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

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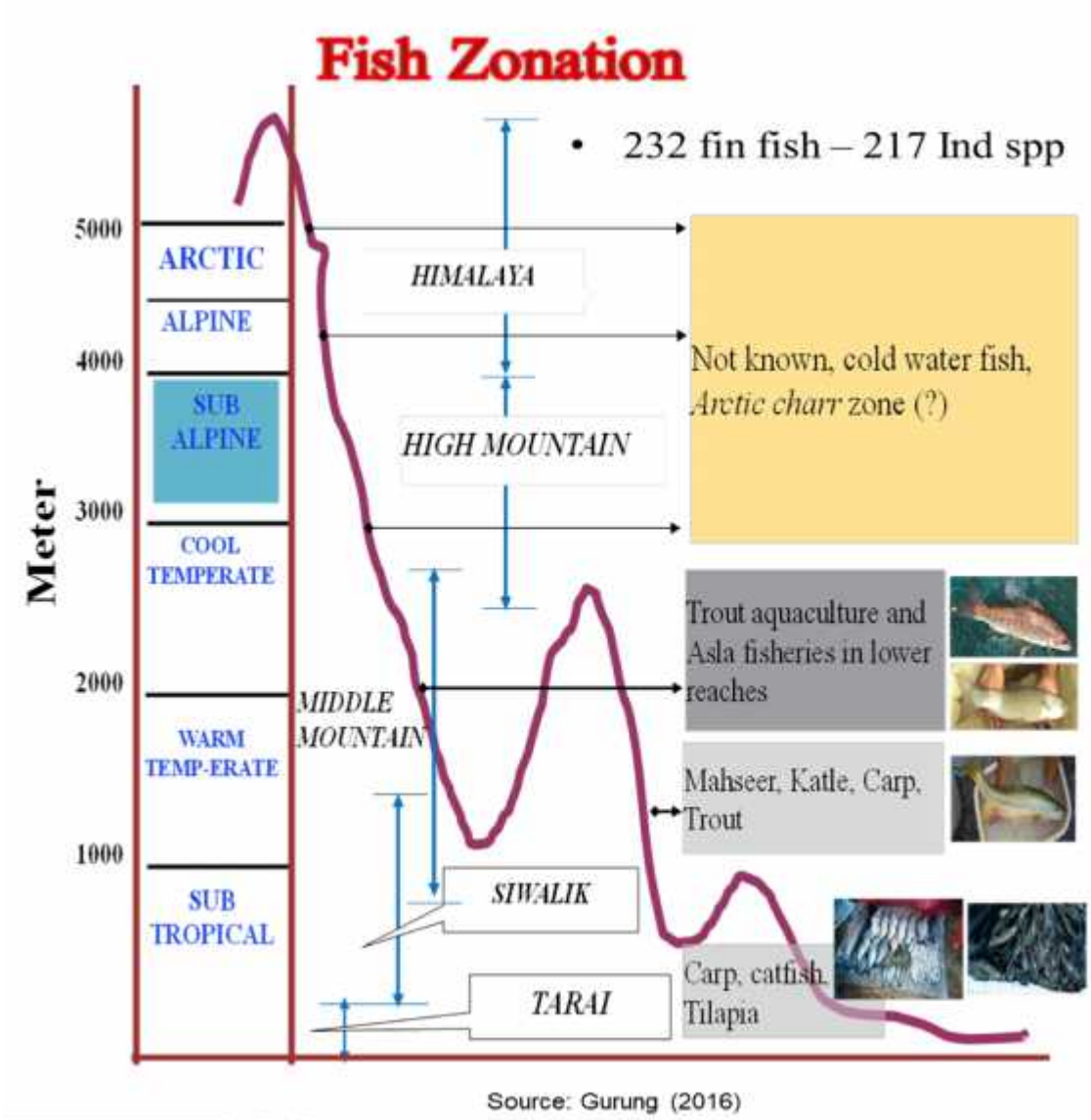
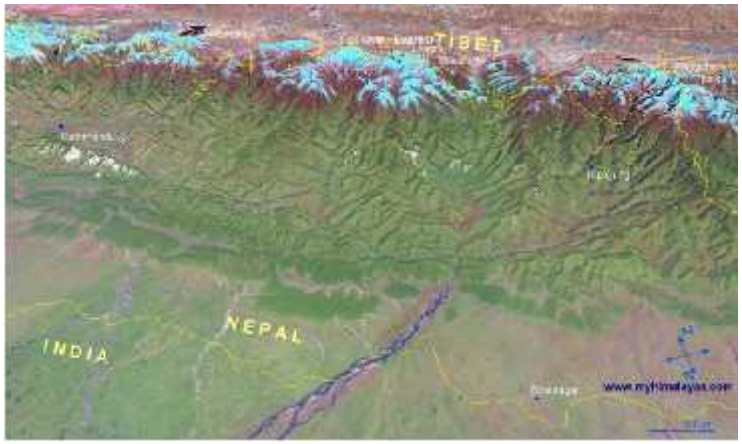
Nepal is endowed with 232 fish species, 217 indigenous in 6000 rivers, the river basins extending to China, Nepal & India in

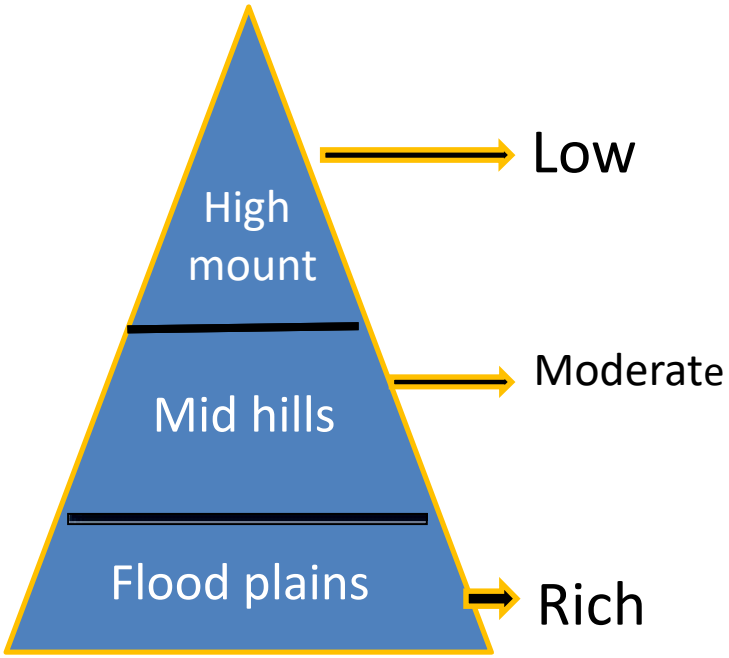
- **3 river basins & 1 river system**



Source: Gurung (2016)



