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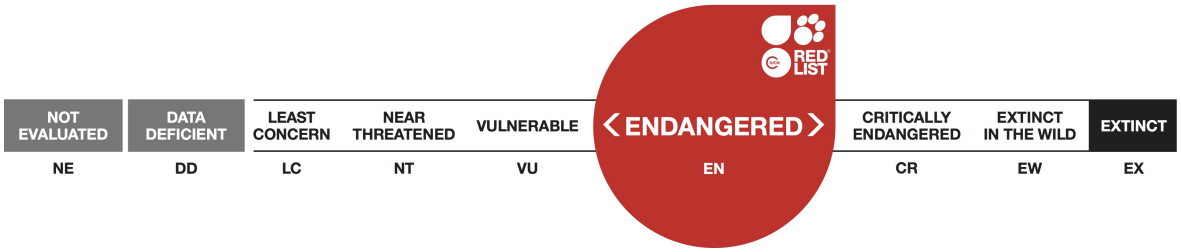
# *Platanista gangetica,* South Asian River Dolphin

**Assessment by: Braulik, G.T. & Smith, B.D.**

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# Taxonomy

| Kingdom | Phylum | Class | Order | Family |
|---|---|---|---|---|
| Animalia | Chordata | Mammalia | Cetartiodactyla | Platanistidae |

**Taxon Name:** *Platanista gangetica* (Roxburgh, 1801)

**Synonym(s):**

- *Delphinus gangetica* Roxburgh, 1801
- *Platanista gangetica* (Roxburgh 1801)
- *Platanista indi* (Blyth 1859)
- *Platanista minor* (Owen 1853)

**Infra-specific Taxa Assessed:**

- *Platanista gangetica* ssp. *gangetica*
- *Platanista gangetica* ssp. *minor*

**Common Name(s):**

- English: South Asian River Dolphin, Blind River Dolphin, Ganges Dolphin, Ganges River Dolphin, Ganges Susu, Indus River Dolphin
- French: Plataniste du Gange, Sousou
- Spanish: Delfín del Ganges

**Taxonomic Notes:**

The South Asian River Dolphin (*Platanista gangetica*) is the only species in the family Platanistidae (Rice 1998). The Indus and Ganges populations were long regarded as identical until Pilleri and Gihr (1971) divided them into two species (*P. gangetica* and *P. minor*). Kasuya (1972; cf. Reeves and Brownell 1989) reduced the two taxa to subspecies of *P. gangetica*, and that treatment is followed here. Shreshta (1995) has questioned the reality of the alleged differences between the two populations. Until the late Pliocene, the present-day Indus, Ganges and Brahmaputra (except for the upper reach, the Yarlung Zangpo Jiang) rivers constituted a single westward-flowing river called the Indobrahm (Hora 1950, 1953). Even up until historical times there was probably sporadic faunal exchange between the Indus and Ganges drainages by way of head-stream capture on the low Indo-Gangetic plains, between the Sutlej (Indus) and Yamuna (Ganges) rivers (Dey 1968).

# Assessment Information

**Red List Category & Criteria:** Endangered A2abcde+3bcde+4abcde ver 3.1

**Year Published:** 2017

**Date Assessed:** July 15, 2017

**Justification:**

Considerable effort has been made to document the status of South Asian River Dolphins since the early 1970s, yet rigorous quantitative data on numbers, mortality, extent of occurrence, and area of occupancy are still lacking for some of the species' range, especially in India and Bangladesh. The diversity and scale of threats—recent, ongoing, and projected—have far outpaced effort at


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documentation. Moreover, this species is the sole living representative of its family (which represents an ancient lineage in the order Cetartiodactyla), and therefore its extinction would mean not just the loss of a single species, but loss of an entire mammalian family regarded as a sister taxon to all other cetaceans. Based on available evidence, the species qualifies for listing as Endangered under criterion A.

Only very limited data are available on life history. Age at first reproduction is probably between 6-10 years (Brownell 1984) and maximum longevity may be close to 30. Therefore, generation time is probably well over 10 but possibly less than 20 years, which would mean that three generations equals at least 30 years (i.e., from 1987 counting backwards or until 2047 counting forwards) but less than 60 (i.e., from 1957 counting backwards or until 2077 counting forwards).

**Criterion A. Population size reduction**: There is no rigorous quantitative estimate of abundance for this species with which to be able to reliably estimate changes in abundance over a three-generation time period (30-60 years). This is particularly the case for the Ganges Dolphin, but is also true for the Indus Dolphin. Although one Indus Dolphin subpopulation (Guddu to Sukkur) appears to be increasing in abundance, almost everywhere else in the range of that subspecies the subpopulations partitioned by barrages are being extirpated and therefore the overall range of Indus Dolphins is shrinking. In the absence of reliable information on rangewide trends in abundance of the species, declines in the extent of occurrence of both Indus and Ganges Dolphins can be used to supplement the supporting evidence of reduced abundance and habitat deterioration and loss.

Subcriterion A1 does not apply because even if the decline in abundance has been greater than 70%, the causes are not clearly reversible, are not understood, and have not ceased.

Subcriterion A2 applies because a population size reduction of more than 50% since 1957 is suspected, given that nearly all of the critical dam and barrage construction associated with the large-scale decline in the area of occupancy of both subspecies has occurred since that time. The increases in riverine pollution, especially in the Ganges, have occurred within the last thirty years following industrialisation and intensification of plains agriculture and reduction of flushing ability of rivers after dam construction. Finally, the large-scale global introduction of monofilament gillnets in the 1960s and 1970s means that fishing-related mortality of these dolphins has increased, probably dramatically, since then. The reduction in population size continues, and its causes have not ceased (more barrages are planned and under construction, habitat quality is expected to deteriorate further, mortality primarily from fishing gear entanglement but also hunting continues in some areas, and range continues to contract). The causes are not fully understood and may not be reversible. The basis for listing could rest on any or all of (a) to (e).

