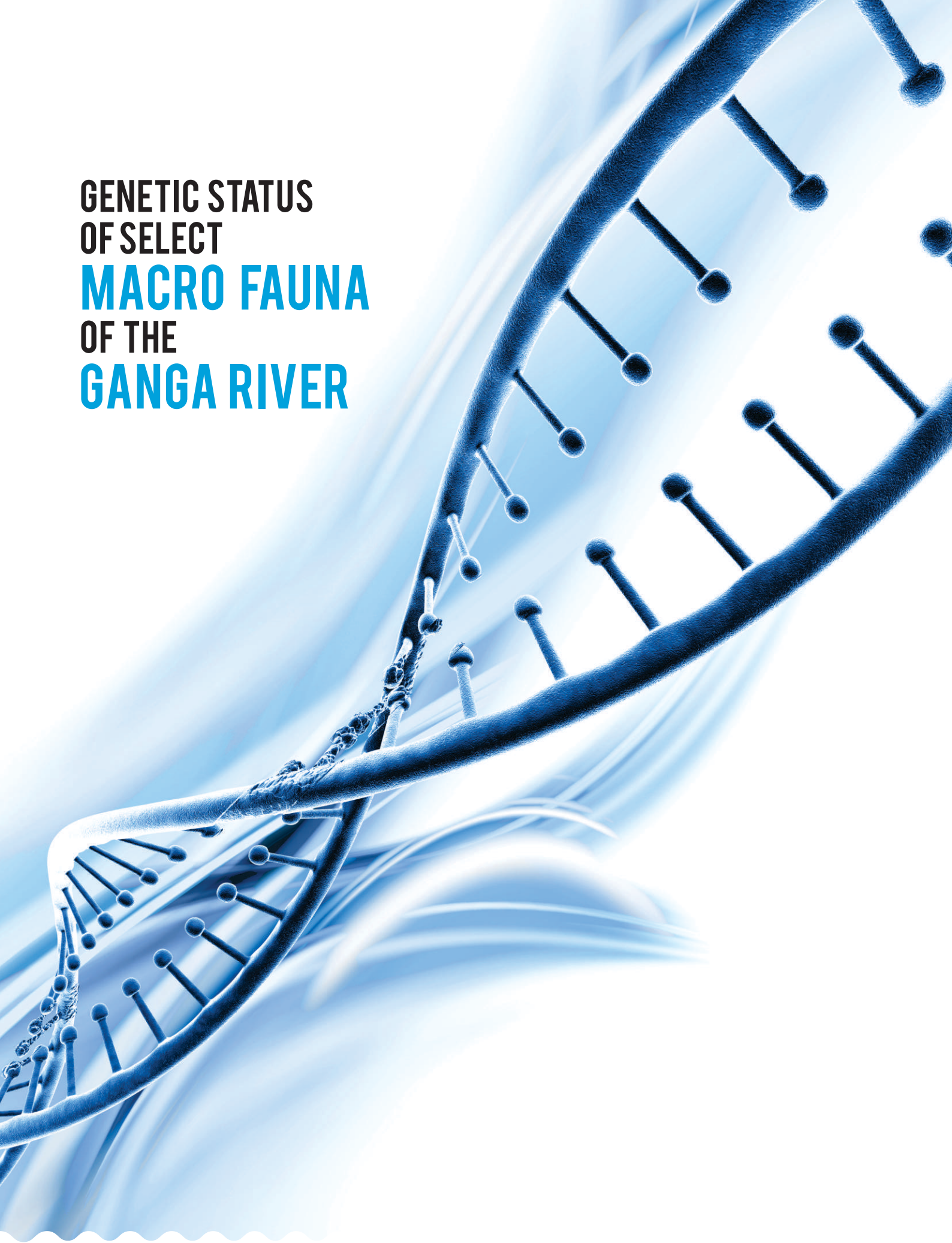
GENETIC STATUS OF SELECT MACRO FAUNA OF THE GANGA RIVER



भारतीय वन्यजीव संस्थान
Wildlife Institute of India

NAMAMI GANGE

VIBRANT GANGA

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Preface

The Himalayan Rivers has characteristic biogeographic attributes and rich species diversity. However, increasing anthropogenic pressure on the Ganga River system has significantly altered the natural habitat, abundance, and population dynamics of the inhabiting species. This makes continuous long-term monitoring crucial to understand the effect of longitudinal connectivity and anthropogenic factors on the population genetic structure of the aquatic species.

We feel immense pleasure in presenting this document titled "Genetic status of select macro fauna of the Ganga River", which elucidates the status of genetic diversity and aids in further strengthening the gene pool of aquatic species by implementing appropriate conservation and management strategies. This document provides concise genetic information and highlights species description, conservation status as well as the threats faced

Sandeep Kumar Gupta
Syed Ainul Hussain

Summary

The Ganga River nurtures a diverse array of aquatic fauna characteristic to the different biogeographic zones shaped by the river. The species that are dispersed across the extensive interconnected river, contemporary level of genetic variation and population structure may be shaped by the interaction of both natural and anthropogenic factors. For decades, freshwater biodiversity has been recognized as highly threatened due to the long history of anthropogenic modifications of aquatic ecosystems, which makes a comprehensive assessment of utmost urgency. A study on genetic variability of select macro fauna across the Ganga River system is crucial to examine the fitness of the existing populations and their adaptive potential in the face of steadily changing environmental conditions and related stress. Information on the conservation genetics of the faunal species is vital for effective conservation planning. The genetic evaluation of the species, especially the fish species of the river can guide sustainable consumption, prevent the spread of diseases, manage brood stocks and help clarify the status of cryptic species, aiding in designing effective conservation measures. We assessed the genetic diversity and gene flow pattern in five fish species: Golden Mahseer (*Tor putitora*), Giant river catfish (*Sperata lamarrii*), Long whiskered catfish (*Spereta aor*), Snow trout (*Schizothorax richardsonii*) and Dwarf Goonch (*Bagarius bagarius*), and five turtle species: Indian flap shell turtle (*Lissemys punctata*), Indian softshell turtle (*Nilssonia gangetica*), Three striped roofed turtle (*Batagur dhongoka*), Brown roofed turtle (*Pangshura smithii*) and Spotted pond turtle (*Geoclemys hamiltonii*), and the Gangetic dolphin (*Platanista gangetica gangetica*).

The study revealed primarily unidirectional migration in select species with limited gene flow and significant genetic diversity in species inhabiting Bhagirathi, Alaknanda and upper Ganga stretches. In the middle Ganga, between Narora and Prayagraj and the lower stretches between Varanasi and Ganga Sagar, moderate to high genetic diversity with high maternal gene flow was observed. However, the genetic variability found in species in different stretches varied and was shaped by their respective restricted or wide distribution range. The evaluation of genetic diversity in the five studied fish species was high. In addition, moderate genetic diversity was observed in Indian flap shell turtle, Indian softshell turtle, Brown roofed turtle and Spotted pond turtle whereas high genetic diversity was observed in Three striped roofed turtle. Moderate level of gene diversity was also observed in the Gangetic dolphin.

This genetic information will contribute to a crucial reference database that will guide management strategies towards conserving these aquatic species under tremendous anthropogenic pressure in the face of highly unpredictable climate change. Understanding the genetic variations of these species will play a key role in practicing efficient *in-situ* and *ex-situ* conservation and management practices.

Photo Credit: Saurabh

Contents

Introduction

The holy river Ganga is hailed as the lifeline of India and supports more than 600 million people. The Ganga River nurtures rich aquatic fauna comprising 143 species of fishes, 13 species of freshwater turtles (including two endangered and two critically endangered), 90 species of amphibians, three species of Otters, Gangetic dolphin (*Platanista gangetica gangetica*), Mugger Crocodile (*Crocodylus palustris*) and Gharial (*Gavialis gangeticus*). Despite its ionic and religious status, high anthropogenic pressure threatens its biodiversity. Rapidly increasing population, reduction in water levels, increasing water pollution, and construction of dams are the growing concerns that significantly affect habitat, abundance, and population structure of its aquatic fauna. These factors act as barriers restricting movement of aquatic species, rendering them into isolated sub-populations. As a result, most species are facing large scale limitation and shifts in distribution ranges of which many freshwater species' are included in the Red List of IUCN, CITES as well as protected under the Wildlife (Protection) Act, 1972.

Species distributions are best considered as ongoing manifestations of microevolutionary adaptation to local ecological regimes, and increasingly human intervention. The contemporary level of genetic variation and population structure may have been shaped by interaction of both natural and anthropogenic factors, which are dispersed across the extensive interconnected river system. Primarily, human activities such as habitat destruction and fragmentation, hunting, and human-mediated translocation coupled with climate change impacts, have influenced the distribution, population structure, and genetic diversity of aquatic species. Therefore, a study on

genetic variability is crucial to identify the fitness of individuals, which regulates adaptation to change in environmental conditions and stress. Degradation of genetic diversity reduces the adaptive potential, increases chances of inbreeding, which poses the risk of species extinction.

There have been very few scientific efforts with minimal baseline information on the genetic status of these threatened aquatic species of Ganga River. Mitochondrial sequence analysis provides valuable information regarding phylogenetics, gene flow and population demography of species, population genetic studies using polymorphic microsatellite makers can also give useful information to understand the status of genetic diversity and fine scale population genetic structure of aquatic species. The knowledge of population demography and genetic fitness of aquatic fauna are essential for developing a science-based conservation and management strategy for species inhabiting small and fragmented habitats. We assessed the genetic diversity and gene flow pattern within the five fish species, five turtle species and Gangetic dolphins which highlights the genetic status of selected Gangetic species and provide baseline information to various stakeholders.