Species Richness



Source: AFU, Rampur (2018)

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)

Key fish species are those :

• Rare, endangered, threatened species as per IUCN criteria	RET Species in Nepal Himalaya
• Endemic species	Endemic species reported
• Exhibiting Habitat Diversity and migratory Pathways	Number of species at altitudinal basis and migratory pathways
• Spawning Biology	*Ex-situ* conservation
• Conservation Biology	I*n-situ* co-managing conservation

Most important biotic and abiotic factors of a river

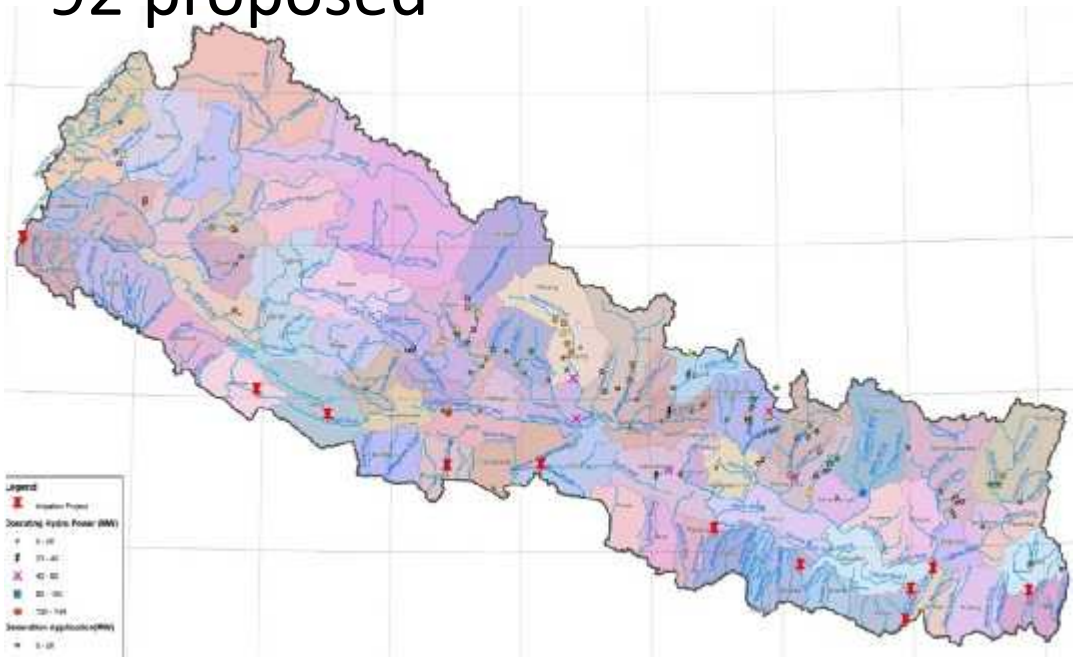
- **Water flow**
- **Substrate**
- **Light**
- **Temperature**
- **Water chemistry**
- **Bacteria**
- **Underwater plants**
- **Invertebrates**
- **Fish**
- **Birds**

