A CHECKLIST OF FISH FAUNA OF SHUKLAPHANTA NATIONAL PARK, KANCHANPUR, NEPAL

Laxman Prasad Poudyal[1], Ganesh Bahadur Thapa✉[2] and Bishal Poudyal [3]

[1]Department National Parks and Wildlife Conservation/Shivapuri Nagarjun National Park, Kathmandu, Nepal
[2]Natural History Museum, Tribhuvan University, Swayambhu, Kathmandu, Nepal
[3]Department of Zoology, Amrit Campus, Tribhuvan University, Thamel, Kathmandu, Nepal
ganeshbdr13@gmail.com

ABSTRACT

An ichthyological survey along with a desk study was carried out at Shuklaphanta National Park, Kanchanpur, Nepal which harbours varieties of fish fauna. To this end, field surveys were held during the spring (March to April) and the autumn (September to October) in 2020 aiming to determine the fish checklist present in the study area. Cast net of different mesh sizes, scoop net, hook and line, flow modification, and local traps of bamboo baskets were the sampling gears employed to collect fish samples. Based on the present survey along with historical records, a combined fish checklist depicted a total of 88 fish species belonging to 7 orders, 21families and 49 genera which apart from 35 fish species adopted from the past studies carried out from 1973 to 2019, and 53 species were recorded during our field survey in 2020. This paper indicates the need for further exploration and studies and proper sustainable management for conserving important fish fauna from being overexploited.

Keywords: Ichthyofauna, research gap, baseline survey, species conservation, management

INTRODUCTION

Fish are limbless cold blooded vertebrate animal characteristically having fins, gills and streamlined body living exclusively in water. Fish use their gills for obtaining oxygen and fins for movement and most fish are covered with scales. Total number of fish species are 34700 described from the world (Forese & Pauly, 2021). The number of valid genera is 5,228, and the number of valid species is 36,272, of which 18,360 are found in freshwater till 5 July 2022 (Fricke et al., 2022). In freshwater, 51% of all fish species (more than 18,000 different species) are found (IUCN, 2021), of which 252 species are recorded in Nepal (Shrestha, 2019).

Nepal comprises both lotic (running) and lentic (stagnant) freshwater ecosystems. Based on the origin, the rivers of Nepal are broadly classified into three categories: i.e. rivers originating at Himalayas (e.g Koshi, Gandaki/Narayani, Karnali and Mahakali); rivers originating at middle mountains and hills (e.g. Mechi, Kamala, Bagmati, Rapti and Babai); and rivers originating at Siwalik zone (e.g. Chaudhar of Kanchanpur and Mohana of Kailali). There are numerous enclosed water bodies all over Nepal and those include lakes, ponds, dams, and other small wetlands. Both the lotic and lentic habitats are nurturing 236 indigenous including 17 endemic and 16 exotic freshwater fish species in Nepal (Shrestha, 2019).

Fish are the source of food for mammals, birds, reptiles and amphibians. Of the 886 bird species recorded in Nepal (DNPWC & BCN, 2018), about 10% of these feed on fish (Inskipp *et al.,* 2016). Some large fish-eating birds such as Pallas's fish eagle (*Haliaeetus leucoryphus*), Black-bellied tern (*Sterna acuticauda*), Indian skimmer (*Rynchо psalbicollis*) and Tawny fish owl (*Ketupa flavipes*) are highly threatened due to decline of fish populations in the wetlands (BCN & DNPWC, 2011). Dolphin, Otters and Fishing Cats largely depend on fish for feeding. Crocodiles, Turtles and Water snakes are also feed on fish. Aquatic amphibians eat water snails, insects, and small fish. Even the carnivorous larger fish eat the smaller fish.

Not only the wildlife but also the people use fish as a vital source of food. Fish consumption per capita in 2013 was 2.10 kg in Nepal (Budhathoki & Sapkota, 2018). The primary sources of fish for human consumption are available from fish farming through different aquaculture production systems. In addition, local people have fishing practices in rivers, streams and other wetlands; though the activities, without permission from the concerned authorities, are illegal. Fishing inside a national park

in Nepal is strictly prohibited. However, by receiving license, the indigenous and tribal communities, who inhabited the area before the park establishment, can catch or hunt the fish for their subsistence if the fish is main source of their food.