Utility of genetic resource in aquatic species conservation

- Assessing genetic diversity and gene flow
- Assessing population genetic structure
- Identifying population demographic trends
- Determining effective population size
- Monitoring inbreeding and outbreeding
- Identifying cryptic, alien or invasive species
- Identifying pure genetic stocks for population recovery programmes
- Designing breeding programmes for conservation and re-introduction plan

GOLDEN MAHSEER
(*Tor putitora*)

Taxonomy

Class	:	Actinopterygii
Order	:	Cypriniformes
Family	:	Cyprinidae
Genus	:	*Tor*
Species	:	*putitora*

Golden mahseer is a flagship species mainly found in foothills of the Himalayan Rivers.

Key field identification features Body streamlined, grown up to 54 kg, head broadly pointed. Two pairs of barbels (maxillary & rostral). The dorsal spine is bony, strong, and smooth. Scales are large with 25 to 28 scales and lateral line present.

Distribution

Reported across the Himalayan region and elsewhere in South and Southeast Asia.

Habitat and Behaviour

Inhabit in mountain streams and rivers, preferring to live among rocks. Ominivours: feeding mainly on insects, small fishes, algae, aquatic plants, and detritus.

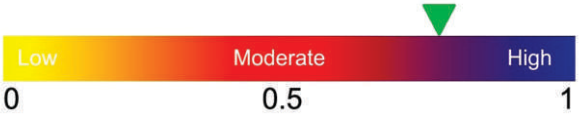
Major threats

Water pollution, hydroelectric and irrigation projects, overfishing, and alterations of natural habitats.

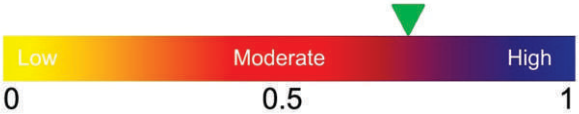
Population Trend
Declining

Genetic Status

mtDNA gene diversity



Nuclear gene diversity

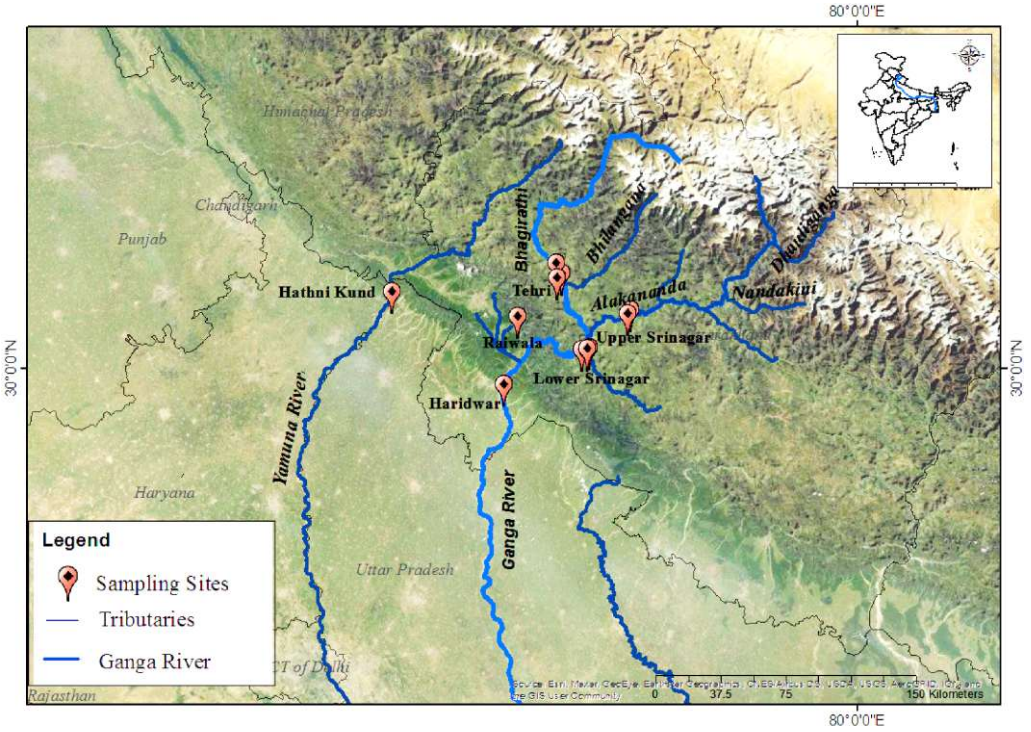


Conservation Status:

IUCN Red List:
Endangered

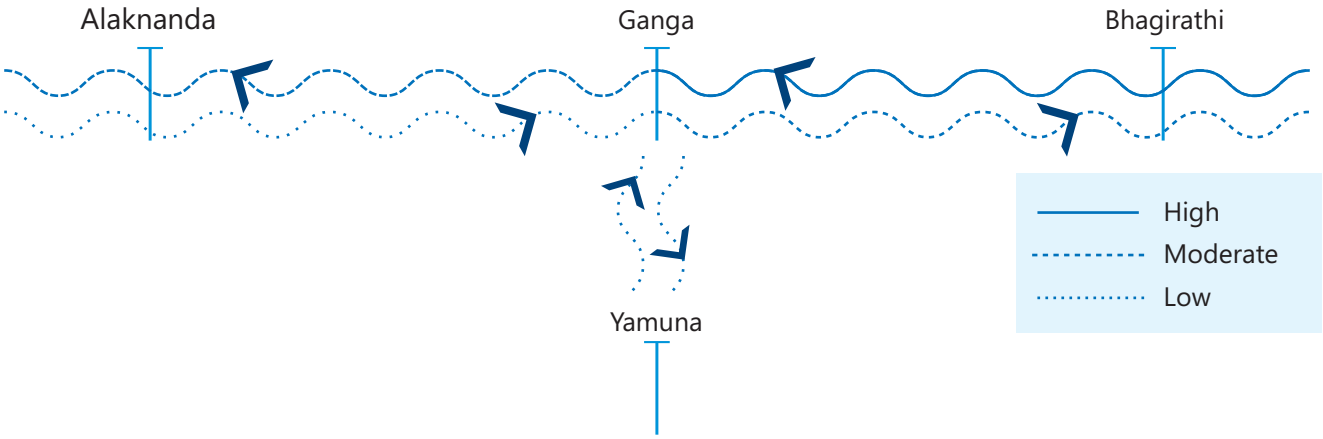
CITES:
Not listed

WPA, 1972:
Not listed



Map of study area showing sampling sites of *Tor putitora*.

Geneflow



Highlights

The construction of major dams such as Tehri and Koteshwar on Bhagirathi River and Srinagar dam on Alaknanda River may have shaped unidirectional migration resulting in limited dispersal ability. A significant level of genetic differentiation was observed in the Alaknanda population. Because golden mahseer is restricted to cold water habitats and is a sensitive species, small climatic fluctuation may affect its genetic structure.

We suggest the establishment of microscale protected areas in Ganga where fishing should be prohibited at the confluence of the Nayar River since it is a GM breeding hotspot. Further analysis from other tributaries may provide better insight into putative structuring and genetic diversity of the population for developing appropriate strategies for stock management and conservation program.

SNOW TROUT
(*Schizothorax richardsonii*)

Taxonomy

Class	:	Actinopterygii
Order	:	Cypriniformes
Family	:	Cyprinidae
Genus	:	*Schizothorax*
Species	:	*richardsonii*

Identification features

Body streamlined and scales are minute. Lower jaw with a hard, horny, and sharp edge. Two pairs of short barbels, maxillary and rostral. The dorsal spine is strong and serrated posteriorly.

Distribution

Restricted to coldwater habitat found in Uttarakhand, Nagaland, Jammu & Kashmir States of India, Nepal, Bhutan, Pakistan, and Afghanistan.

Habitat and Behaviour

Inhabit in mountain streams and rivers, preferring to live among rocks. Herbivores: feeding mainly on algae, aquatic plants, and detritus.

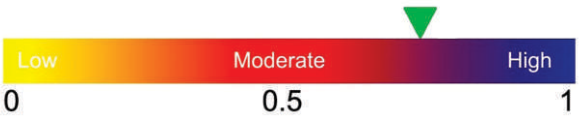
Major threats

Introduction of exotic species, increased water temperature, dam, and overfishing.

Population Trend
Declining

Genetic Status

mtDNA gene diversity

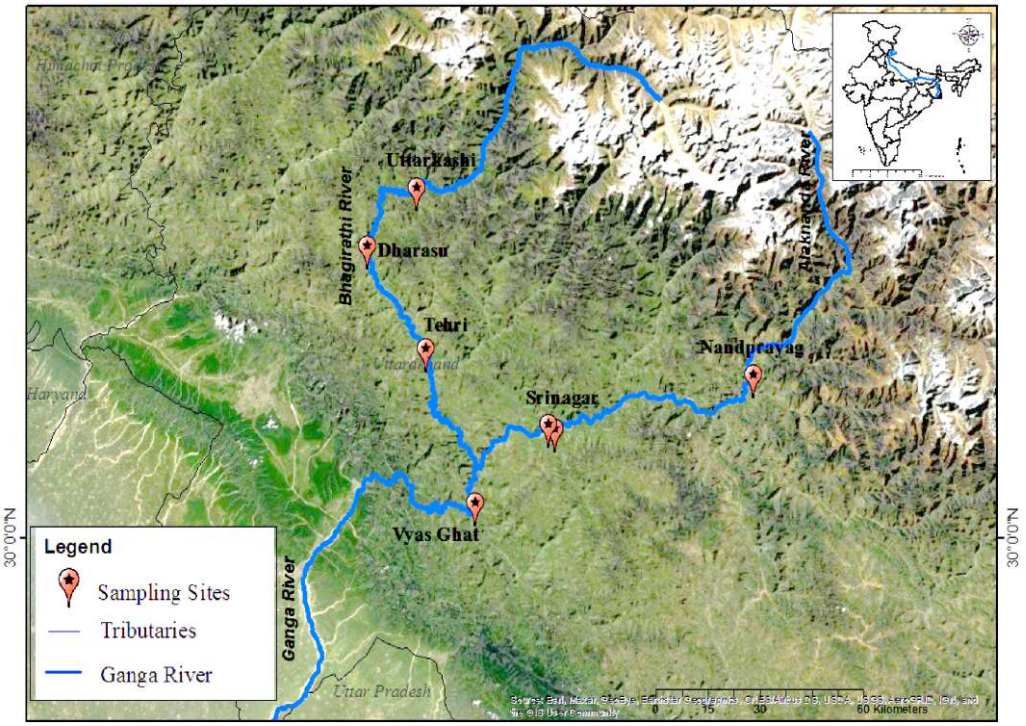


Conservation Status:

IUCN Red List:
Vulnerable

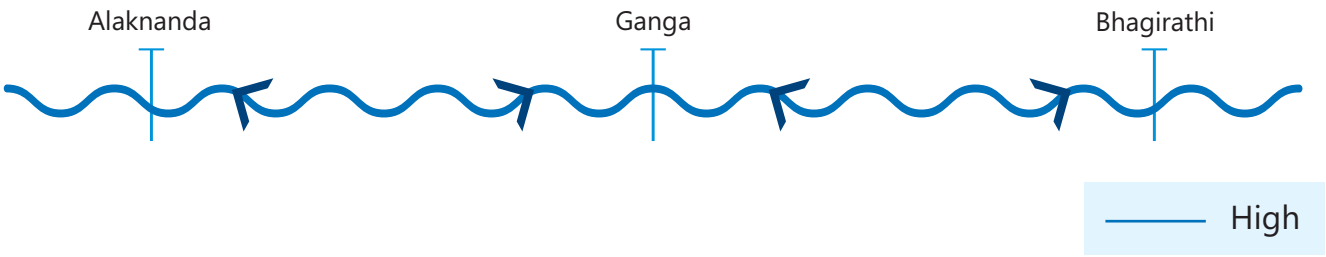
CITES:
Not listed

WPA, 1972:
Not listed



Map of study area showing sampling sites of *Schizothorax richardsonii*.

Geneflow



Highlights

High gene diversity and gene flow were observed in Snow trout (*Schizothorax richardsonii*). Despite the high morphological variations, high genetic similarity was observed among the *Schizothorax* species. We observed that *Schizothorax* are a recently evolved group and exhibit an unclear population genetic signature that might be due to hybridization. The study provides useful insights into evolutionary history and phylogenetic relationships of *Schizothorax richardsonii* that further aids for conservation, breeding and management progammes. We recommend extensive sampling, detail morphometric analysis with genetic support is recommended to resolve the identity of *Schizothorax* species.

GIANT RIVER-CATFISH

(*Sperata lamarrii*)

Taxonomy

Class	:	Actinopterygii
Order	:	Siluriformes
Family	:	Bagridae
Genus	:	*Sperata*
Species	:	*lamarrii*

Identification features

The snout is chisel-shaped. Four pair of barbels is present, maxillary barbels are not extended beyond the middle body. Body is elongated and compressed. Pectoral spine is stronger than dorsal and denticulated posteriorly. Pectoral fin rays are 8 or 9 and caudal fin rays 19 to 21.

Distribution

Ganges, Brahmaputra, Meghna and Indus river basins.

Habitat and Behaviour

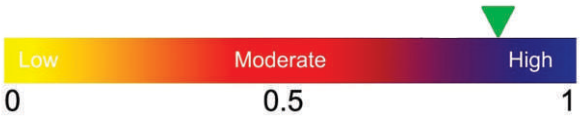
Found in rivers, canals, ditches, inundated fields, and other freshwater areas. Column feeder, predacious in nature and carnivorous feeding habit with insects, prawns, shrimps, crustacean, mollusks, worms, and very rarely algae and aquatic weeds in the diet.

Major threats

Overfishing, pollution, siltation, and invasion of exotic species

Genetic Status

mtDNA gene diversity



Population Trend
Unknown

Conservation Status:

IUCN Red List:

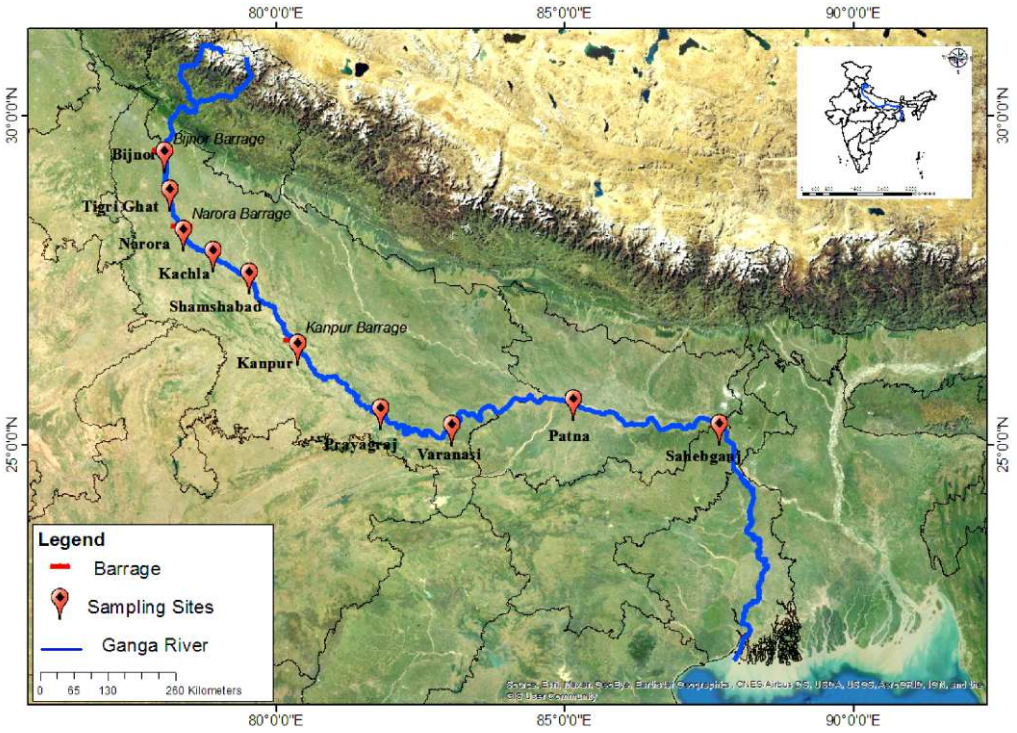
Least Concern

CITES:

Not listed

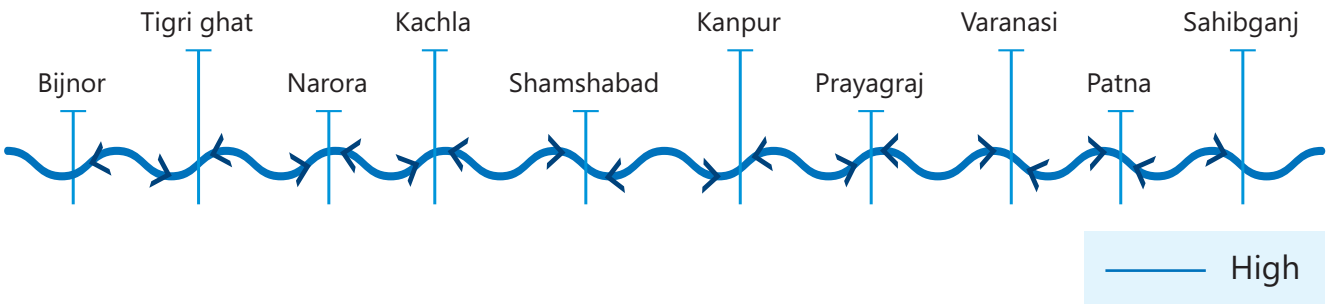
WPA, 1972:

Not listed



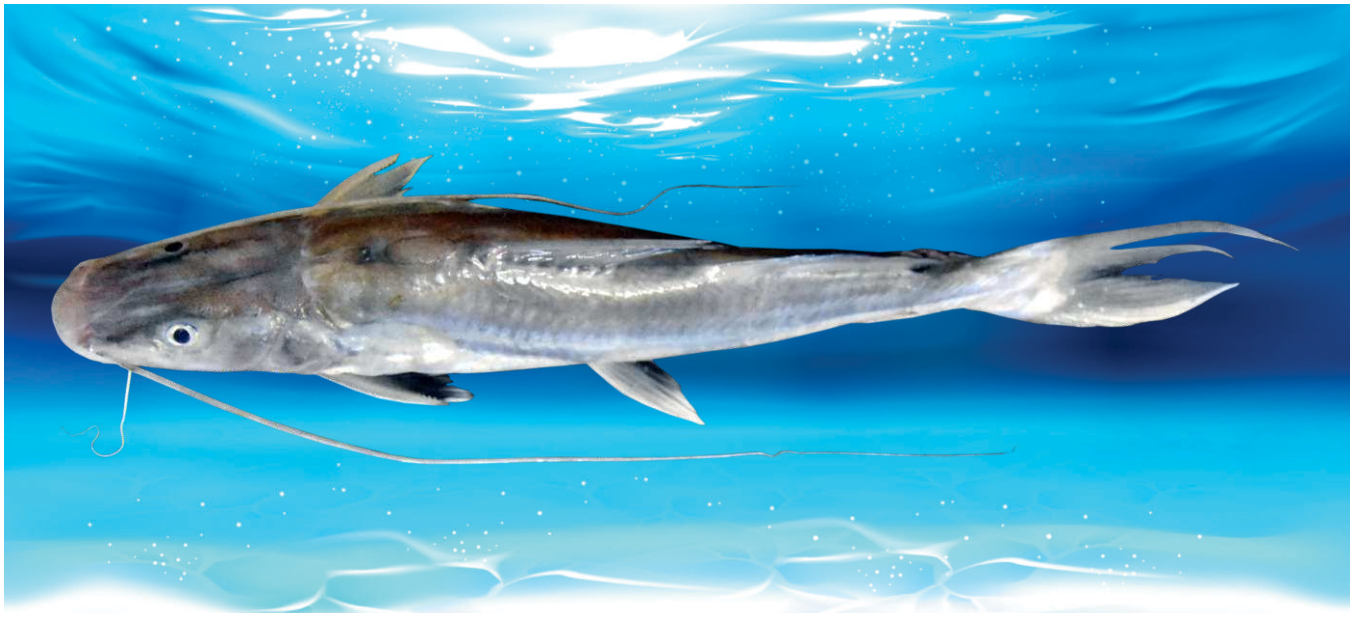
Map of study area showing sampling sites of *Sperata lamarrii*

Geneflow



Highlights

The identification of two closely related species, *Spereta lamarrii* and *Spereta aor* is quite difficult because of similarity in external morphology. The genetic analysis will help in resolving the identification problem. We observed high genetic diversity and gene flow among *Spereta lamarrii* of the Ganga River. The generated data acts as a reference for identification of *Spereta lamarrii* stock and assessing the genetic diversity and structure of other existing *Spereta* populations. The study has significant implications for aquaculture, fisheries management and conservation.