Subcriteria A3 and A4 also apply because a population size reduction of more than 50% can plausibly be projected over the next 30-60 years (A3) and suspected over a period of 30-60 years including both the past and the future (A4), with the causes uncertain, continuing, and quite possibly irreversible, again in either instance based on any or all of (a) to (e). Evidence for A4c is probably the strongest since a precautionary interpretation of life history data indicates a period of 60 years for three generations, which encompasses the dramatic effects of the Farakka Barrage completed in 1974, as well as at least 19 other barrages and 18 high dams constructed in the Ganges-Brahmaputra-Meghna (GBM) and Karnaphuli-Sangu (KS) systems since 1957, and the projected dramatic declines in the area of occupancy, extent of occurrence, and quality of habitat that will undoubtedly occur if the proposed Ganges-

Brahmaputra inter-link canal and dam project, and projects planned under the Indian National Waterways Act 2016, intended to convert 111 reaches of 106 rivers to inland waterways for transport of cargo, coal, and industrial raw materials, and tourism) are completed as planned. The cumulative effects of these projects, together with ongoing mortality from entangling fishing gears, imply a probable population size reduction of more than 50% for the Ganges subspecies from 1957-2017. Even though the number of dolphins in the Sukkur-Guddu segment (and possibly also the Guddu-Taunsa segment) of the Indus River may have increased following a hunting ban in the early 1970s (see above), this could have been partly or largely due to one-way immigration from upstream (the return movements having been substantially impeded by barrages). Also, the decline in overall subspecies distribution in the Indus system continues with extirpation of more subpopulations (e.g., Beas River and Jinnah-Chashma subpopulations) and further range decline is ongoing. Equally, the major changes in the Indus caused by water development since the turn of the last century have reduced the dolphins' area of occupancy by about 80%, reduced the overall carrying capacity for dolphins in the Indus basin, and caused a substantial net decline in population size. Thus, it is reasonable to infer declines of at least 50% in the populations of both subspecies.

**Criterion B**. It has not been possible to estimate the extent of occurrence or area of occupancy for the entire species because the potential total range of the Ganges subspecies is so large and poorly documented. Nevertheless, the aggregate population of Ganges Dolphins has been severely fragmented, and there is great uncertainty about their continued occurrence in many parts of that potential range. The Indus subspecies qualifies as EN under this criterion as: (a) its extent of occurrence is estimated at only about 900 km², compared with the EN threshold of 5,000 km², (b) its population is severely fragmented and it occurs at more than five locations (defined as inter-barrage segments of river), and (c) a continuing decline can be inferred or projected in the quality of its habitat. Although the total populations of both subspecies are severely fragmented and the quality of their habitat continues to deteriorate, it would be difficult to demonstrate that the extent of their aggregate occurrence is less than 5,000 km².

**Criterion C**. Although it is possible that the total number of mature individuals is less than 2,500, current information from field surveys does not allow this criterion to be credibly applied. If future population assessments ultimately indicate that the population meets the <2,500 threshold, then it would qualify under subcriterion C1 because a continuing decline of at least 20% can be expected over the next 20–40 years (see "Threats" and "Conservation Actions"). **Criterion D**. The population size is greater than 250 mature individuals, so this criterion does not apply.

**Criterion E**. No quantitative analysis of extinction probability has been attempted for this species.

## Previously Published Red List Assessments

2012 – Endangered (EN)
http://dx.doi.org/10.2305/IUCN.UK.2012.RLTS.T41758A17355810.en

2008 – Endangered (EN)

2004 – Endangered (EN)

1990 – Vulnerable (V)

1988 – Vulnerable (V)

# Geographic Range

**Range Description:**

This species occurs in the Indus, GBM, and KS river systems of the South Asian subcontinent, from the deltas upstream to where movement is blocked by rocky barriers, shallow water, fast currents, dams, or barrages (low, gated diversion dams). The three river systems are disjunct and therefore so are their respective dolphin subpopulations, although there may be occasional demographic interaction between the latter two during the high-water season if the freshwater plumes of the two systems meet. There is further subpopulation separation within the Indus and GBM systems, some of it natural but much of it caused by physical barriers (dams and barrages) constructed within the last 100 years.

The subspecies *P. g. minor* (referred to throughout this document as the Indus Dolphin) is endemic to the rivers of the lower Indus basin in Pakistan and India. Historically it occurred in the Indus mainstem and the Sutlej, Beas, Ravi, Chenab, and Jhelum tributaries from the Indus delta upstream to the Himalayan foothills (Anderson 1879). The historical range of Indus Dolphins has been fragmented by barrages into 17 river sections. Dolphin sighting and interview surveys showed that dolphins have been extirpated from ten river sections, persist in six sections and are of unknown status in the section of the Sutlej River on the India-Pakistan border (Braulik *et al.* 2014). The linear extent of occurrence is now approximately 1,000 km (Braulik 2006) and approximately 99% of the dolphin population occurs in only 690 km of river, which corresponds to an almost 80% reduction in effective linear range since the 1870s (Reeves 1991). Current occupancy is effectively limited to three subpopulations in the Indus mainstem located between the Chashma and Taunsa, Taunsa and Guddu, and Guddu and Sukkur Barrages with only a handful of animals remaining above and below these sections (Braulik *et al.* 2012). A tiny (<30 animals) remnant subpopulation occurs in the Beas River in India (Khan 2016). The range of the Ganges subspecies (Ganges Dolphin) has declined progressively since the nineteenth century when it was mapped by Anderson (1879). Historically it occurred through several thousand kilometres of free-flowing river in India, Bangladesh, Nepal, and possibly Bhutan. The downstream effects of at least ten dams and barrages constructed in the Ganges mainstem and tributaries have severely reduced and fragmented dolphin habitat (Smith and Reeves 2000). Dolphins have undergone roughly a 100 km decline in their range in the Ganges River since the late 1800s, and disappeared from the upper Ganges between Haridwar and Bijnor, and Narora and Kanpur. Historically, they were found year-round in the Yamuna River approximately 400 km upstream to Delhi (Anderson 1879), but in recent years, dolphins have not been reported in this river above the Chambal River confluence during the dry season because upstream channels have become too shallow and polluted to support dolphins (Sinha 2000). In the northern Ganges tributaries, of the six dolphin subpopulations that were isolated above or between barrages, three have been extirpated (in the Gandak River above the Gandak Barrage, in the Sarda River above the upper and lower Sarda barrages and the Sone River) (Sinha *et al.* 2000) and one has been reduced to insignificant numbers (in the Kosi River above the Kosi Barrage) (Smith 1994, Sinha and Kannan 2014). A few Ganges Dolphins were still present during the mid-1990s as far downstream in the Hoogly River as Kakdwip (Sinha 1997), and more recent surveys suggest their continued presence between Farraka and the Bay of Bengal in West Bengal, India (Chowdhury *et al.* 2016). The lack of adequate of water being released downstream of Farraka Barrage has eliminated dry-season habitat for more than 300 km, or until the Ganges (Padma)-Brahmaputra confluence in Bangladesh (Smith *et al.* 1998).