The diverse habitats from terai plains, hills and Himalayan high mountains in Nepal provide habitat for wide range of wild animals. Terai region in southern Nepal is well-known for its high density of mammals, birds, reptiles, amphibians and fish. Terai is also one of the most densely human populated areas (~ 400/km^2) (CBS, 2020). Protected areas are set-aside to protect the rare and endangered wildlife and their habitats. Shuklaphanta National Park is one of the seven protected areas in the Siwalik and lowland Terai region of Nepal. The first ecological survey of the fish fauna in Shuklaphanta National Park was conducted by Bhatt & Shrestha in 1977 after the establishment of Shuklaphanta Wildlife Reserve in 1976. They collected and enlisted 21 fish species and gathered information of their occurrence and distribution. After Bhatt & Shrestha (1977), It seems a big gap of three decades on the ichthyofaunal studies in the area. There were a couple of studies in the Mahakali River in 2005 and afterwards. Poudel (2008) studied the fish and fishery resources during 2005 and 2006 in Mahakali River in the eastern vicinity of Dodhara and Chandani villages and prepared a list of 23 species. In 2007 and 2008, Chataut (2008) listed 21 fish species from the same river and almost from the nearby locations. Thereafter, Khatri (2010) carried out a study at Mahakali River and nearby cultivated ponds in 2007 and 2008 in the downstream from Sharada barrage near Gaddachauki to suspension bridge near Pipariya and prepared a list of 44 species.

Biodiversity plays a precious role in stabilization of overall environment and ecosystem so the study was carried out in different water bodies of Shuklaphanta National Park in 2020 to depict the updated situation of diversity of the fish fauna of this area after upgraded it as National Park in 2017. The aim of this paper is to update the checklist of fish fauna of Shuklaphanta National Park.

STUDY AREA

Shuklaphanta National Park is situated in the far southwest corner of Nepal in Kanchanpur district and borders India to the west and south. It lies between 28º 45' 47" - 29º 02' 52" N latitudes and 80º05'45"-80º21'43" E longitudes covering 305 sq. km along with buffer zone (243.5 sq. km.). The altitude ranges from 175 -1300 m asl. The park is

connected to Pilibhit Tiger Reserve, India in the south, to Dudhwa National Park, India towards southeast via Laljhadi Forest corridor, and to Nandhaur Wildlife Sanctuary, India towards northwest via Boom-Bhramadev Forest corridor and the Mahakhali River (known as Sarada in India) (Poudyal & Chaudhary, 2019) (Fig. 1).

Shuklaphanta supports a wide range of biodiversity. The main habitats are forests covering 60% of the park, grasslands, for which the park is especially famous, covering 27% of the park and wetlands including rivers, streams, small lakes and marshlands covering about 10% of the park (Poudyal *et al.,* 2019). These habitat types support a wide range of biodiversity including 665 species of flora, 15 species of amphibians, 56 species of reptiles, 456 species of birds and 57 species of mammals (DNPWC, 2003; Poudyal & Chaudhary, 2019; Poudyal *et al.,* 2019; Rawat *et al.,* 2020; Giri *et al.,* 2020; Poudyal *et al.,* 2021). The wetland in ShNP plays very important role to sustain the overall biodiversity of the park that supports varying numbers of threatened animals and plants along with the lower vertebrates including fish. Mahakali River, Chaudhar River, Bahuni River, Syali River, Radha River, Irrigation Canals, Rani Tal (lake), Shikari Tal, Tara Tal, Kalikich Tal, Ghumaune Tal, Lami Tal, Solgaudi Tal, different streams and small waterholes are the major habitats for the fish and other aquatic animals of the park.

