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**Impacts of Large dams of Arunachal Pradesh and Meghalaya on Endangered Ganges River Dolphins (*Platanista gangetica gangetica*) of Brahmaputra River System within Assam, with special references to Lower Siang, Dibang, Lower Demwe, Lower Subansiri and Kulsi Dams**

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## Abstract

Ganges River Dolphin (*Platanista gangetica gangetica*) is an endangered species of River Dolphins, which has a global population of about 2000 individuals. The species is recognized as Schedule-I Species, National Aquatic Animal of India and State Aquatic Animal of Assam. The Brahmaputra river system within North East India has about 300 individuals of the species. Due to less anthropogenic pressures and no water development projects in the mainstream of the River, the Brahmaputra river system has been recognized as one of the last refuges of the species.

However, due to the large dams on various forerunners and tributaries of Brahmaputra within Arunachal Pradesh and Meghalaya, the Brahmaputra River Dolphins are going to face severe threats of extinction. Among the 168 dams of North East India, we found the Lower Siang (on Siang River), Dibang (on Dibang River), Lower Demwe (on Lohit River), Lower Subansiri (on Subansiri River) and Kulsi (on Kulsi River) Dam as the most threatening dams for the survival of Brahmaputra dolphins. Kulsi and Subansiri River have the last two residential populations of the species in the entire Brahmaputra Valley, whereas the other three rivers (Siang, Dibang and Lohit) have seasonally migrated dolphin populations. The dams on these rivers will affect the species by changing the type and seasonal availability of prey, changing the geomorphology of dolphin habitat and disrupting the natural flow regime of the river. There are strong scientific evidences that the large dams have already been creating survival problems for the Ganges River Dolphins in various rivers of Bangladesh, India, Nepal as well as the River Dolphins of Pakistan and China.

Therefore, we strongly recommend the concerned governmental authorities, especially the Ministry of Environment & Forest (MoEF) of Govt of India to prioritize assessing the impact of these dams on the Ganges River Dolphins of Brahmaputra, until which clearances should not be granted. In cases where approval has been granted without such studies, clearances should be suspended until comprehensive studies complete. On the other hand, due to the multiple proposed dams in each of these rivers (except Kulsi River), the cumulative impact of these dams in each river and the Brahmaputra as a whole may create havoc to the entire aquatic ecosystem of Brahmaputra within Assam and being top in that aquatic ecosystem, the Ganges River Dolphin might be highly affected. Therefore, we strongly recommend that a river basin planning approach including cumulative impact assessment studies in advance need to be developed for the better future of the species as well as Brahmaputra riverine ecosystem.

### **The Ganges River Dolphin (*Platanista gangetica gangetica*):**

The Ganges River Dolphin (*Platanista gangetica gangetica*) is one of the four obligate river dolphin species of the world, and is found in the Ganges-Brahmaputra-Meghna and Karnaphuli River systems of India, Nepal and Bangladesh (Anderson 1878, Kasuya & Haque 1972, Jones 1982, Mohan 1989, Reeves & Brownell 1989, Shrestha 1989 and Reeves *et al.* 1993). In the nineteenth century, dolphins were plentiful across the entire distributional range (Sinha & Sharma 2003). However, the range and abundance of this species has sharply declined in the last century (Reeves & Leatherwood 1995) and the IUCN correspondingly revised its threatened status from vulnerable (Klinowska 1991) to endangered (IUCN 1996). It is estimated that currently there are less than 2000 individuals of this species globally. Due to its rapid decline, the species has been categorized as a Schedule-I Species in India under the Wildlife Protection Act, 1972. The Government of India declared it as the National Aquatic Animal in 2009.

