Borneo Journal of Resource Science and Technology (2019), 9(2): 82-93
DOI: https:doi.org/10.33736/bjrst.1776.2019

Fish Diversity in Keshalia River, Morang District, Eastern Nepal

JAY NARAYAN SHRESTHA* & KANCHAN YADAV

Department of Zoology, Post Graduate Campus, Biratnagar, Tribhuvan University, Nepal
*Corresponding authors: jaynstha@gmail.com
Received: 4 September 2019 Accepted: 18 November 2019 Published: 31 December 2019

ABSTRACT

Nepal has unique fish diversity comprising hill stream fishes, migratory fishes and other cold water fishes including *Tor putitora* and *Brachidanio* (*Danio*) *rerio*. Keshalia river is one of the major rivers of eastern Nepal. It originates from Mahabharat mountain and flows down on the border between Morang and Sunsari district. Fishes of the river were collected using cast nets from October 2017 to September 2018 and the collected fishes were preserved in 70% alcohol with head facing downward. The present paper deals with a synopsis of 55 fish species under 41 genera belonging of 18 families of 6 orders. *Lepidocephalus guntea*, *Sisor rhabdophorus*, *Tetraodon cutcutia*, *Acanthocobotis botia*, *Gagata cenia*, *Hara hara*, *Bagarius bagarius* and *Clupisoma garua* are some notable Ichthyofauna of the river. The conservation status of important fishes like *Acanthocobotis botia* was found to be data deficient, *Gagata cenia* & *Hara hara* were found to be rare and *Chagunius chagunio* was vulnerable.

Keywords: Budhi Khola, Ichthyofauna, Indigenous species, Sunsari

INTRODUCTION

Fishes, aquatic poikilothermic vertebrates, do not suffer the loss of substantial amount of energy to maintain body temperature as compared to terrestrial animals. It includes living hag fish, lampreys and cartilaginous and bony fishes. They utilize aquatic resources and are converted into animal protein, which is easily digestible so they are important food for most of the people in the world.

Nepal, a land-locked country, is rich in water resources. It has a large number of rivers like Koshi, Gandaki, Bheri, Narayani, Karnali, Kamala, Bagmati, Trisuli, Rapti, Seti and lakes like Rara, Phewa, Rupa, Begnas and others (Jha, 2008).

The number of species of fresh water fishes inhabiting in these resources are 232 (Shrestha, 2008). The fish species reported in the aforementioned rivers are 170 species in Sapta Gandaki river system and its tributaries (Shrestha, 2008), 108 species in Narayani river (Jha & Bhujel, 2014), 30 species in Seti Gandaki river (Pokharel, 2012) and 118 species in rivers and other water resources of Morang district (Subba *et al*. 2017).

The Koshi river, in the eastern Nepal, is rich in aquatic flora and fauna. *Tor putitora*, *Tor tor*, *Neolissochilus* (*Acrossocheilus*) *hexagonolepis*, *Bagarius bagarius*, *Clupisoma gaura*, *Anguilla bengalensis*, *Silonia silondia*, *Amphipnous (Monopterus) cuchia*, *Channa marulius*, *Notopterus notopterus*, *Chitala* (*Notopterus*) *chitala*, *Wallago attu* and *Aorichthys seenghala* are some game fishes inhabiting in the river (Shrestha, 2008; Gupta, 2015). The unique faunas of the river are mahseer (Sahar) and dolphin (Doody *et at.*, 2016). Several investigations have been carried out in the river with regards to Ichthyofauna. The number of fish species reported in this river is 200 species (Gurung & Sah, 2016).

Shrestha and Mishra (2014) reported that the total fish production in Nepal is 56,000 metric tons (36,000 metric tons from aquaculture) and per caput fish production is 2.0 kg/yr (2012-13). Among them, 35% of the production is from eastern Nepal.

Keshalia river comes from Mahabharat mountain. A small tributary called Budhi Khola starts from the upper region of Panmara Village Development Committee, Sunsari and Yangsila Village Development Committee, Morang. It flows downward to south on the border of

Panmara and Satisale. It runs across the Charkoshe jungle and receives its tributary called Dale Khola at Khorsanekham. During its course, the Budhi Khola crosses the East-West highway and meets with Gachhiya Khola (its tributary) at Khanar. After that the river crosses Dharan-Biratnagar highway at Duhabi from east to west and flows toward south-west direction. The river west of the highway is called Keshalia river. The river flows on the border between Sunsari and Morang district and eventually to the south direction towards India.

The river is west of Biratnagar (72 MSL) with tropical climate. Summer (March-June), rainy (July-October) and winter (November-February) are its three main seasons. Its temperature ranges between 11.1 and 33.9 °C in summer and between 9 to 15.3 °C in winter.

As regards to the information of Ichthyofauna, Berg (1947) classified the fishes both recent and fossils into seven classes and 59 orders. De Witt (1960) gave a contribution to the ichthyology of Nepal. Thapa and Rajbanshi (1968) discussed about the few hill stream fishes of Nepal. Shrivastava (1968) published a taxonomic handbook entitled 'Fishes of eastern U.P, India', in which he mentioned a number of Nepalese fishes. Majumdar *et al.* (1972) has worked on fish fauna of Nepal. Shrestha (1981) published a book "Fishes of Nepal" describing scientific details of 120 fish species. Edds (1986) studied the fishes of Royal Chitwan National Park and the Kali Gandaki/Narayani River of Nepal and listed 107 and 111 fish species respectively. Shrestha (1990) published his book entitled "Resource ecology of the Himalayan water" reporting 74 fish species from Karnali river, 108 species from Trisuli, 102 species from Narayani and 69 species from Mahakali. The swamp land ecology and fish management and conservation were also described in his book. Shrestha (1994) gave a report on Fishes, Fishing implements and Methods of Nepal. She also reported 129 fish species that are belonged to 66 genera. Shrestha (2001) contributed a paper entitled 'Taxonomic Revision of Fishes of Nepal' a taxonomic revision of 186 fish species earlier reported (Shrestha, 1998). Shrestha (2008) published a book entitled 'Itchyology of Nepal' reporting 232 fish species from Nepal. The rivers of Nepal are really rich in fish fauna which needs to be explored scientifically and further conserved. An attempt, therefore, has been made to conduct a thorough survey of fish resources at Keshalia river.