….. and the communities

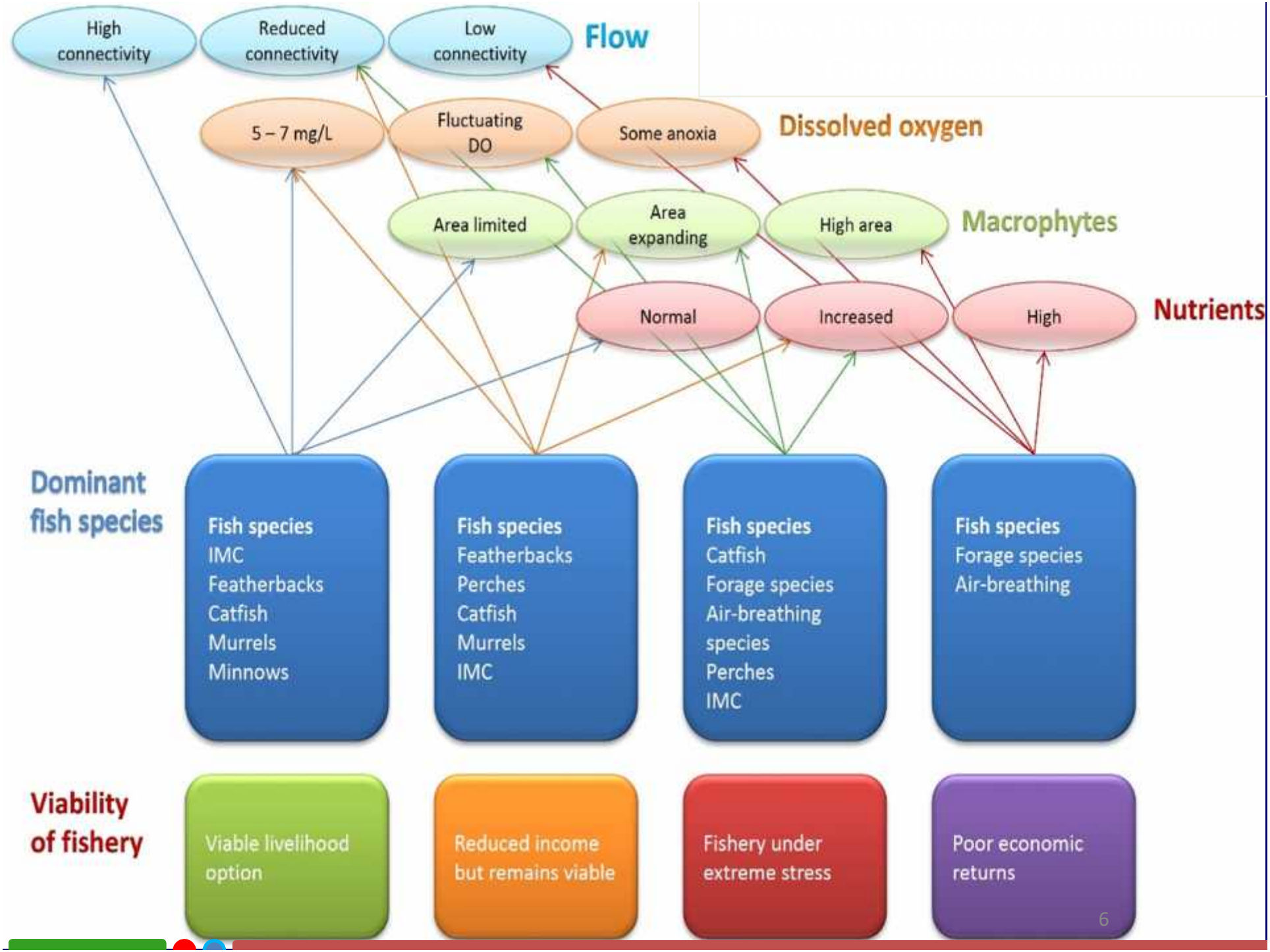
Cross dams in Nepal

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

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



Location of Cross Dams Source: ADB 2014


High connectivity
Reduced connectivity
Low connectivity
Flow
5 – 7 mg/L
Fluctuating DO
Some anoxia
Dissolved oxygen
Area limited
Area expanding
High area
Macrophytes
Normal
Increased
High
Nutrients
Dominant fish species
Fish species
IMC
Featherbacks
Catfish
Murrels
Minnows
Fish species
Featherbacks
Perches
Catfish
Murrels
IMC
Fish species
Catfish
Forage species
Air-breathing species
Perches
IMC
Fish species
Forage species
Air-breathing
Viability of fishery
Viable livelihood option
Reduced income but remains viable
Fishery under extreme stress
Poor economic returns

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 depositional 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 land slide caused fish mortality
Courtsey : Purbeli News

Neolissohilus 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

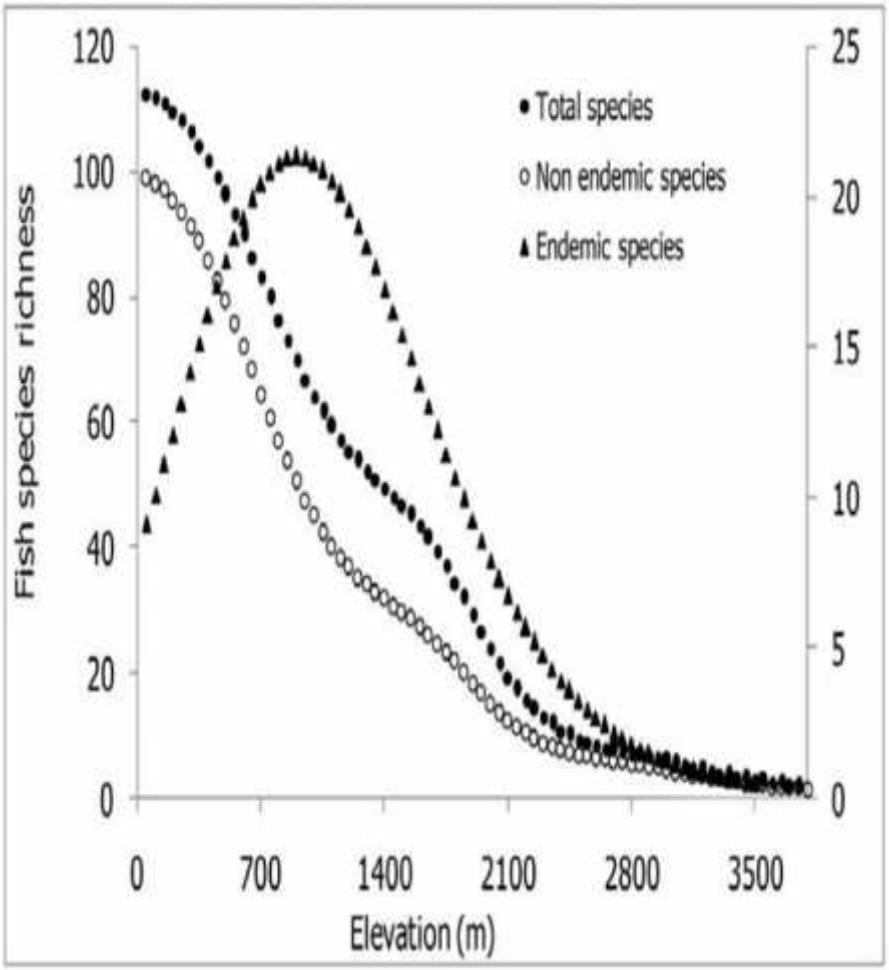
Fish Species	Author	Year	Where
Myersglanis blythii	Jayaram	1991	Pharping
Psilorhynchus pseudechenies	Menon & Datta	1962	Dudh Koshi
P. nepalensis	Conway & Mayden	2008	Rapti, Seti
Pseudeutropius murius batarensis	Shrestha	1981	Trishuli
Schizothoraichthys macropthalmus	Tarashima	1984	Rara Lake
S. nepalensis	Tarashima	1984	Rara Lake
S. raraensis	Tarashima	1984	Rara Lake

Source: ADB (2014)

