

Himalayan Fish Identification



Schizothorax locality from Tila
River, Tributary of Karnali River

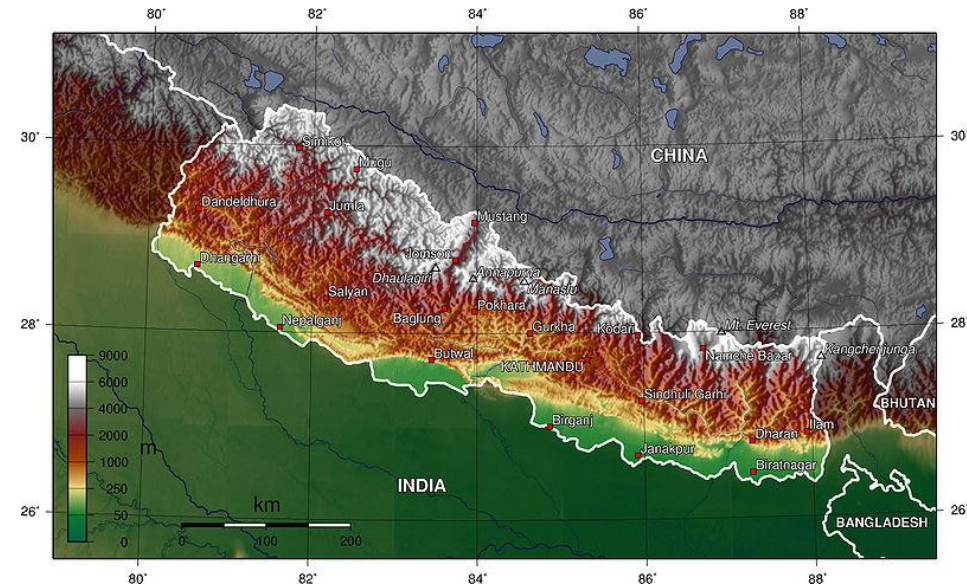


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Centre, Godawari Lalitpur,
Kathmandu, Nepal

Water resources of Nepal

| Resource details | Estimated area (ha) |
|-----------------------|---------------------|
| Natural water | |
| Rivers | 395000 |
| Lakes | 5000 |
| Reservoirs | 1500 |
| Ponds | 11396 |
| Seasonal water | |
| Marginal swamps | 12500 |
| Irrigated rice fields | 398000 |
| Irrigation canal | 3160 |
| Highway side ditches | 262 |
| Total | 826818 |

Source: CFPCC, 2018



- Freshwater resources occupying about 5.6% of the total area of Nepal.

Status of Fish diversity of Nepal

Total Indigenous fish species: 236

- 74 cold water
- 162 warm water

| Type | Species diversity (No.) | Percent of 236 species |
|--------------------------|----------------------------|------------------------------|
| Ecological Region | | |
| High hill | 20 | 10.7 |
| Hills, valleys | 114 | 45.2 |
| Terai | 118 | 46.8 |
| Species Richness | | |
| Gandaki River | 201 | 79.76 |
| Koshi River | 194 | 76.98 |
| Karnali River | 139 | 55.16 |
| Mahakali River | 89 | 35.3 |

| Status | Number of species |
|-------------------------|----------------------|
| Common/ occasional | 71 |
| Insufficiently known | 59 |
| Vulnerable | 11 |
| Endangered | 2 |
| Rare | 23 |

Fish fauna Order wise

13 orders represented in the fresh water ecosystem of Nepal

Order 1. Synbranchiformes:

Dorsal and anal fin vestigial or absent (*Macrogathus*, *Mastacembelus*)



Macrogathus pancalus, sampled from Reu River, CNP, collected by A. Rayamajhi

Order 2 Anguilliformes:

Dorsal and anal fins long continuous with caudal fin (*Anguilla*)



Anguilla bengalensis, Trishuli River

* Order 1 & 2: body
Cylindrical, elongated and eel like.