LONG-WHISKERED CATFISH

(*Sperata aor*)

Taxonomy

Class	:	Actinopterygii
Order	:	Siluriformes
Family	:	Bagridae
Genus	:	*Sperata*
Species	:	*aor*

Identification features

Anterior margin of snout is rounded. Four pairs of barbels are present (one pair maxillary, one pair nasal, and two pairs mandibular). Maxillary barbels are longer in size and prolonged or beyond to the base of the caudal fin. Pectoral spine denticulate posteriorly, pectoral fin rays 10 or 11. Caudal fin deeply forked with pointed lobes, upper longer; caudal fin with 19 rays.

Distribution

Ganges-Brahmaputra-Surma river basins in India and Bangladesh, extending southwards to the Godavari river.

Habitat and Behaviour

Demersal and potamodromous species that inhabit rivers, ponds, lakes, channels, and reservoirs. Predatory, adults feed on small fishes and worms.

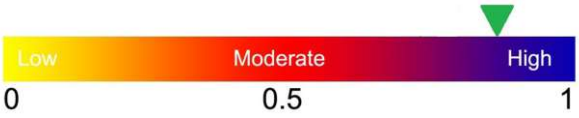
Major threats

Overfishing, pollution, siltation, and invasion of exotic species

Population Trend
Stable

Genetic Status

mtDNA gene diversity



Conservation Status:

IUCN Red List:

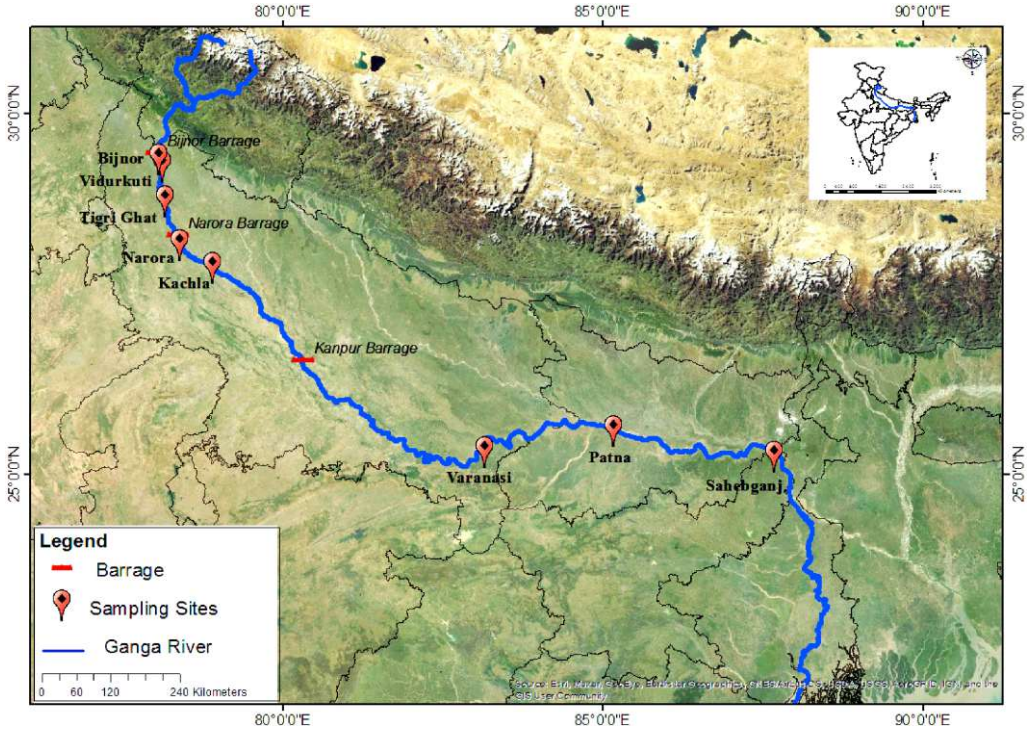
Least Concern

CITES:

Not listed

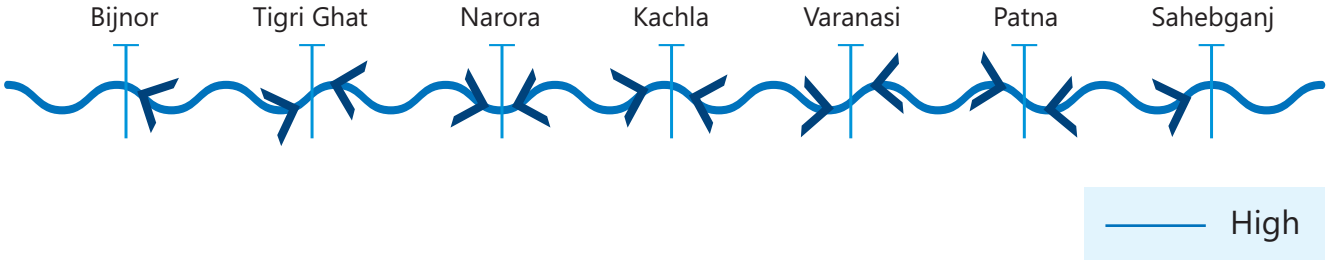
WPA, 1972:

Not listed



Map of study area showing sampling sites of *Sperata oar*

Geneflow



Highlights

High genetic diversity and gene flow was observed within *Sperata aor* of the Ganga River. The genetic structure of *Sperata aor* of river Ganga is distinct from the other *Sperata* populations existing in Sutlej, Beas, Mahanadi, Brahmaputra, Godavari, and Narmada. The genetic data generated from this study will helpful in resolving the identification problem and stock characterization of *Sperata aor*. The study has significant implications for aquaculture, fisheries management and conservation.

DWARF GOONCH

(*Bagarius bagarius*)

Taxonomy

Class	:	Actinopterygii
Order	:	Siluriformes
Family	:	Sisoridae
Genus	:	*Bagarius*
Species	:	*Bagarius*

Identification features

Body elongated, head depressed, and body covered with keratinized skin. Mouth inferior, upper jaw longer. Barbels four pairs, maxillary pair with stiff and broad bases. Dorsal spine smooth. Pelvic fin inserted anterior to base of last dorsal-fin rays. Adipose fin inserted posterior to the anal-fin origin. Pectoral fin rays 9 to 12. Body with large, irregular brown and black blotches or cross bands.

Distribution

Ganges, Brahmaputra, Mekong river in Southeast Asia, and Chao Phraya in Thailand.

Habitat and Behaviour

Inhabits rapid and rocky pools of large and medium-sized rivers. Feed on insects, small fishes, frogs, and shrimps.

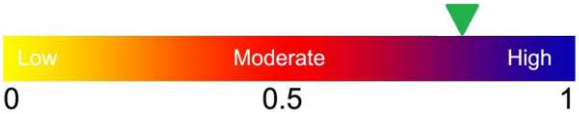
Major threats

Overexploitation, habitat destruction, and invasion of exotic species.

Population Trend
Not assessed

Genetic Status

mtDNA gene diversity

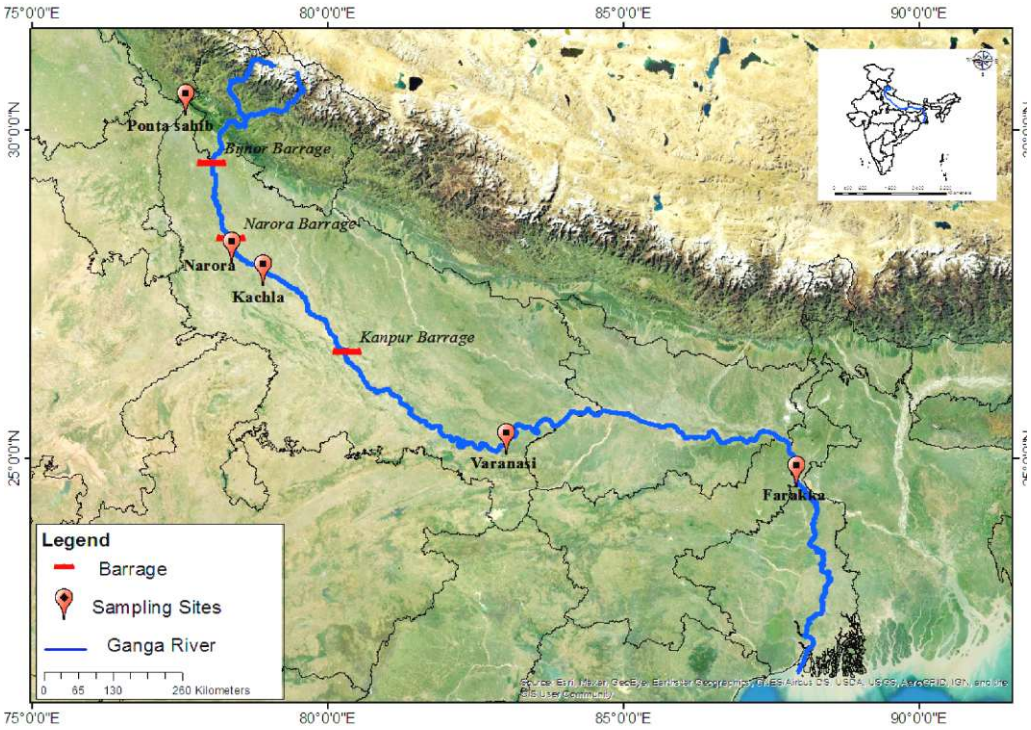


Conservation Status:

IUCN Red List:
Near Threatened

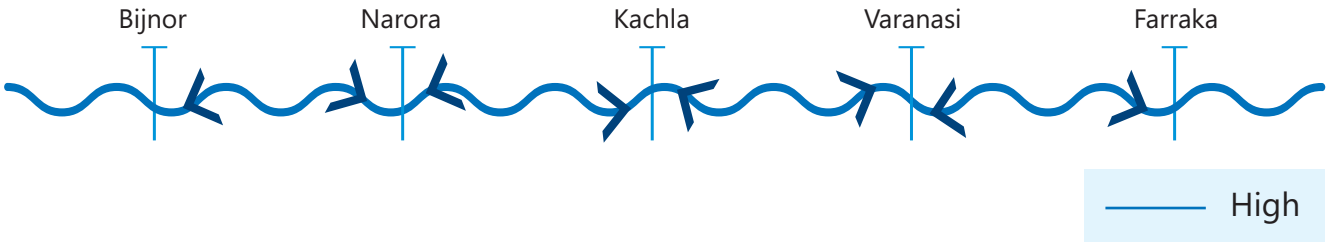
CITES:
Not listed

WPA, 1972:
Not listed



Map of study area showing sampling sites of *Bagarius bagarius*

Geneflow



Highlights

High genetic variability and gene flow was observed in *Bagarius bagarius* of the Ganga River. Wide range analysis covering different Indian rivers will provide more insight into the present genetic stocks and lineages. Detailed information on genetic variation and lineages is in urgent need to avoid the loss of biodiversity by unwanted mixing of different stocks. The study has significant implications for aquaculture, fisheries management and conservation.

INDIAN FLAPSHELL TURTLE

(*Lissemys punctata andersonii*)

Taxonomy

Class	:	Reptilia
Order	:	Testudines
Family	:	Trionychidae
Genus	:	*Lissemys*
Species	:	*punctana*
Subspecies	:	*andersonii*

Identification features

The "flap-shell" name stems from the presence of femoral flaps located on the plastron. Carapace is olive green with yellow blotched on the carapace, head and neck. This marking of the shell may differ slightly with different subspecies. The anterior carapace is broadly oval in adults but more circular in young, widest, just anterior to hind limbs.

Distribution

Distribution from Pakistan, India, Sri Lanka, Nepal, and Bangladesh and Myanmar (Irrawaddy and Salween Rivers).

Habitat and Behavior

The species prefers to live in shallow, muddy ditches, lakes and marshes. It is an omnivore turtle and feeds mainly on frogs, fishes, shrimps, snails and aquatic plants. Lays 4-15 eggs in a single clutch.

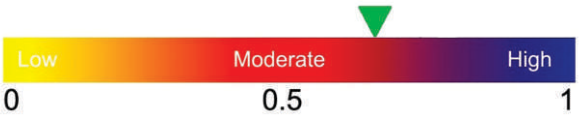
Major threats

Habitat destruction, pollutions, illegal poaching, exploitation for eggs and meat.

Population Trend
Declining

Genetic Status

mtDNA gene diversity

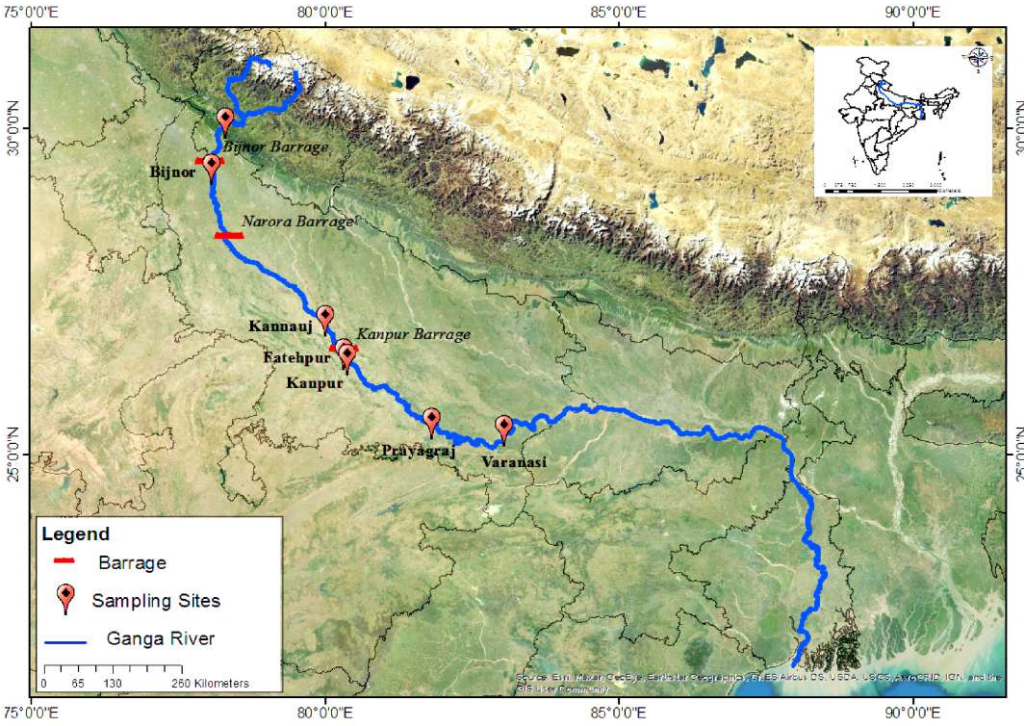


Conservation Status:

IUCN Red List:
Vulnerable

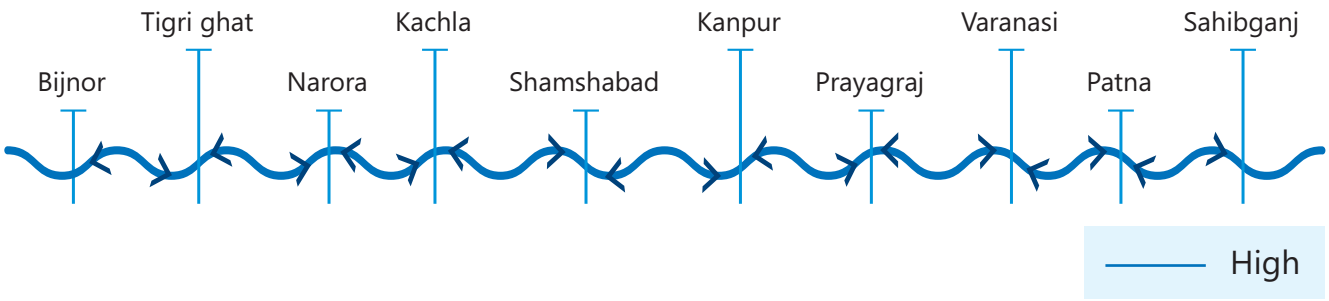
CITES:
Appendix II

WPA, 1972:
Schedule I



Map of study area showing sampling sites of *Lissemys punctata andersonii*

Geneflow



Highlights

Moderate genetic diversity was observed in *Lissemys punctata andersonii* from the selected stretch of Ganga. Clear genetic structuring and high genetic differentiation was observed among the species/ subspecies of Indian Flap Shell turtle: *Lissemys punctata andersonii*, *Lissemys punctata punctata*, *Lissemys punctata vittata*, *Lissemys ceylonensis*, and *Lissemys scutata*.

Considering the moderate gene diversity, urgent targeted management efforts are required to maintain the population viability. Genetic analysis will be helpful in resolving the genetic structure, tracking origin of illegal trade and formulating reintroduction plan.

INDIAN SOFTSHELL TURTLE

(*Nilssonia gangetica*)

Taxonomy

Class	:	Reptilia
Order	:	Testudines
Family	:	Trionychidae
Genus	:	*Nilssonia*
Species	:	*gangetica*

Identification features

The distinguish feature is green/olive colored carapace with or without black reticulation. The carapace is smooth on the surface in adult individuals. The plastron is light yellow; the head is dark green with three to six oblique black bands and a black bar running from eye to nape.

Distribution

Inhabits in Ganga, Mahanadi, Kosi, Indus, Brahmaputra, and other rivers of upper peninsular India.

Habitat and Behaviour

This species is inhabiting in the deep turbid rivers, basking on sandy banks or resting in shallow water with its head striking out of water. It is an omnivorous species, and the diet comprises a wide range of aquatic vegetation and animal food like fish, molluscs, frogs and crustaceans. It is a very prominent scavenger.

Major threats

Overexploitation, increasing anthropogenic pressures, illegal harvest or poaching, habitat loss and fragmentation.