### **Brahmaputra River System:**

The Brahmaputra River system within India is one of the major habitats of the Ganges River Dolphin. The Brahmaputra River is one of the longest rivers in the world traversing Tibet, India and Bangladesh in its 2880 km long journey. The Brahmaputra traverses its first 1625 km in Tibet, the next 918 km in India (Arunachal Pradesh and Assam) and the remaining 337 km in Bangladesh up to its confluence with the Ganges. After entering India, the river flows as the Siang or Dihang River, travels about 52 km from Pasighat in the foothills of the Himalayas before two other major rivers, the Dibang and the Lohit, join it. From this trijunction, the river is known as Brahmaputra. From here the river enters a narrow flat valley, which is known as the Assam Valley or Brahmaputra Valley. The average width of the valley is about 86 km, where the Brahmaputra River itself occupies maximum 15–18 km, and is narrowest near Guwahati. Within Assam, the river traverses a total length of about 900 kms and receives 103 notable tributaries from both sides, 65 from the north bank and 38 from the south bank. In the north, the principal tributaries are the Subansiri, Jia Bharali, Dhansiri (North), Puthimari, Pagladiya, Manas, Champawati and Sankosh Rivers. On the south bank, the main tributaries are the Burhi Dihing, Disang, Dikhow, Dhansiri (South) and Kopili Rivers. The north bank tributaries originate in the Himalayas, have a high gradient and hence they carry a heavy sediment load of coarse material such as gravel and cobbles. The lower reaches of the northern tributaries are braided. The south bank tributaries have lower gradient and their sediment load is relatively low and finer in size; they are meandering rivers with deeper cross-sections.

## Present status and distribution of Ganges River Dolphins in the Brahmaputra River System:

There were two recent range wide population assessment surveys of the Ganges River dolphin in the entire Brahmaputra River system, one in 2005 (Wakid 2005; 2009) and another in 2008 (Wakid & Braulik, 2009). Both of these surveys confirmed the existence of about 300 Ganges River dolphins in the Brahmaputra River system. Details of these two surveys are presented in Table-1.

Table-1: Summary of dolphin status survey in 2005 and 2008

Year	Surveyed River	Surveyed River length (Km)	Dolphin no. (best estimate)	Encounter rate (dolphin no/km)	Reference
2005	Brahmaputra River (Assam-Arunachal border to India-Bangladesh border)	856	197	0.23	Wakid (2005; 2009)
	Kulsi River (Ghuramara to Nagarbera)	71	27	0.38	
	Subansiri River (Sawoldhuwaghat to Jamugurighat)	99	26	0.26	
<b>Total</b>		<b>1026</b>	<b>250</b>	<b>0.24</b>	
2008	Brahmaputra River (Assam-Arunachal border to India-Bangladesh border)	879	212	0.24	Wakid & Braulik (2009)
	Kulsi River (Ghuramara to Nagarbera)	71	29	0.40	
	Subansiri River (Sawoldhuwaghat to Jamugurighat)	94	23	0.24	
<b>Total</b>		<b>1044</b>	<b>264</b>	<b>0.25</b>	

The Brahmaputra River system in Assam is considered to be one of the last refuges for the Ganges River Dolphin as there are less human pressures in this area compared to the Ganges River, and, until now, the river has flowed unimpeded by dams. The construction of dams and hydroelectric schemes in one of the last strongholds of the species may have catastrophic effects on the long term survival of the species.

### Large Dams that might cause serious threats to the Brahmaputra dolphins:

There are 135 dams in various stages of planning, construction and operation in Arunachal Pradesh of North East India (Table-2). They have a total capacity of 57,303 MW (Department of Hydropower, Govt of Arunachal Pradesh; [www.arunachalhydro.org.in](http://www.arunachalhydro.org.in)).

However, four (Lower Siang, Dibang, Lower Demwe, Lower Subansiri) of these dams have maximum potentiality to affect the survival of river dolphins in the Brahmaputra River system. In addition to these four large dams, one dam (Kulsi dam on Kulsi River) in Meghalaya has the potentiality to affect Brahmaputra dolphins (details in Table-3; Fig-1).