Order 3. Clupeiformes

Abdomen with single serration, lateral line absent. They are generally silvery fish (*Gudusia*)



Gudusia chapra, Koshi River at Koshi Barrage, Collected by Asha Rayamajhi, 23 April, 2014

Order 4. Osteoglossiformes

Abdomen with double serration, lateral line present, anal fin very long (*Notopterus*)



Notopterus notopterus, River Rapti Kasara bridge, CNP, Collected by Asha Rayamajhi, 11 February, 2014

Order 5. Cypriniformes

Fish of this group having pharyngeal teeth but mouth is toothless & protractile. Head without scale, mostly a single dorsal fin, Branchiostegal rays usually three, Barbels present around the mouth or absent.

(*Schizothorax*, *Chela*, *Salmostoma*, *Esomus*, *Danio*, *Rasbora*, *Aspidoparia*, *Amblypharyngodon*, *Barilius*, *Cyprinus*, *Semiplotus*, *Puntius*, *Accrossocheilus*, *Tor*, *Cirrhinus*, *Osteocheilus*, *Catla*, *Crossocheilus*, *Garra*, *Psilorhynchus*, *Balitora*, *Aborichthys*, *Noemacheilus*, *Botia*, *Acanthophthalmus*, *Somileptes*, *Lepidocephalus*)

S. richardsonii, Seti River,
Goapghat, Doti, Collected by
Asha Rayamajhi



Aspidopariya jaya, Koshi River,
Sunsari, collected by Asha Rayamajhi,
21 April, 2014



Danio devario, Rapti River nearby
Kasara Bridge, NCP, Collected by
Asha Rayamajhi. 11 Feb. 2014.



Order 6. Siluriformes

Scale less fish, spines present in the pectoral and dorsal fins.

(*Rita*, *Batasio*, *Mystus*,
Sperata, *Aorichthys*, *Ompok*,
Wallago, *Ailia*,
Pseudeutropius, *Clupisoma*,
Eutropiichthys, *Amblyceps*,
Bagarius, *Gagata*, *Erethistes*,
Erethistoides, *Glyptosternum*,
Laguvia, *Pseudolaguvia*,
Glyptothorax, *Exostoma*,
Pseudecheneis, *Sisor*, *Clarias*,
Heteropneustes, *Chaca*)



Erethistoides cavatura, Reu River, CNP, Collected by Asha Rayamajhi, 20 February, 2014



Sperata aor, Koshi River at Barrage, Saptari eastern Nepal, Collected by Asha Rayamajhi, 23 April, 2014.



Glyptothorax

Order 7. Beleniformis

Body cylindrical, jaws produced into long beaks and with sharp teeth, No spines in fins (*Xenentodon*)



Xenentodon cancila, Kasara
Khola/Stream, CNP, Nepal. Collected by
Asha Rayamajhi, 16 Feb. 2014

Order 8. Cyprinodontiformis

No spines in dorsal and anal fins.
Lateral line mainly on head not on
body (*Aplocheilus*)



Aplocheilus panchax aquare.com

Order 9. Channiformes

Body elongate with scales. Head
with plate like scales. Suprabranchial
accessory respiratory apparatus well
developed. Branchiostegals
five. Long dorsal & anal fin (without
spines). Lateral line almost
interrupted (*Chana*).



Chana orientalis, locality from Rapti
River at Major Ghat, Collected by A.
Rayamajhi, 12 Feb. 2014.

Order 10. Synbranchiformes

referring to rudimentary dorsal fin and anal fin
(*Monopterus albus*)



M. albus

Order 11. Perciformes (Perches)

The dorsal and anal fins are mostly divided into two parts (anterior spiny and posterior soft-rayed portions), which may be partially or completely separated. The pelvic fins usually have one spine and up to five soft rays, Scales are usually ctenoid (rough to the touch)
(*Ambassis*, *Chanda*, *Badis*, *Nandus*, *Glossogobius*).