MATERIALS AND METHODS

The fish catching sites in the river were selected and were regularly visited. The study area was divided into three sites namely the first study area was Brampura (Figure 1) below the bridge across the river. The second and third areas were 5 km up toward north and 5 km down toward the south respectively. Fishes from each fishing site were collected with the help of local fisherman using local made fish gears and nets once usually 1st to 4th day of every month for one year (October, 2017 - September, 2018). At the time of collection, the habitat and colour of the fishes were recorded on the spot. Alive fishes were killed in 40% formalin and then preserved in 70% alcohol facing their head downward. For large fishes, a longitude incisor was made to protect the gut contents. The taxonomic identification of preserved fishes was done with the help of the methods adopted from Srivastava (1968), Shrestha (2001) and Shrestha (2008). Then the fishes were kept in separate specimen jars using tags and labels for further classification.

Figure 1. Map showing study area 1 in the river

RESULTS AND DISCUSSION

The present list of fishes includes 55 species belonging to 41 genera, 18 families of 6 orders (Table 1 and Figure 2). There is every chance of over-lapping in fish habitat, which is difficult to be demarcated sharply.

Some of the remarkable fish species of Keshalia river are *Barilius shacra*, *Garra annandalei*, *Bagarius bagarius*, *Badis badis*, *Clupisoma garua*, *Hara hara*, *Nangra nangra*, *Sisor rhabdophorus*, *Nandus nandus* and *Channa marulius*. The river has some game fishes like *Chagunius chagunio*, *Cirrhinus reba*, *Cyprinion semiplotus*, *Notopterus notopterus*, *Aorichthys aor*, *Clupisoma garua*, *Bagarius bagarius*, *Wallago attu* and *Channa marulius*. *Barilius barna*, *Chagunius chagunio*, *Botia lohachata* and *Garra* species are some hill stream fishes of the river. *Garra* species inhabiting in the river are *Garra annandalei* and *Garra rupecula*. Some important native fresh water fishes of the river are fresh water shark (*Bagarius bagarius*), jalkapoor (*Clupisoma garua*) and cat fish (*Glyptothorax pectinopterus*). The river also has some threatened species like *Chagunius chagunio*, *Hara hara*, and *Gagata cenia.* Some species of fishes showed migratory behavior whereas other did not. Migrants are *Bagarius bagarius* and *Barilius barna.* Some larvivorus fishes are *Barilius barna* and *Danio devario.* Fishes like *Clupisoma garua* and *Barilius barna* are very tasty having high demand on the Biratnagar markets. Common and resident species include *Lepidocephalichthyes guntea, Somileptes gongata, Ompok bimaculata, Wallago attu, Mystus spp, Channa species, Macrognathus aral, Glossogobius giuris* and *Mastacembelus armatus*.

The threat status of the fishes inhabiting in the river are 32 common species, 1 vulnerable, 16 least concern, 2 data deficient, 2 conservations dependent rare and 2 near threatened species (Figure 3). The river has 24 species of Cypriniforms, 17 Siluriforms, 8 Perciforms, 4 Synbranchiforms and 1 species each of Osteoglossiform and Tetraodontiform out of 55 species (Figure 4).

The occurrence of Cyprinidae in Keshalia river as a dominant species (24) favours the result of Nepal (Shrestha, 2008; 2013; Rajbanshi, 2012). They reported 86 Cyprinidae (Shrestha, 2008), 18 Balitoridae, 12 Bagridae, 11 Cobitidae, 9 *Schilbeidae*, 2 *Notopteridae*, 4 *Siluridae*, 40 *Sisoridae* and 4 *Mastacembelidae*. The report of fish species made by Shrestha (2013) also includes the fish species reported in the present survey. All fishes found in the Keshalia river in the survey period were also reported in Koshi river (Rajbanshi, 2012). Families Tetraodontidae, Heteropneustidae, Gobiidae and Synbranchidae were represented by single species in this study as well as in the report made by Shrestha (2008) and Shrestha (2013). No fish species belonging to families Anguillidae, Clupeidae, Engraulididae, Psilorhynchidae, Pangasidae, Amblycipitidae, Olyridae, Chacidae, Salmonidae, Hemiramphidae, Belonidae, Aplocheilidae, Poeciliidae, Ambassidae, Sciaenidae, Mugilidae and Gobioididae were recorded from Keshalia river.

Fishes *Acanthocobatis botia, Botia lohachata, Somileptes gongota, Lepidocephalus guntea, Barilius barna, Garra annandalei, Aspidoparia morar, Aspidoparia jaya, Chagunius chagunio, Crossochilus latius, Danio devario, Puntius sarana, Puntius sophore, Barilius bendelisis, Cirrhinus reba, Notopterus notopterus, Colisa fasciatus, Channa punctatus, C. orientalis, C. marulius, Glossogobius giuris, Badis badis, Nandus nandus, Mystus cavasius, M. bleekeri, M. tengara, Aorichthys aor, Clarius batrachus, Heteropneustes fossilis, Ompok bimaculatus, Wallago attu, Gagata cenia, Glyptothorax pectinopterus, Macrognathus aral, M. puncalus, Mastacembelus armatus, Monopterus cuchia and Tetradon cutcutia* were also reported in Koshi river but fishes *Bagarius bagarius, Amblyphryngodon mola, Salmostoma bacaila, S. acinaces, Chela cachius, Puntius ticto, Semiplotus semiplotus, Barilius shacra, Esomus danricus, Garra rupecula, Mystus vittatus, Clupisoma garua, Hara hara, Nangra nangra, N. viridescences, Sisor rhabdophorus* and *Anabas testudineus* were not reported (Rijal *et al*., 2014).

Notopterus notopterus, *Chagunius chagunio*, *Cyprinion semiplotus*, *Barilius shacra*, *Chela cachius*, *Salmostoma acinaces*. *S. bacaila*, *Garra annandalei*, *G. rupecula*, *Hara hara*, *Nangra nangra*, *Sisor rhabdophorus*, *Nandus nandus*, *Badis badis*, *Monopterus cuchia*, *Macrognathus pancalus* and *Tetradon cutcutia* were reported in Keshalia river but these species were not found from Koshi river (Limbu & Subba, 2011).