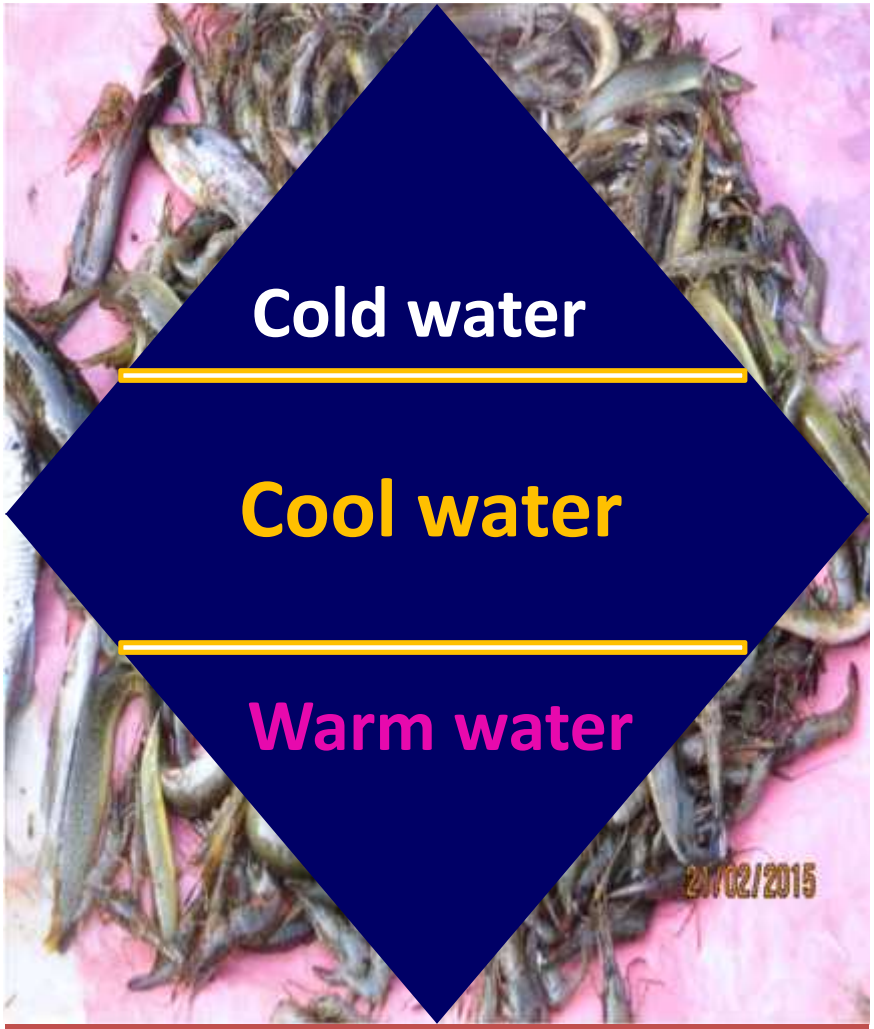
Cont… endemic fishes of Nepal

Batasio macronotus	**Ng & Edds**	2005	**River Sapta Koshi**
Pseudecheneis crassicaudata	**Ng & Edds**	2005	**Mewa Khola (River Tamor)**
P. serracula	**Ng & Edds**	2005	**Seti, Kali Gandaki, Narayani, Mahakali & Karnali**
P. eddsi	**Ng**	2006	**Mahesh Khola (Trishuli)**
Erethistoides ascita	**Ng & Edds**	2005	**Mechi, Kankai, Trijuga, Koshi**
E. cavatura	**Ng & Edds**	2005	**Dhungra, Rapti, Narayani**
Balitora eddsi	**Conway & Mayden**	2010	**Karnali**
Neoanguilla nepalensis	**Shrestha**	2008	**Narayani**
Turchinoemacheilus himalaya	**Conway, Edds, Shrestha & Mayden**	2011	**Indrawati,Kali Gandaki, Narayani**

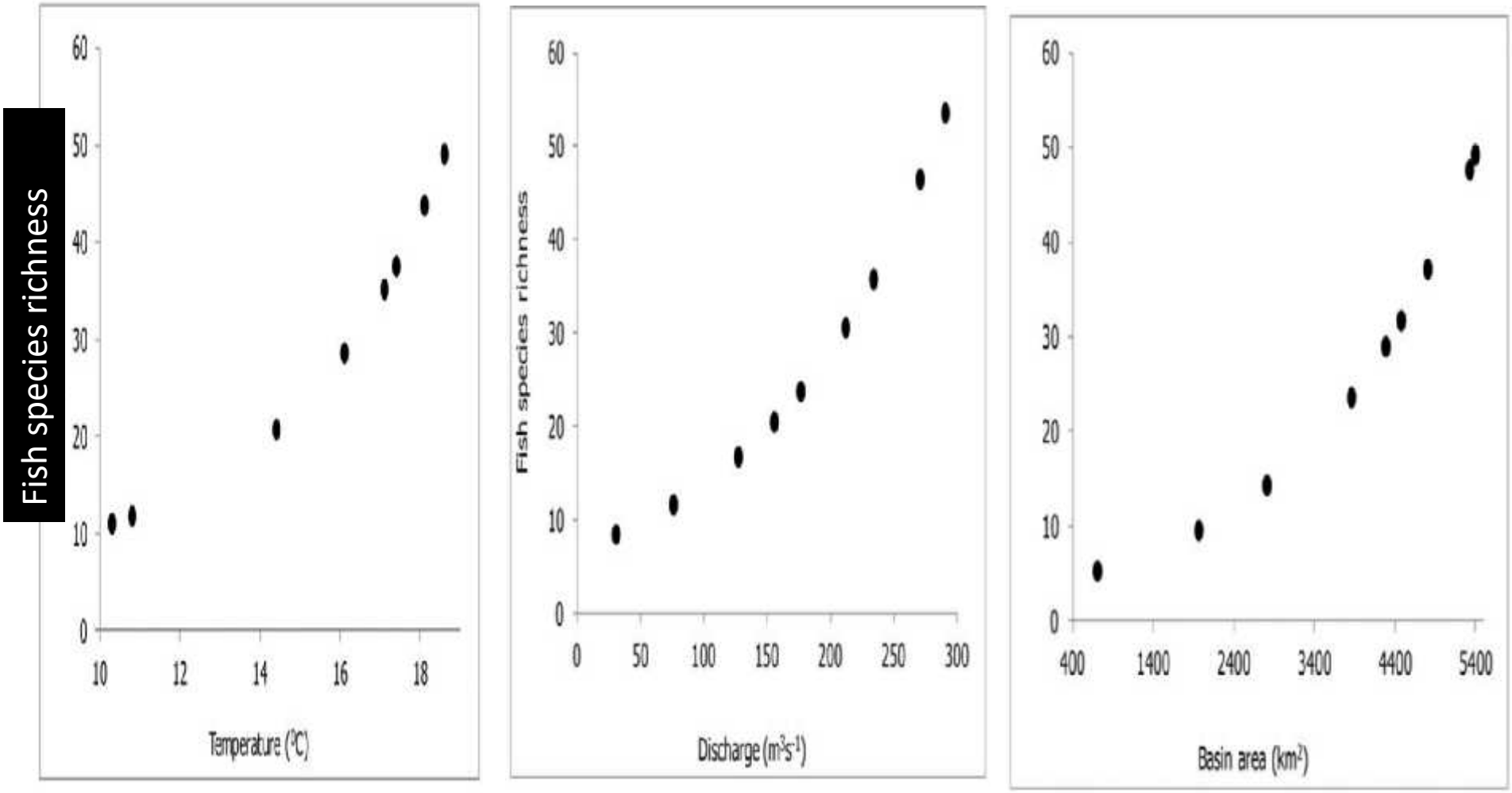
Source: ADB (2014)



