DOLPHIN CONSERVATION ACTION PLAN (2021-2025)

Government of Nepal
Ministry of Forests and Environment

Department of Forests and Soil Conservation
Babarmahal, Kathmandu

Department of National Parks and Wildlife Conservation
Babarmahal, Kathmandu

July 2021

DOLPHIN CONSERVATION ACTION PLAN (2021-2025)

Government of Nepal
Ministry of Forests and Environment

Department of Forests and Soil Conservation
Babarmahal, Kathmandu

Department of National Parks and Wildlife Conservation
Babarmahal, Kathmandu

July 2021

TECHNICAL TEAM

Hari Bhadra Acharya, Ecologist, DNPWC

Madhuri Karki (Thapa), Under Sectary, DoFSC

Bhagawan Raj Dahal, Ph.D, ZSL Nepal

Chiranjibi Prasad Pokharel, Ph.D, NTNC

Hem Raj Acharya, Assistant Ecologist, DNPWC

REVIEW TEAM

Deepak Kumar Kharal, Ph.D, Director General, DNPWC

Man Bahadur Khadka, Director General, DoFSC

Ramchandra Kandel, Ph.D, Secretary, MoITFE, Province -2

PUBLISHED BY

Department of National Parks and Wildlife Conservation and Department of Forests and Soil Conservation, Babarmahal, Kathmandu, Nepal

COPYRIGHT

© Department of National Parks and Wildlife Conservation, and Department of Forests and Soil Conservation, Babarmahal, Kathmandu, Nepal,

CITATION

DNPWC and DoFSC (2021). Dolphin Conservation Action Plan (2021-2025). Department of National Parks and Wildlife Conservation, and Department of Forests and Soil Conservation, Babarmahal, Kathmandu, Nepal,

FRONT COVER PHOTO: © Dolphin Conservation Centre, Kailali

BACK COVER PHOTO: © Deep Narayan Shah, TU

Government of Nepal
Ministry of Forests and Environment
Department of National Parks and Wildlife Conservation

Date: 4 July 2021

Foreword

Nepal Biodiversity Strategy and Action Plan, (2014-2020) has envisioned to formulate the conservation action plans of various endangered wildlife species including the Dolphin. The dolphin population is identified as critically endangered in Nepal. The dolphin is listed in schedule I of National Parks and Wildlife Conservation Act, 1973 and is included in Appendix I of Convention on Illegal Trade in Endangered Species of Wild Fauna and Flora (CITES). Despite being a protected species, it has received least priority in conservation as the major habitat is outside protected areas.

The Department of National Parks and Wildlife Conservation has formulated this first Dolphin Conservation Action Plan (2021-2025) with the main purpose to conserve the dolphin population in Nepal. The conservation action plan provides an assessment of the conservation status of dolphin in Nepal, and sets conservation priorities for the next five years. It also identifies key issues with the conservation of the species and prioritizes the viable actions plans needed to address the issues.

This plan focuses on enhancing the understanding and knowledge of conservation status, ecology, and habitat dynamics of dolphin. Besides, the plan emphases on reducing the anthropogenic pressure on aquatic habitat, and designed to ensure the long-term survival of dolphin and associated species such as freshwater gharials.

I am thankful to the technical team of the Department of National Parks and Wildlife Conservation for formulating this action plan. I would like to greatly acknowledge the contribution of conservation partners and local communities in preparing this action plan and their commitment for the successful implementation. I am hopeful this action plan contribute to guide the further actions in conserving and managing the dolphin population and their habitat with community participation.

4 July 2021

Deepak Kumar Kharal, Ph.D
Director General

G.P.O. Box: 860, Kathmandu, Nepal, Tel. 01-5320912, 5320850, Email: info@dnpwc.gov.np

Government of Nepal
Ministry of Forests and Environment
Department of Forests and Soil Conservation
Babarmahal, Kathmandu

Date: 4 July 2021

Foreword

The Government of Nepal is committed to conserve and safeguard threatened and endangered wildlife including dolphin. Dolphin is one of the most elusive and rarely studied mammals across its range. Four species of river dolphin survive in the freshwater, among these, Ganges River Dolphin *(Platanista gangetica gangetica)* is recorded in Nepal. This species is listed in schedule-1 of National Parks and Wildlife Conservation Act, 1973 and included in Appendix-I of the Convention on Illegal Trade in Endangered Species of Wild Fauna and Flora (CITES).

The dolphin are under threat mostly due to habitat loss and fragmentation, incidental catch in fishing gear, river pollution, and reduction of their prey. Construction of dams along river is another factor causing threats to this illusive animal. So, realizing these facts of threat to the river dolphin, the Government of Nepal has formulated this first Dolphin Conservation Action Plan (2021-2025) for the conservation of this species.

Dolphin Conservation Action Plan (2021-2025) aims to secure dolphin population against emerging threats and recover in the current and historical freshwater ecosystem. This plan focuses on enhancing understanding and knowledge on conservation status, ecology and habitat dynamics of dolphin. In addition, the plan focuses on curbing habitat fragmentation through protection and management of its habitat, and also focus on strengthening the participatory dolphin conservation programs. This plan also highlights to strengthen cooperation and coordination on dolphin conservation at the national and international level. Furthermore, this plan incorporates priority actions to address threats of dolphin.

I am confident that the implementation of this action plan will contribute in conserving and managing river dolphin and their habitat and wish success to ensure that river dolphin population remain secure against emerging threats in Nepal.

With great appreciation, I would like to extend my sincere thanks to the technical team of the Department of National Parks and Wildlife Conservation for preparing this Conservation Action Plan. The Department of Forests and Soil Conservation greatly acknowledges the contribution of wildlife conservation partners, local communities, academia, and expects their continuous support and commitment for the successful implementation of this plan.

04/July/2021

Man Bahadur Khadka
Director General

© Gopal Khanal, Assistant Conservation Officer, DNPWC

Contents

Acronyms & Abbreviations xi

Executive Summary xiv

Unit 1: Introduction 1

1.1 Relevancy of Action Plan 1

1.2 Action Plan Development Process 1

1.3 Scope of Action Plan 2

Unit 2: Background 3

2.1 Global Status and Distribution 3

2.2 National Distribution and Status 4

2.3 Taxonomic Status and Genetics 4

2.4 Species Ecology 4

2.4.1 Physical Description 4

2.4.2 Primitive Characteristics 5

2.4.3 Habitat 5

2.4.4 Biology 5

2.4.5 Behavior 6

2.4.6 Surface Behavior and Dive Times 6

2.4.7 Mating and Birth 7

2.4.8 Dispersal 7

2.4.9 Life Span/Age 7

2.5 Religious value 7

Unit 3: Major Conservation Efforts and Achievements 11

Unit 4: Conservation Threats 13
4.1. River Flow Regulation 13
4.2. Motorized Boat and Ghats 14
4.3 Habitat Destruction and Population Segregation 14
4.4. Accidental Entanglement in Fishing Nets 15
4.5. Poaching 15
4.6. Floods 15
4.7 Toxicity and Pollution 15

Unit 5: Challenges and Opportunities 19
5.1 Challenges 19
5.1.1 Inadequate Research 19
5.1.2 Limited Conservation Awareness 19
5.1.3 Trivialization of Importance and Limitation of Resources and Capacities 19
5.1.4. Under Representation in Protected Area System 20

5.2 Opportunities 20
5.2.1 Indicator and Flagship Species 20
5.2.2 Involvement of Local Community 20
5.2.3 Nature-Based Tourism 20
5.2.4 Use of Cutting-edge Technology in Research and Monitoring 20

Unit 6: Dolphin Conservation Action Plan (2021-2025) 21
6.1 Goal 21
6.2 Objectives 21

Unit 7: Plan Implementation and Monitoring 29
7.1 Implementing Agency 29
7.2 Financial Plan 29
7.3 Monitoring and Evaluation of the Plan Implementation 30

References 31

Annexes 35
Annex 1: Logical Framework 35
Annex 2 : Financial Plan 40

Acronyms & Abbreviations

APU	Anti-Poaching Unit
BNP	Bardia National Park
BZMC	Buffer Zone Management Committee
BZUC	Buffer Zone User Committee
CBAPU	Community-Based Anti-Poaching Unit
CBD	Convention on Biological Diversity
CFUGs	Community Forest User Groups
CIB	Central Investigation Bureau
CITES	Convention on International Trade in Endangered Species of Wild Fauna & Flora
CNP	Chitwan National Park
DCC	District Coordination Committee
DFO	Division Forest Office
DNPWC	Department of National Parks and Wildlife Conservation
DoFSC	Department of Forests and Soil Conservation
GoN	Government of Nepal
I/NGO	International/Non-Governmental Organization
IUCN	International Union for Conservation of Nature
KTWR	Koshi Tappu Wildlife Reserve
MOFE	Ministry of Forests and Environment
NBSAP	Nepal Biodiversity Strategy and Action Plan
NP	National Park
NPWCA	National Parks and Wildlife Conservation Act
NTCC	National Tiger Conservation Committee
NTNC	National Trust for Nature Conservation
NWCCCC	National Wildlife Crime Control Coordination Committee
PA	Protected Area
PNP	Parsa National Park
RM	Rural Municipality
SAWEN	South Asia Wildlife Enforcement Network
TAL	Terai Arc Landscape
WCCB	Wildlife Crime Control Bureau
WWF	World Wide Fund for Nature
ZSL	Zoological Society of London

© Birendra Gautam, NTNC

Executive Summary

The Ganges River Dolphin *(Platanista gangetica gangetica,* Roxburgh 1801) is a sub-species of Asian River Dolphin (*Platanista gangetica gangetica*) and occurs in the human-dominated floodplain rivers Ganga-Brahamaputra-Meghna and their tributaries in Nepal, India, and Bangladesh. It faces threats from habitat loss and fragmentation due to damming of rivers for hydropower and irrigation (Baruah *et al.*, 2012; Choudhary *et al.*, 2012; Braulik *et al.*, 2012), incidental by-catch in fishing gear (Mansur *et al.*, 2008; Dewhurst-Richman *et al.*, 2020), deliberate killing for their oil (Sinha, 2002), river pollution (Kannan, Senthilkumar & Sinha, 1997), and reduction of their prey (Kelkar *et al.*, 2010a). Dolphin are often considered as an indicator species for a healthy freshwater ecosystem (Behera, Singh & Sagar, 2013). They can act as population trend indicators in degraded freshwater ecosystems (Braulik *et al.*, 2014). Conserving river dolphin is therefore important not only because they are globally endangered, but perhaps more so because they are at the apex of the food chain in a freshwater ecosystem, and their conservation benefits other endangered aquatic fauna, and provisions myriad of freshwater ecosystem services for human well-being (Behera *et al.*, 2013).

Despite this importance, river dolphin have received little conservation attention (Behera *et al.*, 2013). As a result, multiple factors continue to threaten their survival. The population of Ganges river dolphin has declined by more than 50% since 1994 and has been thus classified as "Endangered" in IUCN Red List of Threatned Species (Braulik & Smith, 2019). Although robust abundance estimates are not available, many previous studies estimated that there are fewer than 3,000 Ganges River Dolphin left in the wild (Smith *et al.* 2012), out of which fewer than 100 may exist in Nepal as a migratory population in trans-border rivers of Nepal, India, and Bangladesh (Janwali & Bhuju, 2000; Sinha *et al.*, 2000; Jnawali *et al.*, 2011).