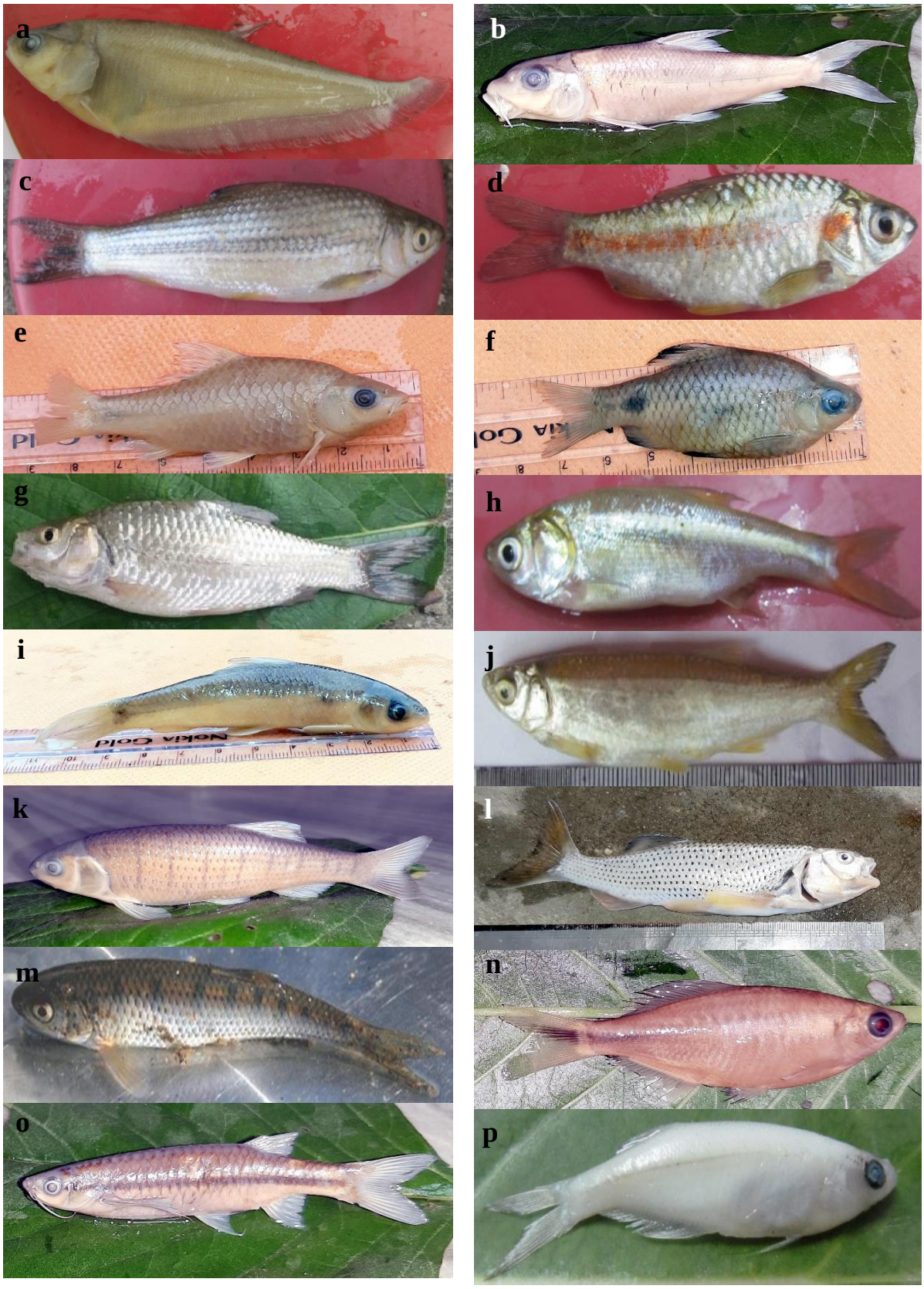

Figure 2. Fishes found in Keshalia river during the study period. a) *Notopterus notopterus;* b) *Chagunius chagunio;* c) *Cirrhinus reba;* d) *Puntius sarana;* e) *Puntius sophore;* f) *Puntius ticto;* g) *Semiplotus semiplotus;* h) *Amblypharyngodon mola;* i) *Aspidoparia jaya;* j) *Aspisoparia morar;* k) *Barilius barna;* l) *Barilius bendelisis;* m) *Barilius shacra;* n) *Danio devario;* o) *Esomus dandricus* and p) *Chela cachius.*