Occasional reports of dolphins in the reservoir behind Kaptai Dam (built in 1961) of the KS system

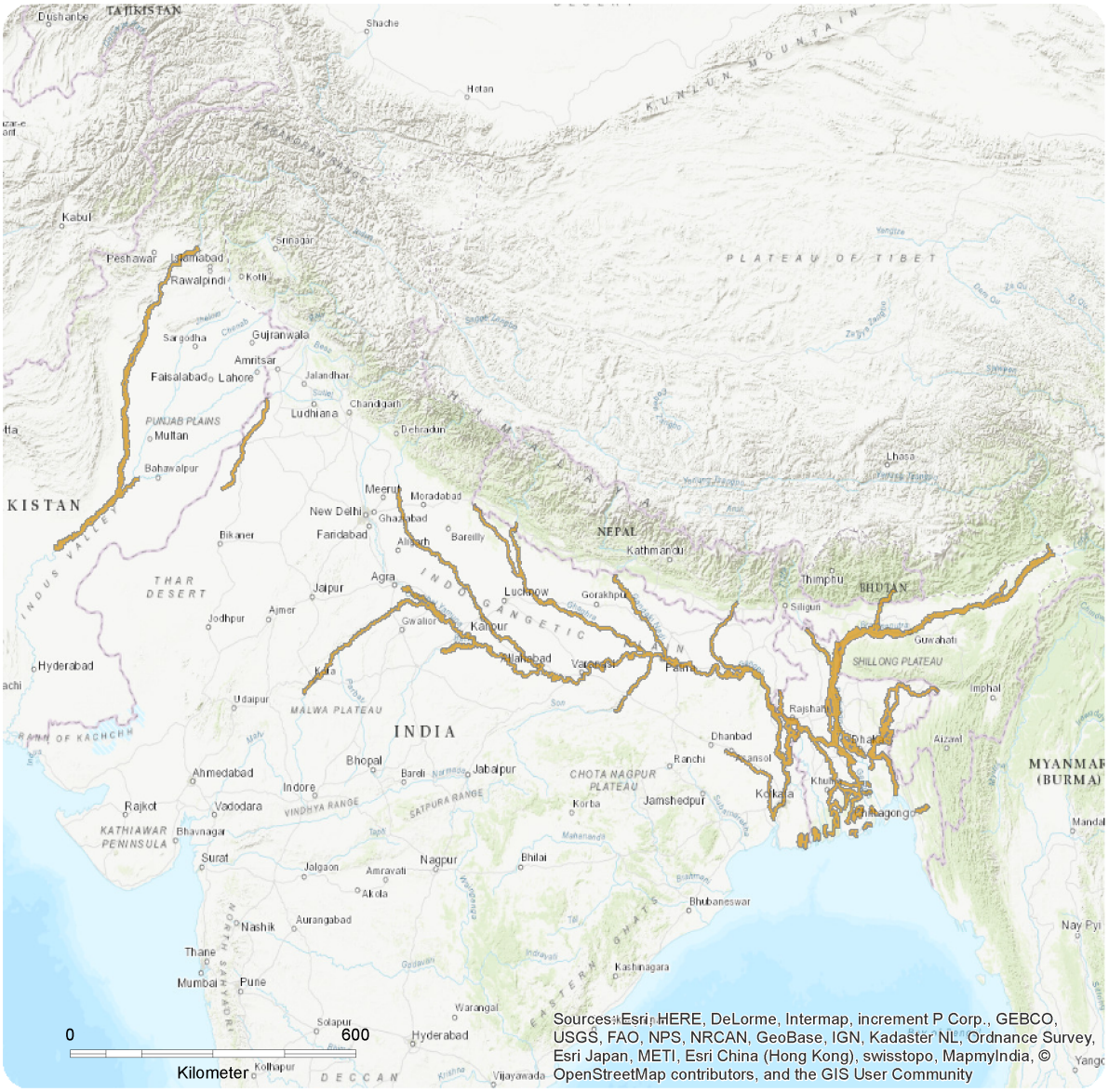
occurred until the mid-1990s (Ahmed 2000), but surveys in the late 1990s found no evidence that any Ganges Dolphins survive there (Smith *et al.* 2001). Thus, the dam's construction likely caused a substantial reduction in the subspecies' range in southeastern Bangladesh, but the absence of any historical information on occurrence in the upper Karnaphuli makes any quantitative estimate of range reduction impossible  Dolphins are expected to have been extirpated from the Subansiri River because of periodic dramatic declines in river discharge from the newly completed Lower Subansiri hydroelectric project (Baruah *et al.* 2012).  The map produced by Sinha and Kannan (2014) shows where the species occurred as of that time

