives cannot be overemphasised: for river dolphins, for fisher folk, and for the river itself.<sup>51</sup>

After the dolphin was declared the national aquatic animal, Bihar has taken some measures, such as the appointment of dolphin *mitras* (friends)<sup>52</sup> from among local fishermen who will monitor illegal fishing and intentional killing of dolphins. However, this has the danger of becoming reduced to symbolic cash incentives and may not be enough, particularly in the absence of sustained funding and governmental interest. In fact, fishers themselves never took to the scheme because of these uncertainties.<sup>53</sup> Nevertheless, the scheme can, if well supported, inculcate a sense of goodwill about dolphins among local fishers, and could be developed into a means of conservation, through economic gains to complying fishers. Enlisting local fishers as informers of harmful fishing and poaching activities in the river could be an important community-based monitoring initiative that bestows honour and responsibility to local partners and resource users.

Vikramshila sanctuary, with its multivariate creases offers a mirror to the conjugated futures of dolphins and people. It provides the best juxtaposition of situations and can be a foundry for interdisciplinary ecological research, where ideas may be tested right in the river. With virtual, fuzzy and often abstract boundaries of definition, spatiotemporal changes of the river's course, ambiguous tenure and uncertainty, this riverscape defies many existing ideas of managing nature. Amidst this, Vikramshila still offers hope and holds the promise of evolving into a 'true' sanctuary for dolphins. As at the same time, it illustrates the prospect of rivers such as the Ganga regaining their true meaning as sanctuaries for humankind and for fellow creatures that share the riverscape adjacent to age-old centres of human occupation and use.

Rivers in India—or elsewhere for that matter—are living, organic and dynamic entities, with their flow and flood, their feed and seed, worshipped and feared by humanity for what they give and what they can take away. They are the strong threads to which the pulse of our lives is inextricably tied: the baselines of civilisation. Yet today, they represent one of the biggest tragedies of our culture and ecology: many have been choked, depleted, poisoned and interrupted by dams. The biophysical nature of a river that flows from the mountains and hills to the sea, transporting water, sediment, nutrients and sustaining diverse ecosystems and communities, has been now thwarted severely by human activities. In many rivers, the entire dry season flow is diverted for agriculture, industrial and urban use until the river itself ceases to exist. Despite the demonstrated folly of not allowing rivers to flow unbounded from headwaters to estuaries and deltas, technocratic policy and public discourse is still dominated by an idiom of 'rivers flowing wastefully into the sea.' Belatedly, the National Water Policy has made a token, last priority mention of 'minimum environmental flows' to be maintained in a river, although this itself is an obsolete concept and needs to be replaced with 'ecological flow regimes.' The biogeochemical and physical functions and ecosystem services it provides, especially for downstream coastal ecosystems and dependent communities, are largely ignored. The dominant existing paradigms of water resource development are also socially unjust apart from being ecologically shortsighted. Rivers have become muted, sad metaphors to the erosion of our ecological wisdom. Reducing water consumption and pollution by agricultural and urban sectors, cooperative floodplain pond-based fisheries, alternative livelihoods and restoration of fish stocks can enable rivers to sustain biodiversity, local communities and ecosystem services. Keeping rivers alive with their natural flows,<sup>53</sup> productivity and dynamism will ultimately support coexistence of fisheries with river dolphin conservation. Conserving these together will also help in keeping intact a range of ecosystem services and inculcating a deeper regard not only for life but for the systems and cycles that keep the river a living biological entity.

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## Notes

1. Also sometimes known as the South Asian river dolphin. The other species, found in the Amazon river system, is the Amazon River Dolphin or Boto *Inia geoffrensis*. Another species, the Chinese River Dolphin or Baiji *Lipotes vexillifer*, is thought to have become extinct in the last decade. A few other dolphin species, though mostly marine, have a few populations occurring in rivers and estuaries.
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3. B. Collen, L. McRae, G. Kothari, R. Mellor, O. Daniel, A. Greenwood, R. Amin, S. Holbrook and J. Baillie, *Living Planet Index 2010 and Beyond: Rising to the biodiversity challenge* (Gland, Switzerland: World Wildlife Fund, 2008).
4. Notification No. 521, registered no. 33004/99 (New Delhi: Ministry of Environment and Forests, Government of India, 2009).
5. The 'Gangapuputaka' mentioned in Pillar Edict V is not the Ganges river dolphin, contrary to popular belief, but most likely the Red Junglefowl (see M. B. Chitampalli, *Nisargavachan* [Marathi], Nagpur: Sahitya Prasar Kendra, 2007). This seems the most valid translation. We thank Professor Upinder Singh, M. B. Chitampalli and Meera Vishwanathan for their help in this matter.
6. Many conservationists have argued that the critically endangered gharial should have been made the National Aquatic Animal, as it needs much more protection today, and requires undisturbed (or 'pristine') stretches of rivers and sand banks for nesting, free of human disturbance (see J. Lenin, 'The song of the Ganges gharial: Reorienting conservation', *Seminar* 577 [2007]; and T. Nair, *Ecological and Anthropogenic Covariates Influencing Gharial *Gavialis gangeticus* Distribution and Habitat Use in Chambal River, India* [Mumbai: Tata Institute of Fundamental Research, 2010]). On the other hand, the river dolphin is a highly resilient river predator that seems to persist even in ecologically degraded rivers (see N. Kelkar,

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