In Nepal, they were once widely distributed across all the major rivers of Nepal. However, they have been extirpated from the Mahakali River with a few individuals remaining in the Koshi, Narayani, and Karnali Rivers (Sinha *et al.*, 2000; Smith *et al.*, 1994). Remaining dolphin in the Koshi and Karnali rivers have become isolated by barrages (i.e. low gated dams) that were constructed along the Indian frontier for irrigation purposes in the late 1960s (Khatri *et al.*, 2010a; Smith *et al.*, 1994). The National IUCN Red List Assessment of Nepal has classified the Dolphin as "Critically Endangered" (Jnawali *et al.*, 2011).

Until recently, very little was known about the status and ecology of Ganges river dolphin in Nepal. The Karnali and Koshi Rivers, perhaps the only rivers having a viable population in Nepal (Khanal *et al.*, 2016; Paudel, Timilsina, *et al.*, 2015; Smith, 1993), has been under tremendous anthropogenic pressure for the last few decades. This has threatened the very existence of river dolphin in Nepal, particularly during the dry season when the river flow is low which intensifies fishing pressure and makes fewer habitat patches available for foraging (Braulik *et al.*, 2012). A lack of robust information on the river dolphin status and distribution, coupled with a low level of conservation awareness among responsible agencies,

has been a major constraint to conservation in Nepal. Understanding of threats and opportunity to conservation is important for developing this conservation action plan. Therefore, successful conservation of river dolphin in Nepal will largely depend upon how the threats are addressed and opportunity grabbed at the particular sites. This conservation action plan has been envisioned with the goal to maintain viable population of river dolphin and conserve their habitat in Nepal. Following four objectives have been set to achieve this goal:

Objectives
1. Enhance the understanding and knowledge on conservation status, ecology, and habitat dynamics of dolphin.
2. Protect and manage the dolphin population and their habitat.
3. Strengthen and extend participatory dolphin conservation programs.
4. Strengthen cooperation and coordination on dolphin conservation at the national and international level.

A log-frame has been developed to guide the proper implementation and monitoring of this conservation action plan. The Department of National Parks and Wildlife Conservation and the Department of Forests and Soil Conservation will take overall lead in implementing this conservation action plan. Both departments will coordinate with respective ministry at the province level and their field offices along with other government and international agencies to secure the fund and strengthening cooperation. Based on this action plan, annual plans will be developed with specified roles of each conservation partner and monitoring and evaluation of the progress of this action plan will be carried out regularly. A mid-term and final review of the action plan implementation progress will also be conducted by involving a team of independent consultants. The total estimated cost for the implementation of this conservation action plan is NPR. 146,750,000.

© Deep Narayan Shah, TU

Unit 1 Introduction

1.1 Relevancy of Action Plan

Dolphin (*Platanista gangetica gangetica*), a sub-species of Asian River Dolphin, is a globally endangered freshwater cetacean. It inhabits in Ganges-Brahmaputra-Meghna River systems of Nepal, India, and Bangladesh (Sinha & Kannan, 2014)., The species continues to be threatened with habitat loss and fragmentation due to damming of rivers for hydropower and irrigation (Baruah *et al.*, 2012; Choudhary *et al.*, 2012; Braulik *et al.*, 2014), incidental by-catch in fishing gear (Mansur *et al.*, 2008), deliberate killing for their oil (Sinha, 2002), river pollution (Kannan *et al.*, 1997), and reduction of their prey (Kelkar *et al.*, 2010b). In Nepal, 52 individuals remain in the Karnali, Koshi, and Gandaki River systems (Shah *et al.*, 2020).

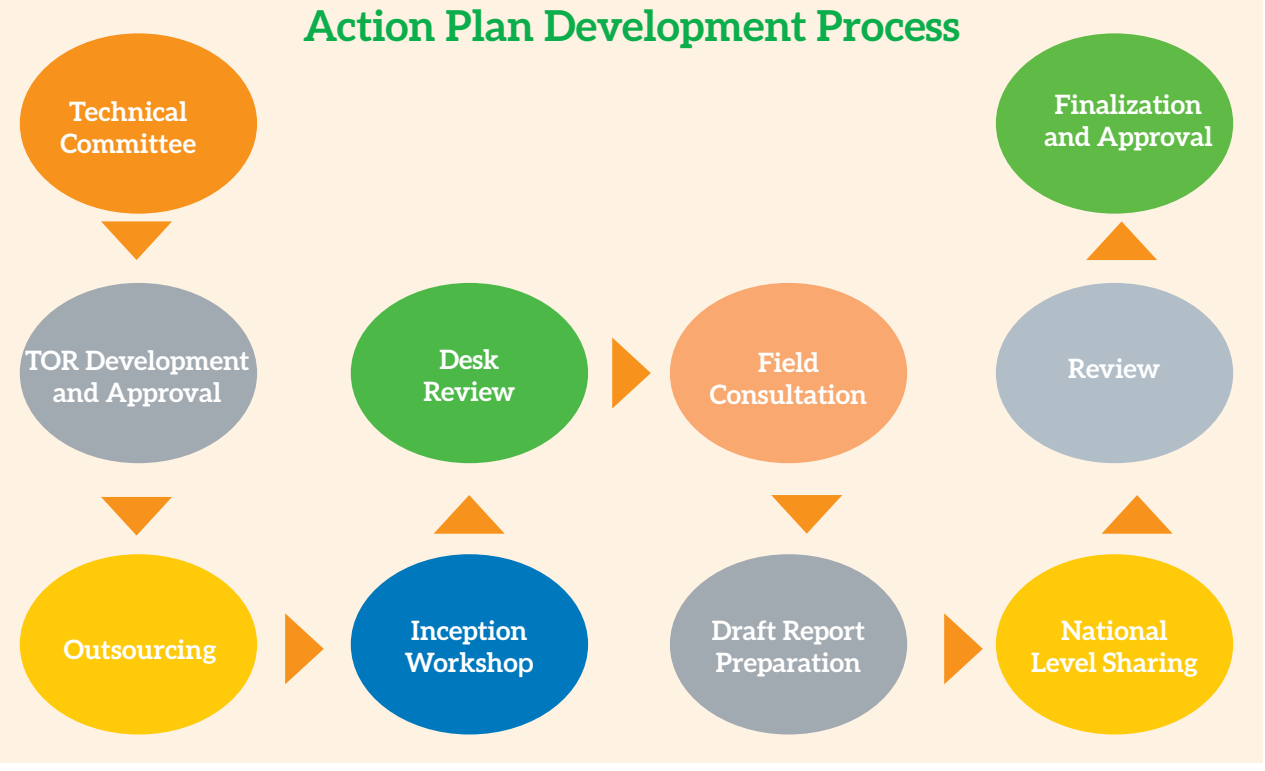
There have been some efforts for dolphin conservation by the government, non governmental orgnation (NGOs), and local community but these efforts are often insufficient to guide collective action and ensure the long-term survival of the species. Given the precarious situation of river dolphin in Nepal with less than 100 individuals remaining in Koshi, Karnali, and Naryani, preparing a species conservation action plan of dolphin for the long term conservation and management of the particular species is of utmost importance. Hence, the Dolphin Conservation Action Plan (2021-2025) has been prepared to maintain the viable dolphin population by addressing threats and challenges for dolphin conservation in Nepal. This conservation action plan will help to implement conservation programs in a more coordinated way.

1.2 Action Plan Development Process

A technical committee under the Department of National Parks and Wildlife Conservation (DNPWC) recommended for preparing conservation action plan of Dolphin. Then, DNPWC prepared and approved the Terms of Reference (ToR) and assigned team of consultant. The consultant organized an inception workshop where the methodology and time frame for the preparation of the document was discussed and finalized. After the workshop the consultants' team reviewed the literature and other related documents, this was followed by field consultation. During the field visit, series of group discussions were organized at various sites that accompanied park officials of Chitwan National Park, Koshi Tappu Wildlife Reserve, Bardia National Park, provincial-level Ministry of Industry, Tourism, Forests and Environment, Forest Directorate, Division Forest Offices (DFOs), Buffer Zone User Committees (BZUCs), NGOs, Community-based organization (CBOs), and voluntary organization.

Based on these consultations, a draft report was prepared and shared amongst the technical committee members and experts for review. The final plan has prepared by incorporating the feedback and comments received from experts.

Figure 1: The process followed in the preparation of the action plan



1.3 Scope of Action Plan

The protected area network includes only a few habitats of dolphin. Much of the habitat of dolphin in Nepal falls outside the protected area system. The action plan hereafter will serve as a guiding document for any future research as well as conservation activities by bridging the gaps in existing conservation issues and future opportunities. The action plan will also ensure the implementation of the NPWC Act, 1973 and National Biodiversity Conservation Strategy and Action Plan (2014-2020) by bringing together the enforcement agencies (DNPWC and DoFSC, PAs, DFOs), conservation partners, and local communities under the same umbrella for conservation of dolphin.

© River Dolphion Trust

Unit 2 Background

2.1 Global Status and Distribution

Dolphin are among the world's most threatened mammalian species (Reeves, Smith & Kasuya, 2000). River dolphin are at the top of the food chain and are often been regarded as indicators of ecosystem degredation in large tropical rivers. (Gomez-Salazar, Coll & Whitehead, 2012). The decline indicates the degrading quality of water resources and is a warning to use our water resources more wisely (WWF Nepal Program, 2006).

Most of the dolphin are marine, but several species inhabit sporadically or exclusively in freshwater habitat. The three obligate riverdolphin are (i) the blind river or Asian River Dolphin (*Platanista gangetica*), the Yangtze River Dolphin (*Lipotes vexillifer*) which inhabited the lower and middle reaches of the Yangtze River in China, but now extinct and (iii) the Amazon River Dolphin (*Inia geoffrensis*), which is largely distributed in northern South America in the Orinoco and Amazon river system and the upper Rio Maderia drainage. The fourth species classified as the riverdolphin is the La Plata (*Pontoporia blainvillei*), which is found in estuaries and coastal waters of eastern South America (Sinha & Kannan, 2014).

The Asian River Dolphinin habit some of the largest river systems of southern Asia, and their environmental requirements link them to food and water security issues in the world's most densely populated human environments (Reeves *et al.*, 2000; Sinha & Kannan, 2014). Among the two subspecies of Asian River Dolphin (*Platanista gangetica gangetica*), the Ganges River Dolphin (*Platanista gangetic gangetica*) occur in Ganga Brahmaputra – Meghna (GBM) and its tributaries in Nepal, India, and Bangladesh, whereas Indus River Dolphin (*Platanista gangetica gangetica minor*) is found in Indus River system in Pakistan and Punjab region of India (Sinha & Kannan, 2014) (Figure 1).