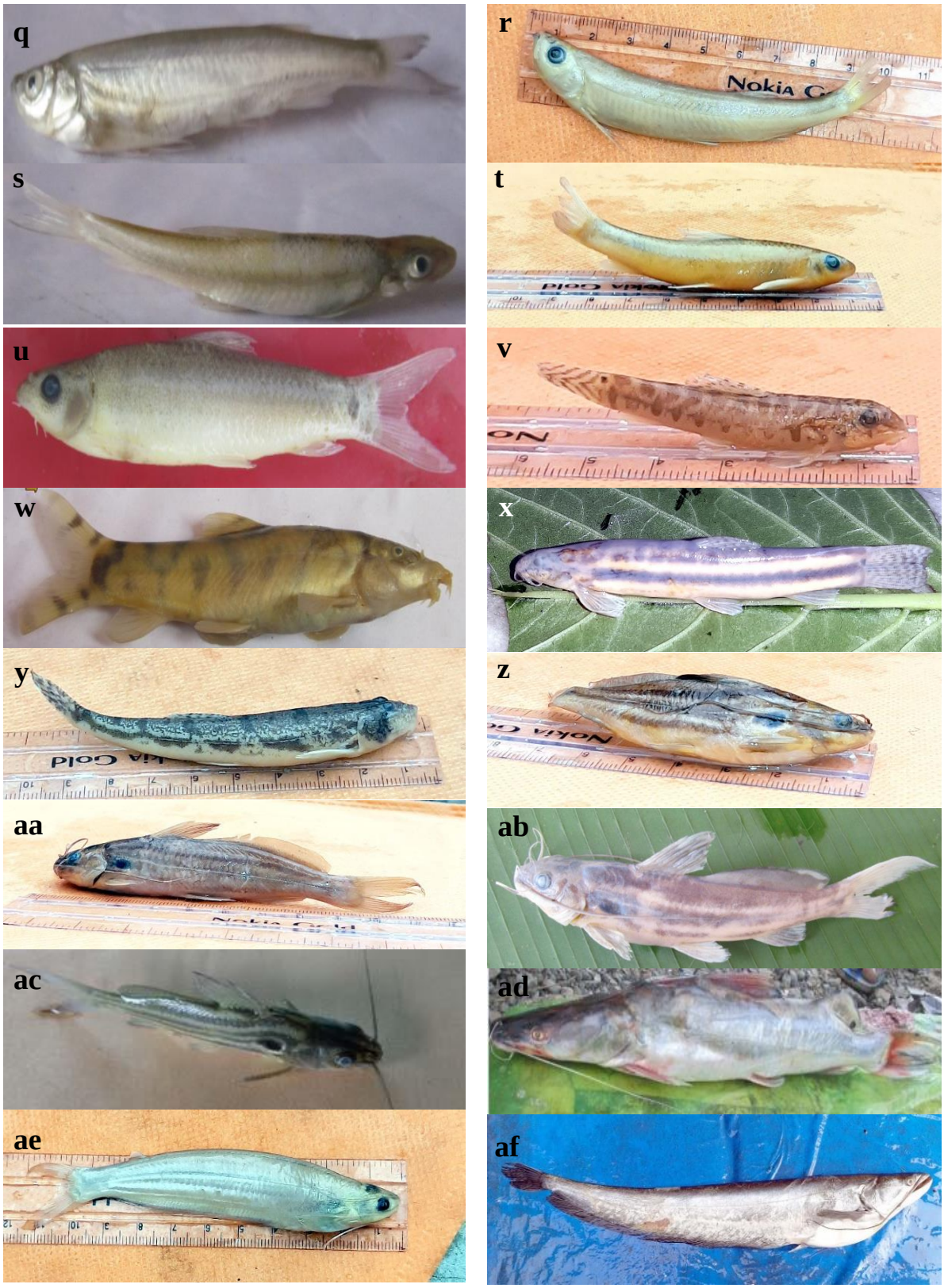

Figure 2. (*continue*) q) *Salmostoma acinaces;* r) *Salmostoma bacaila;* s) *Crossocheilus latius latius;* t) *Garra annandalei*, u) *Garra rupecula;* v) *Acanthocobotis botia;* w) *Botia lohachatta;* x) *Lepidocephalus guntea;* y) *Semileptes gongota;* z) *Mystus bleekeri;* aa) *Mystus cavasius;* ab) *Mystus tengara;* ac *Mystus vittatus;* ad) *Aorichthys aor;* ae) *Ompok bimaculatus* and af) *Wallago attu.*

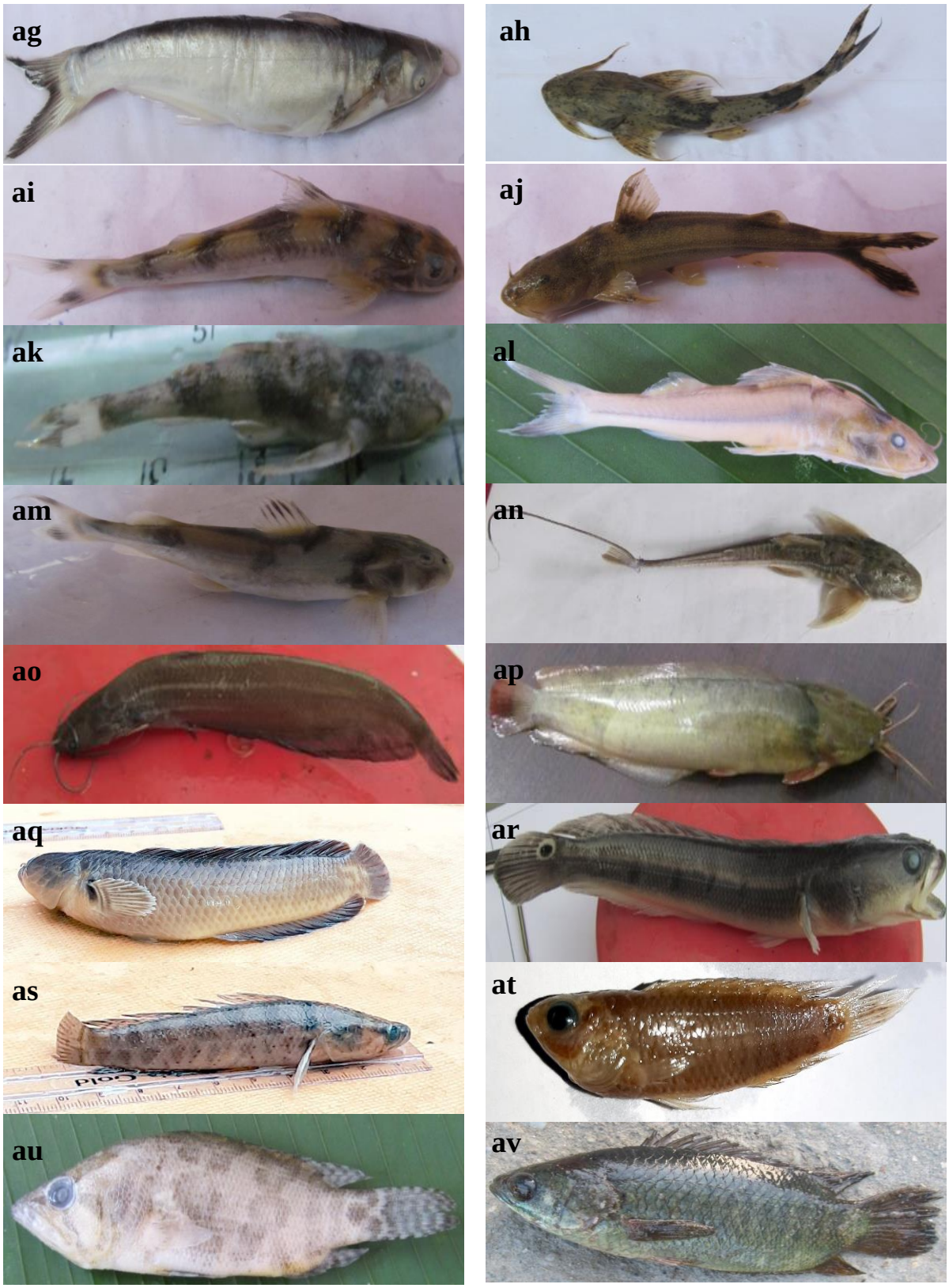

Figure 2. (*continue*) ag) *Clupisoma garua;* ah) *Bagarius bagarius;* ai) *Gagata cenia;* aj) *Glyptothorax pectinopterus;* ak) *Hara hara;* al) *Nangra nangra;* am) *Nangra viridescens;* an) *Sisor rhabdophorus;* ao) *Heteropneustes fossilis;* ap) *Clarias batrachus;* aq) *Channa orientalis;* ar) *Channa marulius;* as) *Channa punctatus;* at) *Badis badis;* au) *Nandus nandus* and av) *Anabus testudineus.*