Population Trend
Declining

Genetic Status

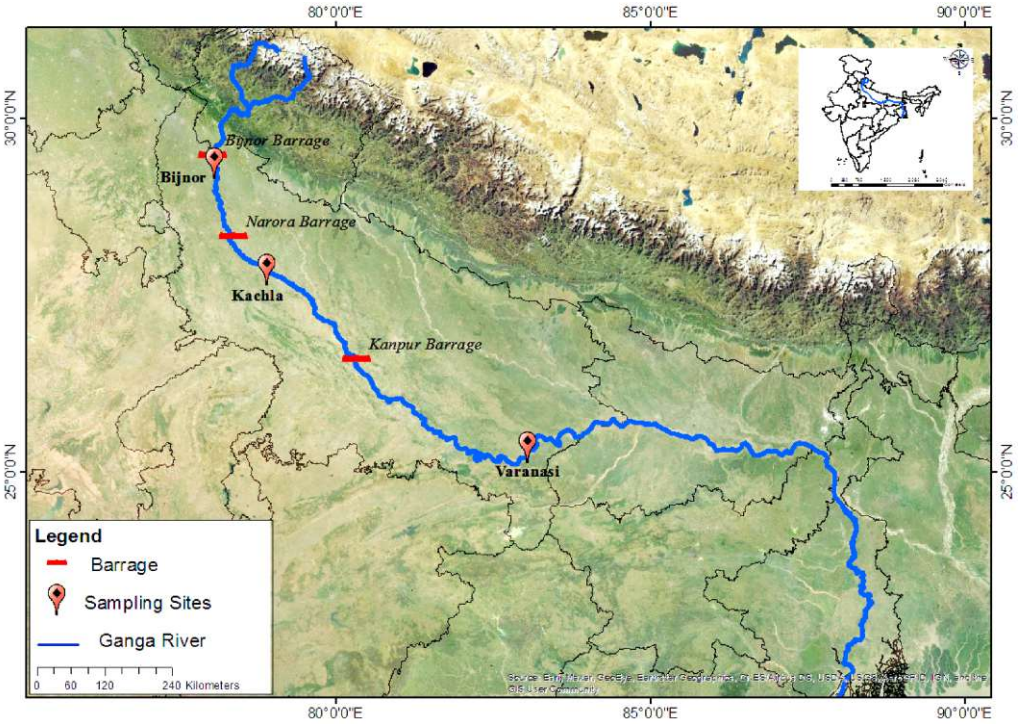
mtDNA gene diversity

Conservation Status:

IUCN Red List:
Endangered

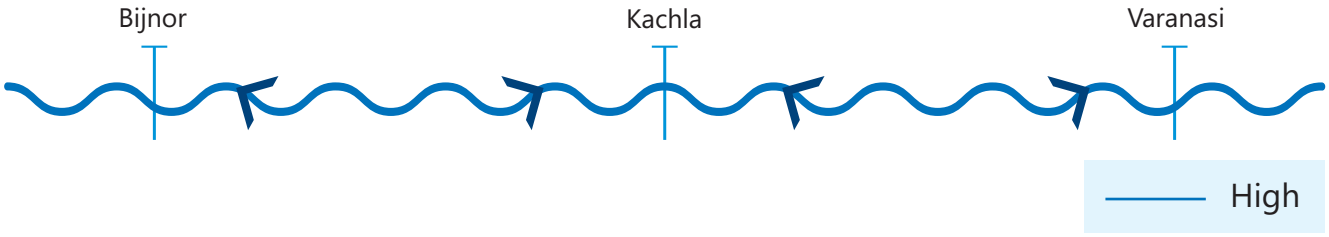
CITES:
Appendix I

WPA, 1972:
Schedule I



Map of study area showing sampling sites of *Nilssonia gangetica*

Geneflow



Highlights

Moderate gene diversity and high maternal gene flow was observed in *Nilssonia gangetica* from the selected stretch of river Ganga. Considering the vulnerable status in IUCN Red List and moderate gene diversity, urgent conservation efforts are required to maintain population viability. The study will help resolve the genetic structure, track the origin of illegal trade, and formulate a reintroduction plan. Moreover, comprehensive genome analysis, including samples from different Indian rivers, will be required to strengthen the genetic database to track the origin of illegal trade and species origin and formulate the reintroduction plan.

THREE STRIPTED ROOFED TURTLE

(*Batagur dhongoka*)

Taxonomy

Class	:	Reptilia
Order	:	Testudines
Family	:	Geoemydidae
Genus	:	*Batagur*
Species	:	*dhongoka*

Identification features

The head is moderately long with a pointed snout that projects beyond the lower jaw and is shorter than the orbit. Females are larger than males and reach a maximum length of 40 cm. Males never exceed 20 cm in length. The skin of the posterior portion of the head is divided into shields. Skull is with a bony temporal arch. The carapace is smooth, depressed, unicarinate, the keel interrupted, most prominent upon the second and third vertebral shields.

Distribution

Bangladesh, India, and Nepal.

Habitat and Behaviour

It inhabits stagnant and running water sources, wetlands, lakes, ponds, streams, and irrigation canals. The species is entirely aquatic and lives on vegetable matter. About 30 to 35 elongate eggs measuring 55 x 3 mm are deposited on the sandy banks in a single clutch.

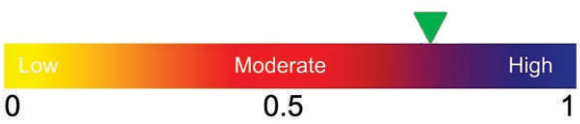
Major threats

Overexploitation, increased anthropogenic pressure, accidental capture, entanglement and drowning in fishing nets, and destruction of nesting habitat.

Population Trend
Declining

Genetic Status

mtDNA gene diversity

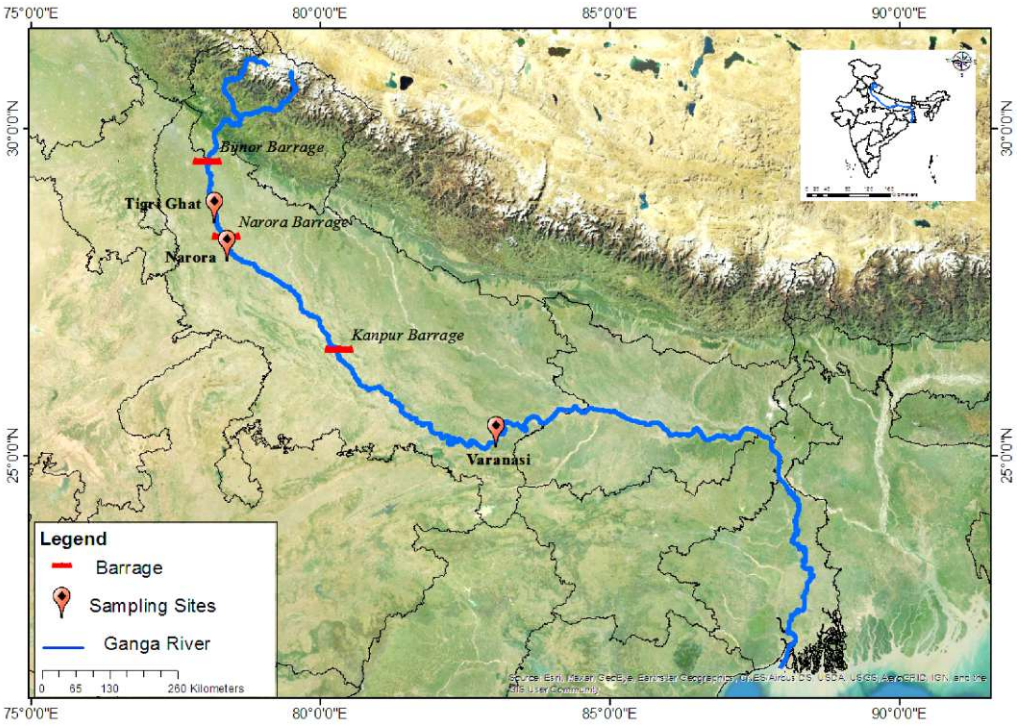


Conservation Status:

IUCN Red List:
Critically Endangered

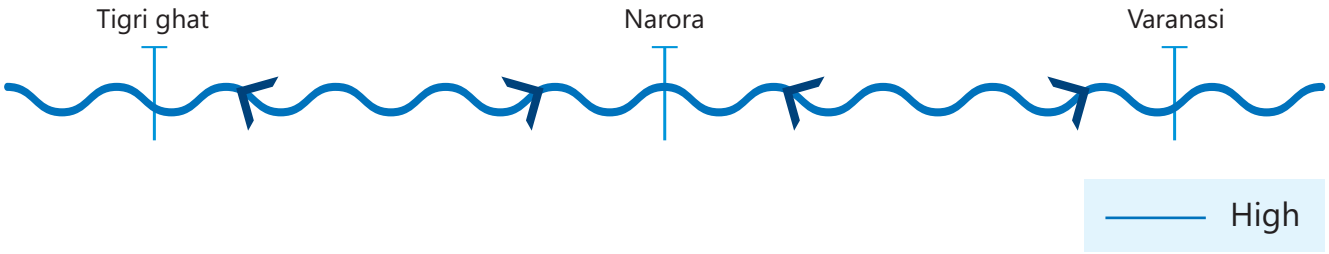
CITES:
Appendix II

WPA, 1972:
Schedule I



Map of study area showing sampling sites of *Batagur dhongoka*

Geneflow



Highlights

High gene diversity and gene flow was observed within the species. The genetic data generated from this study will help in management strategies for the conservation breeding program of critically endangered *Batagur dhongoka* from the Ganga River. The study will be helpful to resolve the genetic structure, track the origin of illegal trade, and formulate an appropriate reintroduction strategy. Moreover, comprehensive genome analysis, including broad sampling from different Indian rivers, will be required to strengthen the genetic database.

Photo Credit: Abhijit Das

INDIAN BROWN ROOFED TURTLE

(*Pangshura smithii*)

Taxonomy

Class : Reptilia
Order : Testudines
Family : Geoemydidae
Genus : *Pangshura*
Species : *smithii*

Identification features

The lateral part of the neck with yellow or cream stripes. Plastron white, primarily pigmented. Carapace oval and low. Vertebral I, III and IV longer than wide, II and V wider than long. Marginals in 12 pairs. Upper jaw with a weak notch. Plastron almost as long as carapace, angulate laterally and truncated anteriorly, notched posteriorly.

Distribution

Bangladesh, India, Nepal, and Pakistan

Habitat and Behaviour

It inhabits in wetlands, lakes, ponds, streams, and irrigation canals. Omnivorous.