Table-2: List of dams of Arunachal Pradesh having potentiality to affect on the ecology of Brahmaputra river system

River basins	No of probable dams	Total capacity (MW)
Dibang	17	10,977
Siang	26	17,308
Lohit	10	7,980
Tawang	8	2,057
Subansiri	26	12,658
Kameng	46	6,183
Tirap	2	140
<b>Total</b>	<b>135</b>	<b>57,303</b>

Table-3: Dams of North East India with the maximum possibility to affect Ganges River dolphins of Brahmaputra

Name of the Dam	Name of the River	Production capacity (MW)	Dam location	Dam height (m)	Status of the Dam	Minimum distance to known dolphin habitat (km)
Lower Siang Dam	Siang River	2700	Rotung (near Pasighat) of Arunachal Pradesh	65	Proposed; undergoing environment clearance	12
Dibang Multipurpose Dam	Dibang River	3000	Near the confluence of the Ashu Pani and Dibang Rivers and about 43 km from Roing in Arunachal Pradesh	288	Proposed; undergoing environment clearance	5
Lower Demwe Dam	Lohit River	1750	Near Parasuramkund of Arunachal Pradesh	124	Proposed; received environment clearance	30
Lower Subansiri Dam	Subansiri River	2000	Near Garukamukh of Assam-Arunachal Border	116	Undergoing construction	12
Kulsi Dam	Kulsi River	36	Near Ukium village of Assam-Maghalaya border	42	Proposed	15

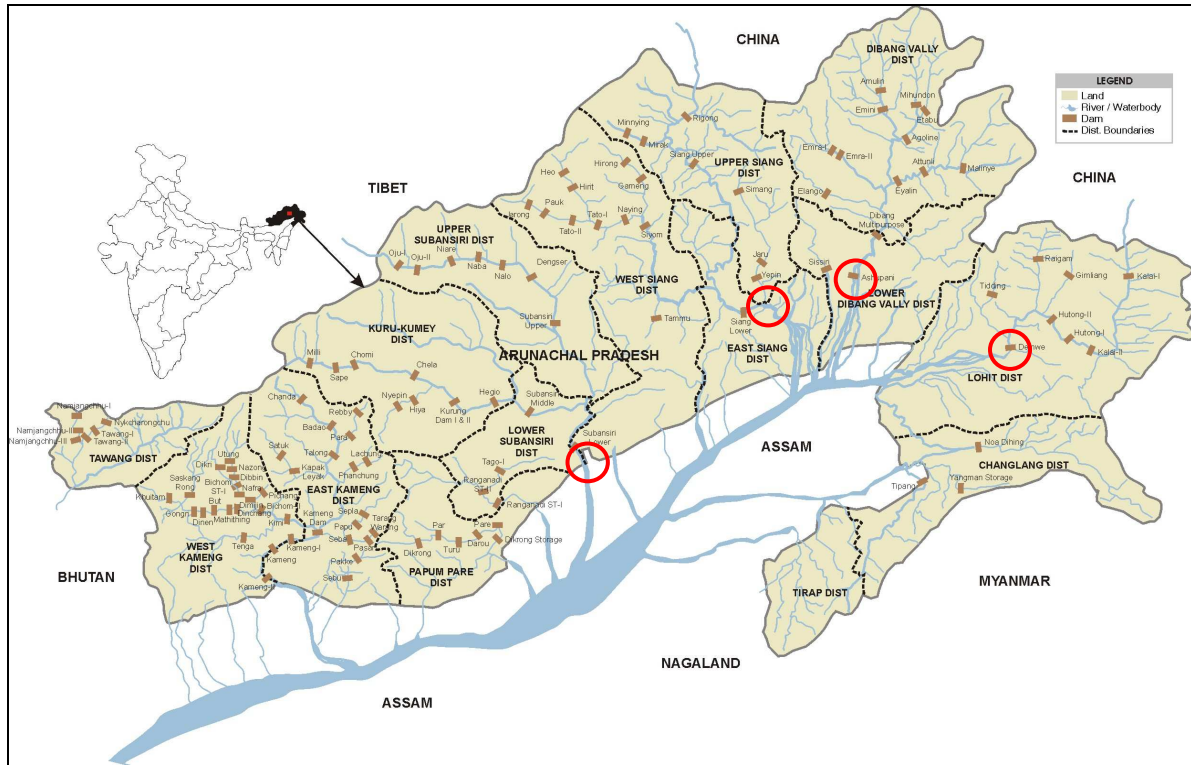


Fig-1: Distribution map of the dams of Arunachal Pradesh. Four Large Dams are indicated in the map with marked in red coloured circle which might affect Brahmaputra River Dolphins. Map credit: Sanctuary Asia (the map is adapted from the map of Dept of Hydropower, Arunachal Pradesh). The Kulsri Dam is in Meghalaya and not shown in the map

