Overview of the key fish species and their biology in Himalayan Rivers in Nepal

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Regional Meeting of Fish Experts
29-30 April, 2018, Hotel Yak and Yeti
Kathmandu, Nepal
Nepal is endowed with 232 fish species, 217 indigenous in 6000 rivers, the river basins extending to China, Nepal & India in

- 3 river basins & 1 river system

Source: Gurung (2016)
Species Richness

- High mount: Low
- Mid hills: Moderate
- Flood plains: Rich

Cool water fish (not permanently in cold or warm waters), most life history strategies (12 to 29°C), Cold water species (7-20°C) Warm water (15 to 32°C)

Source: AFU, Rampur (2018)
Key fish species are those:

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rare, endangered, threatened species as per IUCN criteria</td>
<td>RET Species in Nepal Himalaya</td>
</tr>
<tr>
<td>Endemic species</td>
<td>Endemic species reported</td>
</tr>
<tr>
<td>Exhibiting Habitat Diversity and migratory Pathways</td>
<td>Number of species at altitudinal basis and migratory pathways</td>
</tr>
<tr>
<td>Spawning Biology</td>
<td><em>Ex-situ</em> conservation</td>
</tr>
<tr>
<td>Conservation Biology</td>
<td><em>In-situ</em> co-managing conservation</td>
</tr>
</tbody>
</table>
Most important biotic and abiotic factors of a river

- Water flow
- Substrate
- Light
- Temperature
- Water chemistry
- Bacteria
- Underwater plants
- Invertebrates
- Fish
- Birds

..... and the communities

Cross dams in Nepal

210 cross dam projects in different rivers (NEA 2013):

- 84 in operation,
- 34 under construction,
- 92 proposed

Location of Cross Dams  Source: ADB 2014
General features of the Himalayan Rivers

• Himalayan rivers have large basins
• Perennial flows, mostly fast flowing with higher velocity in mountains due to slopes in ‘V’ shaped valleys with higher vertical gradients mostly with spectacular gorges
• They perform intensive erosional activities upstream and carry large amount of load of sand and silt
• In plains forming numerous depository features like flood plain, river bluffs and levees
• Rivers have immense social, spiritual, cultural aspiration, religious aspiration
• Generally final rituals are performed in ‘ghats'
General biological aspects of Himalayan Fish

- Live in torrential hill stream
- Lower abundance in higher altitude
- Higher diversity in lower flood plains
- High endemism in mid hills comparing to flood plain and high mountains
- Mammoth size fish even from foot hills and mid hills
- Cool water fish
- A source of animal protein for landlocked hilly people
- Most fishes declining rapidly
Key fish species Nepal’s Rivers

Fish market in Barhbise bazar

Source: Newspapers (2015, 2016),

Photo source: Internet
Middle : Cool water fisheries (Semi-commercial)

June 13, 2015
River Tamor: Heavy flood and landslide caused fish mortality
Courtsey: Purbeli News

Neolissochilus hexagonolepis
Flood plain fisheries (near commercial)

Koshi floodplains: fishing bots and nets

Feather backs and Chitala from Koshi floodplains
## Endemic fish species (16) of Nepal

<table>
<thead>
<tr>
<th>Fish Species</th>
<th>Author</th>
<th>Year</th>
<th>Where</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Myersglanis blythii</em></td>
<td>Jayaram</td>
<td>1991</td>
<td>Pharping</td>
</tr>
<tr>
<td><em>Psilorhynchus pseudechenies</em></td>
<td>Menon &amp; Datta</td>
<td>1962</td>
<td>Dudh Koshi</td>
</tr>
<tr>
<td>P. nepalensis</td>
<td>Conway &amp; Mayden</td>
<td>2008</td>
<td>Rapti, Seti</td>
</tr>
<tr>
<td><em>Pseudeutropius murius batarensis</em></td>
<td>Shrestha</td>
<td>1981</td>
<td>Trishuli</td>
</tr>
<tr>
<td><em>Schizothoraichthys macrophthalmus</em></td>
<td>Tarashima</td>
<td>1984</td>
<td>Rara Lake</td>
</tr>
<tr>
<td>S. nepalensis</td>
<td>Tarashima</td>
<td>1984</td>
<td>Rara Lake</td>
</tr>
<tr>
<td>S. raraensis</td>
<td>Tarashima</td>
<td>1984</td>
<td>Rara Lake</td>
</tr>
</tbody>
</table>