## Country Occurrence:

**Native:** Bangladesh; India; Nepal; Pakistan

# Distribution Map

*Platanista gangetica*



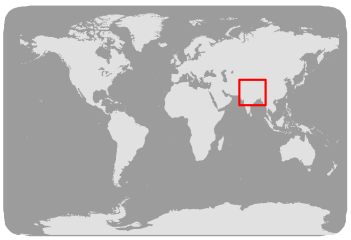

Range

Extant (resident)

Compiled by:

IUCN (International Union for Conservation of Nature)

NE DD LC NT VU EN ENDANGERED CR EW EX



The boundaries and names shown and the designations used on this map do not imply any official endorsement, acceptance or opinion by IUCN.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# Population

Published data on abundance consist primarily of uncorrected counts conducted within discrete portions of the vast network of riverine and deltaic habitat occupied by these dolphins. Few rigorous estimates of absolute abundance, with measures of precision, are available. Combining current knowledge on abundance from the Indus and Ganges we make an educated guess that the entire species numbers less than 5,000 individuals of all ages. More specific information on each of the subspecies is provided below:

**Ganges Dolphin**

In the Sundarbans of Bangladesh, concurrent double-platform visual surveys in 2002 resulted in an abundance estimate of 225 Ganges Dolphins (CV=12.6%) and an encounter rate of 0.47 individuals/linear km, with Irrawaddy Dolphins (*Orcaella brevirostris)* replacing *Ganges Dolphins* in higher-salinity waters of the southern and western portions of the delta (Smith *et al.* 2006). No information is available on the status of Ganges Dolphins in the Indian Sundarbans, except for historical reports of occurrence (Anderson 1879, Jones 1982). In 65 km of the Vikramshila Gangetic Dolphin Sanctuary on the Ganges, Kelkar *et al.* (2010) estimated Ganges Dolphin abundance as 179 (SE=7, 95% CI 148–208) and 270 (SE=8, 95% CI 240–304) in the mid and peak dry seasons, respectively. At the far upstream extent of their distribution, an estimated 37-42 dolphins remain in the Karnali, Sapta Koshi, and Narayani Rivers in Nepal (Paudel *et al.* 2015). In southern Bangladesh, at least 125 dolphins occurred in the Karnaphuli and Sangu Rivers in 1999 (Smith *et al.* 2001), and 197 were counted in the Brahmaputra River in 2005 (Wakid 2009). The highest encounter rates of Ganges Dolphins have been observed in the Ganges mainstem between Maniharighat and Buxar (1.6/km) (Sinha and Kannan 2014); and within this segment, particularly in the Vikramshila Gangetic Dolphin Sanctuary in the lower Ganges (3.3/km; (Chaudhary *et al.* 2012), 1.13/km in the middle reaches of the Gandak River, and 1.4/km in the lower Sangu River, Bangladesh (Smith *et al.* 2001). An encounter rate of 0.23 dolphins/km was recorded in the entire Brahmaputra River (Wakid 2009). Compiling direct counts and abundance estimates from numerous surveys by different groups over approximately the last ten years, Sinha and Kannan (2014) tabulated a total of 3,526 individuals for the Ganges River subspecies. However, it is not clear how accurate this is because the various researchers cited did not follow consistent and robust methods and at least some of the counts are likely to be negatively biased. In addition, many tributaries north of the Ganges River, such as Mahananda, Mechi, Bagmati, Kamala, Balan, and Burhi Gandak, have not yet been surveyed, of which Mahananda and Bagmati are large rivers (Sinha and Kannan 2014). Similarly, the Indian portion of the Sundarbans Delta and some large and many small rivers in Bangladesh have not been assessed, so the true total could be much higher.

Although no credible time series of abundance estimates is available for most of the subspecies' range, survey data imply downward trends in a number of the upstream tributaries.

**Indus Dolphin**

The entire current range of the Indus subspecies was surveyed in a coordinated manner in 2001, 2006, 2011, and 2017 (Braulik 2006, Braulik *et al.* 2012, Noureen 2013) and all surveys resulted in estimates of well under 2,000 individuals for the entire subspecies. All surveys consisted of direct counts by three observers from a viewing platform on an oar-powered wooden vessel travelling downstream along a thalweg transect, and in 2006, 2011, and 2017, direct counts were conducted from vessels travelling in tandem, separated by 1 km, and mark-recapture methods were used to correct for groups that were

missed, resulting in higher point estimates of abundance along with measures of precision (Braulik *et al.* 2012, Noureen 2013). The abundance estimates in all four surveys were similar, ranging between 1,200 and 1,800 individuals for the entire subspecies. The largest and most important subpopulation is located between Guddu and Sukkur barrages in northern Sindh. This 190 km river section supports approximately 70% of all Indus Dolphins, at encounter rates approaching 10 individuals/km. Dolphin encounter rate and subpopulation abundance decline in each river section as one proceeds upstream (Braulik *et al.* 2015). Between Guddu and Sukkur barrages, the dolphin counts increased from 138 in 1974 (Pilleri and Zbinden 1973-74) to 902 in 2008 and showed a statistically significant exponential rate of increase of 5.65% per year (Braulik *et al.* 2012). The lack of confidence intervals on these counts means that firm conclusions about population growth rates cannot be made; however, all surveys indicate that there has been some increase in the Guddu to Sukkur subpopulation since the 1970s. The increase could be explained by recovery of this subpopulation after implementation of a hunting ban in 1974 (see Conservation Actions), perhaps supplemented by permanent immigration from upstream subpopulations (see Threats). A comprehensive review of previous survey data is presented in Braulik *et al.* (2015).

**Current Population Trend:** Unknown

## Habitat and Ecology **(see Appendix for additional information)**

South Asian River Dolphins are generally concentrated in counter-current pools below channel convergences and sharp meanders and above and below mid-channel islands. Annual monsoon-driven flooding causes great variability in the dolphins' access to large parts of their range. Isolation in seasonal lakes or deep river channels sometimes occurs, as does "escapement" from the rivers into canals and reservoirs. Deltaic (brackish) waters are a component of the total range, but Ganges Dolphins are not generally known to occur in salinities greater than 10 ppt.