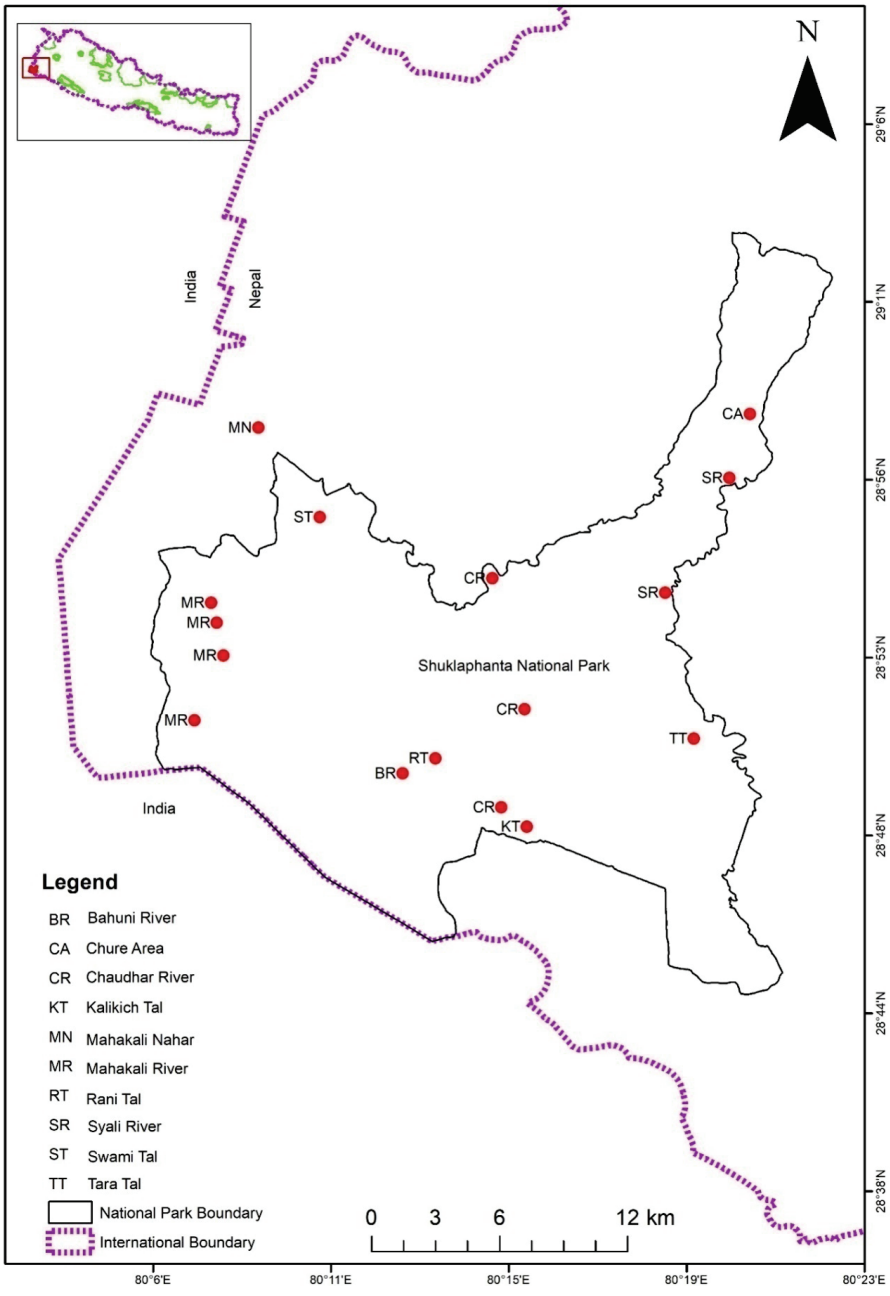

Fig. 1. Map of Shuklaphanta National Park with fish species recorded sites.