Source: ADB (2014)
<table>
<thead>
<tr>
<th><strong>Endemic Fishes of Nepal</strong></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Batasio macronotus</strong></td>
<td>Ng &amp; Edds</td>
<td>2005</td>
<td>River Sapta Koshi</td>
</tr>
<tr>
<td><strong>Pseudecheneis crassicaudata</strong></td>
<td>Ng &amp; Edds</td>
<td>2005</td>
<td>Mewa Khola (River Tamor)</td>
</tr>
<tr>
<td><strong>P. serracula</strong></td>
<td>Ng &amp; Edds</td>
<td>2005</td>
<td>Seti, Kali Gandaki, Narayani, Mahakali &amp; Karnali</td>
</tr>
<tr>
<td><strong>P. eddsi</strong></td>
<td>Ng</td>
<td>2006</td>
<td>Mahesh Khola (Trishuli)</td>
</tr>
<tr>
<td><strong>Erethistoides ascita</strong></td>
<td>Ng &amp; Edds</td>
<td>2005</td>
<td>Mechi, Kankai, Trijuga, Koshi</td>
</tr>
<tr>
<td><strong>E. cavatura</strong></td>
<td>Ng &amp; Edds</td>
<td>2005</td>
<td>Dhungra, Rapti, Narayani</td>
</tr>
<tr>
<td><strong>Balitora eddsi</strong></td>
<td>Conway &amp; Mayden</td>
<td>2010</td>
<td>Karnali</td>
</tr>
<tr>
<td><strong>Neoanguilla nepalensis</strong></td>
<td>Shrestha</td>
<td>2008</td>
<td>Narayani</td>
</tr>
<tr>
<td><strong>Turchinoemacheilus himalaya</strong></td>
<td>Conway, Shrestha, Edds, &amp; Mayden</td>
<td>2011</td>
<td>Indrawati, Kali Gandaki, Narayani</td>
</tr>
</tbody>
</table>

Source: ADB (2014)
Endemism trends in Nepalese Rivers?

Bhatt JP, Manish K, Pandit MK (2012)
Fish species richness

Temp °C

Discharge m⁻³s⁻¹

Basin Area, km²

Bhatt JP, Manish K, Pandit MK (2012)
Migratory Fish

Deep-bodied Mahseer, *Tor tor*

Golden Mahseer, *Tor putitora*

Jalkapoorn, *Pseudeotropius antherinoides*

Gonch, *Bagarius yarrellii*

Rajbam, *Anguilla bengalensis*

Source: KGFH (2018)
Fish Passages in Nepal

- Fish ladder/pass design were probably derived from the European or North American pool type & vertical slot passes (Jha 2007).

- However, the fish ladders or passes are not functioning well, the discharge through the pass is too low or none.

- Kali Gandaki (NEA/NARC 2010)
- Jhimruk
- Andhikhola (Jha 2007)
- Trishuli NEA (Shrestha)
- Koshi barrage (Yadav 2002)
- Chandra Nahar (Rajbanshi 2002)
- Trijuga (Jha 2007)
- Gandak barrage (Rajbanshi 2002)
Too many dams?

Source: Salil, 2016
<table>
<thead>
<tr>
<th>Scientific name</th>
<th>Com. name</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Acrossocheilus hexagonolepis</em></td>
<td>Katle</td>
<td>Koshi, Gandaki, Karnali, Mahakali</td>
</tr>
<tr>
<td><em>Chagunius chagunio</em></td>
<td>Rewa</td>
<td>Koshi, Gandaki, Karnali, Mahakali</td>
</tr>
<tr>
<td><em>Tor putitora</em></td>
<td>Mahseer</td>
<td>Koshi, Gandaki, Karnali, Mahakali</td>
</tr>
<tr>
<td><em>Tor tor</em></td>
<td>Sahar</td>
<td>Gandaki, Mahakali</td>
</tr>
<tr>
<td><em>Danio rerio</em></td>
<td>Zebra macha</td>
<td>Gandaki, Karnali</td>
</tr>
<tr>
<td><em>Schizothorax plagiostomus</em></td>
<td>Buchhe asla</td>
<td>Koshi, Bheri, Gandaki, Karnali</td>
</tr>
<tr>
<td><em>Schizothorax richardsonii</em></td>
<td>Asala soal</td>
<td>Koshi, Gandaki, Karnali</td>
</tr>
<tr>
<td><em>Schizothoraichthys progastus</em></td>
<td>Chuche asala</td>
<td>Koshi, Gandaki, Karnali</td>
</tr>
<tr>
<td><em>Psilorhynchus pseudecheneis</em></td>
<td>Tite macha</td>
<td>Koshi</td>
</tr>
<tr>
<td><em>Anguilla bengalensis</em></td>
<td>Rajabam</td>
<td>Koshi, Gandaki, Karnali</td>
</tr>
</tbody>
</table>