Ganges Dolphins are generally concentrated in counter-current pools below channel convergences and sharp meanders (Smith 1993, Smith *et al.* 1998) and above and below mid-channel islands, bridge pilings, and other engineering structures that cause scouring. Several studies have demonstrated that Ganges Dolphins are concentrated into deep pool habitat in the dry season, which increases their conflict with fisheries that also concentrate in these productive areas (Kelkar *et al.* 2010, Bashir *et al.* 2012). Their fidelity to counter-current pools is probably greatest in fast-flowing channels. Isolation in seasonal lakes sometimes occurs (especially in the Brahmaputra basin). Deltaic (brackish) waters are a major component of the total range of this subspecies, but the animals are not generally known to occur in salinities greater than 10 ppt, although they have been observed in waters as saline as 23 ppt. Indus Dolphins generally occur in the deepest river channel and are less common in secondary channels and small braids (Braulik 2006). During the low-water season (October to April), barrages divert almost all river water such that dolphin habitat downstream of Sukkur Barrage and in some tributary segments has been eliminated and so have the dolphins. As water levels drop in the winter, dolphins are concentrated in the remaining deep areas, including the head ponds upstream of barrages. A comprehensive habitat study demonstrated that Indus Dolphins selected locations in the river with significantly greater mean depth, maximum depth, cross-sectional area, and hydraulic radius, and significantly narrower river width and a lower degree of braiding than areas where dolphins were absent (Braulik *et al.* 2012). Channel cross-sectional area was the most important factor affecting dolphin presence and abundance, with the area of water less than 1 m in depth exerting the greatest influence. Indus Dolphins avoided channels with small cross-sectional area (<700$m^2$), presumably owing to the risk


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of entrapment and reduced foraging opportunities. Male South Asian River Dolphins attain sexual maturity at a body length of about 170 cm and physical maturity at 200-210 cm. Females attain sexual maturity at similar or slightly larger body lengths but physical maturity at about 250 cm. The generally larger rostrum of females accounts for this sexual dimorphism. Length at birth is estimated to be about 70 cm. Gestation lasts approximately one year, with possible peak birthing seasons in early winter and early summer. Young begin feeding on small prey at about one or two months and are weaned within a year (Kasuya 1972). Brownell (1984) estimated age at sexual maturity to be roughly 6-10 years in this species.

**Systems:** Freshwater

# Use and Trade

The Ganges subspecies is hunted locally for food, and to extract oil which is used as a fish attractant. The Indus Dolphin is no longer used by humans or for trade.

## Threats (see Appendix for additional information)

**Water development projects** such as dams and irrigation barrages (diversion dams) have dramatically affected the habitat, abundance, and population structure of this species throughout its range. Barrages and dams are physical barriers that isolate dolphins into small sections of river, fragmenting the population. In addition to fragmentation, dams and barrages have degraded downstream habitat and created impoundments with high sedimentation and altered assemblages of fish and invertebrate species. Canals branching from the river channels upstream of barrages represent population "sinks", as dolphins enter them with little or no prospect of safe return; this problem has been especially well documented in Pakistan. More dams and barrages are either under construction or in advanced planning stages. Water diversion and use in the South Asian subcontinent, including intra- and inter-basin transfers, will continue to be driven principally by the escalating demands for water from agriculture, industry, and municipalities; by strategic considerations; and by the need to control flooding. The range of the South Asian River Dolphin will probably continue to decline as subpopulations are extirpated due to habitat loss related to escalating water demands, large engineering structures (e.g., high dams, barrages, and embankments), and long-term climate changes (Smith *et al.* 2010, Chaudhary *et al.* 2012, Braulik *et al.* 2014). **Pollutant loads** in South Asian rivers are increasing and can be expected to continue to do so with industrialization and the spread of intensive agricultural practices facilitated by irrigation with river water. The capacity of these rivers to dilute pollutants (e.g., arsenic, DDT, industrial effluents) and salinity has already been drastically reduced because of upstream water abstraction, diversion, and impoundment. Again, this problem is bound to worsen as more development takes place and with few controls on pollutant discharges.

**Deliberate killing** of River Dolphins has declined in many areas but still occurs at least occasionally. Dolphins are hunted by tribal people in the upper Brahmaputra for their meat and by fishermen in the middle reaches of the Ganges for their oil, which is used as a fish attractant.

**Mortality in fishing gear**, especially gillnets, is a severe problem for Ganges Dolphins throughout most of their range and is an increasing problem for Indus Dolphins. They are particularly vulnerable because their preferred habitat is often in the same location as the fishing grounds (Kelkar *et al.* 2010).


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More specific information on the subspecies is provided below:

***Ganges Dolphin***

Construction of at least 50 dams and barrages within the known or historical range of the Ganges Dolphin (Smith *et al.* 2000) has dramatically affected its habitat, abundance, and population structure. The subspecies exists as a metapopulation, with numerous subpopulations isolated to varying degrees by mostly manmade barriers, as described above. In addition to fragmenting dolphin populations, dams and barrages degrade downstream habitat and create small reservoirs (known as head ponds (or pondage in India) in the case of barrages) with high sedimentation and altered assemblages of fish and invertebrate species. For example, luxuriant growth of macrophytes and excessive siltation have eliminated suitable habitat immediately above Farakka Barrage (Sinha 2000). Low flows downstream of Farakka barrage have also allowed salt water to intrude an additional 160 km into the Sundarbans Delta, further decreasing the amount of suitable habitat for this obligate freshwater dolphin. A high dam has been planned for some time just upstream of the dolphins' current (or at least recent) range in the Karnali River, Nepal. If built, this structure would almost certainly eliminate the small amount of dolphin habitat in Nepal's last river with a potentially viable dolphin population (Smith and Reeves 2000). Disturbance and environmental degradation associated with geotechnical feasibility studies and bridge and road construction for the dam already may have contributed to a decline in the number and range of dolphins above the Nepal-India border (Smith 1993, 1994). Another high dam has been proposed for the Surma River in Cachar, India, which would certainly affect dolphins downstream in the Kalni-Kushiyara distributary.