MATERIALS AND METHODS

Field survey and specimen collection

The collection of fish fauna was done during the spring (March to April) and the autumn (September to October) in 2020. Fish fauna were collected from the different wetlands of the park; viz Mahakali River, Chaudhar River, Irrigation Canal, Bahuni River, Syali River, Swami Tal, Tara Tal, Kalikich Tal and Badepani/Kharghat streams. Three domestic elephants, a four-wheel vehicle and two motorcycles were used for the transportation for reconnaissance and specific extensive survey. Two fishermen were hired for capturing the fish in the field and for local support. Information on local names and their special behavior were obtained from the fishermen and field guide books. The fish species collected from the sampling sites using cast net of different mesh size, scoop net, hook and line, flow modification and local traps of bamboo baskets thereafter identified in the field using standard field guides e.g. Jayram (1981; 2010), Shrestha (1981), Shrestha (2001), Shrestha (2008), Shrestha (2019). The excess live fish were released back to their natural habitat immediately once it was identified and photographed. The collected specimens were preserved in 10% formalin solution and stored in glass jar, brought to the Natural History Museum. Fish samples were identified by observing distinguished morphological characteristics; e.g. structure and location of fins, mouth position, snout and tail shape, presence or absence of barbels, colour pattern, body length, and scale counts. All set of fish species were kept in the Natural History Museum,Tribhuvan University, Swayambhu, Kathmandu and some of them were kept at Department of Zoology, Amrit Campus, Tribhuvan University, Thamel, Kathmandu,

Desk study and literature review

A desk study was carried out at Central Library, Tribhuvan University during the September 2021. Open internet sources were also searched through the Google search engine. Relevant informations were collected from published articles, books and theses. From the several collected sources, Bhatt & Shrestha (1977), Poudel (2008), Chataut (2008), Khatri (2010) and Joshi and Joshi (2020) were reviewed and taken into account as these literatures were completely or partially relevant to the Shuklaphanta National Park.

RESULTS AND DISCUSSION

Altogether 88 fish species belonging to 7 orders, 21families and 49 genera are documented in the Shuklaphanta National Park collected from Mahakali River, Chaudhar River, irrigation canal, Bahuni River, Syali River, Swami Tal, Tara Tal, Kalikich Tal, Rani Tal and Badepani/Kharghat (Chure area) streams (Table 1). This list includes 53 species recorded in 2020 during our present study and rest of the 35 species were adopted from the past studies carried out since 1973 to 2019. The list mostly followed the taxonomy provided by Nelson *et al.* (2016) and also consulted Froese & Pauly (2021) and IUCN (2021). Densly populated species were of *Barilius vagra, Tor tor, Garra gotyla, Labeo rohita* and *L. dyocheilus,* and rarely found species were of *Botia dario, Sperata seenghala,Clarias magur* and *Labeo fimbriatus. Lepidocephalichthys guntea, Channa* spp. and *Puntius* spp. were moderately distributed and found almost all study sites. Although *Mystus bleekeri, M. vittatus, M. cavasius* were thinly distributed but found in all sites. Likewise, *Glyptothorax* spp., *Clupisoma* sp., *Eutropichthys murius, Glossogobius giuris, Neolissochilus hexagonolepis, Bangana dero, Bengal elanga, Giebelion catla, Schizothorax richardsoni, Labeo calbasu, L. pangusia* and *Anguilla bengalensis* were found only in Mahakali river (Table 1).

In Pathariya river of Kailali, Farwestern, 25 species from 4 orders, 8 families, and 16 genera were recorded and *Puntius ticto* had the mostly found followed by *Puntius sophore* and *Mystus tengra,* while *Labeo caeruleus* had the fewest these 25 species (Neupane & Rajbanshi, 2022). The wetlands of Sudurpaschim province diversified with 87 fish species (Ghimire *et al.,* 2021) but in this study found 88 spp. of fish in ShNP alone. Most species diversity was similar to the findings of 118 fish species spread over 11 orders, 26 families and 64 genera inhabited in different water bodies in Morang district of Province 1 eastern Nepal. The order Cypriniformes is the richest (Subba *et al.,* 2017). Hence, the fish diversity pattern is similar in Sudurpaschim and eastern Nepal but not rich spp. as in Province 1. Some of the documented fish fauna from the Shuklaphanta National Park such as Reba Carp (*Cirrhinus reba*), Stinging Catfish (*Heteropneustes fossilis*), Guntea Loach*, Lepidocephalichthys guntea),* Gangetic Leaf Fish (*Nandus nandus*), Dwarf Gourami (*Trichogaster lalius*) and Indian Trout (*Raiamas bola*) are shown in Plate 1-6.