Source: ADB (2014)
# 21 Fish species under IUCN Red List

<table>
<thead>
<tr>
<th>Sci. Name</th>
<th>Eng Name</th>
<th>Nepal’s Name</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Glyptothorax kashmirensis</strong></td>
<td>Snow trout</td>
<td>Tikhe Asla</td>
<td>Cri. Endangered</td>
</tr>
<tr>
<td><strong>Schizothoraichthys nepalensis</strong></td>
<td>Snow trout</td>
<td>Asla</td>
<td>Cri. Endangered</td>
</tr>
<tr>
<td><strong>Schizothoraichthys raraensis</strong></td>
<td>Snow trout</td>
<td>Asla</td>
<td>Cri. Endangered</td>
</tr>
<tr>
<td><strong>Tor putitora</strong></td>
<td>Gold Mahseer</td>
<td>Sahar</td>
<td>Endangered</td>
</tr>
<tr>
<td><strong>Physoschistura elongata</strong></td>
<td>Suiree</td>
<td></td>
<td>Vulnerable</td>
</tr>
<tr>
<td><strong>Puntius chelynoides</strong></td>
<td>Dark Mahseer</td>
<td>Halundae</td>
<td>Vulnerable</td>
</tr>
<tr>
<td><strong>Schistura prashadi</strong></td>
<td>Gadela</td>
<td></td>
<td>Vulnerable</td>
</tr>
<tr>
<td><strong>Schizothorax richardsonii</strong></td>
<td>Snow trout</td>
<td>Buche Asla</td>
<td>Vulnerable</td>
</tr>
<tr>
<td><strong>Ailia coila</strong></td>
<td>Gangetic Ailia</td>
<td>Patsi</td>
<td>Near threatened</td>
</tr>
</tbody>
</table>

Source: ADB (2014)
Cont.... Fish species under IUCN Red list

<table>
<thead>
<tr>
<th><strong>Bagarius bagarius</strong></th>
<th>Goonch</th>
<th>Gounch</th>
<th>Near threatened</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bagarius yarrelli</strong></td>
<td>Goonch</td>
<td>Gounch</td>
<td>Near threatened</td>
</tr>
<tr>
<td><strong>Balitora brucei</strong></td>
<td>Gray's Stone Loach</td>
<td>Patthartata</td>
<td>Near threatened</td>
</tr>
<tr>
<td><strong>Chitala chitala</strong></td>
<td>Featherback</td>
<td>Chittal</td>
<td>Near threatened</td>
</tr>
<tr>
<td><strong>Ctenops nobilis</strong></td>
<td>Frail Gourami</td>
<td></td>
<td>Near threatened</td>
</tr>
<tr>
<td><strong>Garra rupecula</strong></td>
<td></td>
<td>Buduna</td>
<td>Near threatened</td>
</tr>
<tr>
<td><strong>Labeo pangusia</strong></td>
<td>Pangusia, Labeo</td>
<td>Thed</td>
<td>Near threatened</td>
</tr>
<tr>
<td><strong>Neolissochilus hexagonolepis</strong></td>
<td>Copper Mahseer</td>
<td>Katle</td>
<td>Near threatened</td>
</tr>
<tr>
<td><strong>Ompok bimaculatus</strong></td>
<td>Butter Catfish</td>
<td>Nauni</td>
<td>Near threatened</td>
</tr>
<tr>
<td><strong>Ompok pabda</strong></td>
<td>Pabda Catfish</td>
<td></td>
<td>Near threatened</td>
</tr>
<tr>
<td><strong>Tor tor</strong></td>
<td>Red-finned Mahseer</td>
<td>Ratar/Sahar</td>
<td>Near threatened</td>
</tr>
<tr>
<td><strong>Wallago attu</strong></td>
<td>Whiskered Catfish</td>
<td>Buhari</td>
<td>Near threatened</td>
</tr>
</tbody>
</table>
The key species and their biology

*Tor putitora*

- Widely distributed in south and southeast Asia, confined to foothills and mid hill stream, lakes and rivers.
- According to IUCN Red List Category & Criteria: Endangered A4acde ver 3.1
- However, captive breeding technology successful with fry rearing technology and slower growth.