Current population trends of Asian River Dolphin are unclear. Population assessment in 2017 estimated less than 5,000 individuals for the species as a whole, of which about 3,500 belong to the Ganges sub-species and about 1,500 to the Indus subspecies (Braulik *et al.*, 2015). However, the underlying surveys are temporally patchy and believed to contain uncertainty.

The Ganges River Dolphin (*Platanista gangetica gangetica*) has been classified as 'Endangered' in the IUCN Red List of Threatened Species. The IUCN changed its status from 'Vulnerable' to 'Endangered' in 1996 as the species population was declining in its entire distribution range. It is included in Appendix I of the Conventionon International Trade in Endangered Species of Wild Fauna and Flora (CITES).

2.2 National Distribution and Status

Dolphin is classified as 'Critically Endangered' in National Red List of Nepal (Jnawali *et al.*, 2011). It is listed in schedule-1 of the National Parks and Wildlife Conservation Act, 1973 as protected species. Once the dolphin were widely distributed in Koshi, Karnali, Narayani, and Mahakali river systems (Shrestha, 1989a; Smith, 1993, Shrestha, 1989a; Smith, 1993; Smith *et al.*, 1994), they are now largely confined to main channels of Karnali, Narayani and Koshi river systems with less than 100 in number (Thapa, 2006; Khatri, Shah & Mishra, 2010b; Paudel *et al.,* 2015a; Shah *et al.*, 2020). They also live in tributaries in Mohana river of Kailali district during monsoon season. They have become extinct from Mahakali river.

The national estimate of river dolphin population in Nepal varies seasonally. (Paudel *et al.,* 2015b; Shah *et al.*, 2020). A study conducted in July-August, 2016 showed that there could be as high as 61 river dolphin across Nepal with best estimate of 52 dolphin. While river dolphin countinue to occur in Koshi, Karnali, and Naryani river with small isolated population, their distribution range continues to shrink over the years. A study shows that the dolphin distribution in the Karnali river shifted downstream and the population declined from 11 in 2012 to 6 in 2015 (Khanal *et al.*, 2016). The southern extent of the Koshi population is connected to the Indian population so the individual can immigrate and disperse to India, and possibly be lost from the Nepalese population. Even as the largest sub-population in Nepal, the KoshiRiver populationis not likely a genetically viable population without immigration from India and the potential translocation of the individual. In the past, river dolphin were recorded as far as Deoghat in the Narayani River, Nepal, 250 m above sea level and approximately 100 km farther upstream than Anderson recorded in 1879 (KASUYA, 1972).

2.3 Taxonomic Status and Genetics

There are 88 recognized species of cetaceans, of which 41 species that belong to 21 genera. Of all the four obligate species, both the Ganges and Indus River Dolphin species hold the most ancient evolutionary lineage, separated from all other cetaceans by around 30 million years ago (Hamilton *et al.*, 2001; Yan, Zhou & Yang, 2005). The taxonomic division is given in Table 1 1.

Kingdom:	Animalia
Phylum:	Chordata
Class:	Mammalia
Order:	Artiodactyla
Infraorder:	Cetacea
Family:	Platanistidae
Genus:	*Platanista* Wagler, 1830
Species:	*P. gangetica*
Subspecies	*Platanista gangetica gangetica* *Platanista minor minor*

2.4 Species Ecology

2.4.1 Physical Description

The Dolphin is grey-brown, although sometimes a lighter coloration is exhibited on the ventral side. Their beaks are distinctively swollen at the tip and are highly elongated, attaining 15-27 percent of the length of their bodies depending on age and sex, with large visible teeth. The adult female has 140 prehensile teeth in both jaws, with the upper jaw's tending to have more teeth than the lower jaw.

Although narrow and sharp in youth, the teeth become worn, and flattened with age (Anderson 1879). A newly borne baby was observed to be without teeth but on the margins of both jaws, there were teeth-like rows of elevation.

2.4.2 Primitive Characteristics

The dolphin *(Platanista gangetica gangetica)* bears some of the very primitive characteristics not seen in other cetaceans, namely presence of caecum at the junction of the small and large intestine (Anderson 1879), and the position of the testes is much more dorsal than in other marine cetaceans (testes are extra-peritoneal in terrestrial mammals). Many of the male oceanic dolphin have their testes situated more dorsally and are much less descended than is seen in *Platanista.* Subcutaneous muscle between two layers of blubber was seen in *Platanista*. Further, the simple air sacs, and accessory air sacs around the nasal passage might indicate that the *Platanista* is more primitive than are other oceanic dolphin.

2.4.3 Habitat

The dolphin exhibit preference to areas that create eddy countercurrents, such as small islands, sand bars, river bends, and convergent tributaries. In the monsoon season, dolphin migrate locally to tributaries and then return to larger river channels in the dry, winter season (Sinha *et al.*, 2000; Sinha & Kannan, 2014; Smith, 1993). River confluences and river segments with deep pools have been suggested as high-quality habitat for the river dolphin in Asia (Smith, 1993; Mazumder *et al.*, 2014). Deep pools have also been identified as preferred habitat by the river dolphin and there in the upper stretch of Ganges River in India.

Smith (1993) identified primary and marginal habitats of dolphin in the Karnali River. Primary habitats are characterized by an eddy counter-current system in the main river flow caused by a fine sand/silt point bar formed from sediment of a convergent stream branch or a tributary. Marginal habitats are characterized by a smaller eddy counter-current system caused by an upstream meander. Dolphin concentrate on locations of high prey availability and reduced flow. The primary habitats are also areas of greater human activity. The high biological productivity of habitats results in fishermen concentrating the majority of their efforts in these river reaches. The dolphin preferentially congregate in such locations that are preferred by local fishermen, and the sites with higher biomass of small fish (Kelkar *et al.,* 2010).

2.4.4 Biology

Dolphin have highly developed sonar systems. They use pulse sounds, but not whistles, to navigate. This allows them to perceive objects, specifically prey in murky water (Jensen *et al.,* 2013). Over a 24-hr period, there is almost always a constant emission of sound; 87% of these sounds are clicked for echolocation, and the remaining vocalization is used in communication. However, enough studies have not been conducted to determine the significance of these communicative sounds (Moreno 2003; Nowak 2003; Reeves and Brownell 1989). Recent studies by WWF-India, and Japanese researchers on the acoustics of the dolphin in the upper reaches of the Ganges River at Narora are expected to yield information on underwater activities (Sasaki-Yamamoto *et al.,* 2013).

2.4.5 Behavior

The dolphin is a solitary animal but occasionally congregates in groups of three to ten individuals. Mothers and calves stay together until the infants are weaned (Sinha 1999). They are found in loose congregations, especially at confluences where prey congregate. The dolphin swim almost constantly, often on their sides, a method of progression previously unknown among cetaceans (Herald *et al.*, 1969). Shortly after initiating a dive, they spin 90° on their lateral axis and 180° on their longitudinal axis to swim in the direction opposite from the surfacing direction (Smith,1993). While the dolphin swim sideward, the pectoral flipper either touches the bottom or trails about 2 to 3 cm above it. The tail is higher in the water than the head so that the body is at an oblique angle concerning the bottom of approximately 10°. The flippers are thought to have an important tactile function (Pilleri & Gihr, M. & Kraus, 1970; Pilleri *et al.*, 1976). This probably explains why the flippers almost feel the bottom as a means to identify habitat. It is not possible to identify individuals using photographs because they do not appear to have any unique features, and obtaining pictures of them is prohibitively difficult. It is only when dolphin are kept in clear water in captivity that anything of their underwater behavior can be discerned. Three female Indus dolphin captured by Herald *et al.,* (1969) were kept in holding pens in Karachi en route to the United States, and this was the first time that their unique side-swimming behavior was observed. One pectoral flipper either touched the bottom or trailed just above it. The lower flipper repeatedly touched the bottom during sideward swimming (Pilleri and Pilleri, 1987). Pilleri (1970) suggested that side swimming may occur only in certain situations and is an adaptation that allows dolphin to move through shallow water.

2.4.6 Surface Behavior and Dive Times

Indus and Ganges river dolphin surface alone; only mothers, and young calves surface in near synchrony. Whether the species shows great diversity in surfacing patterns depends on several environmental factors and age-class. One of the study investiagted surfacing and diving behavior vis-à-vis several covariates in the free-ranging dolphin population at Gandak-Ganges confluence at Patna(Sinha *et al.*, 2010). The study showed that dolphin displayed different surfacing patterns depending upon their position from offshore distance as well as on day-hours. Between 25 and 50 m from shore, exposure of head, and dorsal fin dominates in adult and sub-adults (Sinha *et al.*, 2010). Within the same distance, juveniles expose rostrum, head, and dorsal fin. Feeding activities, and adaptive strategies to minimize foraging costs resulted in aggregation, and vigorous surfacing of dolphin in the impact zone of confluence. The adults and sub-adults were found to have different types of surfacing in different day-hours. Exposure of the head and dorsal fin was dominant among adults throughout the day while exposure of the rostrum, head, and dorsal fin among the sub-adults was common in the morning and afternoon. The surfacing of adult dolphin was usually vigorous (leaping/rostrum, head, dorsal fin, and fluke rise). The juveniles were observed only during the morning, and afternoon and dive-time was highest during morning hours (range 23 – 267 second, mean 142, SD ±70). Head and dorsal fin in the morning, and rostrum, head, dorsal fin and fluke exposures in the afternoon were dominant. *Ad libitum* observation of the groups showed that they were active, as demonstrated by vigorous and frequent surfacing during morning and afternoon hours. The morning and afternoon were observed to be feeding hours of the dolphin (Sinha *et al.*, 2010). Dive-time of the dolphin ranges from 10 to 465 seconds. (Sinha *et al.*, 2010).

2.4.7 Mating and Birth

There is limited information available on the mating systems of dolphin. Kasuya (1972) estimated the age of sexual maturity to be 10 years or less for both sexes. Males may become sexually mature at about 170 cm in length or less when they are 10 years old or slightly younger. Mating activities occur in low-water season between March and May. Gestation lasts approximately one year, with possible peak birthing seasons in early winter and early summer. Anderson (1879) reported the gestational period to be 8 to 9 months. Dolphin bear a single offspring of 70-90 cm long. Weaning can begin as early as two months to as late as 12 months, with a typical duration of 9 months (Kasuya 1972, Reeves and Brownell 1989). Once offsprings have been weaned they disperse and become independent (Moreno 2003; Nowak 2003; Jefferson *et al.* 2008). In dolphin there might be two peaks of parturition, one in early summer and the other in early winter. Neonates have been sighted in April and October as well. It appears that the parturition occurs during October and May. Kasuya (1972) reported that the juveniles were born from October to March, with a peak in December and January in rivers in Bangladesh. Young begin feeding on small prey at about one or 2 months and are weaned within a year (Kasuya 1972)

2.4.8 Dispersal

Researches have indicated that dolphin move downstream to main channel in the winter season when river discharge is low and as the floodwater rise in the monsoon season, dolphin move into upstream water that comprise smaller tributaries (Anderson 1879; Kasuya and Haque 1972; Shreshtha 1989; Sinha and Sharma 2003a; Kelkar *et al.,* 2010). During the flood season, many dolphin enter into the smaller tributaries and most return to the main channel of the large rivers after the flood. However, some individuals stay back in pools of the tributaries during the dry season (Pelletier and Pelletier, 1980), which makes them vulnerable and subject to being killed by local fishermen.