The updated checklist presented in this paper certainly depicts baseline information that will aid efforts to conserve the biodiversity of the Shuklaphanta National Park in the future because in spite of important ecological roles of these fish fauna, further research into its many aspects including threat either through anthropogenic activities or through habitat degradation and loss, invasive species and climate change are needed. Furthermore, it is needful for the improvement of conservation and management plan for the sustainability of fishery resources of the ShNP.

Table 1. Fish species in Shuklaphanta National Park.

S.N.	Order/Family/Species	Common Name	Species presence in different sites of ShNP										
			MR	MN	BR	CR	SR	ST	TT	KT	RT	CA	WL
	ORDER:ANGUILLIFORMES												
	Family:Anguillidae												
1.	*Anguilla bengalensis* (Gray, 1831)	Mottled Eel	5										
	ORDER: CLUPEIFORMES												
	Family:Clupeidae												
2.	*Gudusia chapra* (Hamilton, 1822)	Indian River Shad			4								
	ORDER:CYPRINIFORMES												
	Family:Cyprinidae												
3.	*Labeo bata* (Hamilton, 1822)	Minor Carp	1	1		1	1			1			
4.	*Labeo rohita* (Hamilton, 1822)	Rohu	1,5	1	1, 4	1							
5.	*Labeo gonius* (Hamilton, 1822)	Kuria Labeo	1	1									
6.	*Labeo dyocheilus* (McClelland, 1839)	Brahmaputra Labeo	1, 2,6	1	1	1	1						
7.	*Labeo fimbriatus* (Bloch, 1795)	Fringed-lipped Peninsula Carp		1									
8.	*Labeo calbasu* (Hamilton, 1822)	Orangefin Labeo	5										

S.N.	Order/Family/Species	Common Name	Species presence in different sites of ShNP										
			MR	MN	BR	CR	SR	ST	TT	KT	RT	CA	WL
9.	*Labeo pangusia* (Hamilton, 1822)	Pangusia Labeo	2,6										
10.	*Labeo angra* (Hamilton, 1822)	Angra Labeo	6		4								
11.	*Garra annandalei* (Hora, 1921)	Annandale Garra	1,2, 3,5				1					1	
12.	*Garra nasuta* (McClelland, 1838)	Khasi Garra	1				1					1	
13.	*Garra gotyla* (Gray, 1830)	Gotyla	2, 3	5									4
14.	*Puntius chola* (Hamilton, 1822)	Swamp Barb	1	1,5	1	1	1	1		1			
15.	*Puntius terio*(Hamilton, 1822)	Onespot Barb	1	1			1	1					
16.	*Puntius ticto*(Hamilton, 1822)	Ticto Barb	1	1	1	1	1	1					
17.	*Puntius sophore* (Hamilton, 1822)	Spotfin Swamp Barb	1, 3	1,5	1, 4	1	1	1					
18.	*Tor mosal* (Hamilton, 1822)	Mosa lMahseer	2	1						1			
19.	*Tor tor* (Hamilton, 1822)	Tor Mahseer	4,5,6	1						1			
20.	*Tor putitora*(Hamilton, 1822)	Putitor Mahaseer	2,3,6							1			
21.	*Cirrhinus reba* (Hamilton, 1822)	Reba Carp	1	1	1	1				1			4
22.	*Chagunius chagunio*(Hamilton, 1822)	Medium Carp	2	1									
23.	*Barilius vagra* (Hamilton, 1822)	VagraBaril	1,2,6	1,5				1					
24.	*Barilius shacra*(Hamilton, 1822)	ShacraBaril	1	1			1	1					
25.	*Barilius bendelisis* (Hamilton, 1822)	HamiltonBaril	1, 2	1,5		1	1	1					
26.	*Barilius barila*(Hamilton, 1822)	Barred Baril	1	1		1							
27.	*Barilius modestus*(Day, 1872)	Indus Baril	1	1									
28.	*Raiamas bola* (Hamilton, 1822)	Indian Trout	1,5	1		1	1	1		1			
29.	*Raiamas guttatus*(Day, 1870)	Burmese trout		1		1	1						
30.	*Esomus danrica* (Hamilton, 1822)	Flying barb	1	1,5	4	1							