Badis badis, Rapti River, CNP,
collected by Asha Rayamajhi,
12 February, 2014.

Order 12. Anabantiformes: climbing perch, climbing gouramis

Characterized by the presence of highly folded suprabranchial accessory breathing organ
(*Anabas*)

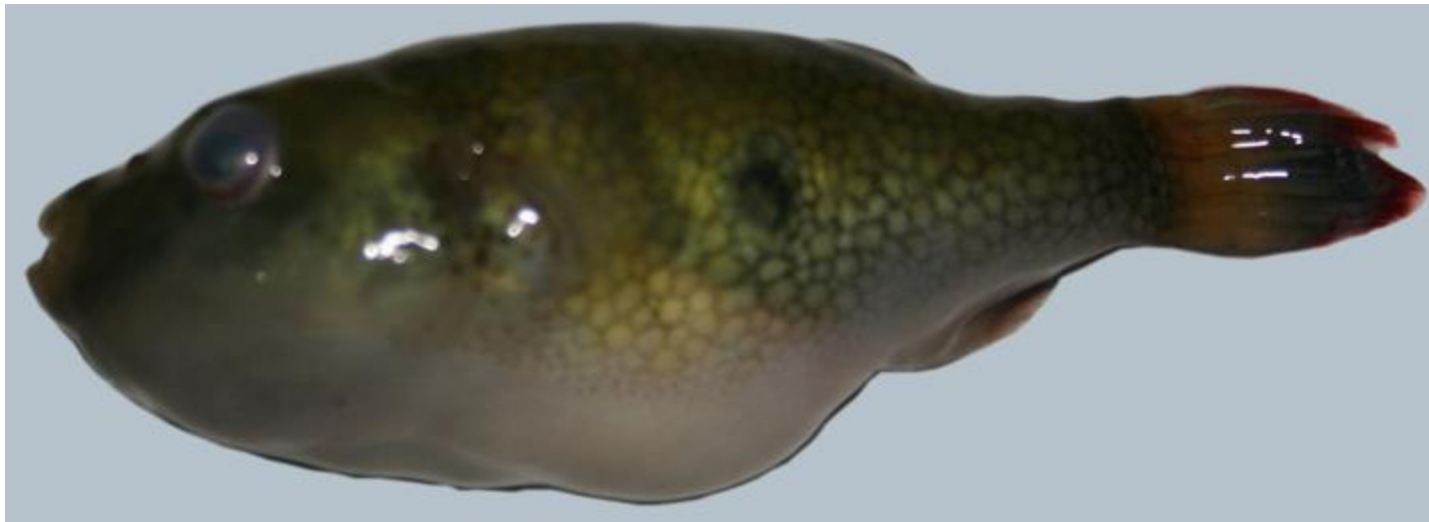


Anabas cobojius,
Hari pur fish market, Sunsari,
collected by Asha Rayamajhi,
24 April, 2014.

Order 13. Tetraodontiformes

(pufferfish, ocellated blowfish)

Body short, two large teeth on each jaw, broad head and back is tapering abruptly to tail, scales minute (Tetraodon)



Tetrodon cutcutia samples from tributaries of Rapti River and Kasara Khola/stream at old Kasara Ghat, Chitwan, CNP,

Native fish collection in Nepal

| Organization | Total species collection | Remarks |
|--|--------------------------|---------------------------|
| National Fishery Research Centre Godawari (NFRC) | 130 | |
| Tribhuvan University (TU) | 105 | |
| Agriculture and Forestry University (AFU) | 113 | " |
| Kathmandu University (KU) | ... | Uncertain fish record no. |
| Central Fisheries Promotion and Conservation Center (CPDD) | ... | " |
| Natural History Museum | ... | " |
| The Center for Molecular Dynamics Nepal (CMDN) | ... | " |
| Other | | |