2.4.9 Life Span/Age

Not much is known about the longevity of the river dolphin. Sexual and physical maturity may be attained at the ages of approximately 10 years or less, and more than 20 years, respectively (Kasuya 1972). Physical maturity is attained when all the intervertebral discs become completely fused with their respective vertebrae. Females attain sexual maturity when they are between 170 and 200 cm in body length (Kasuya, 1972). Anderson (1879) reported a physically mature male of 211 cm. Similarly, physical maturity was not complete in a 233cm female, but a 252 cm long female was found to be physically matured. Almost all the teeth of the 252-cm female were worn down, and her posterior teeth were flat. The Brownell (1984) estimated age at sexual maturity to be roughly 6-10 years in this species.

2.5 Religious value

River dolphin is one of the world's first protected species. Emperor Ashoka had given a special protection status under his reign 2300 years ago. *Malaha* community of eastern Nepal worship it as a protector of their ancestor. Due to its religious and conservation values, India has declared it as National Aquatic Animal on October 5, 2009.

© Deepak Rajbanshi, Bardiya

© Deep Narayan Shah, TU

Unit
3

Major Conservation Efforts and Achievements

The clause 51 (g) of the Constitution of Nepal mentions that 'The State shall endeavor to protect and improve the environment and to preserve and safeguard the natural resources, biodiversity, wetlands, forests, and wildlife for the present and future citizens'. Moreover, as a party to the Convention on Biological Diversity (CBD), Nepal is working with the international community to ensure the conservation and sustainable use of its biological resources.

Dolphin are listed as 'Endangered' on IUCN Red List and it is 'Critically Endangered' in the national red list of the threatened species. It is listed in CITES Appendix-I, which bans all international trade of dolphin and its derivative products. The government of Nepal has taken the highest consideration by enlisting it in Schedule I of the National Parks and Wildlife Conservation Act 1973.

At present, a few of its habitat is protected within the protected areas system (KTWR, CNP, and BNP). The various conservation activities and monitoring in these areas are conducted by respective protected areas. Apart from the PAs, various academic institutions, I/NGOs and CBOs have been carrying out various research and awareness-raising programs in its habitat areas. Governmental organizations (DNPWC, DoFSC, DFOs), national and international organizations (NTNC, WWF Nepal, River Dolphin Trust, Centre for Ecological Studies, Dolphin Conservation Centre Kailali, Nepal Biodiversity Research Society, Himalayan Nature) are supporting various projects either financially or technically. Furthermore, local communities such as Malaha, Bote, Majhi, and Mushar are playing a pivotal role by their traditional and spiritual practices in the conservation of dolphin and their prey in Nepal.

The various conservation initiatives taken until the date has led to some fruitful achievements. The frequent census, researches, and monitoring conducted by concerned authorities have helped to take necessary actions for dolphin conservation. The publications of various researches have established the recognition, and concern of national and international institutions. It has helped in generating the funds to carry out various projects. Moreover, the communities have become more aware than before and are actively participating in conservation activities such as by the formation of eco-club. The Dolphin Conservation Action Plan formulation itself is another milestone for dolphin conservation in Nepal.

©Gopal Khanal, Assistant Conservation Officer, DNPWC

© River Dolphion Trust

Unit 4 Conservation Threats

Dolphin in Nepal are at risk from multiple stressors; major of which include habitat fragmentation, changes in water quantity and quality, habitat modification, climate change, over-exploitation of resources, pollution, and invasive species (WWF Nepal Program, 2006; Shah *et al.*, 2020). Similarly, the construction of embankments, dams and barrages, chemical discharges from the household, industry, agriculture, mining and health sector, and deforestation which leads to heavy siltation are other reasons for their endangerment (Sinha & Kannan, 2014). Declining dolphin population in the river's upstream of the dams and barrages on the India–Nepal border, and in other areas possibly indicate ecosystem degradation. Thus, low number of dolphin population in some locations can be related to environmental degradation in the river basin. Some major threats of dolphin are described below.

4.1. River Flow Regulation

River flow regulation is one of the most pressing global threat to freshwater biodiversity, ecosystem processes, and associated human activities (Dudgeon, 2019). Habitat fragmentation and loss through flow regulation can have drastic effects on distribution, gene flow, movement, migration patterns, and behavior of riverine species (Bunn & Arthington, 2002; Lytle & Poff, 2004). Large dams, flood-control structures, and embankments for irrigation projects and hydroelectric power have had substantial impacts on river ecosystem services, and biodiversity at both local and landscape scales (Dudgeon, 2000; Nilsson *et al.,* 2005). Large dams in the river basin of the Indian subcontinent have severely altered natural flow regimes, particularly in the low-flow dry season reducing historical ranges of dolphin (Smith & Reeves, 2000). Altered flows could have negative impacts on endangered species such as the dolphin (Choudhary *et al.*, 2012) and their habitat (Sonkar & Gaurav, 2020). Over 50 dams and barrages have been built within the historical home range of the river dolphin (Smith *et al.* 2000, 2012). Dams are known to serve as geographical barriers for the movement of river dolphin (Smith *et al.*, 1998). Girijapuri, Gandak, and Koshi barrages have impeded the migration of dolphin and associated prey species thus limiting the possibilities of genetic mixing and erosion. These dams have moreover, obstructed the cross-country movement of the dolphin between Nepal and India. The post-flood movement to the Karnali channel likely became an 'ecological trap' for the dolphin population where former adaptive preferences became maladaptive given the combined impacts of irrigation and fisheries by catch risk (Khanal *et al.*, 2016).

4.2. Motorized Boat and Ghats

Motorized boats in ghats produce significant underwater noise. This is prevalenet in all dolphin habitat in Nepal. Such anthropogenic noise has the potential to impact behavioral and physiological eclogy of river dolphin. Anthropogenic pressure such as the presence of motorboats for transportation along the Ghat area is the associated threats all of which are appeared to be more localize yet they are likely compounding effect in declining the dolphin populations. Moreover, fishing boats used commercially by the fishing communities has been a major threat to dolphin. In India, interactive effects of noise of motorized boats and low water depth have been found to increase the risk of metabolic stress on river dolphin (Dey *et al.*, 2019).

4.3 Habitat Destruction and Population Segregation

The northernmost population of dolphin occurs in Nepalese rivers, which are fragemented by the low gated dams (barrages) constructed along the Indo-Nepal border for irrigation purposes. This fragmentation has segregated the breeding groups of river dolphin with potential deleterious effects on their gene pool. For example, the Girijapuri barrage located at Kailashpuri, 20km downstream of India-Nepal border along the Karnali river channel has isolated the upstream remnant population from any possible genetic mixing. Barrages on the Mahakali River (Sarda in India) at Banbasa on the India-Nepal border in 1928, and at Sardanagar in 1974 about 160 km into Indian territory, have resulted in the extinction of dolphin from the Mahakali River. Haphazard collection of sand, stone and other river resources has caused destruction in existing riverine habitat.

4.4. Accidental Entanglement in Fishing Nets

Riverine fisheries also result in multiple threats to dolphin, especially through accidental entanglement in gillnets (bycatch) and occasional targeted killing for use as fishing bait (Sinha and Kannan, 2014; Smith and Braulik, 2012; Bashir *et al.,* 2012; Mansur *et al.*, 2008). Incidental killings by fishing gear (Mohan 1995; Smith & Reeves 2000; Sinha 2002) are considered as the significant reasons for the decline of the species and ecological integrity of its habitats. A study from Bangladesh has found the probability of accidental entaglement into nets increases when the water depth is low and mesh size of nets is high (Dewhurst-Richman *et al.*, 2020). The same study has also showed that current level of fisheries related accidental mortalities exceeds the sustainable limit recommended by the International Whaling Commission. A recent study has shown that more than two third of reported accidental mortalities of Asian river dolphin occurred in fishing nets that are considered legal nets by fisherise law of the dolphin range countries (Kelkar & Dey, 2020). The same study suggests the need to amend the current fishery regulations to regulate mesh size in nets so as to reduce by-catch (Kelkar & Dey, 2020). Long shore nets, gill nets, drag nets, lift nets, and fishing rods are illegally used to catch fish. The fishing nets, especially the gill nets, are the biggest direct threat to dolphin, because the dolphin often get entangled into the net and die in suffocation. If it is found alive in fishing net, the fishermen occasionally kill it in order to free the net and sale the dead.

4.5. Poaching

There is a myth that the oil extracted from a dolphin is believed to have the power to heal pain when it is applied externally (Shrestha, 1989b; Sinha, 2002). Use of dolphin oil as a fish attractant was believed to have reduced. However, a recent study has found evidence for the continued use of dolphin oil as a bait for fishing and traditional medicine (Kolipakam *et al.*, 2020). The meat is used as the bait for big fishes, prawns, and crabs. Even, the poor fisherman is encouraged by the rich people to deliberately kill the dolphin for money.

4.6. Floods

During the monsoon season, dolphin move into tributaries to reduce the risk of floods and floating debris. They are particularly threatened in the upstream reaches of the smaller tributaries, where populations are often isolated behind barrages and are more vulnerable to human activities because of the reduced habitat area and perhaps the most endangered populations are in Nepal (Sinha *et al.,* 2000). Moreover, during the flooding, the water sweeps the mud and other organic matter from the adjoining forest area resulting in degradation in river water quality.

4.7 Toxicity and Pollution

The household as well as agricultural and industrial discharges in the rivers pollutes the water. This not only affects the health of the dolphin but also its associated prey. Toxic contaminants like organochlorine and butyltin concentrations in samples from the tissues of the river dolphin have been found to be high enough to cause concern about effects (Kannan *et al.*, 1997, 2005).

© Naresh Khanal, Centre for Ecological Studies

© Naresh Khanal, Centre for Ecological Studies

Unit
5 Challenges and Opportunities

5.1 Challenges

5.1.1 Inadequate Research

Dolphin research has received little priority in Nepal. Although occasional studies and monitoring of river dolphin populations date back to 1980s (Shrestha, 1989a), and while there have been recent increase in research (WWF, 2006; Khatri *et al.*, 2010b; Paudel *et al.*, 2015a; Khanal *et al.*, 2016; Paudel *et al.*, 2020b; Paudel & Koprowski, 2020; Paudel, Koprowski & Cove, 2020a; Shah *et al.*, 2020) long term systematic monitoring of their population trends and habitat dynamics is almost absent in Nepal. Filling up the gap of limited information and knowledge on status, ecology, and movement patterns is one of the major challenges to dolphin conservation in Nepal. Improving our understanding of the changing climatic patterns, flow regulation and diversion, and emerging threats due to water pollution, invasive fish species is also key challenge to conservation planning in Nepal.