**Why these Dams will cause serious threats to the Brahmaputra dolphins?**

- Dam construction and operation cause major changes in the flow regime, sediment load, and water quality of running waters (Smith & Reeves, 2000). Dams degrade the dynamic attributes of downstream waters and reduce the flow of sediments essential to the formation of stream channel islands and bars (Ward 1975, Sioli 1986, Ligon *et al.* 1995). Downstream discharge is often prevented from reaching the critical magnitude necessary for water to overspill riverbanks onto adjacent floodplains, thereby resulting in dramatic decreases in biological production (Junk *et al.* 1989). Many riverine fishes in India rely on the annual flood to spawn on the floodplains. Dams suppress natural fluctuations in flow, temperature, and detritus loading, which encompass optimum conditions for a large number of aquatic organisms, and the number of ecological niches available for supporting diverse biotic communities is

reduced (Smith & Reeves, 2000). The combination of these radical changes in environment and ecology downstream of the dams will likely affect the Ganges River Dolphins by changing the type and seasonal availability of prey, changing the geomorphology of dolphin habitat and disrupting the natural flow regime of the river.

- The Siang, Dibang and Lohit Rivers are the main water sources for Brahmaputra River in India and Bangladesh. The Siang River has a water flow of average 830 cumecs in January (source: EIA Report of Lower Siang Dam; [http://www.apspcb.org.in/japl\\_eia\\_emp.html](http://www.apspcb.org.in/japl_eia_emp.html)). Likewise, the Dibang River has 400 cumec average flow in January (source: draft DPR) and the Lohit River has 350 - 400 cumecs water flow in winter season (source: EIA report on Lower Demwe at [http://www.apspcb.org.in/eia\\_demwe.htm](http://www.apspcb.org.in/eia_demwe.htm)). All these water flow level will fluctuate greatly when the proposed dams begin operation. For example in the Siang River, the water flow will fluctuate from 60 cumecs (when water will be stored behind dam for approximately 20 hours) to 5440 cumecs (when water is released during power generation during peak load hours of 3-4 hours). Likewise, in the Lohit River the flow will fluctuate between 35 to 1729 cumecs. These huge flow fluctuations will result in rapid unpredictable increases and decreases in depth and velocity. This has caused a reduction in fish diversity and abundance in other rivers subject to similar fluctuations (Bain *et al.*, 1988). The dramatic and rapid changes in discharge downstream of the dams will likely make the downstream of the rivers unsuitable for dolphins and will also affect the species in the Brahmaputra mainstream.
- Within Assam, the Subansiri and Kulsī River are the last two tributaries of Brahmaputra River, where dolphins are found round the year. The Subansiri River has about 23 dolphins and the Kulsī River has about 29 dolphins (Wakid & Braulik, 2009). The Subansiri River has a water flow of 250-550 cumecs in winter season (Expert Committee Report, 2010), which after construction of the dam will fluctuate between 6 cumecs (when water will be stored behind dam for approximately 20 hours) and 2560 cumecs (when water will be released during power generation during peak load of 3-4 hours). The 2560 cumecs is equivalent or more than average monsoon flows, which will be released for a few hours in winter. The same event of unusual flow variations in winter will also impact the Kulsī River. These types of alternate starving and flooding on a daily basis with massive flow fluctuations will be strong enough to wipe out these two last remaining dolphin populations from these two rivers.