Fu et al. (2004) Global Ecol Biogeogr 13: 543–552
Bhatt JP, Manish K, Pandit MK (2012)



Endemism trends in Nepalese Rivers?



Temp °C

Discharge $m^{-3}s^{-1}$

Basin Area, km^2

Fu et al. (2004) Global Ecol Biogeogr 13: 543–552
Bhatt JP, Manish K, Pandit MK (2012)

Migratory Fish

Deep-bodied Mahseer, *Tor tor*

Source: KGFH (2018)

Golden Mahseer, *Tor putitora*

Jalkapoor, *Pseudeotropius antherinoides*

Gonch, *Bagarius yarrellii*

Rajbam, *Anguilla bengalensis*

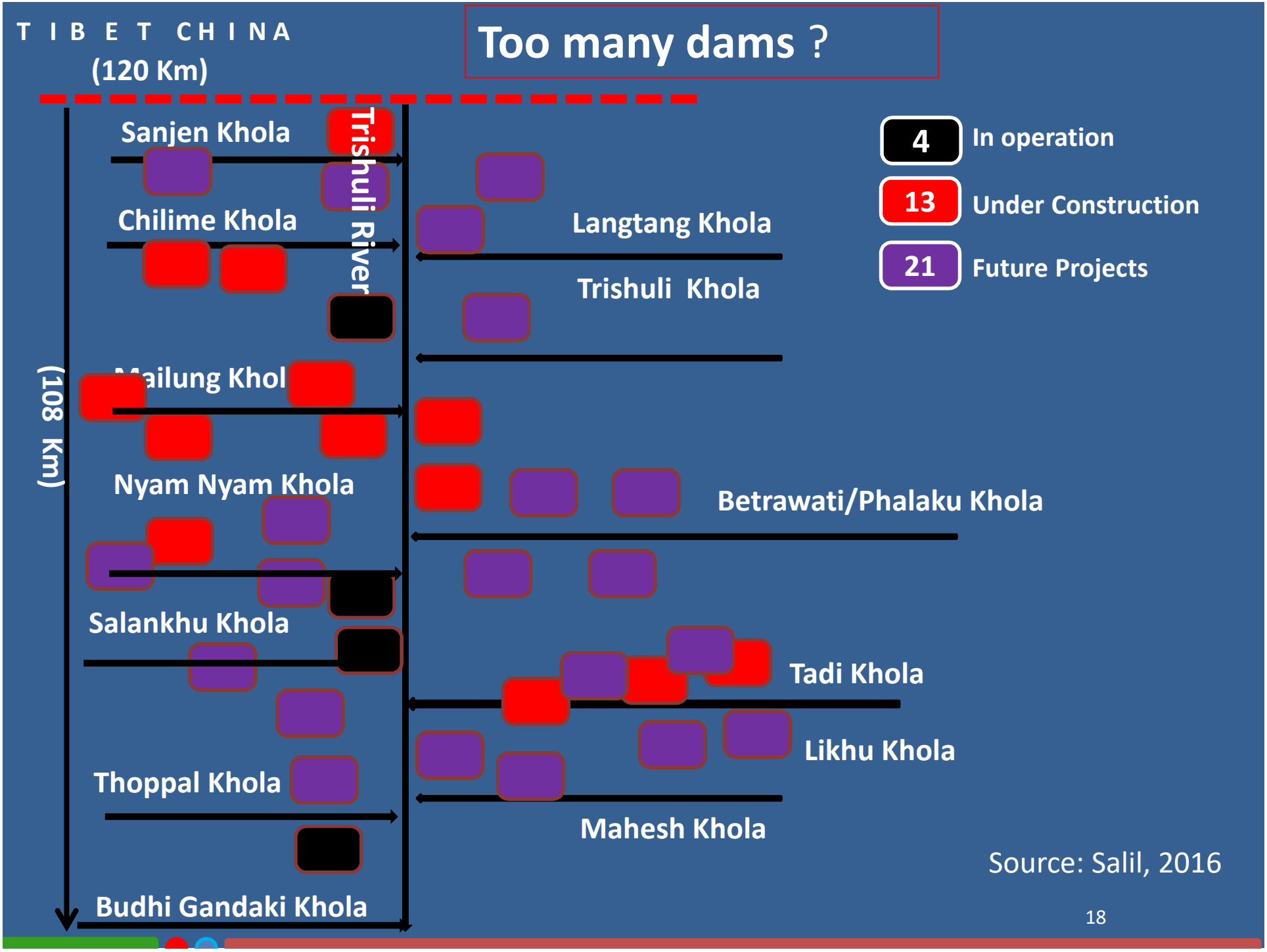
Fish Passages in Nepal

- 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.