5.1.2. Limited Conservation Awareness

A low level of awareness of the negative impacts of overfishing and legal aspects of conservation also poses a challenge to the last remaining population of dolphin in Nepal. As the knowledge level of local stakeholders play a vital role in the conservation of critical species like dolphin, additional efforts are needed to promote awareness, sensitization, and information among local communities. Additionally, recording the existing traditional, and indigenous knowledge on the site-specific context of the species seems equally important. It is important to implement the strategies through the participation of local scientists, managers, and community groups or stakeholders.

5.1.3 Trivialization of Importance and Limitation of Resources and Capacities

With major conservation torch towards terrestrial megafaunas, dolphin are given less conservation priority in Nepal. Although dolphin plays a significant role in the freshwater ecosystem, its role as flagship of the freshwater ecosystem has been trivialized. The prioritization of dolphin conservation can be a breaking point for the effective conservation of freshwater ecosystem. Besides, there are lack of trained personnel on handling, rescuing, and conducting research on dolphin. Several socio-economic factors lead to the destruction of habitat and decline in dolphin population. On the other hand, economic and social incentives to preserve optimal habitats for dolphin are insufficient to encourage local communities. The benefits of eco-tourism when planned to be distributed efficiently, may instill positive motives in local communities for dolphin conservation.

5.1.4. Under Representation in Protected Area System

Rivers are not well represented in Nepal's protected area network (Shrestha *et al.*, 2010) and water availability has been strongly constrained by competing demands for irrigation, hydropower, etc. (Smakhtin, Shilpakar & Hughes, 2006; Khanal *et al.*, 2016). Kaudiyala, the western channel of Karnali River, and Mohana River are not represented in protected area network. A study has shown that water diversion to meet the competing demands for irrigation reduces the water depth in the river aggravating the chances of river dolphin entanglement in fishing nets (Khanal *et al.*, 2016).

5.2 Opportunities

5.2.1 Indicator and Flagship Species

Dolphin share their habitat with other river species such as the endangered gharial (*Gavialis gangeticus*), vulnerable mugger (*Crocodylus palustris*), the river otters (*Lutrinae*) and different species of turtles and various freshwater fishes. Protecting the river dolphin also protects these species. Moreover, there is no record of dolphin harming humans, which supports enormous public support for ensuring the maintenance and protection of the dolphin. As a flagship species, its conservation requires greater effort and priority. Additionally, with habitat outside PAs, conservation in the wild particularly outside the PAs also needs to be focused. This will be effective through concerted efforts and collaboration at the local level. Dolphin can thus serve as a flagship species for the conservation of the entire biodiversity of the freshwater ecosystem. As a flagship species, dolphin can also be instrumental in fundraising and developing an integrated conservation program.

5.2.2 Involvement of Local Community

Conservation interventions targeting this endangered species are very minimal in the majority of its habitat. This scenario underpins the need for a community-based conservation program that ensures the co-existence of dolphin and human beings. Besides, the encouraging experience of local communities involved in conservation from Kailali further paved the way to replicate this community-based conservation approach in other ranges.

5.2.3 Nature-Based Tourism

Dolphin are charismatic species. Its slender body and movement are worth a while to watch. Hence, dolphin offer a great possibility for eco-tourism. However, guidelines and codes of conduct should be developed, adopted, and promoted to ensure that unregulated dolphin watch tourism does not become a menace for dolphin and hence ensure sustainable eco-tourism.

5.2.4 Use of Cutting-edge Technology in Research and Monitoring

The studies based on remote sensing, satellite GPS collaring, acoustic monitoring and non-invasive genetic analysis provide a better opportunity for understanding their habitat, ecological, behavioral, physiological, and genetics aspects. Despite the dolphin being a habitat specialist, the impact of climate change on its distribution and survival is yet to be studied, and whatever is available is limited (Smith & Reeves, 2012). This could be another pertinent avenue for further exploration based on modern tools and techniques. Likewise, the use of smart technologies seems to be equally feasible in dolphin study and monitoring.

Unit 6 Dolphin Conservation Action Plan (2021-2025)

6.1 Goal

Maintain viable population of dolphin and conserve their habitat.

6.2 Objectives

Objective 1: Enhance the understanding and knowledge on conservation status, ecology, and habitat dynamics of dolphin.

Rationale

Despite being a flagship species for freshwater biodiversity conservation, dolphin have received little research and conservation attention. As a result, our understanding of the population and conservation status of dolphin in Nepal, and the threats they face is limited. Whatever information available is sparse with high degree of uncertainty. Sound information on population abundance, distribution, and habitat dynamics is a key prerequisite for effective species conservation planning. Therefore, research should be conducted to develop robust baseline information on population status and distribution of dolphin. Survey methods should be standardized so that systematic monitoring could be conducted to monitor the trend in population size and distribution dynamics. Research on impact of changing hydrological pattern, anthropogenic disturbance, and genetic diversity of population is also important. Research on river morphology, and seasonal habitat dynamics is imperative for the development of site-specific conservation actions for dolphin in Nepal. Regular assessments of population trends, and habitat dynamics by the scientific community are paramount for the implementation, monitoring, and evaluation of future river conservation action plans (Reeves *et al.,* 2000). The potential impact of flow regulation via dams, barrage, embankment, and development infrastructure including irrigation channels on dolphin ecology, genetic makeup, and habitat is poorly understood. In recent decades, there have been significant progress in the use of digital technology to study wildlife ecology and behavior. Use of technologies such as acoustic monitoring, satellite telemetry should be explored to improve understanding of dolphin ecology and behavior.

Outputs

- Knowledge of ecology, behavior, and habitat dynamics of dolphin enhanced,
- Impact of climate change, barrage, development infrastructure and other anthropogenic threats assessed,

Actions

- Develop robust and reliable baseline information on population size and distribution for whole Nepal,
- Map potential, optimal and marginal dolphin habitat identifying key hotspots across its current distribution in Nepal,
- Study on habitat dynamics (e.g., spatial and temporal change in river course, hydrology) in response to natural and anthropogenic factors,
- Regular monitoring of dolphin population at every 5 year interval,
- Study on distribution, density, and diversity of fish prey species,
- Develop and publish a field manual standardizing survey methods for population and habitat monitoring,
- Study on the impact of dams, and other development infrastructure on environmental flows, population distribution, and genetic diversity of dolphin,
- Modeling potential climate change impacts on dolphin habitat,
- Assessment of the impact of pesticide and industrial waste on dolphin and its habitat,
- Study on historical and potential river course change, with reference to river dolphin ecology,
- Pilot genetic study of river dolphin across its habitat to understand genetic diversity of the population.

Objective 2: Protect and manage the dolphin population and their habitat

Rationale

Deforestation, haphazard road construction in upstream areas and intensive floodplain farming practices increase the sediment load of river channels and degrade the habitat (Reeves *et al.*, 2000). Various types and levels of nutrients, sediments, and pollutants drained from agricultural fertilized fields, and urban areas have degraded the dolphin habitat (Khatiwada, Chalise & Sharma, 2019). Changes in land-use patterns, and deforestation due to increased human pressure have caused the river banks to slump, and erode, reducing flows, and eliminating the deep pools because of silting (WWF, 2006). Additionally, dredging, and the removal of stones, sand, and woody debris also compromise the ecological integrity of the riverine environments, especially in small tributaries (Reeves *et al.*, 2000).

Degradation, fragmentation, and loss of quality of habitat are major challenges for dolphin conservation which must be seriously consider in future conservation endeavors. Drivers of habitat loss and degradation, however, vary from one place to another. Therefore, a site-specific assessment is important before planning the conservation program for different areas. Also, considering the potential impacts of climate change on habitat specialist species like dolphin, it is crucial to identify and protect large resilient patches from non-climatic stressors (Thapa *et al.,* 2015) while maintaining connectivity. The livelihoods of people living around dolphin habitats depend on fishing and agriculture; therefore, dolphin conservation planning should include support for livelihood development that links the needs of local villagers to conservation. With the increase in human population and developmental needs, demand for stones, boulders, and sand from the banks of the river, which are also habitats for dolphin, is certain to increase. Thus, it is of utmost importance that certain sections of the river should be banned for such activities.

The dolphin oil is often used as an attractant to catch two economically important fish—*Clupisoma garua* and *Eutropiichthyes vacha*. And there is some recent evidence of continued use of dolphin oil as fish bait.

In some areas, fishing activities take place during the night time using electricity. The use of gill net is destructive to the fishing population as it entangles fishes of all sizes that ultimately hampers the breeding fish population though instances of dolphin entanglement have not been reported. Dolphin usually feed upon smaller fishes and shrimps, the mesh size of fishing nets can be regulated so that the fishermen catch only larger fishes, and allow smaller fishes to escape. Therefore, it is imperative to implement law enforcement measures along with conservation awareness to reduce direct threats to river dolphin. Poaching, electrocution, and poisoning of river dolphin often occur as a result of weak surveillance due to insufficient staffing, capacity, and inadequate coordination among relevant enforcement agencies. At the grassroot level, *mallaha-bote-majhi-musahar* community contributed to the conservation of prey. Furthermore, the area outside the protected area and south of the Koshi barrage are under less priority or neglected for conservation. In this context, this conservation action plan envisions to reinforce the current efforts, and build the national and local capacity to combat illegal activities.

Outputs

- Site-specific drivers of habitat degradation identified and addressed,
- Development pressure on river dolphin habitat controlled,
- Cases of dolphin killing, poisoning, electrocution, and use of use of harmful fishing practices such as Mahajal reduced.

Actions

- Promote to construct fish ladder and mechanism for dolphin movement in dams and barrage,
- Establish the mechanism for rescue of dolphin and develop protocols for rescue and handling,
- Reduce deforestation in upstream habitat to stop siltation and widening of the river channel,
- Reduce the inflow of pollutants from agricultural fields, urban and industrial area to the dolphin habitat,
- Regulate the collection of river bed material (e.g., gravel and sand) from optimal dolphin habitat such as confluences and deep water pools,
- Tree plantation along the Mohona, Karnali, and Koshi rivers,
- Regulate and monitor the state of compliances of Environmental Impact Assessment (EIA) and other environmental guidelines by water development projects including irrigation channels (Ranijamara Kulariya, Koshi, Gandak irrigation channel),
- Monitoring of chemical discharge on key dolphin habitats throughout the year,
- Awareness campaigns on dolphin conservation,
- Establish a capacity building and incentive mechanism for fishing communities (Mallaha, Bote, Musahar),
- Promote sustainable fishing practices by developing fishing guidelines to reduce accidental entanglement in fishing nets and overfishing.

Objective 3: Strengthen and extend participatory dolphin conservation programs

Rationale

Since substantial proportion of dolphin habitat fall outside the current protected area nerwork, local community involvement, and stewardship is vital for dolphin conservation in Nepal. While some community-based dolphin conservation initiatives are being implemented in Kailali, Sunsari, and Saptari districts, they should be capacitated and strengthened to protect dolphin and their habitat. Dolphin based eco-tourism initiative will have great potential for ecotourism development. However, an evaluation of the ongoing conservation program would better help improve further actions. So, this sort of community-based conservation program would be more effective in conserving dolphin. But, such feasible sites should be identified before the initiation of a community-based conservation program. Mallaha-Bote community, local forest user groups, and community-based organizations should be given priority while implementing the conservation measures.