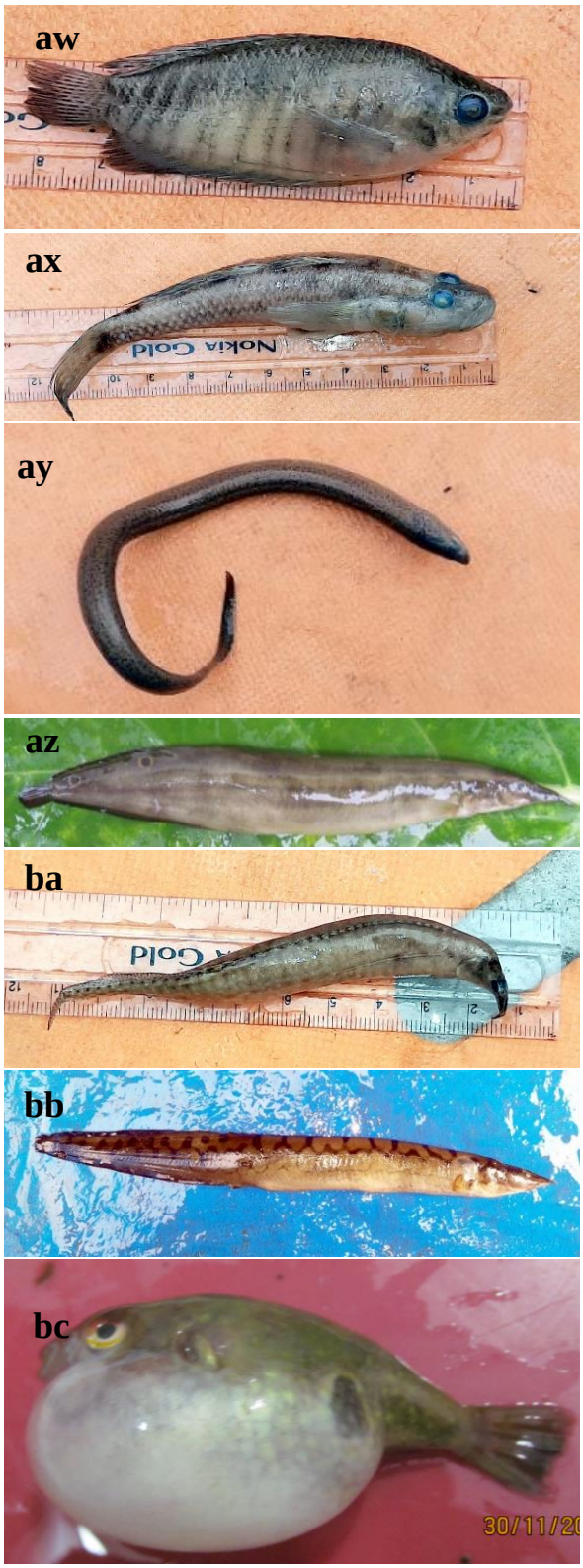

Figure 2. (*continue*) aw) *Colisa fasciatus;* ax) *Glossogobius giuris;* ay) *Monopterus cuchia;* az) *Macrognathus aral;* ba) *Macrognathus pancalus*; bb) *Mastacembelus armatus* and bc) *Tetraodon cutcutia*

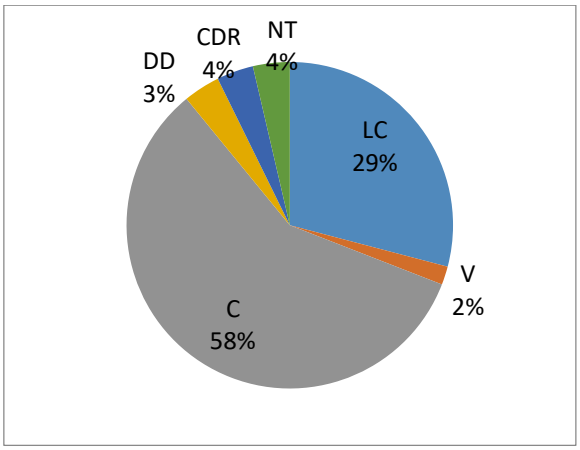

Figure 3. Conservation status (%) of the species (LC = Least Concern; NT = Near Threatened; CDR = Conservation Dependent Rare; DD = Data Deficient; C = Common; V= Vulnerable)

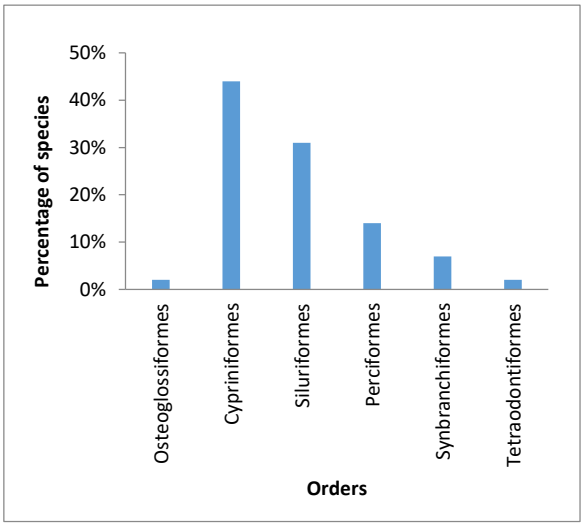

Figure 4. Fish species (%) in different orders

Fish *Garra rupecula* from Gandaki river; *Botia lohachata*, *Aorichthys aor*, *Garra rupecula* and *Sisor rhabdophorus* from Karnali river; *Chela cachius*, *Puntius sophore*, *Garra rupecula*, *Botia lohachata*, *Mystus bleekeri*, *Aorichthys aor*, *Nangra nangra*, *Hara hara*, *Glyptothorax pectinopterus* and *Sisor rhabdophorus* from Mahakali river were not recorded (Rajbanshi, 2012). These fish species were reported in the present study from Keshalia river. Similarly, fishes *Chela cachius*, *Aspidoparia jaya*, *Barilius shacra*, *Garra rupecula* and *Nangra nangra* were not reported from Narayani river (Jha & Bhujel, 2014). Fishes like *Anguilla bengalensis*, *Xenentodon cancila and Olyra longicaudata* were not found in the study from Keshalia river.