Mandate: National Fishery Research Center, Godawari

- Strengthen and upgrade the laboratories operated at NFRC as Central Laboratory of Fisheries Research.
- Carry out germplasm collection, conservation, promotion and maintenance of genetically improved pure line carps and economically important native fish species.
- Enhance the productivity of fish through prevention and control of pathogenic parasites and diseases through effective dose determination and use of different fish drugs and traditionally important herbs.
- Develop and validate the good fish health management practices through Aquaculture Field School and Fish disease health camp.
- Survey the potential lakes, wetland and other water resources for aquaculture and prepare native aquatics inventory based on morphometric, meristic characteristics and PCR techniques.
- Develop cost-effective quality fish feed using local raw materials.
- Develop value added fisheries products through processing technology.
- Assist Nepal Agricultural Research Council in development and formulation of research oriented policies and strategies of fisheries sector.
- Co-ordinate and develop linkage among the extension, education and other stockholder for fishery research and development.
- Validate the latest fisheries technologies developed in the international arena for Nepal through adaptive research.
- Develop POP of economically important native fish species and aquatics and recommend the competitive advantageous species for release.

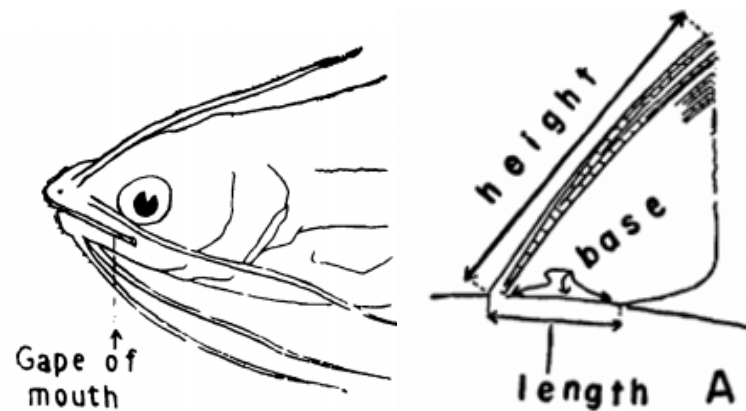
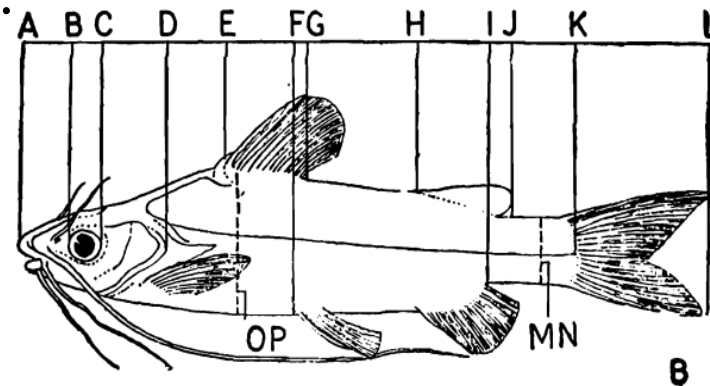
Techniques of identification of fish in Nepal

The identification of a fish is based on:

- Morphometric characters
- Meristic characters
- Descriptive characters
- Use of local (folk) expertise
- PCR tools: Initiated