Outputs

- River dependent community people trained, sensitized, and involved in dolphin conservation,
- Dolphin based eco-tourism promoted and strengthened,
- Capacity and concern of local government in dolphin conservation enhanced.

Actions

- Awareness program in *Mallaha-Bote-Majhi-Musahar* community,
- Construction and management of fish pond, involving river dependent people and involve in benefit-sharing,
- Establish Dolphin Friends' Group involving local youth and river dependent people,
- Provide skills development training and seed money,
- Survey potential site for ecotourism promotion,
- Establish home stay on Bhardaha, Bhajani, Dhungana Tole, Baidi, Chisapani,
- Construct and maintain dolphin observation machan (considering the distance),
- A national level workshop involving local government representative (DCC, RM, Municipality),
- Incorporation of a dolphin conservation program in policy and program of local government.

Objective 4: Strengthen cooperation and coordination on dolphin conservation at the national and international level

Rationale

Preparing this dolphin conservation action plan has already brought together some key stakeholders. To implement the action plan, collaboration needs to be continued at the national level and, most importantly, be developed locally at all the priority sites to fulfill its goal. Nepal's new federal system has further manifested the need for cooperation, and collaboration amongst the local institutions. Not only the dolphin habitat has connectivity with neighboring India, but also there are some incidences of dolphin oil trafficking to India. The low-gated dams (barrage) constructed along the Nepal-India boarder

for flood control, and irrigation have significant impacts on dolphin movement, and hence mechanism for free movement is imperative. Therefore, trans-boundary cooperation with India is necessary to safeguard the dolphin and their habitat. Likewise, the exchange, and sharing of knowledge are equally important to enhance the impact of conservation programs.

Outputs

- Trans-boundary cooperation with India strengthened for dolphin conservation,
- Coordination and cooperation among three tiers of government taken in place.

Actions

- Conduct Nepal-India transboundary level meeting for conservation of shared dolphin habitat,
- Conduct a regional level (Nepal, India, and Pakistan) workshop on river dolphin conservation to share knowledge and document best conservation practices Construct structure to ensure movement of dolphin, and prey species across the barrages and, dams,
- Conduct joint field surveys to estimate population of river dolphin along the trans-border area,
- Complete MoU signing process with India on river dolphin and freshwater biodiversity conservation and effective implementation of it,
- Joint conference of local, provincial and federal government representative,
- Form and operationalize local level coordination comittee at Kailali, Saptari/Sunsari and Nawalparsi districts (Lead by respective DCC),
- Inform local and provincial government to harmonize and incorporate issues of dolphin conservation in environmental assessment,
- Facilitate implementation of the environment management plan of development projects.

© Deep Narayan Shah, TU

© Rohit Raj Jha, Centre for Ecological Studies

Unit 7 Plan Implementation and Monitoring

7.1 Implementing Agency

The DNPWC will take a lead role in overall implementation of this conservation action plan and undertake activities inside the PAs while the DoFSC will be responsible for the implementation of the activities outside the PAs. Both departments will coordinate with the provincial governments (Ministry of Industry, Tourism, Forest and Environment), Ministry of Energy, Water Resources and Irrigation, and local governments for implementation of this plan. Also, the conservation partner organizations will contribute to implement the action plan. Most of the researches, and studies will be supported by IUCN, NTNC, WWF, ZSL, and Nepalese universities in partnership and coordination with DNPWC and/or DoFSC. Similarly, other research organizations/individuals will also be encouraged to support, and conduct researches on dolphin conservation. Technical and financial support from these conservation partners will be acquired while implementing the plan. Besides, provincial and local governments, BZMCs, BZUCs, CFUGs, and other CBOs, CBAPUs, security forces, and various government and non-government agencies will also have significant contribution to the implementation of this plan.

7.2 Financial Plan

The total estimated cost for the implementation of this conservation action plan is NPR 146,750,000 (Table 1). The fund will be managed from the government's regular budget, and existing conservation partners like NTNC, IUCN, WWF, and ZSL which have been working in dolphin conservation in Nepal. The provincial government and local government are other crucial source of funding. The other national and international conservation organizations will be encouraged to seek the fund for the plan implementation. Detail breakdown of the budget is presented in the Annex-2

Table 1

Objectives	Annual Budget (NPR. in 000)	%
Enhance the understanding and knowledge on conservation status, ecology, and habitat dynamics of dolphin.	13,400	9.13
Protect and manage the dolphin population and their habitat.	33,850	23.07
Strengthen and extend participatory dolphin conservation programs.	69,750	47.53
Strengthen cooperation and coordination on dolphin conservation at the national and international level.	29,750	20.27
Total Estimated Budget	**146,750**	**100**

7.3 Monitoring and Evaluation of the Plan Implementation

The monitoring and evaluation of this conservation action plan will be carried out regularly during its implementation. The work plan will guide government agencies, conservation partners and local communities for program development and implementation. Monitoring of the progress will be carried out by the respective implementing partners and that will be shared during the review meetings. In addition, a mid-term and final evaluation will also be conducted by involving a team of independent consultants.

© Deep Narayan Shah, TU

References

Baruah, D., Hazarika, L.P., Bakalial, B., Borah, S., Dutta, R. & Biswas, S.P. (2012). A grave danger for the Ganges dolphin (Platanista gangetica Roxburgh) in the Subansiri River due to a large hydroelectric project. *Environmentalist* 32, 85–90.

Behera, S.K., Singh, H. & Sagar, V. (2013). Status of Ganges River Dolphin (Platanista gangetica gangetica) in the Ganga River Basin, India: A review. *Aquat. Ecosyst. Health Manag.*16, 425–432.

Braulik, G.. & Smith, B.D. (2019). Platanista gangetica. The IUCN Red List of Threatened Species 2019: e.T41758A50383612.

Braulik, G.T., Arshad, M., Noureen, U. & Northridge, S.P. (2014). Habitat fragmentation and species extirpation in freshwater ecosystems; causes of range decline of the indus river dolphin (Platanista gangetica minor). *PLoS One* 9.

Braulik, G.T., Noureen, U., Arshad, M. & Reeves, R.R. (2015). Review of status, threats, and conservation management options for the endangered Indus River blind dolphin. *Biol. Conserv.* 192, 30–41.

Braulik, G.T., Reichert, A.P., Ehsan, T., Khan, S., Northridge, S.P., Alexander, J.S. & Garstang, R. (2012). Habitat use by a freshwater dolphin in the low-water season. *Aquat. Conserv. Mar. Freshw. Ecosyst.*22, 533–546.

Bunn, S.E. & Arthington, A.H. (2002). Basic Principles and Ecological Consequences of Altered Flow Regimes for Aquatic Biodiversity. *Environ. Manage.*30, 492–507.

Choudhary, S., Dey, S., Dey, S., Sagar, V., Nair, T. & Kelkar, N. (2012). River dolphin distribution in regulated river systems: implications for dry-season flow regimes in the Gangetic basin. *Aquat. Conserv. Mar. Freshw. Ecosyst.*22, 11–25.

Dewhurst-Richman, N.I., Jones, J.P.G., Northridge, S., Ahmed, B., Brook, S., Freeman, R., Jepson, P., Mahood, S.P. & Turvey, S.T. (2020). Fishing for the facts: river dolphin bycatch in a small-scale freshwater fishery in Bangladesh. *Anim. Conserv.*23, 160–170.

Dey, M., Krishnaswamy, J., Morisaka, T. & Kelkar, N. (2019). Interacting effects of vessel noise and shallow river depth elevate metabolic stress in Ganges river dolphin. *Sci. Rep.*9, 1–13.

Dudgeon, D. (2019). Multiple threats imperil freshwater biodiversity in the Anthropocene. *Curr. Biol.*29, R960–R967.

Gomez-Salazar, C., Coll, M. & Whitehead, H. (2012). River dolphin as indicators of ecosystem degradation in large tropical rivers. *Ecol. Indic.*23, 19–16.

Hamilton, H., Caballero, S., Collins, A.G. & Brownell, J. (2001). Evolution of river dolphin. *Proc. R. Soc. B Biol. Sci.*268, 549–556.

Herald, E.S., Brownell, R.L., Frye, F.L., Morris, E.J., Evans, W.E. & Scott, A.B. (1969). Blind river dolphin: First side-swimming cetacean. *Science (80-.).*166, 1408–1410.

Jensen, F.H., Rocco, A., Mansur, R.M., Smith, B.D., Janik, V.M. & Madsen, P.T. (2013). Clicking in Shallow Rivers: Short-Range Echolocation of Irrawaddy and Ganges River Dolphin in a Shallow, Acoustically Complex Habitat. *PLoS One*8, e59284.

Jnawali, S.R., Baral, H.S., Lee, S., Acharya, K.P., Upadhyay, G.P., M. Pandey, M., Shrestha, R., Joshi, D., Laminchhane, B.R., Griffiths, J., Khatiwada, A.P., Subedi, N. & (compilers), & R.A. (2011). *The Status of Nepal ' s Mammals : The National Red List Series.*

Kannan, K., Ramu, K., Kajiwara, N., Sinha, R.K. & Tanabe, S. (2005). Organochlorine Pesticides, Polychlorinated Biphenyls, and Polybrominated Diphenyl Ethers in Irrawaddy Dolphin from India. *Arch. Environ. Contam. Toxicol.*49, 415–420.

Kannan, K., Senthilkumar, K. & Sinha, R.K. (1997). Sources and Accumulation of Butyltin Compounds in Ganges River Dolphin, Platanista gangetica. *Appl. Organomet. Chem.*11, 223–230.

KASUYA, T. and A.K.M.A.H. (1972). Some informations on distribution and seasonal movement of the Ganges dolphin. (Platanista gangetica). *Sci. REPORTS WHALES Res. Inst. TOKYO 24109-115, +1pl. 1972.* 8.

Kelkar, N. & Dey, S. (2020). Mesh mash: Legal fishing nets cause most bycatch mortality of endangered South Asian river dolphin. *Biol. Conserv.*252, 108844.

Kelkar, N., Krishnaswamy, J., Choudhary, S. & Sutaria, D. (2010a). Coexistence of fisheries with river dolphin conservation. *Conserv. Biol.*24, 1130–1140.

Kelkar, N., Krishnaswamy, J., Choudhary, S. & Sutaria, D. (2010b). Coexistence of fisheries with river dolphin conservation. *Conserv.* Biol.

Khanal, G., Suryawanshi, K.R., Awasthi, K.D., Dhakal, M., Subedi, N., Nath, D., Kandel, R.C. & Kelkar, N. (2016). Irrigation demands aggravate fishing threats to river dolphin in Nepal. Biol. *Conserv.*204, 386–393.

Khatiwada, S., Chalise, M.K. & Sharma, S. (2019). Distribution and Habitat Status of Ganges River Dolphin (Platanista gangetica) in Mohana River Segment of Western Nepal. *J. Inst. Sci. Technol.*24, 58–67.