Since the 1980s, momentum has been growing within India to proceed with large-scale inter-basin water transfer projects, which will involve additional dam construction and diversion of water from rivers inhabited by dolphins. This has been proposed for many years but is gaining momentum and plans are being solidified to make this a reality. Several key categories of potential threat are: (a) further fragmentation of the dolphin metapopulation, (b) reduction or elimination of habitat simply in terms of dry-season flow, (c) "escapement" of dolphins into canals where they are unlikely to be able to get back into rivers and are therefore doomed, (d) cascading effects from interrupted migrations of prey organisms, degradation of prey spawning habitat etc., (e) contaminant flux leading to significant changes in chronic and/or acute exposure to toxins, (f) loss of complexity (channelization, sediment entrapment upstream of dams, etc.) making the rivers less habitable for dolphins and (g) downstream effects on the ecology of the delta (e.g., saline encroachment, loss of sediment). A related initiative is a series of projects planned under the Indian National Waterways Act 2016. This initiative has raised concerns regarding the possible negative impacts of these developments and the associated lack of water, capital dredging, construction of additional barrages, increased vessel traffic, and pollution. Embankments cause sediments to be deposited in the riverbed instead of on the floodplain, thereby eliminating or reducing the extent of the eddy counter-currents where dolphins are generally found (Smith *et al.* 1998). They also restrict access to floodplain habitat critical to the reproduction and growth of riverine fish species. Approximately 3,500 km of embankments have been constructed in the Ganges mainstem and the Gandak, Buri Gandak, Bagmati, Kamala, Yamuna, and Son tributaries (Mishra 1999). Dolphins were apparently extirpated from at least 35 km of the Punpun tributary of the Ganges after embankments were constructed in 1975 (Sinha *et al.* 2000). Other sources of habitat degradation in the GBM system include dredging (Smith *et al.* 1998) and the removal of stones (Shrestha 1989), sand (Mohan 1989), and woody debris (Smith 1993). These activities compromise the ecological integrity of

the riverine environments, especially small tributaries where suitable habitat is limited and disproportionately vulnerable to local disturbance. Although the long-term implications of reduced dry-season flows in the Ganges are catastrophic for the survival of both River Dolphins and a major portion of the world's human population that inhabits the Ganges basin, minimum flow requirements to maintain ecological integrity have only been superficially assessed and even if minimum flows were prescribed in principle or in law, there is little prospect of their being implemented. Meanwhile, new projects to divert dry-season flow, such as Kanpur Barrage in the upper Ganges, continue to be constructed (Sinha *et al.* 2000).

Organochlorine and butyltin concentrations in samples from the tissues of Ganges Dolphins were high enough to cause concern about effects (Kannan *et al.* 1993, 1994, Kannan 1997, 2005; Senthilkumar *et al.* 1999). Pollutant loads can be expected to increase with industrialization and the spread of intensive agricultural practices. River Dolphins may be particularly vulnerable to industrial pollution because their habitat in counter-current pools downstream of confluences and sharp meanders often places them in close proximity to point sources in major urban areas (e.g., Allahabad, Varanasi, Patna, Calcutta, and Dhaka). Furthermore, the capacity of rivers to dilute pollutants (e.g., arsenic, DDT) and salts has been drastically reduced in many areas because of upstream water abstraction, diversion, and impoundment. Again, this problem is bound to worsen as more development takes place.

Deliberate killing of River Dolphins is believed to have declined in most areas but still occurs at least occasionally in the middle Ganges near Patna, India (Sinha *et al.* 2000, Smith and Reeves 2000), in the Kalni-Kushiyara River of Bangladesh (Smith *et al.* 1998), and in the upper reaches of the Brahmaputra River in Assam, India (Wakid 2009). Dolphins are killed by tribal people in the upper Brahmaputra for their meat and by fishermen in the middle reaches of the Ganges for their oil, which is used as a fish attractant.

Mortality in fishing gear, especially gillnets, is a severe problem for Ganges Dolphins throughout most of their range. From 2007 to 2013, 13 of 40 documented deaths in the eastern Sundarbans, Bangladesh were a result of entanglement in fishing gear (10 in gillnets, 2 in longlines, and 1 in a set bag-net), 2 of vessel strikes, 2 of directed killing, and the rest of unknown causes (Mansur *et al.* 2014). Although Ganges Dolphins appear somewhat resilient to changes in fish community structure from overfishing (Kelkar *et al.* 2010), fatal entanglements, particularly in gillnets, will undoubtedly increase with growing demands on freshwater fisheries. In the middle Ganges, although harpooning is now "rare", mortality in fishing nets remains "widespread" (Sinha 2002). A specific problem is that, because dolphin oil is highly valued as a fish attractant, fishermen have a strong incentive to kill any animals found alive in their nets and even to set their nets strategically in the hope of capturing dolphins (described by Sinha 2002 as "assisted incidental capture"). Meaningful quantitative data on the magnitude of catches, either deliberate or incidental, are unavailable and unlikely to become available in the absence of a well-organized, adequately funded, and incorruptible fishery/wildlife management system.