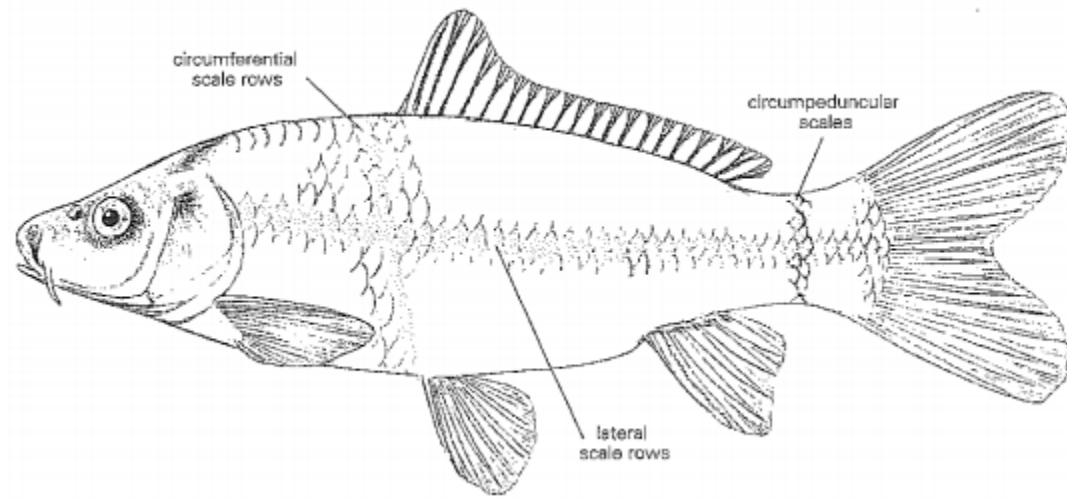
Morphometric measurements: morphometric term suggest, it is the external measurements of the fish body.

- Total length (AL),
- Standard length (AK)
- Head length (AD)
- Body depth (OP)
- Eye diameter (BC)
- Width of gape of mouth
- Snout length (AB)
- Predorsal length (AE)
- Prepelvic distance (AF)
- Preanal distance
- Depth or least height of caudal peduncle (MN)
- Length of caudal peduncle (IK)
- Post-orbital length (CD)
- Occiput, barbel
- Height of fin or length of fin spine



Meristic characters: The characters depicted by numbers. These includes:

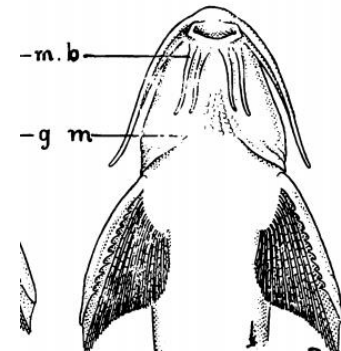
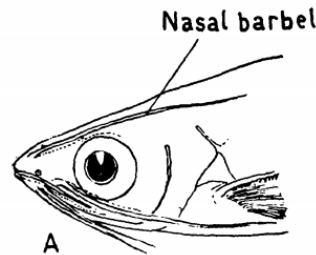
- **Scales:** scale counts are useful to recognize families or distinguish between close species and scale shape is useful for discrimination among genera.
 - Scales from df base to Ll
 - Scales from Ll to pf
 - Pre-dorsal scales
 - Circumpeduncular scales
- **Lateral line counts:** Complete, Interrupted, Incomplete (no)
- **Barbels:** Nasal barbel, Rostral barbel, Maxillary barbel, Mandibular barbel



Body scale counts:

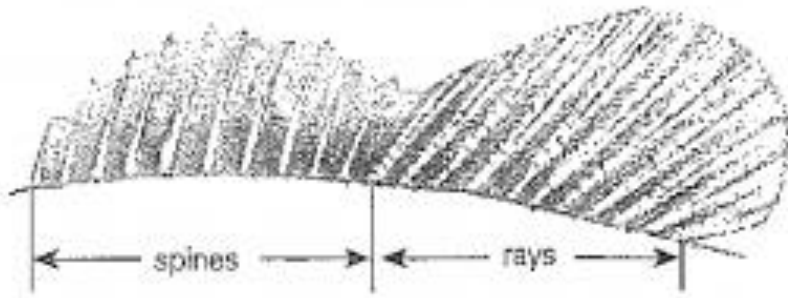
The Ll scale row counts is 38;

The circumferential scalae row counts is $10+10+2$, total 22; the Circumpeduncular scale counts is $6+6+2$, total 14.