S.N.	Order/Family/Species	Common Name	Species presence in different sites of ShNP										
			MR	MN	BR	CR	SR	ST	TT	KT	RT	CA	WL
31.	*Rasbora daniconius*(Hamilton, 1822)	Slender Barb	1	1,5	3	1	1						
32.	*Devario aequipinnatus* (McClelland, 1839)	Giant Danio	1	1	1			1					
33.	*Devario devario* (Hamilton, 1822)	Bengal Danio			1			1					
34.	*Salmostoma acinaces* (Valenciennes, 1844)	Silver Razorbellyminnow	1	1	1	1	1	1					
35.	*Salmostoma bacaila* (Hamilton, 1822)	Large Razorbelly Minnow	3	5									
36.	*Schizothorax richardsonii* (Gray, 1832)	Asla	2										4
37.	*Schizothorax progastus* (McClelland, 1839)	DinnawaSnowtrout	2,5	5									
38.	*Schizothorax plagiostomus* (Heckel, 1838)	Snow Trout	3,5	5									
39.	*Tariqilabeo latius*(Hamilton, 1822)	Gangetic Latia	3,5		4								
40.	*Bangana dero* (Hamilton, 1822)	Kalabans	3,5,6										
41.	*Bengala elanga* (Hamilton, 1822)	Bengala Barb	3										
42.	*Gibelion catla* (Hamilton, 1822)	Catla	4										
43.	*Danio rerio* (Hamilton, 1822)	Zebra Danio		5									
44.	*Neolissochilus hexagonolepis* (McClelland, 1839)	Katli	2										
45.	*Opsarius barna* (Hamilton, 1822)	BarnaBaril	2	5									
46.	*Cirrhinus mrigala* (Hamilton 1822)	Mrigal	2										
47.	*Systomus sarana* (Hamilton, 1822)	Olive Barb	3	5	4								
	Family: Botiidae												
48.	*Botia dario* (Hamilton, 1822)	Bengal Loach			1								
49.	*Botia lohachata* (Chaudhuri, 1912)	Reticulate Loach	3,5	5									

S.N.	Order/Family/Species	Common Name	Species presence in different sites of ShNP										
			MR	MN	BR	CR	SR	ST	TT	KT	RT	CA	WL
	Family: Cobitidae												
50.	*Lepidocephalichthys guntea* (Hamilton, 1822)	GunteaLoach	1	1,5	1, 4	1	1	1					
	Family: Nemacheilidae												
51.	*Acanthocobitis botia* (Hamilton, 1822)	Mottled Loach	3	5			1						
52.	*Schistura beavani* (Günther, 1868)	Creek Loach	3	4									
53.	*Nemacheilus corica* (Hamilton, 1822)	Stone Loach		5									
	Family: Danionidae												
54.	*Cabdio morar* (Hamilton, 1822	Morar	1	1	1	1		1					
	ORDER: SILURIFORMES												
	Family: Siluridae												
55.	*Wallago attu* (Bloch & Schneider, 1801)	Helicopter Catfish	5		4	1							
56.	*Glyptothorax pectinopterus* (McClelland, 1842)	River Cat	1, 3									1	
57.	*Glyptothorax telchitta* (Hamilton, 1822)	Telchitta	2										
58.	*Glyptothorax trilineatus* (Blyth, 1860)	Three-lined Catfish	2										
59.	*Pseudecheneis sulcata* (McClelland, 1842)	Remora Catfish	2										
60.	*Bagarius bagarius* (Hamilton, 1822)	Dwarf Goonch	2										4
61.	*Bagarius yarrelli* (Sykes, 1839)	Goonch Catfish	2										
	Family: Ailiidae												
62.	*Clupisoma garua* (Hamilton, 1822)	River Catfish	3										
63.	*Eutropiichthys murius* (Hamilton, 1822)	Jalkapoor	3										
	Family: Bagridae												