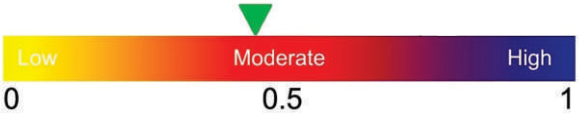
Major threats

Overexploitation, water pollution, habitat destruction.

Population Trend
Declining

Genetic Status

mtDNA gene diversity



Conservation Status:

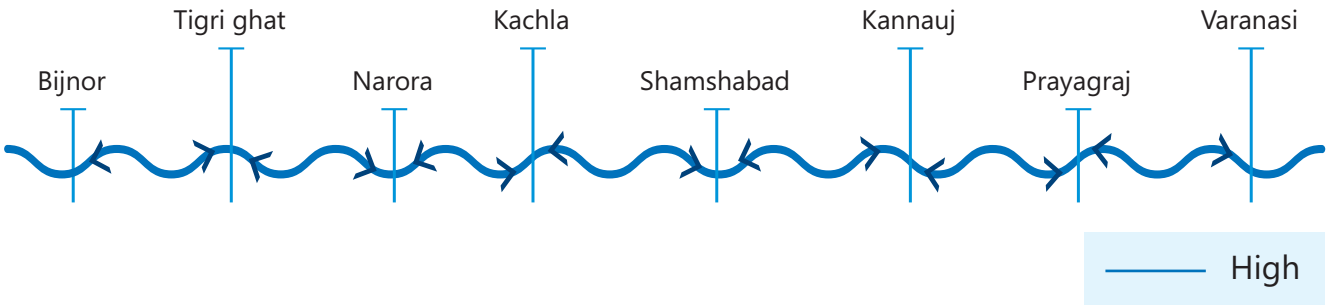
IUCN Red List:
Near Threatened

CITES:
Appendix II

WPA, 1972:
Schedule IV

Map of study area showing sampling sites of *Pangshura smithii*

Geneflow



Highlights

Moderate gene diversity and high maternal geneflow was observed in Indian Brown Roofed turtle from the Ganga River. Considering the near-threatened status in IUCN Red list and moderate genetic diversity, special attention is required to maintain the genetic integrity of the population viability. The generated genetic data will be helpful to resolve the genetic structure, track the origin of illegal trade and build appropriate reintroduction plans. Moreover, comprehensive genome analysis and broad sampling from different Indian rivers will be required to strengthen the genetic database.

Photo Credit: Anuja Mital

SPOTTED POND TURTLE

(*Geoclemys hamiltonii*)

Taxonomy

Class : Reptilia
Order : Testudines
Family : Geoemydidae
Genus : *Geoclemys*
Species : *hamiltonii*

Identification features

Spotted Pond Turtle is mainly black with small yellowish spots, and a much-elevated carapace, with three interrupted keels or series of nodose prominences corresponding to the vertebral and costal shields.

Distribution

Inhabits in lowlands of the Indus, Ganga and Brahmaputra River basins.

Habitat and Behaviour

Shallow and densely vegetated standing water bodies, but may also occur in rivers, ponds, and reservoirs and basks preferentially in reed beds. Nests in marshy areas among vegetation. Clutch size 18-30, eggs.

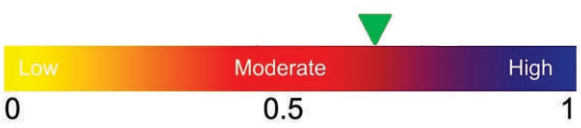
Major threats

Accidental capture, entanglement and drowning in fishing nets, and destruction of nesting habitat, pet trade.

Population Trend
Declining

Genetic Status

mtDNA gene diversity

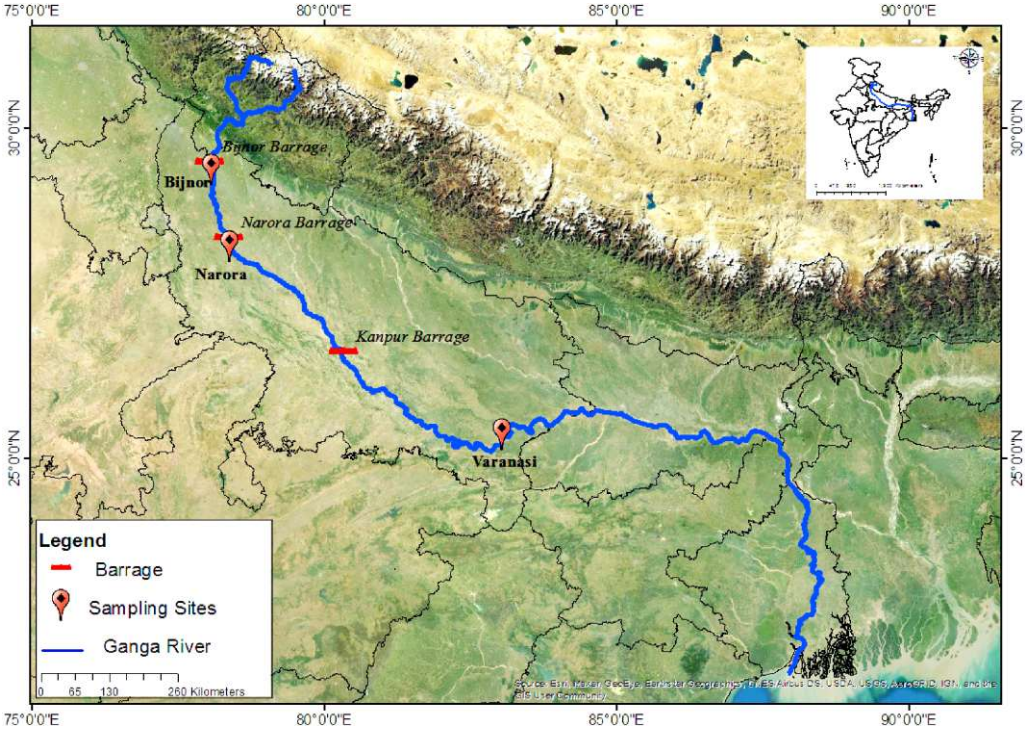


Conservation Status:

IUCN Red List:
Endangered

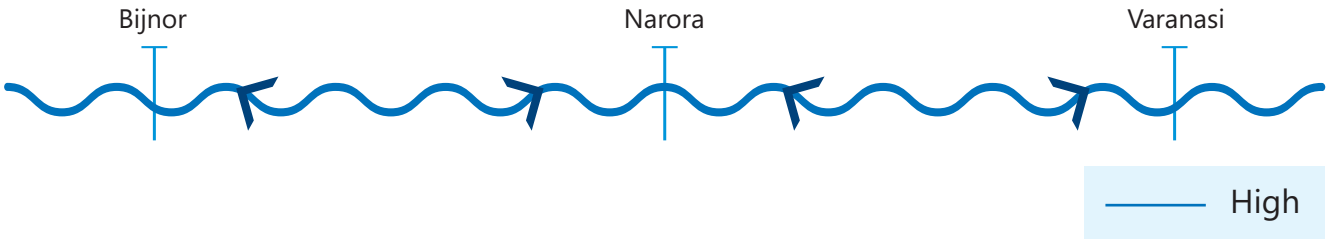
CITES:
Appendix I

WPA, 1972:
Schedule I



Map of study area showing sampling sites of *Geoclemys hamiltonii*

Geneflow



Highlights

Moderate gene diversity with high maternal gene connectivity was observed in Spotted Pond Turtle from the middle stretch of river Ganga which necessitates urgent targeted conservation efforts to maintain the population viability. For successful conservation plans, a range-wide understanding of its genetic variation is urgently required to avoid loss of genetic diversity by unwanted mixing of different stocks. The genetic analysis will help resolve the genetic structure and track the origin of large-scale illegal trade.

Photo Credit: WWF

GANGES RIVER DOLPHIN, SUSU

(*Platanista gangetica gangetica*)

Taxonomy

Class	:	Mammalia
Order	:	Cetartiodactyla
Family	:	Platanistidae
Genus	:	*Platanistidae*
Species	:	*gangetica*
Subspecies	:	*gangetica*

Identification features

The body is brownish color and stocky in the middle. It has a long, thin, pointed nose, and teeth are available in both upper and lower jaws. The snout thickens towards its end. The flippers and tail are thin and large in comparison with the body size with a round belly. Male is about 2-2.2m. and female is 2.4-2.6m.

Distribution

Two geographically isolated subspecies of South Asian river dolphin is recognized; the Indus River dolphin (*Platanista gangetica minor*) restricted to the Indus river system of India and Pakistan, and the Ganges River dolphin (*Platanista gangetica gangetica*) inhabiting in Ganges, Brahmaputra, Meghna and Karnaphuli–Sangu of India, Bangladesh Nepal, and Bhutan.

Habitat and Behaviour

Generally concentrated in counter-current pools, deep pool, and fast-flowing channels. Top predator, navigate by echolocation.

Major threats

Habitat destruction due to the construction of dams and barrages, unintentional killing through entanglement in fishing gear. Illegal hunting for food and oil extraction is used as a fish attractant for fishing.