Table 1. Checklist of fishes found in Keshaliya river, Biratnagar

No.	Indigenous species	Common name	Conservation status
a	I. ORDER: OSTEOGLOSSIFORMES Sub order: Notopteroidei Family: Notopteridae Genus: *Notopterus* Lacepede 1800 *Notopterus notopterus* (Pallas) 1767	Grey Feathery back	Uncommon or LC
b	II. CYPRINIFORMES Family: Cyprinidae Subfamily: Cyprininae Genus: *Chagunius* Smith 1945 *Chagunius chagunio* (Hamilton-Buchanan) 1822	Chaguni	Vulnerable
c	Genus: *Cirrhinus* Oken 1817 *Cirrhinus reba* (Hamilton-Buchanan) 1822	Reba Carp	Uncommon or LC
d	Genus: *Puntius* Hamilton-Buchanan 1822 *Puntius sarana* (Hamilton-Buchanan) 1822	Olive Barb	Uncommon or LC
e	*Puntius sophore* (Hamilton-Buchanan) 1822	Spotfin Swamp Barb	Common
f	*Puntius ticto* (Hamilton-Buchanan) 1822	Ticto Barb	Uncommon or LC
g	Genus: *Cyprinion* (*Semiplotus*) Bleeker 1859 *Semiplotus semiplotus* (McClelland) 1839	Assamese Kingfish	Uncommon or LC
h	Subfamily: Rasborinae (Danioninae) Genus: *Amblypharyngodon* Bleeker 1860 *Amblypharyngodon mola* (Hamilton-Buchanan) 1822	Mola Carplet	Common
i	Genus: *Aspidoparia* Heckel 1847 *Aspidoparia jaya* (Hamilton-Buchanan) 1822	Jaya	Common
j	*Aspidoparia morar* (Hamilton-Buchanan) 1822	Aspidoparia	Common
k	Genus: *Barilius* Hamilton-Buchanan 1822 *Barilius barna* (Hamilton-Buchanan) 1822	Barna Baril	Common
l	*Barilius bendelisis* (Hamilton-Buchanan) 1822	Hamilton's Barila	Common
m	*Barilius shacra* (Hamilton-Buchanan) 1822	Shacra Baril	Uncommon or LC
n	Genus: *Danio* Hamilton-Buchanan 1822 *Danio devario* (Hamilton-Buchanan) 1822	Devario Danio	Common
o	Genus: *Esomus* Swainson 1839 *Esomus danricus* (Hamilton-Buchanan) 1822	Flying Barb	Common
p	Subfamily: Cultrinae Genus: *Chela* Hamilton-Buchanan 1822 *Chela cachius*	Silver Hatchet Chela	Common
q	Genus: *Salmostoma* Swainson 1839 *Salmostoma acinaces* (Valenciennes) 1842	Silver Razor Belly Minnow	Common
r	*Salmostoma bacaila* (Hamilton-Buchanan) 1822	Large Razor Belly Minnow	Common
s	Subfamily: Garrinae Genus: *Crossocheilus* Kuhl van and Hasselt 1823 *Crossocheilus latius latius* (Hamilton-Buchanan) 1822	Stone Roller	Uncommon or LC
t	Genus: *Garra* (Hamilton-Buchanan) 1822 *Garra annandalei* Hora 1921	Annandale Garra	Uncommon or LC
u	*Garra rupecula* (McClelland) 1839	Buduna	Common
v	Family: Balitoridae Subfamily: Nemacheilinae Genus: *Acanthocobotis* Peters 1861 *Acanthocobotis botia* (Hamilton-Buchanan) 1822	Pate Gadela	Data Deficient or PRO
w	Family: Cobitidae Subfamily: Botiinae Genus: *Botia* Gray 1831 *Botia lohachatta* Chaudhari 1912	Tiger Loach	Uncommon or LC
x	Subfamily: Cobitinae Genus: *Lepidocephalus* Bleeker 1858 *Lepidocephalus guntea* (Hamilton-Buchanan) 1822	Guntea Loach	Conservation Dependent Rare
y	Genus: *Somileptes* Swainson 1839 *Somileptes gongota* (Hamilton-Buchanan) 1822	Gongota Loach	Common
z	III. SILURIFORMES Family: Bagridae Subfamily: Bagrinae Genus: *Mystus* Scopoli 1777 *Mystus bleekeri* (Day) 1878	Day's Mystus	Common