Fish ladder in (A) (Shrestha) (B) Andhikhola

- 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 ?
T I B E T CH I NA
(120 Km)
(108 Km)
Trishuli River
Sanjen Khola
Chilime Khola
Langtang Khola
Trishuli Khola
Nyam Nyam Khola
Betrawati/Phalaku Khola
Salankhu Khola
Tadi Khola
Likhu Khola
Thoppal Khola
Mahesh Khola
Budhi Gandaki Khola
4
In operation
13
Under Construction
21
Future Projects
Source: Salil, 2016

List of Spp. (10) recommended for legal protection

Scientific name	Com. name	Distribution
Acrossocheilus hexagonolepis	Katle	**Koshi, Gandaki, Karnali, Mahakali**
Chagunius chagunio	Rewa	**Koshi, Gandaki, Karnali, Mahakali**
Tor putitora	Mahseer	**Koshi, Gandaki, Karnali,**
Tor tor	Sahar	**Gandaki, Mahakali**
Danio rerio	Zebra macha	**Gandaki, Karnali,**
Schizothorax plagiostomus	Buchhe asla	**Koshi, Bheri, Gandaki, Karnali,**
Schizothorax richardsonii	Asala soal	**Koshi, Gandaki, Karnali,**
Schizothoraichthys progastus	Chuche asala	**Koshi, Gandaki, Karnali,**
Psilorhynchus pseudecheneis	Tite macha	**Koshi**
Anguilla bengalensis	Rajabam	**Koshi, Gandaki, Karnali,**

Source: ADB (2014)

21 Fish species under IUCN Red list

Sci. Name	Eng Name	Nepal's Name	Status
Glyptothorax kashmirensis			**Cri. Endangered**
Schizothoraichthys nepalensis	Snow trout	Tikhe Asla	**Cri. Endangered**
Schizothoraichthys raraensis	Snow trout	Asla	**Cri. Endangered**
Tor putitora	Gold Mahseer	Sahar	**Endangered**
Physoschistura elongata		Suiree	**Vulnerable**
Puntius chelynoides	Dark Mahseer	Halundae	**Vulnerable**
Schistura prashadi		Gadela	**Vulnerable**
Schizothorax richardsonii	Snow trout	Buche Asla	**Vulnerable**
Ailia coila	Gangetic Ailia	Patsi	**Near threatened**

Source: ADB (2014)

Cont…. Fish species under IUCN Red list

Bagarius bagarius	Goonch	Gounch	Near threatened
Bagarius yarrelli	Goonch	Gounch	Near threatened
Balitora brucei	Gray's Stone Loach	Patthartata	Near threatened
Chitala chitala	Featherback	Chittal	Near threatened
Ctenops nobilis	Frail Gourami		Near threatened
Garra rupecula		Buduna	Near threatened
Labeo pangusia	Pangusia, Labeo	Thed	Near threatened
Neolissochilus hexagonolepis	Copper Mahseer	Katle	Near threatened
Ompok bimaculatus	Butter Catfish	Nauni	Near threatened
Ompok pabda	Pabda Catfish		Near threatened
Tor tor	Red-finned Mahseer	Ratar/Sahar	Near threatened
Wallago attu	Whiskered Catfish	Buhari	Near threatened

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

Figure 1: Lateral view of *Glyptothorax kashmirensis*

- Commercially important food fish, relished taste.

- No biological study being carried in Nepal

www.iucnredlist.org/details/166525/0

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.

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

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

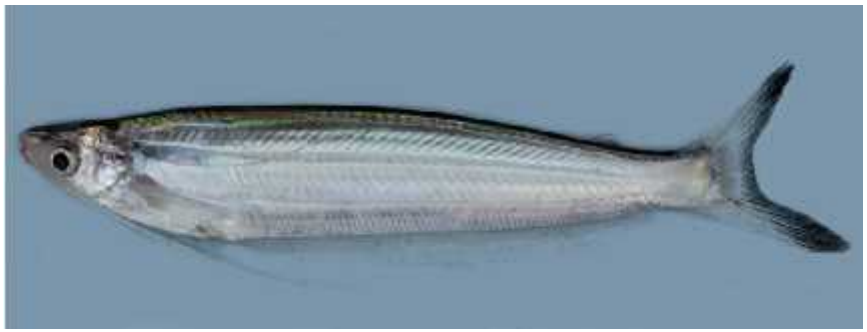
Pop. trend: decreasing

- *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

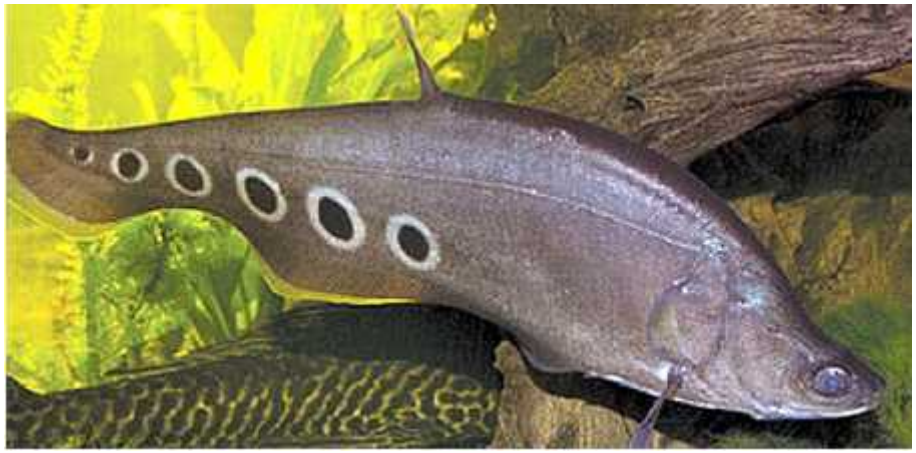
- No biological studies going on.

Chitala (Notopterus) chitala

Status: Near Threatened ver 3.1

Pop : Decreasing

Featherback



Some specimen being collected.

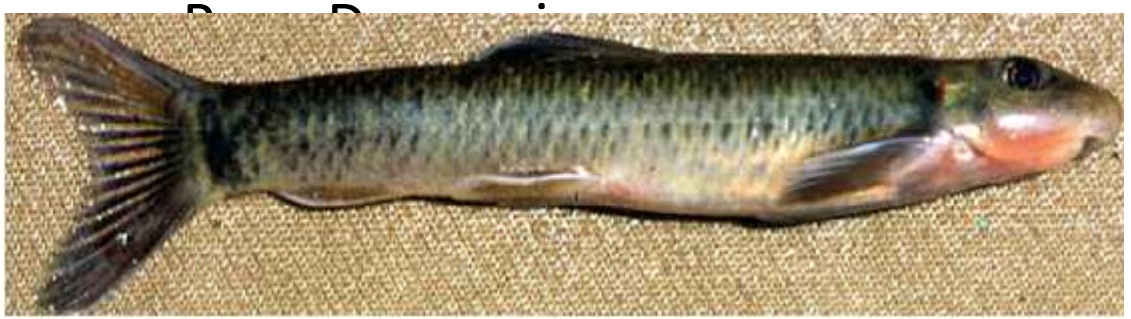
Ctenops nobilis

Status: Near Threatened ver 3.1

Pop. trend: decreasing

***Garra rupecula* (Mishmi garra)**

Status: Near Threatened ver 3.1



Ompok pabda

Status: Near Threatened ver 3.1

Pop : Decreasing

Ompok bimaculatus

Status: Near Threatened ver 3.1

Pop. trend: unknown

Labeo pangusia (Pangusia labeo)