- Question of hatchery propagated vs natural breeds.
The key species and their biology

*Tor tor*

- Encountered less frequently confined to foothills and mid hill stream, lakes and rivers.
- According to IUCN Red List Category & Criteria: Status: Near Threatened ver 3.1
- Population: Decreasing
- However, captive breeding technology successful with fry rearing technology, slow growth.
The key species and their biology

**Acrossochilus hexagonolepis**

- Encountered frequently, with a restricted area of occupancy, Status: Near Threatened ver 3.1
- Pop: Decreasing

- Captive breeding technology successful with fry rearing technology, survival rate around 20-30%, slow growth.

Katle, *Neolissocheilus hexagonalepis*
The key species and their biology

*Anguilla bengalensis* (Indian Mottled Eel, Rajbaam)
Status: Near Threatened ver 3.1
Pop : Unknown

Only collection of some of the specimens
**Glyptothorax kashmirensis**
Status: Critically Endangered A3ce ver 3.1
Pop. trend: unknown

- Commercially important food fish, relished taste.
- No biological study being carried in Nepal

**Schizothorax raraensis**
*(Rara Snowtrout)*
Status: Critically Endangered B1ab(iii) ver 3.1
Pop. trend: unknown
- Rara snow trout, is a cyprinid
- First collected in 1979 Rara National Park.

**Schizothorax richardsonii**
Status: Vulnerable A2acd+3cde+4acde ver 3.1
Pop: Decreasing

- Widely distributed along the Himalayan foothills. Recent observations indicate drastic declines in many areas.

www.iucnredlist.org/details/166525/0
**Physoschistura elongata**

Status: Vulnerable B1ab(iii) ver 3.1  
Pop. trend: Unknown

- A small fish may be suitable for aquarium ornamental fish species.  
- No recent biological information available

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**Schistura prashadi**

Status: Vulnerable B1ab(iii) ver 3.1  
Pop. trend: unknown

‘Gadela’ in Nepali. No information on status of biological studies.
**Naziritor (Tor, Puntius) chelynoides** (Karange, Dark Mahseer)
Status: Vulnerable B2ab(i,ii,iii,iv,v) ver 3.1
Pop. trend: Decreasing

- Record on recent biological information available.

**Bagarius yarrelli**
Status: Near Threatened ver 3.1
Pop. trend: decreasing

- *Bagarius yarrelli*, known as the giant devil catfish or goonch

- Very large catfish found in rivers in South Asia.
**Ailia coila (Gangetic ailia)**

Status: Near Threatened ver 3.1
Pop. trend: decreasing

### Biology
- Adults found in large rivers and connected waters. They inhabit surface to mid-waters. Occur in shoals (Ref. 4833). Oviparous, eggs are unguarded (Ref. 205).

- This fish is of importance to local commercial fisheries.
**Balitora brucei**
Status: Near Threatened ver 3.1
Pop. trend: unknown

Common name: Gray's Stone Loach

- No biological studies going on.

**Chitala (Notopterus) chitala**
Status: Near Threatened ver 3.1
Pop: Decreasing

Featherback

Some specimen being collected.
*Ctenops nobilis*
Status: Near Threatened ver 3.1
Pop. trend: decreasing

*Garra rupecula* (Mishmi garra)
Status: Near Threatened ver 3.1
Pop. trend: decreasing
**Ompok pabda**
Status: Near Threatened ver 3.1
Pop: Decreasing

**Ompok bimaculatus**
Status: Near Threatened ver 3.1
Pop. trend: unknown
**Labeo pangusia** (Pangusia laboe)
Status: Near Threatened ver 3.1
Pop: Decreasing

![Labeo pangusia](image1)

**Wallago attu**
Status: Near Threatened ver 3.1
Pop: Decreasing

![Wallago attu](image2)
Nepal: Fish Research Facilities
Main achievements in riverine fish propagation
Kali Gandaki Fish Hatchery

*Labeo dero* (Gardi)  *Labeo pangusia* (Hade)  *Labeo angra* (Thend)

*Tor putitora* (Golden Mahseer)  *Tor tor* (Malunge Mahseer)

Source: KGFH (2018)
Breeding Biology of Some of the Key Species of Himalayan Rivers Fishes
Breeding activities of key species, *Tor* and others

Hatchery Operation
Breeding procedures, embryonic development and larval production
Transportation and stocking of key species in Kali Gandaki River
In-situ conservation of *Tor* and *Neolissocheilus* in Lake Phewa, Nepal
## Annual Fry Production of Key Fish Species