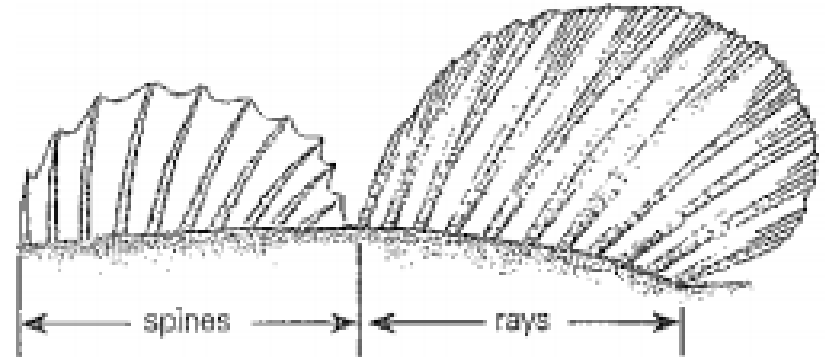


Meristic characters.....

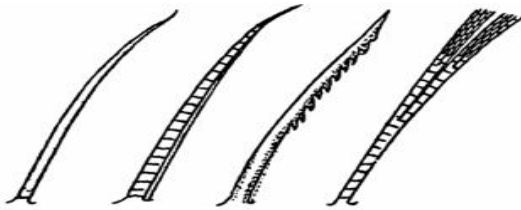
Fin rays type and counts: Soft ray, Spinous rays, Branched ray



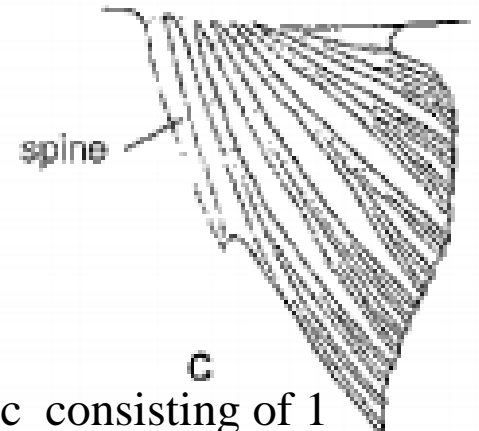
Single dorsal fin of spines and rays
(10 spines and 11 ray.



Double dorsal fin of spines and
rays (10 spines and 11 ray.