***Indus Dolphin***

The most significant threat to dolphins in the Indus has been the construction of the Indus basin irrigation system that has severely fragmented the population and reduced the amount of available habitat. Since the 1880s, 19 irrigation barrages have been constructed on the lower Indus within, or at the limits of, the former range of the dolphins. Dolphins have now been extirpated from approximately 80% of their former range because many of the rivers are now dry (Braulik *et al.* 2014). The dolphin

range decline is a dynamic process and it is probable that both the Beas River and the Jinnah-Chashma dolphin subpopulations have been extirpated within the last five years. Low dry-season river discharge, due to water extraction at irrigation barrages is the principal factor responsible for both the temporal and spatial pattern of the dolphins' range decline (Braulik *et al.* 2014). Reductions in flow affect dolphins directly by reducing the physical space available to them, reducing average water velocity and depth and increasing water temperature. During the dry season Indus Dolphins are concentrated in the remaining deep pool habitat in the river, and they avoid shallow river sections (Braulik *et al.* 2012). Removal of water from the river exacerbates and concentrates anthropogenic threats, for example, by increasing the concentration of nutrients and pollutants, and forcing the dolphins to congregate in deep pools that are also important areas for fishing, thereby increasing the chances of negative interactions with humans. It has been suggested that dolphins sometimes move through barrage gates and between subpopulations (Reeves *et al.* 1991). The only solid evidence of this is from a single radio-tracked dolphin released above Sukkur Barrage during canal closure that traversed the barrage in both upstream and downstream directions several times (Toosy *et al.* 2009). The barrage gates were eventually closed, leaving the animal below the barrage, trapped in a new subpopulation downstream from its origin. The potential implications of large-scale movements of animals through barrages are great. If animals are more likely to move downstream than upstream, the result would be the gradual attrition of upstream subpopulations and the augmentation of those downstream. Migration of this type could dramatically deplete upstream subpopulations over time, especially as many of these are already very small, potentially leading to their gradual extirpation (Reeves *et al.* 1991). Pollution may be affecting the viability of the Indus subspecies, especially considering the decline in flushing and dilution due to reduced flows and increasing industrial effluent discharges. More than 75% of the dolphin population occurs downstream of the confluence with the Panjnad River, which receives a large pollution load from the industrialized cities of the Punjab. There are almost no facilities for treatment of municipal waste in Pakistan and few controls on industrial effluent. Massive fish kills from industrial pollution have reportedly become common in urban areas, and also human deaths from contact with toxic industrial discharges, not to mention increasing runoff of pesticides used on irrigated crops grown along the riverbanks. Commonly used pesticides – DDT, Cypermethrin, Deltamethrin and Endosulfan – were found in the tissue of three Indus Dolphins that died in Sukkur in January 2011 (WWF-Pakistan 2011). The pressures on river water supply and continued untreated discharge of pollutants imply that there will be a continuing decline in the amount and quality of dolphin habitat, and similar to Ganges River Dolphins, Indus Dolphins are likely to be exposed to very high levels of toxic contaminants that could compromise health.

Deliberate killing for meat and oil was a traditional and widespread practice until at least the early 1970s (Pilleri and Zbinden 1973-74). The Indus Dolphin became a protected species in the early 1970s and within a few years, and following some prosecutions in the courts, dolphin hunting largely ceased (Bhatti and Pilleri 1982). Indus Dolphins are accidentally captured in nets when they stray into irrigation canals which, due to their narrow and shallow dimensions, are easily and heavily fished. Net entanglement is a major concern between Sukkur and Kotri barrages where the Indus flow is so severely depleted that fixed nets span the river. However, in general, the Indus River main channel has not been intensively fished as fishing activity is concentrated in side channels and adjacent pools that are reported to be warmer and have higher fish densities. However, entanglement is an increasing threat as boats become mechanised and better able to negotiate the main channel. In 2007, changes in fishery management led to larger numbers of fishermen using the river and a coincident jump in the number of

dolphin deaths. From 1993 to 2010 a total of 35 dolphins were reported dead between Guddu and Sukkur, however in 2011 alone 45 dead dolphins were reported and another 15 from January to May 2012, with similar monitoring systems present in each year (Waqas *et al.* 2012). In 2011 at least six dolphins were killed when insecticides were dumped into the river to increase fish catch, a practice that is increasingly common (WWF-Pakistan 2011).

## Conservation Actions **(see Appendix for additional information)**

The species is legally protected in all range states and occurs in a number of national parks and other designated areas, including dolphin reserves or sanctuaries, where at least nominal enforcement takes place. In Pakistan, the enforcement of regulations prohibiting dolphin hunting appears to have arrested a rapid population decline in the Indus during the early 1970s. Also in Pakistan, a program exists to rescue dolphins trapped in irrigation canals and return them to the Indus main channel. Although sample sizes were limited, trials in India to determine the effectiveness of shark and scrap fish oils as catfish attractant were judged provisionally successful, but it is unclear to what extent fishermen have converted to using them instead of dolphin oil.
The species is listed on CITES Appendix I.

Ganges Dolphins are legally protected from hunting in all range states. The Vikramshila Gangetic Dolphin Sanctuary, Bihar, India, between Sultanganj and Kahalgaon in the mainstem of the Ganges River was designated as a protected area for dolphins in August 1991 but there is little government support to enforce protective measures. The designation of the Ganges Dolphin as the National Aquatic Animal and the development of a Ganges Dolphin Conservation Action Plan (Sinha *et al.* 2010) were positive steps forward in their conservation which had been previously described as "completely ineffective," however it remains unclear if these steps have actually improved on-the-ground protection (Sinha 2002). Declaration of three small wildlife sanctuaries to protect Ganges Dolphins in key hotspots within the Sundarbans Delta of Bangladesh was an important step in their conservation. In a few smaller tributaries, dolphins receive nominal protection by virtue of the fact that small portions of their habitat are within or adjacent to national parks and sanctuaries (e.g., Kaziranga National Park in Assam, India; National Chambal Sanctuary in Madhya Pradesh, India; and Royal Bardia National Park and Katerniya Ghat Gharial Sanctuary, respectively north and south of the Nepal-India border).

In 1972, Indus Dolphins were protected under the Wildlife Act of Sindh and in 1974 the government of Sindh declared the Indus River between the Sukkur and Guddu Barrages a dolphin reserve. The government of Punjab prohibited deliberate killing of dolphins in the Punjab Wildlife Protection Act in 1974 and established the Taunsa Wildlife Sanctuary and Chashma Wildlife Sanctuary in 1983 and 1984, respectively (Chaudhry 1989, Reeves *et al.* 1991, Reeves and Chaudhry 1998). Enforcement of regulations prohibiting dolphin hunting appears to have arrested the rapid population declines reported by Pilleri and Zbinden (1973-74) for these river segments. A long-term programme to rescue dolphins trapped in irrigation canals and return them to the Indus mainstem has had good success in reducing mortality.