Status: Near Threatened ver 3.1

Pop : Decreasing

Wallago attu

Status: Near Threatened ver 3.1

Pop. : Decreasing

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)

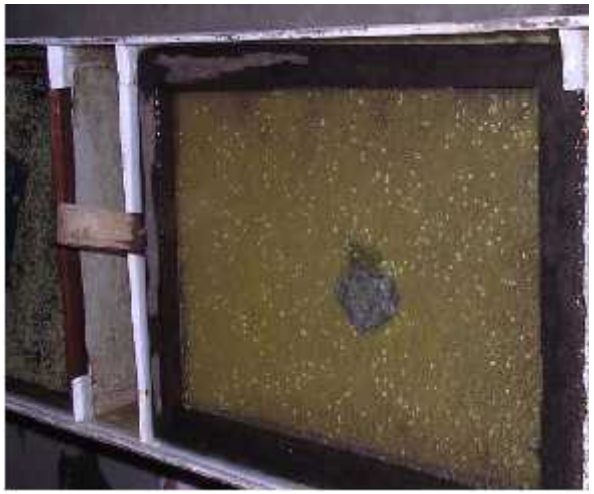
Source: KGFH (2018)

Breeding Biology of Some of the Key Species of Himalayan Rivers Fishes

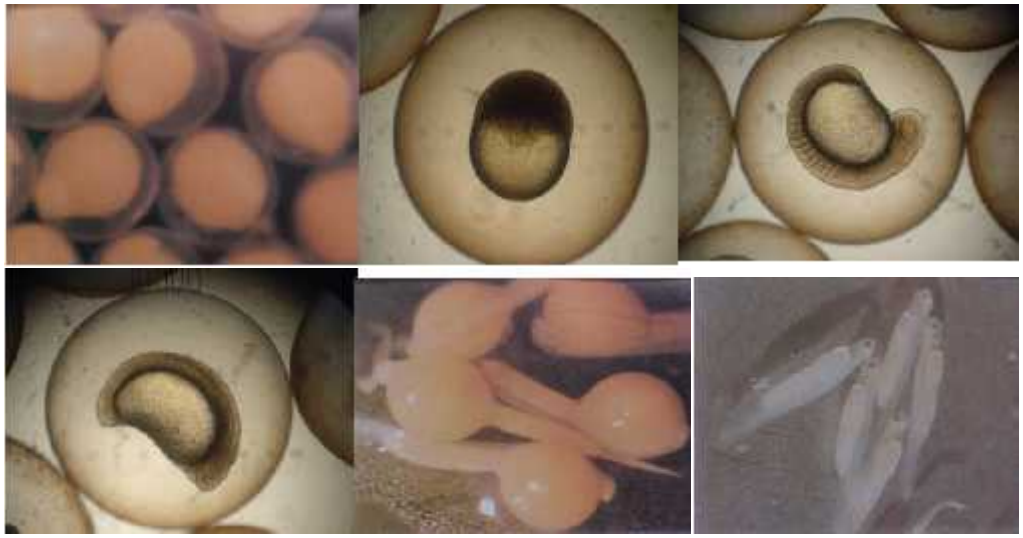
Breeding activities of key species, *Tor* and others

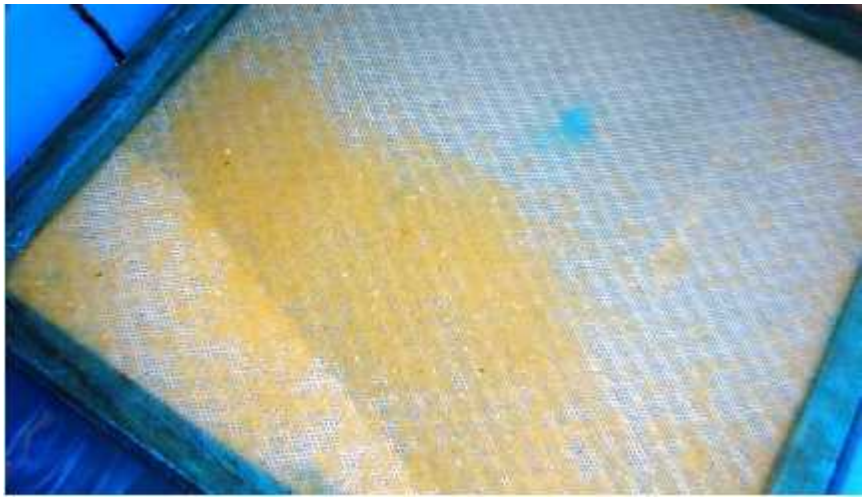


Hatchery Operation


Breeding procedures, embryonic development and larval production





Transportation and stocking of key species in Kali Gandaki River

Source: Kali Gandaki Fish Hatchery

Some research findings

Source: AFU, Rampur

In-situ conservation of *Tor* and *Neolissocheilus* in Lake Phewa, Nepal





Annual Fry Production of Key Fish Species

Riverine species	**Fry Released Numbers**
Labeo dero	339,000
Labeo pangusia	306,000
Labeo angra	225,000
Barilias	3000
Shizothorax	60
Neolissocheilus hexagonolepis	100
Tor tor	310
Tor putitora	100
Total	**873620**

Source: KGFH (2018)