Population Trend
Declining

Genetic Status

mtDNA gene diversity

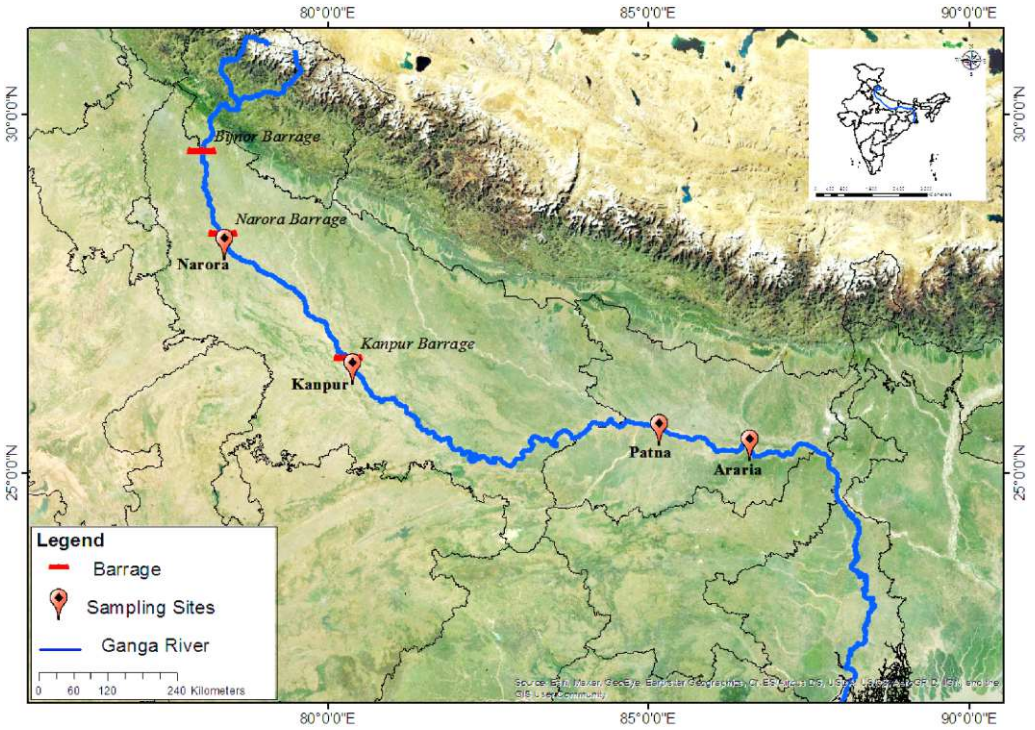
Conservation Status:

IUCN Red List:
Endangered

CITES:
Appendix I

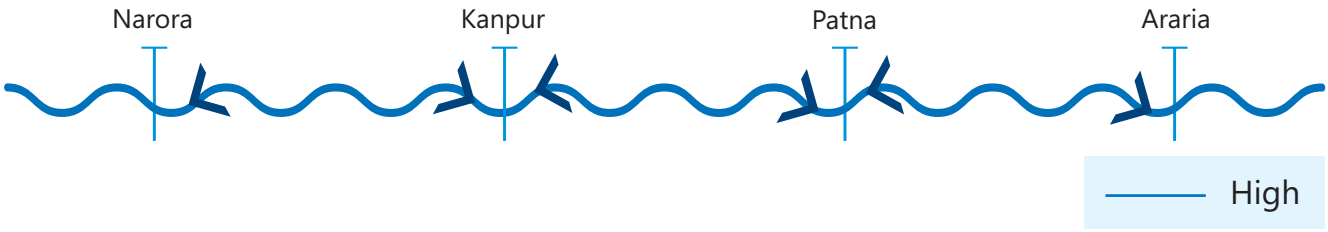
WPA, 1972:
Schedule I

CMS:
Appendix II



Map of study area showing sampling sites of *Platanista gangetica gangetica*

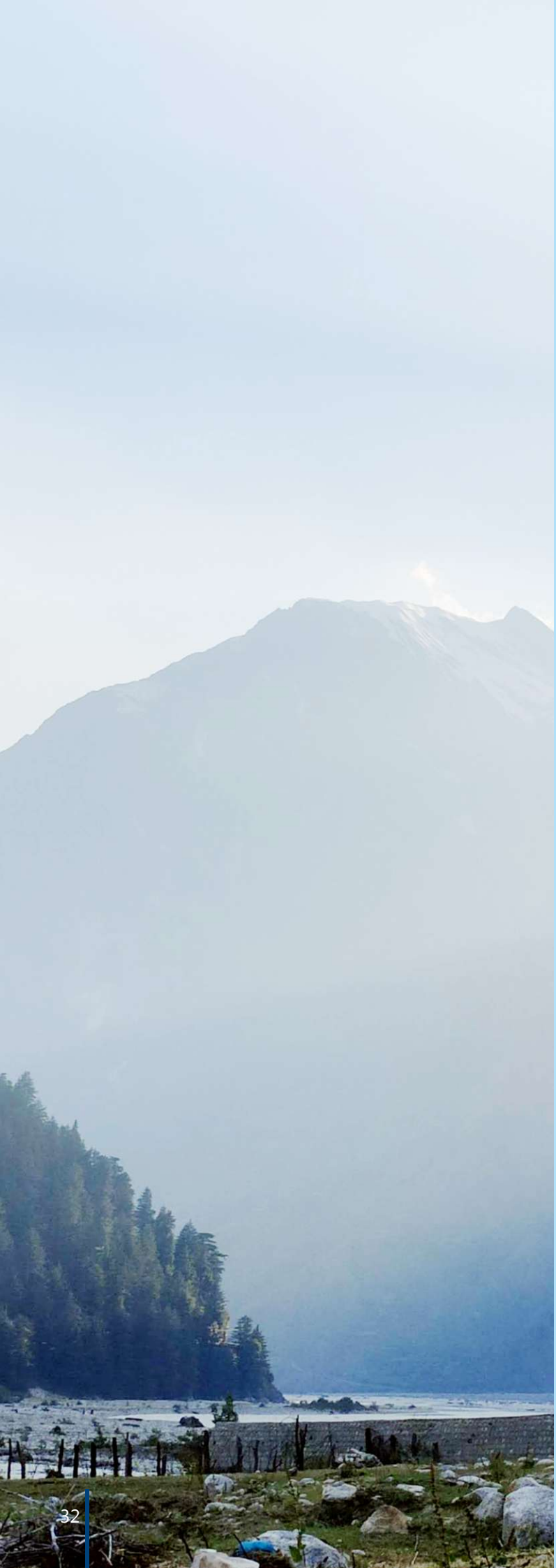
Geneflow



Highlights

Moderate gene diversity and high maternal gene connectivity was observed in Gangetic river dolphin. The phylogenetic position of Gangetic river dolphin holds scientific relevance. It is considered the evolutionary link with beaked whales rather than other existing river dolphins

The data generated serve as crucial baseline information for genetic monitoring, spatial distribution range, and evolutionary relationship analysis. Long term study is required for clear evidence of genetic structuring and the migration pattern of this endangered species. Moreover, region wise genetic sampling, large scale genome analysis will help to examine the origin of species for forensic validation, re-introduction plan and dolphin evolutionary research.



Conclusion

The biodiversity of the Ganga River is under stress due to rapidly increasing population, reduced water availability, habitat degradation, pollution, and unsustainable resource extraction. Genetic variability is fundamental for adaptive processes in a species. Alteration of habitat reduces the adaptive potential of species aggravating the risk of extinction. The study undertaken provides valuable information regarding the genetic variability and gene flow within the species, which can give useful information to understand the current status of the population genetic structure of the studied aquatic species. Here, we observed a moderate level of genetic diversity in Indian flapshell turtle, Indian softshell turtle, Brown roofed turtle, Spotted pond turtle, and in Gangetic dolphin. In contrast, high genetic diversity was observed in Three-striped roofed turtles. High level of genetic diversity was observed in fish species such as Golden Mahseer, Snow trout, Giant river catfish, and Dwarf Goonch. Moderate to high levels of genetic diversity generally confer a higher probability for moderate to long-term population survival. The present results demand targeted species based conservation efforts to conserve diversity and maintain gene flow of the species. Moreover, the genetic signature determined in the present study can play a pivotal role in determining the genetic fitness of the aquatic fauna, guiding re-introduction plans, and aiding in wildlife forensics to track the origin of the highly poached species.

#D,I?9#BJ7+0

DNA (deoxyribonucleic acid)

It is the carrier of genetic information within a cell that is transmitted from generation to generation. It is composed of nucleotides (Adenine, Guanine, Thymine, and Cytosine).

Mitochondrial DNA (mtDNA)

It is a double standard molecule that forms a circular genome, located in mitochondria, and passed from a mother to offspring.

Nuclear DNA (nDNA)

It is located in cell nucleus, inherited from both mother and father and allows individuals identification.

Genetic diversity

It represents variation in the genetic composition among individuals of population. It indicates the health of the population.

Geneflow

It represents the genetic connectivity of populations, also called gene migration.

Note

- If the environment changes, a population that has a higher genetic diversity and high geneflow will be better able to evolve to adapt to the new environment.
- Species having low genetic diversity and gene flow are prone to extinction risk.

FIELD GUIDE

Sample collection

Invasive method
Direct sampling (Blood, tissue, and scutes)

Non-invasive method
Indirect sampling
(Feces, Shed feather, eDNA, dead remain tissue and bones)

Preservation

Blood
Vacutainer tubes with EDTA
(stored at 4ºC until handover to the lab)

Tissue/Scutes/Carapace/Eggshell/Feces
Screw-capped small vial
~ 50-100 ml/gm capacity

Filled with 2/3rd volume of the container with 70% ethanol or absolute ethanol

Fill approximately half of the vial with Silica gel (5-8 mess size)

Do's

- ✓ Directly dip the sample in ethanol
- ✓ Wear gloves during sample collection
- ✓ Write the species name, GPS and date of collection on the vials

Don'ts

- ✗ Never use formalin as a preservative for genetic analysis because it degrades the DNA.
- ✗ Avoid direct contact with biological samples

PRESERVATIVE MATERIALS

Dehydrating the sample using silica gel

Dehydrating sample using Ethanol (70-100%)

Dehydrating the sample using Salt powder

Dehydrating the sample by Sun / oven dry

Details required during the collection of biological samples for genetic study

S.No.	Species Name	Sex	Sample Code	Sample Type*	Sample Location	GPS location		Date of collection	Remark
						N	E		

* **T**=Tissue; **S**=Scutes; **C**= Carapace**; E**=Egg shell; **F**= Feces

References

https://www.iucnredlist.org

https://www.fishbase.se

https://iucn-tftsg.org/taxonomic-literature-database/

For further details visit our website

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