# Credits

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## Disclaimer

## External Resources

For Images and External Links to Additional Information, please see the Red List website.

# Appendix

## Habitats

(http://www.iucnredlist.org/technical-documents/classification-schemes)

| Habitat | Season | Suitability | Major Importance? |
|---|---|---|---|
| 5. Wetlands (inland) -> 5.1. Wetlands (inland) - Permanent Rivers/Streams/Creeks (includes waterfalls) | Resident | Suitable | Yes |
| 5. Wetlands (inland) -> 5.6. Wetlands (inland) - Seasonal/Intermittent Freshwater Lakes (over 8ha) | Unknown | Marginal | - |
| 9. Marine Neritic -> 9.10. Marine Neritic - Estuaries | Unknown | Marginal | - |
| 15. Artificial/Aquatic & Marine -> 15.1. Artificial/Aquatic - Water Storage Areas (over 8ha) | Unknown | Marginal | - |

## Threats

(http://www.iucnredlist.org/technical-documents/classification-schemes)

| Threat | Timing | Scope | Severity | Impact Score |
|---|---|---|---|---|
| 5. Biological resource use -> 5.4. Fishing & harvesting aquatic resources -> 5.4.1. Intentional use: (subsistence/small scale) [harvest] | Ongoing | - | - | - |
| | Stresses: | 2. Species Stresses -> 2.1. Species mortality | | |
| 5. Biological resource use -> 5.4. Fishing & harvesting aquatic resources -> 5.4.4. Unintentional effects: (large scale) [harvest] | Ongoing | - | - | - |
| | Stresses: | 2. Species Stresses -> 2.1. Species mortality | | |
| 7. Natural system modifications -> 7.2. Dams & water management/use -> 7.2.11. Dams (size unknown) | Ongoing | - | - | - |
| | Stresses: | 1. Ecosystem stresses -> 1.1. Ecosystem conversion<br>1. Ecosystem stresses -> 1.2. Ecosystem degradation | | |
| 7. Natural system modifications -> 7.2. Dams & water management/use -> 7.2.8. Abstraction of ground water (unknown use) | Ongoing | - | - | - |
| | Stresses: | 1. Ecosystem stresses -> 1.2. Ecosystem degradation | | |
| 9. Pollution -> 9.1. Domestic & urban waste water -> 9.1.3. Type Unknown/Unrecorded | Ongoing | - | - | - |
| | Stresses: | 1. Ecosystem stresses -> 1.2. Ecosystem degradation | | |
| 9. Pollution -> 9.2. Industrial & military effluents -> 9.2.3. Type Unknown/Unrecorded | Ongoing | - | - | - |
| | Stresses: | 1. Ecosystem stresses -> 1.2. Ecosystem degradation | | |
| 9. Pollution -> 9.3. Agricultural & forestry effluents -> 9.3.4. Type Unknown/Unrecorded | Ongoing | - | - | - |
| | Stresses: | 1. Ecosystem stresses -> 1.2. Ecosystem degradation | | |


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## Conservation Actions in Place

**(http://www.iucnredlist.org/technical-documents/classification-schemes)**

| **Conservation Actions in Place** |
|---|
| In-Place Research, Monitoring and Planning |
| Action Recovery plan: No |
| Systematic monitoring scheme: No |
| In-Place Land/Water Protection and Management |
| Conservation sites identified: Yes, over entire range |
| Occur in at least one PA: Yes |
| In-Place Species Management |
| Successfully reintroduced or introduced beningly: Yes |
| In-Place Education |
| Included in international legislation: Yes |
| Subject to any international management/trade controls: Yes |

## Conservation Actions Needed

**(http://www.iucnredlist.org/technical-documents/classification-schemes)**

| **Conservation Actions Needed** |
|---|
| 1. Land/water protection -> 1.1. Site/area protection |
| 1. Land/water protection -> 1.2. Resource & habitat protection |
| 2. Land/water management -> 2.1. Site/area management |
| 3. Species management -> 3.1. Species management -> 3.1.1. Harvest management |
| 3. Species management -> 3.2. Species recovery |
| 4. Education & awareness -> 4.3. Awareness & communications |
| 5. Law & policy -> 5.1. Legislation -> 5.1.2. National level |
| 5. Law & policy -> 5.4. Compliance and enforcement -> 5.4.2. National level |

## Research Needed

**(http://www.iucnredlist.org/technical-documents/classification-schemes)**

| **Research Needed** |
|---|
| 1. Research -> 1.2. Population size, distribution & trends |
| 1. Research -> 1.3. Life history & ecology |

| Research Needed |
| --- |
| 1. Research -> 1.5. Threats |
| 1. Research -> 1.6. Actions |
| 3. Monitoring -> 3.1. Population trends |

# Additional Data Fields

| Distribution |
| --- |
| Continuing decline in area of occupancy (AOO): Yes |
| Continuing decline in extent of occurrence (EOO): Yes |
| Lower elevation limit (m): 0 |
| Upper elevation limit (m): 0 |
| Upper depth limit (m): 0 |
| **Population** |
| Population severely fragmented: Yes |
| **Habitats and Ecology** |
| Continuing decline in area, extent and/or quality of habitat: Yes |
| Generation Length (years): 10-20 |
| Movement patterns: Not a Migrant |
| Congregatory: Congregatory (year-round) |


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# The IUCN Red List Partnership


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The IUCN Red List Partners are: Arizona State University; BirdLife International; Botanic Gardens Conservation International; Conservation International; NatureServe; Royal Botanic Gardens, Kew; Sapienza University of Rome; Texas A&M University; and Zoological Society of London.