Continue Table 1

No.	Indigenous species	Common name	Conservation status
aa	*Mystus cavasius* (Hamilton-Buchanan) 1822	Gangatic Mystus	Common
ab	*Mystus tengara* (Hamilton-Buchanan) 1822	Tengara Mystus	Common
ac	*Mystus vittatus* (Bloch) 1797	Striped Dwarf Catfish	Common
ad	Genus: Aorichthys Wu 1939 *Aorichthys aor* Sykes 1841	Long whiskered catfish	Uncommon or LC
ae	Family: Siluridae Genus: *Ompok* Lacepede 1803 *Ompok bimaculatus* (Bloch) 1797	Butter-Catfish	Common
af	Genus: *Wallago* Bleeker 1851 *Wallago attu* (Schneider) 1801	Fresh water Shark	Common
ag	Family: Schilbeidae Subfamily: Schilbeinae Genus: *Clupisoma* Swainson 1839 *Clupisoma garua* (Hamilton-Buchanan) 1822	Garua Bachcha	Uncommon or LC
ah	Family: Sisoridae Genus: *Bagarius* Bleeker 1853 *Bagarius bagarius* (Hamilton-Buchanan) 1822	Gangatic Goonch	Uncommon or LC
ai	Genus: *Gagata* Bleeker 1858 *Gagata cenia* (Hamilton-Buchanan) 1822	Gagata	Rare or Near Threatened
aj	Genus: *Glyptothorax* Blyth 1861 *Glyptothorax pectinopterus* (McClelland) 1839	-	Uncommon or LC
ak	Genus: *Hara* Blyth 1860 *Hara hara* (Hamilton-Buchanan) 1822	Koshi Hara	Rare or Near Threatened
al	Genus:*Nangra* Day 1877 *Nangra nangra* (Hamilton-Buchanan) 1822	Koshi Nangra	Uncommon or LC
am	*Nangra viridescens* (Hamilton-Buchanan) 1822	Huddah Nangra	Uncommon or LC
an	Genus: *Sisor* Hamilton-Buchanan 1822 *Sisor rhabdophorus* Hamilton-Buchanan 1822	Sisor Catfish	Conservation Dependent Rare
ao	Family: Heteropneustidae Genus: *Heteropneustes* Muller 1840 *Heteropneustes fossilis* (Bloch) 1785	Stinging Catfish	Common
ap	Family: Clariidae Genus: *Clarias* Scopoli 1777 *Clarias batrachus* (Linnaeus) 1758	Magur	Common
aq	IV. ORDER PERCIFORMES Suborder: Channoidei Family**:** Channidae Genus: *Channa* Scopoli 1777 *Channa orientalis* Bloch and Schneider 1801	Asiatic Snakehead	Common
ar	*Channa marulius* (Hamilton-Buchanan) 1822	Giant Snakehead	Common
as	*Channa punctatus* (Bloch) 1793	Spotted Snakehead	Common
at	Family: Nandidae Subfamily: Badinae Genus: *Badis* Bleeker 1853 *Badis badis* (Hamilton-Buchanan) 1822	Badis	Common
au	Subfamily: Nandinae Genus: *Nandus* Valenciennes 1831 *Nandus nandus* (Hamilton-Buchanan) 1822	Mottled Nandus	Common
av	Sub order: Anabantoidei Family: Anabantidae Genus: *Anabus* Cuvier 1816 *Anabus testudineus* (Bloch) 1795	Climbing Perch	Common
aw	Family**:** Belontidae Sub family: Trichogasterinae Genus: *Colisa* Cuvier 1831 *Colisa fasciatus* (Schneider) 1801	Stripled Gourami	Common
ax	Sub order: Gobioidei Family: Gobiidae Genus: *Glossogobius* Gill 1839 *Glossogobius giuris* (Hamilton-Buchanan) 1822	Tank Goby	Common

Continue Table 1

No.	Indigenous species	Common name	Conservation status
ay	V. ORDER SYNBRANCHIFORMES Sub order: Synbranchoidei Family: Synbranchidae Sub family: Gobiinae Genus: *Monopterus* Lacepede 1800 *Monopterus cuchia* (Hamilton-Buchanan) 1822	Chuchia	Uncommon or LC
az	Sub order: Mastacembeloidei Family: Mastacembelidae Sub family: Mastacembelinae Genus: *Macrognathus* Lacepede 1800 *Macrognathus aral* (Bloch and Schneider) 1801	-	Common
ba	*Macrognathus pancalus* Hamilton-Buchanan 1822	-	Common
bb	Genus: *Mastacembelus* Scopoli 1777 *Mastacembelus armatus* (Lacepede)1800	Tire-track/Spiny Eel	Common
bc	VI. ORDER TETRAODONTIFORMES Family**:** Tetraodontidae Sub family: Tetraodontinae Genus: *Tetraodon* Linnaeus 1758 *Tetraodon cutcutia* (Hamilton-Buchanan) 1822	Ocellated Puffer Fish	Data Deficient or PRO

Note: LC = Least Concern and PRO = Pristine Rare Ornamental

These fishes were reported in Triyuga river (Shrestha, 2016). Similarly, *Glyptothorax cavia*, *G. trilineatus*, *G. telchitta*, *Pseudeutropius atherineides*, *Pseudeutropius murius batarensis*, *Eutropiichthys vacha*, *Alia colia*, *Tor putitora*, *Puntius conchonius*, *P. ticto*, *Labeo calbasu*, *L. rohita*, *Garra lamta*, *Danio rario*, *Cirrhinus mrigala*, *Chela laubuca*, *Barilius bola*, *Botia dario*, *Chanda nama*, *C. ranga*, *Xanantodon cancila* and *Batasio batasio* were not found in the river but these species were recorded from Koshi river (Limbu & Subba, 2011).

Some species under domestication and captive breeding are *Clarias batracus* (Fisheries Research Center, Pokhara; Regional Agricultural Research Station, Tarahara), *Botia lohachata*, *Garra annandalei* and *Chagunius chagunio* (Kaligandaki Fish Hatchery, Syanja). *Chagunius chagunio* (a table fish) also inhabits in torrential rivers such as the Trisuli and Tadi and it is also present in Lake Phewa at an altitude of 742 m (Shrestha, 1981). *Clupisoma garua* (*jalkapur*) is also present in rivers Trisuli, Narayani and Karnali up to 1440 m (Shrestha, 1981). *Bagarius bagarius* (gonch) is the largest and migratory fish which starts upstream migration in early May to reach by June headwaters of rivers and streams up to the 1424 m altitude and also reported in the Sun Koshi (Shrestha, 1979).

CONCLUSION

Keshalia river has great biodiversity especially of ichthyo-fauna. Present study includes 55 species belonging to 41 genera, 18 families and 6 orders. Some of the remarkable fish species are *Barilus shacra*, *Garra annandalei*, *Nandus nandus*, *Badis badis*, *Sisor rhabdophorus*, *Bagarius bagarius*, *Notopterus notopterus*, *Somileptes gongota*, *Channa marulius*, *Clupisoma garua* and *Hara hara*. The river also has some migratory fishes and threatened species (vulnerable species) to Nepal. Some fishes like *Garra rupecula*, *Botia lohachatta*, *Aorichthys aor*, *Nangra nangra*, *Glyptothorax pectinopterus*, *Clupisoma garua*, *Salmostoma bacaila*, *Chagunius chagunio*, *Monopterus cuchia* and *Tetradon cutcutia* are special. The river is rich in fish resources and is ecologically important. In-depth investigations fishes of Keshalia river is recommended for the conservation of migratory and threatened fish species.