S.N.	Order/Family/Species	Common Name	Species presence in different sites of ShNP										
			MR	MN	BR	CR	SR	ST	TT	KT	RT	CA	WL
64.	*Mystus bleekeri* (Day, 1877)	Day's Mystus	1, 2	1	1			1	1	1			
65.	*Mystus vittatus* (Bloch, 1794)	Striped Dwarf Catfish	1,5	1	1, 4	1		1	1	1			
66.	*Mystus cavasius* (Hamilton, 1822)	Gangetic Mystus	1	1	1		1	1					
67.	*Mystus tengara* (Hamilton, 1822)	TengaraCatfish	2	5	4								
68.	*Sperata seenghala* (Sykes, 1839)	Giant River Catfish				1							
	Family: Clariidae												
69.	*Clarias magur* (Hamilton, 1822)	Mangur							1				
	Family: Heteropneustidae												
70.	*Heteropneustes fossilis* (Bloch, 1794)	Stinging Catfish		5	1			1					
	ORDER: BELONIFORMES												
	Family: Belonidae												
71.	*Xenentodon cancila* (Hamilton, 1822)	Freshwater Garfish	1	1	1			1				1	4
	ORDER: SYNBRANCHIFORMES												
	Family: Synbranchidae												
72.	*Monopterus cuchia* (Hamilton, 1822)	Gangetic Mud Eel	1, 2		1, 4								
	Family: Mastacembelidae												
73.	*Macrognathus aculeatus* (Bloch, 1786)	Lesser Spiny Eel	5		4								
74.	*Macrognathus pancalus (*Hamilton, 1822)	Barred Spiny Eel	1,5		1, 4			1					
75.	*Mastacembelus armatus* (Lacepède, 1800)	Spiny Eel	2, 3										
	ORDER: PERCIFORMES												
	Family: Channidae												
76.	*Channa marulius* (Hamilton, 1822)	Bullseye Snakehead	1, 3	1,5	1	1		1		1			4

S.N.	Order/Family/Species	Common Name	Species presence in different sites of ShNP										
			MR	MN	BR	CR	SR	ST	TT	KT	RT	CA	WL
77.	*Channa striata* (Bloch, 1793)	Striped Snakehead	1	1,5	1, 4			1					
78.	*Channa barca* (Hamilton, 1822)	Barca Snakehead			1								
79.	*Channa stewarti* (Playfair, 1867)	Assamese Snakehead	1		1			1		1			
80.	*Channa punctata* (Bloch, 1793)	Spotted Snakehead	1, 3	1	1	1	1	1		1			
81.	*Channa gachua* (Hamilton 1822)	Dwarf Snakehead	3								4		
	Family: Ambassidae												
82.	*Parambassis baculis* (Hamilton, 1822)	Himalayan Glassy Perchlet	1	1	1	1	1	1		1			
83.	*Chanda nama* (Hamilton, 1822)	Elongate Glass-perchlet	5		4								
	Family: Osphronemidae												
84.	*Trichogaster fasciata* (Bloch & Schneider, 1801)	Banded Gourami						1					
85.	*Trichogaster lalius* (Hamiltion,1822)	Dwarf Gourami			1, 4			1		1			
	Family: Anabantidae												
86.	*Anaba testudineus* (Bloch, 1792)	Climbing Perch					1	1	1				
	Family: Nandidae												
87.	*Nandus nandus* (Hamilton, 1822	Gangetic Leaf Fish	1	1	1			1	1	1			
	Family: Gobiidae												
88.	*Glossogobius giuris* (Hamilton, 1822)	Bareye Goby	4,5										

Note: Site's abbreviations denote as MR: Mahakali River, MN: Mahakali Nahar, BR:Bahuni River, CR:Chaudhar River, SR:Syali River, ST: Swami Tal, TT: Tara Tal, KT:Kalikich Tal, RT: Rani Tal, CA:Chure Area and WL: Without details of Location.

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Photographs showing some fish species from Shuklaphanta National Park.

Plate 1. Reba Carp (*Cirrhinus reba*)

Plate 2. Stinging Catfish (*Heteropneustes fossilis*)

Plate 3. Guntea Loach (*Lepidocephalichthys guntea*)

Plate 4. Gangetic Leaf Fish (*Nandus nandus*)

Plate 5. Dwarf Gourami (*Trichogaster lalius*)

Plate 6. Indian Trout (*Raiamas bola*)