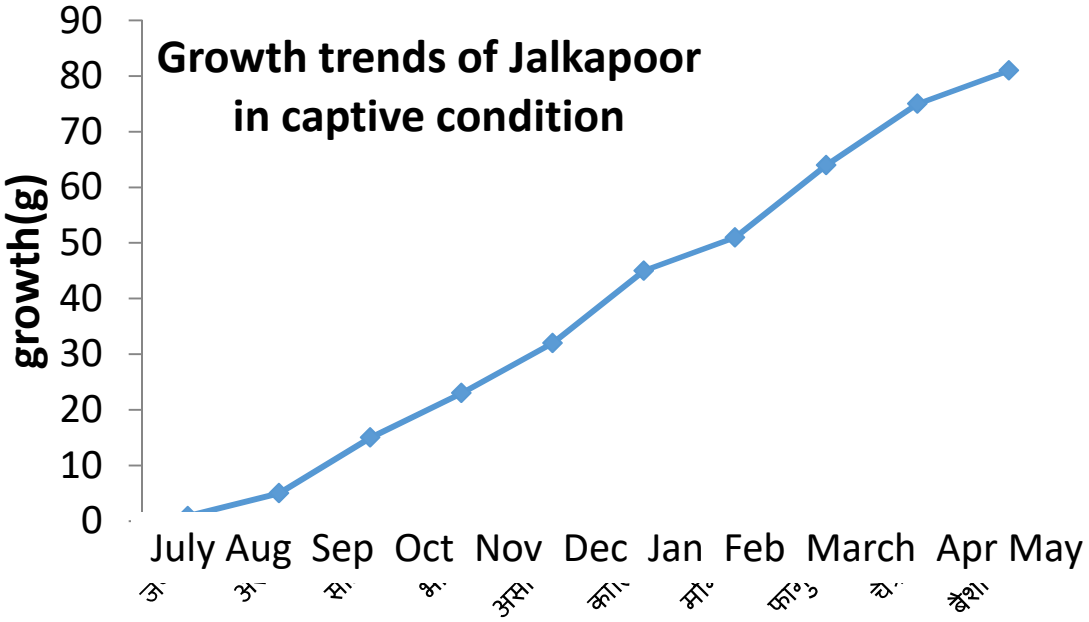
Fish Species Composition of Captured fisher in Up and Downstream of Kali Gandaki River in year 2016/2017

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

Source: KGFH (2018)

Initiatives on Jalkapoor

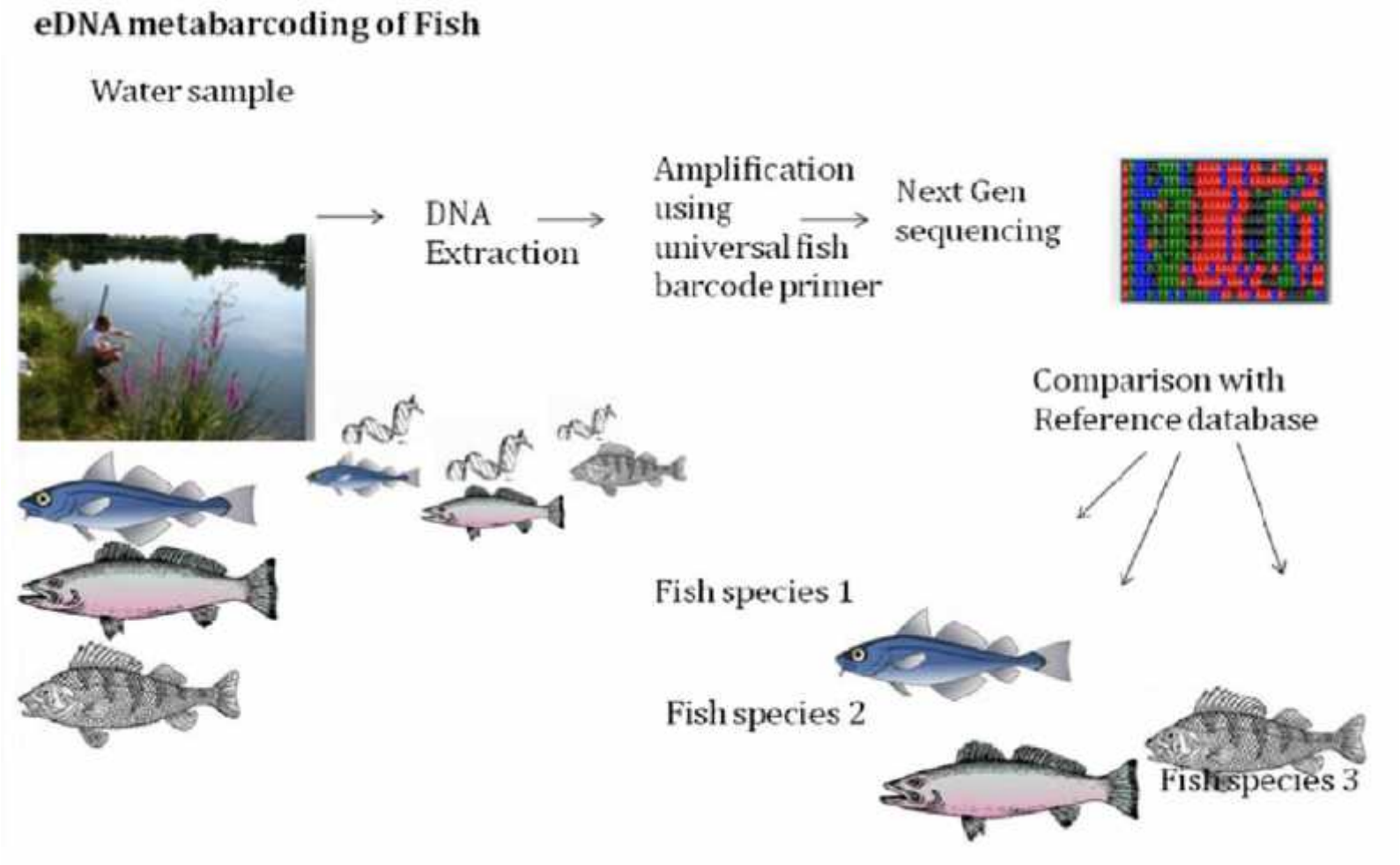
- 92 Jalkapoor under investigated at at 21-25 oC after collection from Kali Gandaki River in Trishuli Fish Farm.
- 0.2 to 50 gm BW Jalkapoor were collected.
- Jalkapoor collected at 26 0C WT.



Source: Trishuli Fisheries Researc 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.**