<table>
<thead>
<tr>
<th>Riverine species</th>
<th>Fry Released Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Labeo dero</em></td>
<td>339,000</td>
</tr>
<tr>
<td><em>Labeo panguis</em></td>
<td>306,000</td>
</tr>
<tr>
<td><em>Labeo angra</em></td>
<td>225,000</td>
</tr>
<tr>
<td><em>Barilias</em></td>
<td>3000</td>
</tr>
<tr>
<td><em>Shizothorax</em></td>
<td>60</td>
</tr>
<tr>
<td><em>Neolissocheilus hexagonolepis</em></td>
<td>100</td>
</tr>
<tr>
<td><em>Tor tor</em></td>
<td>310</td>
</tr>
<tr>
<td><em>Tor putitora</em></td>
<td>100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>873620</strong></td>
</tr>
</tbody>
</table>

Source: KGFH (2018)
## Fish Species Composition of Captured Fisher in Up and Downstream of Kali Gandaki River in Year 2016/2017

<table>
<thead>
<tr>
<th>Species</th>
<th>Captured Fishery</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Upstream</td>
<td>Downstream</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number</td>
<td>%</td>
<td>Number</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td><em>Labeo dero</em> (Gardi)</td>
<td>357</td>
<td>32.54</td>
<td>3894</td>
<td>78.10</td>
<td></td>
</tr>
<tr>
<td><em>Neolissocheilus hexagonalepis</em> (Katle)</td>
<td>347</td>
<td>31.63</td>
<td>81</td>
<td>1.62</td>
<td></td>
</tr>
<tr>
<td><em>Tor putitora</em> (Sahar)</td>
<td>210</td>
<td>19.14</td>
<td>68</td>
<td>1.36</td>
<td></td>
</tr>
<tr>
<td><em>Schizothorax spp</em> (Asala)</td>
<td>47</td>
<td>4.28</td>
<td>5</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td><em>Anguilla bengalensis</em> (Rajbam)</td>
<td>0</td>
<td>0</td>
<td>125</td>
<td>2.51</td>
<td></td>
</tr>
<tr>
<td><em>Bagarius bagarius</em> (Gonch)</td>
<td>0</td>
<td>0</td>
<td>50</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td><em>Labeo pangusia</em> (Hade)</td>
<td>90</td>
<td>8.21</td>
<td>30</td>
<td>0.60</td>
<td></td>
</tr>
<tr>
<td><em>Labeo angra</em> (Thend)</td>
<td>0</td>
<td>0</td>
<td>70</td>
<td>1.40</td>
<td></td>
</tr>
<tr>
<td><em>Pseudotropius murius</em> (Jalkapoor)</td>
<td>0</td>
<td>0</td>
<td>559</td>
<td>11.21</td>
<td></td>
</tr>
<tr>
<td><em>Garra annandelai</em> (Lahare)</td>
<td>0</td>
<td>0</td>
<td>45</td>
<td>0.90</td>
<td></td>
</tr>
<tr>
<td><em>Garra gotyla</em> (Buduna)</td>
<td>45</td>
<td>4.11</td>
<td>14</td>
<td>0.28</td>
<td></td>
</tr>
<tr>
<td><em>Khosre</em></td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td><em>Tilwa</em></td>
<td>0</td>
<td>0</td>
<td>40</td>
<td>0.80</td>
<td></td>
</tr>
<tr>
<td><em>Others</em></td>
<td>1</td>
<td>0.09</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1097</strong></td>
<td><strong>4986</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: KGFH (2018)
Initiatives on Jalkapoor

- 92 Jalkapoor under investigated at at 21-25 oC after collection from Kali Gandaki River in Trishuli Fish Farm.
- 0.2 to 50 gm BW Jalkapoor were collected.
- Jalkapoor collected at 26 0C WT.

![Growth trends of Jalkapoor in captive condition](source: Trishuli Fisheries Research Center)
Some initiatives on e-DNA studies in Fishery

In association with Centre for Molecular Dynamics (CMDN) Nepal, NARC is working in e-DNA on Nepalese Fish
Conclusion

• Fish biology of riverine fish especially those are under the IUCN red list are poorly known.

• *In-situ* and *ex-situ* conservation and breeding biology of some major key species such as *T. putitora, T. tor* are gradually progressing.

• Nepal is one of the best location in South Asia to have a CoE on *Tor* and other Himalayan key fish species. Therefore, it is recommended that there should be key fish restoration project, so the red list fishes could be brought into the IUCN Green list using hydropower and/or related funds.