- The recorded maximum upstream distribution of Ganges River Dolphins in the Siang, Dibang, Lohit, Subansiri and Kulsir Rivers are about 12 km, 5 km, 30 km, 12 km and 15 km downstream of the concerned dams. However, during the summer it is believed that dolphins migrate more upstream. Construction of the proposed dams may reduce the upstream distribution of dolphins in the concerned rivers and block any upstream migration. The most relevant example is the Ranganadi Dam on the Ranganadi River of Lakhimpur district of Assam, which reduces the summer distribution of Ganges River Dolphins in this river by about 30 km. Therefore, a detailed study including the seasonal movement pattern of dolphins in these rivers is essential. It is observed that no such detailed studies on river dolphin distribution, movements or migration were conducted during the preparation of EIA Reports for these dams. Therefore, it is extremely important to conduct comprehensive EIAs to examine whether these projects are feasible or not from a dolphin perspective. Where projects may be relatively benign, comprehensive EMP would still be necessary to ensure long term survival of the dolphins.

#### **Impact of large dams on the River Dolphins in South East Asia:**

- There are scientific evidences that altogether 19 large dams in India, three in Nepal and one in Bangladesh have been affecting the Ganges River Dolphins. Besides, eight large dams in Pakistan have been affecting the Indus River Dolphins and four large dams in China affected the Yangtze River Dolphins (Smith *et al.*, 2000).

#### **Recommendations:**

- Out of the estimated 2000 last remaining Ganges River dolphins in the world, about 300 dolphins are surviving in the Brahmaputra river system. The Ganges River dolphin is not only an Endangered, Schedule-I Species, National Aquatic Animal of India, but also the Flagship Species of the Brahmaputra River system. Concerned Governmental authorities like Ministry of Environment & Forest (MoEF), must prioritize assessing the impact of the dams on the Brahmaputra dolphins before approving the environmental clearances of these dams, since destruction of this species will affect the entire aquatic ecosystem of the Brahmaputra River.
- No special attention has been given on the potential impacts on the Brahmaputra dolphins during the planning stage of the abovementioned dams till now. The Terms of References of EIA on Dibang Dam are silent about impact on dolphins. Likewise,

dolphin impact was ignored in Lower Subansiri during clearance stage, but it was only part of recent post-clearance EIA. Impact on dolphin has only been prescribed as a post-clearance study in Lower Demwe Dam. Only in Lower Siang project the impact on dolphin been finally prescribed as a pre-clearance study. Therefore, we recommend that the concerned management authorities must emphasize to conduct detail impact assessment of these dams on dolphins of the entire Brahmaputra Valley. Adequate information on the pre-development ecological conditions of the river needs to be collected. Cumulative and synergistic impacts of multiple developments should be considered. Methods for assessing potential impacts should be standardized. An independent panel of qualified experts should evaluate environmental impact assessments. If the impacts of these dams are judged to be severe and cannot be reduced to acceptable levels, then the option of not constructing the project should be considered.

- No dams should be developed at main stream of the river. Lower Subansiri Dam and Kulsai Multi-purpose dam should not be constructed since these are the only two tributaries of Brahmaputra having resident dolphin populations and if these dams are constructed, these two populations may be destroyed completely. In other three dams (Lower Siang, Dibang and Lower Demwe Dam) also, mainstream of the river should be clear at all time to maintain sufficient water flow to Brahmaputra Valley for a secure habitat of the species.
- Besides the above-mentioned dams, each of Siang, Dibang, Lohit and Subansiri has additional 25, 16, 9 and 25 other proposed dams in their river basins with additional 14608 MW, 7977 MW, 6230 MW and 10658 MW production capacities respectively. The cumulative impact of these dams in each river and the Brahmaputra as a whole may create havoc on the entire aquatic ecosystem of Brahmaputra and being top in that aquatic ecosystem, the Ganges River Dolphin might be highly affected. Therefore, we strongly recommend that a river basin planning approach need to be developed and individual clearances should be put on hold till such comprehensive cumulative impact studies are completed, for the better future of the Ganges River Dolphin as well as Brahmaputra riverine ecosystem.

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