serrations or teeth

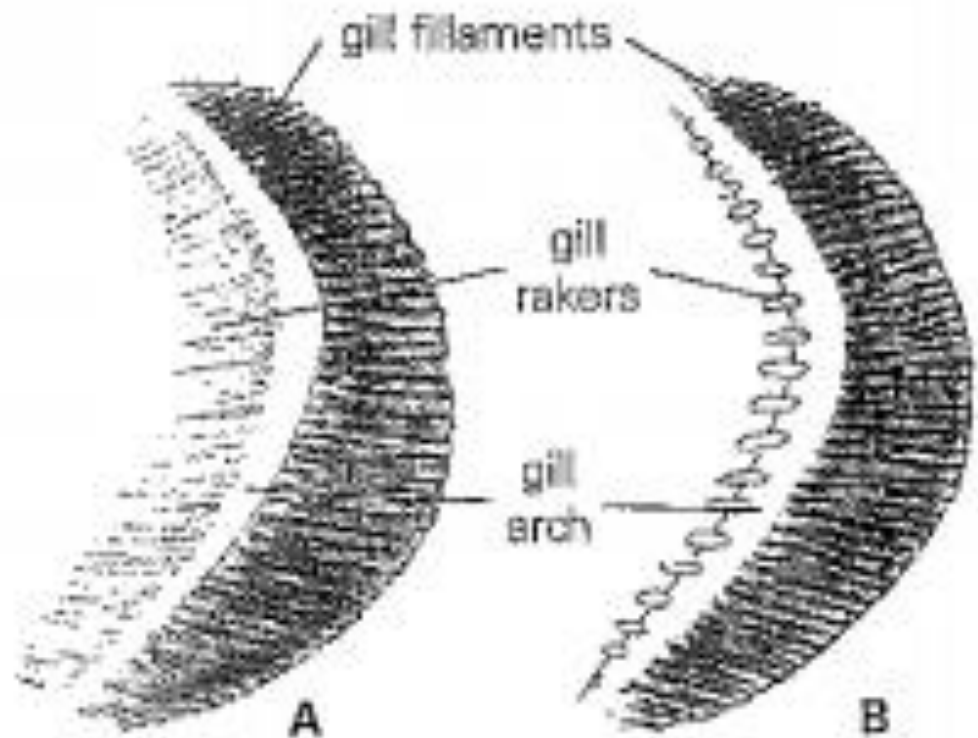
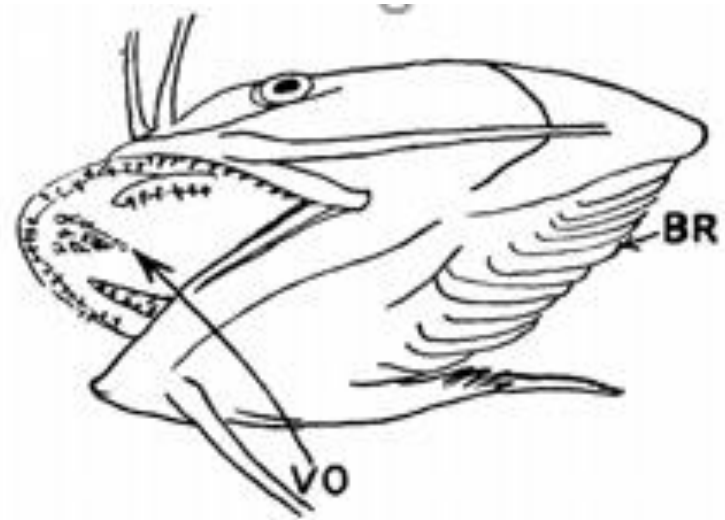


C
Pelvic consisting of 1
spine and 5 rays

Meristic characters.....

**Branchiostegal rays
counts**

Gill rakers counts





Barilius barna, Phewa Lake, Kaski, Collected by Asha Rayamajhi, 11 April, 2014



Raiamas bola, Rapti River, CNP, Collected by Asha Rayamajhi, 12 Feb., 2014



Parliosoma daniconius, collected by Asha Rayamajhi, 23 April, 2014



W-shaped band



Acanthocobitis botia, Reu River at Rapti Kasara Bridge, collected by Asha Rayamajhi, 13 February, 2014.



Naziritor cheilynoides, Mardi Stream, Kaski, collected by A. Rayamajhi, 12 April, 2014

Descriptive characters:

- The colouration of body and fins
- Pigmentation patterns
- Bands on body, head and fins

Flagship species of Himalayan waters

Flagship species or charismatic animals that promote environmental awareness can be an important conservation tool (Caro and O'Doherty 1999; Barua et al. 2011). Flagship species of Himalayan waters belong to the Actinopterygii class under the Chordata phylum in the Animalia kingdom.