ACKNOWLEDGEMENTS

We would like to give a special thanks to a retired Associate Professor Dr. Bharat Raj Subba, Post Graduate Campus, Tribhuvan University,

Biratnagar, who encouraged and co-operated with us for this work. We would like to express our deep sense of gratitude to Professor Dr. Damodar Thapa Chetri, Head of Zoology Department, Post Graduate Campus, T.U. Biratnagar for allowing us to use the laboratories and facilities. Finally, we sincerely thank fisherman 'Jageshor' who helped to collect the fishes from the river.

REFERENCES

Berg, L.S. (1947). *Classification of fishes both recent and fossils* (English and Russian), J.W. Edwards, inc. Ann. Arbor, Michigan (U.S.A.). Pp 246-517.

De Witt, H.H. (1960). A contribution to the ichthyology of Nepal. *Stanford Ichthyological Bulletin*, 7(4): 63-88.

Doody, T.M., Cuddy, S.M. & Bhatta, L.D. (2016). Connecting flow and ecology in Nepal: current state of knowledge for the Koshi Basin. Sustainable Development and Fisheries. *The Journal of NEFIS*, 1: 109-123.

Edds, D.R. (1986). Fishes of Kali Gandaki/ Narayani Rivers, Nepal. *Journal Natural History Museum*. 10(14): 13-22.

Gupta, S. (2015). *Silonia silondia* (Hamilton, 1822), A Threatened Fish of Indian Subcontinent. *World Journal of Fish and Marine Science*, 7(5): 362-364.

Gurung, T.B. & Sah, U. (2016). Capture fishery of Koshi Tappu of Saptakoshi River, Nepal: Way forward for sustainable management. *In:* Song, A.M., Bower, S.D., Onyango. P., Cooke, S.J. & Chuenpagdee, R. Eds. *Inter-Sectoral Goernance of Inland Fisheries*, TBTI Publication Series, St John's, NL, Canada.

Jha, D.K. & Bhujel, R.C. (2014). Fish diversity of Narayani River System in Nepal. *Nepalese Journal of Aquaculture and Fisheries*, 1: 94-108.

Jha, S. (2008). Status and conservation of lowland Terai Wetland in Nepal. *Our Nature*, 6: 67-77.

Limbu, K.P. and Subba, B.R. (2011). Status of key faunal in Koshi Tappu Wildlife Reserve after Koshi flood disaster 2008. *Nepalese Journal of Biosciences*, 1: 41-54.

Majumdar, N.N., Majupuria, T.C. & Shrestha, J. (1972). New records from Nepal. *Journal of the Zoological Society of India*, 2: 213-215.

Pokharel, K.K. (2012). Study on Fish Ecology of the Seti Gandaki River Pokhara: II. Spatio-Temporal Variations in Fish Communities. *Nepal Journal of Science and Technology*, 12: 350-357.

Rajbanshi, K.G. (2012). Bio-diversity and distribution of fresh water fishes of Central/Nepal Himalayan Region. *Nepalese Journal of Aquaculture and Fisheries*. *The Journal of NEFIS*. Pp 136.

Rijal, P.K., M.K. Shrestha, A.K. Singh & Dahal, B.R. (2014). Fish diversity and their contribution in livelihoods of fishers' in Koshi River basin. *Nepalese Journal of Aquaculture*, 1: 109-123.

Shrestha, J. (1981). *Fishes of Nepal*. Curriculum Development Centre, Tribhuvan University, Kathmandu, Nepal.

Shrestha, J. (1994). *Fishes, Fishing implements and Methods of Nepal. Smt. M.D.Gupta, Lalitpur Colony, Lashkar (Gwalior) India* (T.C. Majupuria). Pp 150.

Shrestha, J. (1998). *Aquatic habitats and natural water, fish and fisheries in Nepal*. Paper presented in Environmental Assessment Background Training, Adbta-2613-NEP, NEAED, 2-6, Kathmandu, Nepal, Pp. 28.

Shrestha, J. (2001). Taxonomic Revision of Fishes of Nepal. Environment and Agriculture. *In*: P.K. Jha et al., eds. *Biodiversity, Agriculture and Pollution in South Asia*, ECOS, Kathmandu. Pp. 171-180.

Shrestha, J. (2013). Biodiversity: Fish. *In*: Jha, P.K., Neupane F.P., Shrestha M.L. & IKhanal I.P. eds. *Biological Diversity and Conservation*, Nepal Academy of Science and Technology, Khumaltar, Lalitpur. Pp. 69-81.

Shrestha, J.N. (2016). Fish diversity of Triyuga River, Udayapur District, Nepal. *Our Nature*., 14(1): 124-134.

Shrestha, M.K. & Mishra, R.N. (2014). *Fish Production System in Nepal*. Annual Innovation Lab Council Partners Workshop Shangri-la Hotel Kathmandu, Nepal.

Shrestha, T.K. (1979). Life History of the Hill-stream Trout Schizothorax plagiostomus (Heckel). *Journal of Institute of Science*, 2(1): 209-222.

Shrestha, T.K. (1990). *Resource ecology of the Himalayan waters*. Curriculum Development Centre, Tribhuvan University, Kathmandu, Nepal.

Shrestha, T.K. (2008). *Ichthyology of Nepal: a study of fishes of the Himalayan waters*. Himalayan Ecosphere, Kathmandu. Pp 390.

Shrivastava, G. (1968). *Fishes of eastern U.P*., Vishwavidyalaya prakashn, Varanasi. Pp163.

Subba, B.R., Pokharel, N. & Pandey, M.R. (2017). Ichthyo-faunal diversity of Morang district, Nepal. *Our nature*. 15(1-2): 55-67.

Thapa, R.B. & Rajbansi, K.G. (1968). *Reports on few hill stream fishes of Nepal*. Regional Seminar of Ecology of Tropical Highland, UNESCO/HMG. Kathmandu, Nepal.