Khatri, T.B., Shah, D.N. & Mishra, N. (2010a). Post-flood status of the Endangered Ganges River Dolphin Platanista gangetica gangetica (Cetartiodactyla : Platanistidae) in the Koshi River, Nepal. *JoTT*2, 1365–1371.

Khatri, T.B., Shah, D.N. & Mishra, N. (2010b). Post-flood status of the Endangered Ganges River Dolphin Platanista gangetica gangetica (Cetartiodactyla: Platanistidae) in the Koshi River, Nepal. *J. Threat. Taxa*2, 1365–1371.

Kolipakam, V., Singh, S., Ray, S., Prasad, L., Roy, K., Wakid, A. & Qureshi, Q. (2020). Evidence for the continued use of river dolphin oil for bait fishing and traditional medicine: implications for conservation. *Heliyon*.

Lytle, D.A. & Poff, N.L. (2004). Adaptation to natural flow regimes. *Trends Ecol. Evol.*19, 94–100.

Mansur, E.F., Smith, B.D., Mowgli, R.M. & Diyan, M.A.A. (2008). Two Incidents of Fishing Gear Entanglement of Ganges River Dolphin (Platanista gangetica gangetica) in Waterways of the Sundarbans Mangrove Forest, Bangladesh [WWW Document]. *Aquat. Mamm.* URL http://www.aquaticmammalsjournal.org/index.php?option=com_content&view=article&id=364:two-incidents-of-fishing-gear-entanglement-of-ganges-river-dolphin-platanista-gangetica-gangetica-in-waterways-of-the--sundarbans-mangrove-forest-bangladesh&catid=30&Ite

Mazumder, M.K., Boro, F., Barbhuiya, B. & Singha, U. (2014). A study of the winter congregation sites of the Gangetic River Dolphin in southern Assam, India, with reference to conservation. *Glob. Ecol. Conserv.*2, 359–366.

Paudel, S. & Koprowski, J.L. (2020). Factors affecting the persistence of endangered Ganges River dolphin (*Platanista gangetica gangetica*). *Ecol. Evol.*10, 3138–3148.

Paudel, S., Koprowski, J.L. & Cove, M. V. (2020a). Seasonal flow dynamics exacerbate overlap between artisanal fisheries and imperiled Ganges River dolphin. *Sci. Rep.*10, 1–12.

Paudel, S., Koprowski, J.L., Thakuri, U., Sigdel, R. & Gautam, R.C. (2020b). Ecological responses to flow variation inform river dolphin conservation. *Sci. Rep.*10, 1–13.

Paudel, S., Pal, P., Cove, M. V., Jnawali, S.R., Abel, G., Koprowski, J.L. & Ranabhat, R. (2015a). The endangered Ganges River dolphin Platanista gangetica gangetica in Nepal: Abundance, habitat and conservation threats. *Endanger. Species Res.*29, 59–68.

Paudel, S., Timilsina, Y.P., Lewis, J., Ingersoll, T. & Jnawali, S.R. (2015b). Population status and habitat occupancy of endangered river dolphin in the Karnali River system of Nepal during low water season. *Mar. Mammal Sci.*31, 707–719.

Pilleri, G. & Gihr, M. & Kraus, C. (1970). Feeding behavior of the gangetic dolphin, Platanista gangetica, in captivity. *Invest. Cetacea*2, 69–73.

Pilleri, G., Gihr, M., Purves, P., E., Zbinden, K. && Kraus, C. (1976). On the behaviour, bioacoustics and functional morphology of the Indus River dolphin (Platanista indi Blyth, 1859). *Invest. Cetacea*20, 2–33.

Reeves, R.R., Smith, B.D. & Kasuya, T. (2000). *Biology and Conservation of Freshwater Cetaceans in Asia. Iucn.*

Sasaki-Yamamoto, Y., Akamatsu, T., Ura, T., Sugimatsu, H., Kojima, J., Bahl, R., Behera, S. & Kohshima, S. (2013). Diel changes in the movement patterns of Ganges River dolphin monitored using stationed stereo acoustic data loggers. *Mar. Mammal Sci.*29, 589–605.

Shah, D.N., Poudyal, A., Sharma, G., Levine, S., Subedi, N. & Dhakal, M. (2020). Status, distribution, threats, and conservation of the Ganges River Dolphin Platanista gangetica (Mammalia: Artiodactyla: Cetacea) in Nepal. *J. Threat. Taxa*12, 15106–15113.

Shrestha, T.K. (1989a). Biology, Status and Conservation of the Ganges River Dolphin in Nepal. In *Biology and Conservation of River Dolphin: Proceedings of theWorkshop on Biology and Conservation of the Platanistoid Dolphin held atWuhan, People's Republic of China, October 28–30, 1986. IUCN/SSC Occasional Paper No. 3. IUCN, Gland, Switzerland.:* 70–76. Perrin, W.F., Jr., B., R.L., K. & Z., Jiankang, L. (Eds.).

Shrestha, T.K. (1989b). Biology, status and conservation oof the Ganges River Dolphin, Platanista gangetica, in Nepal. In *Biology and Conservation of the River Dolphin*: 70–76. Perrin, W.F., Brownell Jr., R.L., Kaiya, Z. & Jionkang, L. (Eds.). IUCN.

Sinha, R.., Smith, B., Sharma, G., Prasad, K., Choudhary, B., Sapkota, K., Sharma, R. & Behera, S. (2000). Status and distribution of the Ganges susu (Platanista gangetica) in Ganges River system of India and Nepal. *Biol. Conserv. Freshw. cetaceans Asia, IUCN Species Surviv. Comm. Occas. Pap. No. 23* 54–60.

Sinha, R.K. (2002). An alternative to dolphin oil as a fish attractant in the Ganges River system: Conservation of the Ganges River dolphin. *Biol. Conserv.*107, 253–257.

Sinha, R.K. & Kannan, K. (2014). Ganges River Dolphin: An Overview of Biology, Ecology, and Conservation Status in India. *Ambio.*

Sinha, R.K., Sinha, S.K., Kedia, G.S. & Kedia, D.K. (2010). Surfacing and diving behaviour of free-ranging Ganges river dolphin, Platanista gangetica gangetica. *Curr. Sci.*98, 230–236.

Smakhtin, V.U., Shilpakar, R.L. & Hughes, D.A. (2006). Hydrology-based assessment of environmental flows: An example from Nepal. *Hydrol. Sci. J.*51, 207–222.

Smith, B.D. (1993). 1990 Status and Conservation of the Ganges river dolphin (Platanista gangetica) in Karnali River, Nepal. *Biol. Conserv.*66, 159–169.

Smith, B.D., Haque, A.K.M., Aminul, Hossain, M.S. & Khan, A. (1998). River dolphin in Bangladesh: conservation and the effects of water development. *Environ. Manage*.22, 323–335.

Smith, B.D. & Reeves, R.. (2000). Report of the Workshop on the Effects of Water Development on River Cetaceans. In *Biology and Conservation of Freshwater Cetaceans in Asia:* 15–21. IUCN Gland, Switzerland: IUCN.

Smith, B.D. & Reeves, R.R. (2012). River Cetaceans and Habitat Change: Generalist Resilience or Specialist Vulnerability? *J. Mar. Biol.*2012, 1–11.

Smith, B.D., Sinha, R.K. & Regmi, U. (1994). STATUS OF GANGES RIVER DOLPHIN (PLATANISTA GANGETICA) IN THE KARNALI, MAHAKALI, NARAYANI and SAPTA KOSI RIVERS OF NEPAL AND INDIA IN 1993. *Mar. Mammal Sci.*10, 368–375.

Sonkar, G.K. & Gaurav, K. (2020). Assessing the impact of large barrages on habitat of the Ganga River dolphin. *River Res. Appl.*36, 1916–1931.

Thapa, K. (2006). *Study on Status and Distribution of Snow Leopard and Blue Sheep including People Interaction: A case study from Kanchanjunga Conservation Area, Taplejung and Shey-Phoksundo National Park, Dolpa Nepal.*

WWF Nepal Program. (2006). *Status, Distribution and Conservation Threats of Ganges River Dolphin in Karnali River, Nepal.*

Yan, J., Zhou, K. & Yang, G. (2005). Molecular phylogenetics of "river dolphin" and the baiji mitochondrial genome. *Mol. Phylogenet. Evol.*37, 743–750.

Annexes

ANNEX 1: LOGICAL FRAMEWORK

Narrative Summary	Indicator	Means of Verification	Assumption/Risk
Goal: "Maintain viable population of dolphin and conserve their habitat"			
Objective 1: Enhance the understanding and knowledge on population, conservation status, ecology, and habitat dynamics of dolphin.	Number of systematic population monitoring and scientific studies on dolphin increased.	DoFSC & DNPWC's record of research permits granted; research reports, academic degree thesis and number of scientific papers published in peer reviewed journals	Government policy remain supportive, and funding source remain available to carry out research.
			Conservation partners including academic institutions prioritize and support research on dolphin.

Outputs		
Knowledge of ecology, behavior and habitat dynamics of dolphin enhanced	Baseline information on national dolphin population size, and distribution generated	Research reports and papers published
	Available potential habitat of Dolphin mapped, and key hotspots identified	Research reports and papers published
	Field manual on river dolphin population and habitat monitoring techniques published	Copies of field manual published
Impact of climate change, barrage, water development infrastructure and other anthropogenic threats assessed.	Impact of water development project or flow regulation on river dolphin habitat assessed	Research reports and papers published
	Future climate change scenario and, change in river flow projected in relation to river dolphin conservation	Research reports and papers
	Impact of pesticide, industrial waste, erosion and mining assessed	Techincal reports

Actions

- Develop robust and reliable baseline information on population size and distribution for whole Nepal,
- Map potential, optimal and marginal dolphin habitat identifying key hotspots across its current distribution in Nepal,
- Study on habitat dynamics (e.g., spatial and temporal change in river course, hydrology) in response to natural and anthropogenic factors,
- Regular monitoring of dolphin population every 5 year interval,
- Study on distribution, density, and diversity of fish prey species,
- Develop and publish a field manual standardizing survey methods for population and habitat monitoring,
- Study on the impact of dams, and other development infrastructure on environmental flows, population distribution, and genetic diversity of dolphin,
- Modeling potential climate change impacts on dolphin habitat,
- Assessment of the impact of pesticide and industrial waste on dolphin and its habitat,
- Study on historical and potential river course change, with reference to river dolphin ecology,
- Pilot genetic study of river dolphin across its habitat to understand genetic diversity of the population.

Narrative Summary	Indicator	Means of Verification	Assumption/Risk
Objective 2 : Protect and manage the river dolphin population and their habitat	Area of habitat conserved through habitat restoration, strict protection regime increased	Reports of DoFSC, DNPWC, and other conservation partners	DoFSC, DNPWC, conservation partners prioritize dolphin conservation; Socio-political, and geographical situation remains conducive.

Outputs		
Site-specific drivers of habitat degradation identified, and addressed	Map of hotspots and potential degraded site produced	Research reports and GIS/ remote sensing based maps
	Number of priority areas, hotspotsidentified and conserved	Project reports and annual reports of DoFSC, DNPWC, and other conservation partners
	Site specific management plan prepared	Management plan
Reduce water development pressure on river habitat	Area of potential habitat conserved	Project reports and annual reports of DoFSC, DNPWC, and other conservation partners
	No. of EIA of development project that incorporated dolphin conservation program	EIA report of development project
	No. of degraded water sources restored	Project reports, and annual reports of DoFSC, DNPWC, DFOs and other development partner
Cases of dolphin killing, poisoning, electrocution, and use of Mahajal reduced	No of individual dolphin killed	Project reports and annual reports of DoFSC, DNPWC, and other conservation partners
	No of dolphin rescued to the secured habitat	Officer record

Actions

- Promote to construct fish ladder and mechanism for dolphin movement in dams and barrage,
- Establish the mechanism for rescue of dolphin and develop protocols for rescue and handling,
- Reduce deforestation in upstream habitat to stop siltation and widening of the river channel,
- Reduce the inflow of pollutants from agricultural fields, industries to the dolphin habitat,
- Regulate the collection of river bed material (e.g., gravel and sand) from optimal dolphin habitat such as confluences and deep water pools,
- Tree plantation along the Mohona, Karnali, and Koshi Rivers,
- Regulate and monitor the state of compliances of EIA and other environmental guidelines by water development projects including irrigation channels (RanijamaraKulariya, Koshi, Gandak irrigation channel),
- Monitoring of chemical discharge on key dolphin habitats throughout the year,
- Awareness campaigns on dolphin conservation,
- Establish capacity building and incentive mechanism for fishing communities (Mallaha, bote, Musahar),
- Promote sustainable fishing practices by developing sustainable fishing guidelines to reduce accidental entanglement in fishing nets and overfishing.

Narrative Summary	Indicator	Means of Verification	Assumption/Risk
Objective 3: Strengthen and extend participatory dolphin conservation programs	Number of local families involved in dolphin conservation increased; No. of local people benefitted from river dolphin based eco-tourism increased	Baseline and end-line reports; Annual reports of DoFSC, DNPWC and other conservation partners	DoFSC, DNPWC, conservation partners prioritize dolphin conservation;
			Socio-political and geographical situation remains conducive.
			Proactive participation and willingness of local communities

Outputs		
River dependent community people trained, sensitized, and involved in dolphin conservation	No of sites dolphin conservation activities conducted	Feasibility report, progress report
	No of river dependent community involved in dolphin conservation	Annual report
Dolphin based eco-tourism promoted, and strengthened	Dolphin based tourism promotion sites increased	Project reports and annual reports of DoFSC, DNPWC and other conservation partners
	No. of families benefitted from tourism promotion increased	Project monitoring/evaluation report
	No. of tourists visiting for river dolphin sighting increased	Visitors record maintained in tourism promoted sites
Capacity, and concern of local government in dolphin conservation enhanced	Number of training and other capacity building program conducted	Project reports and annual reports of DoFSC, DNPWC and other stakeholders

Actions

- Awareness program in *Mallaha-Bote-Majhi-Musahar* community,
- Construction and management of fish pond, involving river dependent people and involve in benefit-sharing,
- Establish Dolphin Friends' Group involving local youth and river dependent people,
- Provide skills development training and seed money,
- Survey potential site for ecotourism promotion,
- Establish home stay on Bhardaha, Bhajani, Dhungana Tole, Baidi and Chisapani,
- Construct and maintain dolphin observation machan (considering the distance),
- A national level workshop involving local government representative (DCC, RM, Municipality),
- Incorporation of a dolphin conservation program in policy and program of local government. Incorporation of dolphin conservation program in policy and program of local government.

Narrative Summary	Indicator	Means of Verification	Assumption/Risk
Objective 4: Strengthen cooperation and coordination on dolphin conservation at national and International level	No. of meetings organized at national/ International, transboundary and state level increase; Budget being spent on Dolphin research and conservation increased	Reports of DoFSC, DNPWC, and other conservation partners	Conservation partners including government and non-government agencies equally prioritize dolphin conservation
Outputs			
Trans-boundary cooperation with India strengthened for dolphin conservation	No. of trans-boundary level meetings increased	Project reports and annual reports of DoFSC, DNPWC and other conservation partners	
	Cooperation and funding received from International agencies increased	Annual work plan/budget of DoFSC, DNPWC and other conservation partners reports of DoFSC, DNPWC and other conservation partners	
Coordination and cooperation among three tires of government taken in place	No. of meetings organized at federal, state and local level increased	Project reports and annual reports of DoFSC, DNPWC and other conservation partners	
	Budget allocated dolphin conservation at federal, state and local level increased	Project reports and annual reports of DoFSC, DNPWC and other conservation partners	

Actions

- Conduct Nepal-India transboundary level meeting for conservation of shared dolphin habitat
- Conduct a regional level (Nepal, India and Pakistan) workshop on river dolphin conservation to share knowledge and document best conservation practices
- Construct structure to ensure movement of dolphin, and prey species across the barrages and, dams
- Conduct joint field surveys to estimate population of river dolphin along the trans-border area
- Complete MoU signing process with India on river dolphin and freshwater biodiversity conservation and effective implementation of it,
- Joint conference of local, provincial and federal government representative,
- Form and operationalize local level coordination comittee at Kailali, Saptari/Sunsari and Nawalparsi districts (Lead by respective DCC),
- Inform local and provincial government to harmonize and incorporate issues of dolphin conservation in environmental assessment,
- Facilitate implementation of the environment management plan of development projects.

© Gopal Khanal, Assistant Conservation Officer, DNPWC

ANNEX 2 : FINANCIAL PLAN

S.N	Objectives/Activities	Annual Budget (NPR. in 000						%
		Year 1	Year 2	Year 3	Year 4	Year 5	Total	
Objective 1: Enhance the understanding and knowledge on population, conservation status, ecology and habitat dynamics of dolphin							**13400**	**9.13**
1.1	Develop robust and reliable baseline information on population size and distribution for whole Nepal	1500					1500	
1.2	Map potential, optimal and marginal dolphin habitat identifying key hotspots across its current distribution in Nepal		500				500	
1.3	Study on habitat dynamics (e.g., spatial and temporal change in river course, hydrology) in response to natural and anthropogenic factors		1500				1500	
1.4	Regular monitoring of dolphin population at 5 year interval. Study on distribution, density, and diversity of fish prey species			2500			2500	
1.5	Develop and publish a field manual standardizing survey methods for population and habitat monitoring				1000		1000	
1.6	Study on the impact of dams, and other development infrastructure on environmental flows, population distribution, and genetic diversity of dolphin		2000				2000	
1.7	Modeling potential climate change impacts on dolphin habitat		700				700	
1.8	Assessment of the impact of pesticide and industrial waste on dolphin and its habitat			2000			2000	
1.9	Study on historical and potential river course change, with reference to river dolphin ecology					1200	1200	
1.10	Pilot genetic study of river dolphin across its habitat to understand genetic diversity of the population					500	500	
Objective 2: Protect and manage the river dolphin population and their habitat							**33850**	**23.07**
2.1	Promote to construct fish ladder and mechanism for dolphin movement in dams and barrage		3500				3500	

2.2	Establish the mechanism for rescue of dolphin and develop protocols for rescue and handling	300	300	300	300	300	1500	
2.3	Reduce the deforestation in upstream habitat to stop the siltation and widening of the river channel	500	550	600	650	700	3000	
2.4	Reduce the inflow of pollutants from agricultural fields, industries to dolphin habitat	350	400	450	500	550	2250	
2.5	Regulate the collection of river bed material (e.g., gravel and sand) from optimal dolphin habitat such as confluences and deep water pools	500	550	600	650	700	3000	
2.6	Tree plantation along the Mohana, Karnali and Koshi River	1000	1000	1000	1000	1000	5000	
2.7	Regulate and monitor the state of compliances of EIA and other environmental guidelines by water development projects including irrigation channels (Ranijamara Kulariya, Koshi, Gandak irrigation channel)	1000	1000	1000	1000	1000	5000	
2.8	Monitoring of chemical discharge on key dolphin habitats throughout the year,	500	500	500	500	500	2500	
2.9	Awareness campaigns on dolphin conservation	1000	1000	1000	1000	1000	5000	
2.1	Establish a capacity building and incentive mechanism for fishing communities (Mallaha, bote, Musahar)	500	500	500	500	500	2500	
2.11	Promote sustainable fishing practices by developing sustainable fishing guidelines to reduce accidental entanglement in fishing nets and overfishing		600				600	
Objective 3: Strengthen and extend participatory dolphin conservation programs							**69750**	**47.53**
3.1	Awareness program in *Mallaha-Bote-Majhi-Musahar* community	550	600	650	600	650	3050	
3.2	Construction and management of fish pond, involving river dependent people and involve in benefit-sharing	2000	2000	2000	2000	2000	10000	
3.3	Establish Dolphin Friends' Group involving local youth and river dependent people	1000		1000		1000	3000	
3.4	Provide skills development training and seed money	1500	1500	1500	1500	1500	7500	

3.5	Survey potential site for ecotourism promotion	1000					1000	
3.6	Establish home stay on Bhardaha, Bhajani, Dhungana Tole, Baidi, Chisapani.	1200	1500	1500	1500	1500	7200	
3.7	Construct and maintain dolphin observation Machan (considering the distance)		30000		3000		33000	
3.8	National level workshop involving local government representative (DCC, RM, Municipality)			2500			2500	
3.9	Incorporation of dolphin conservation program in policy and program of local government	500	500	500	500	500	2500	
Objective 4 : Strengthen cooperation and coordination on dolphin conservation at national and International level							**29750**	**20.27**
4.1	Conduct Nepal-India transboundary level meeting for conservation of shared dolphin habitat	750			750		1500	
4.2	Conduct a regional level (Nepal, India, Pakistan and India) workshop on river dolphin conservation to share knowledge and document best conservation practices					2500	2500	
4.3	Construct structure to ensure movement of dolphin, and prey species across the barrages and, dams	5000		5000		5000	15000	
4.4	Conduct joint field surveys to estimate population of river dolphin along the trans-border area	500		500		500	1500	
4.5	Joint conference of local, provincial and federal government representative		2000				2000	
4.6	Form and operationalize local level coordination comittee at Kailali, Saptari/ Sunsari and Nawalparsi districts (Lead by respective DCC)	500	500	500	500	500	2500	
4.7	Inform local and provincial government to harmonize and incorporate issues of dolphin conservation in environmental assessment		500	500		500	1500	
4.8	Facilitate implementation of the environment management plan of development projects	650	650	650	650	650	3250	
TOTAL PROPOSED BUDGET							**146,750**	

Department of Forests and Soil Conservation
Babarmahal, Kathmandu Nepal
Tel: 977-1-4220303, 4221231, 4216379
Fax: 977-01-4227374
Email: info@dof.gov.np
Web: www.dof.gov.np

Department of National Parks and Wildlife Conservation
Babarmahal, Kathmandu Nepal
Tel: 977-01-5320912, 5320850
Email: info@dnpwc.gov.np
Web: www.dnpwc.gov.np