- *Tor* spp. (3 spp.)
- *Schizothorax* spp. (10 spp.)

| SN Indigenous species | |
|-----------------------|------------------------------------|
| 1 | <i>Schizothorax richardsonii</i> |
| 2 | <i>Schizothorax sinuatus</i> |
| 3 | <i>Schizothorax curvifrons</i> |
| 4 | <i>Schizothoraichthys esocinus</i> |
| 5 | <i>Schizothoraichthys labiatus</i> |
| 6 | <i>Schizothorax macrophthalmus</i> |
| 7 | <i>Schizothorax nepalensis</i> |
| 8 | <i>Schizothorax raraensis</i> |
| 9 | <i>Schizothorax niger</i> |
| 10 | <i>Schizothorax progastus</i> |

| SN Indigenous species | |
|-----------------------|---------------------|
| 1 | <i>Tor putitora</i> |
| 2 | <i>Tor tor</i> |
| 3 | <i>Tor mosal</i> |

Tor

- Golden mahseer (*Tor putitora*) and Deep bodied mahaseer (*Tor tor*) are found in Nepalese Himalayan rivers Its native name, sahar, refers to its large head. IUCN (2010) has categorized Golden mahseer as endangered.
- Nepalese rivers where *Tor* spp. are found continue to suffer from various anthropogenic stressors.

Genus Tor gray: Body elongate, head big, thick continuous lip, 2 pairs of barbels, large scale, lateral line complete.

Key to the species

Tor putitora (Golden mahaseer)

Length of head considerably greater than depth of body.

Lower fins yellowish

Maxillary barbels longer reaching beyond posterior margin of eye

Tor tor (Hamilton) (Deep bodied mahaseer)

Length of head shorter than depth of body.

Fins deep orange

Maxillary barbels shorter than diameter of eye.



Tor putitora, Babai River at Bardiya National Park, Collected by Asha Rayamajhi, 14 March, 2014



Tor tor, Babai River at Bardiya National Park, Bardiya, collected by Asha Rayamajhi, 14 March, 2014

Tor putitora

Lateral line scales 23-28.

2 ½ rows of scale between L.l. and base of pelvic fin, 4 ½ rows between L.l. and base of dorsal fin, 9-11 scales before dorsal fin and 11-12 rows around caudal peduncle.

Tor tor

Lateral line scales 22-28.

2 ½ to 3 ½ rows between L.l. and base of pelvic fin, 3 ½ to 4 ½ rows between L.l. and base of dorsal fin, 11-12 scales before dorsal fin and 11-12 rows around caudal peduncle.



Tor putitora



Tor tor

- To date, 10 species of *Schizothorax* including *Schizothoraichthys* reported in Nepal.
- These species are Himalayan cold water specialist as a model organism to predict the current suitability and climate driven potential range and range shifts due to their wide distribution across most mountainous catchments worldwide (Mohseni et al., 2003; Battin et al., 2007; Filipe et. al., 2013; Isaak et al., 2015).
- Trishuli, Gandaki, Koshi, Karnali, Mahalkali River and its feeder streams :
 - livelihoods of certain ethnic community
 - often bear the impact of overexploitation through damming and illegal fishing activities.

Genus *Schizothorax* Heckel

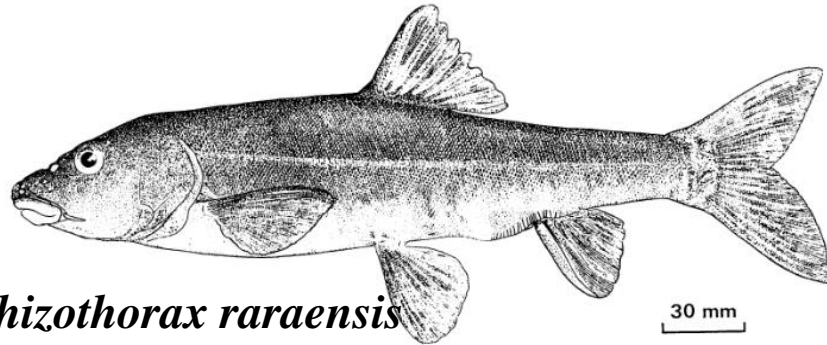
The *Schizothorax* genus key characteristic is head cone shaped, mouth wide and inferior, The scales are very minute and embedded in the skin, elliptical, vent and anal fin-sheath covered by an enlarged row of scales, barbels 2 pairs.



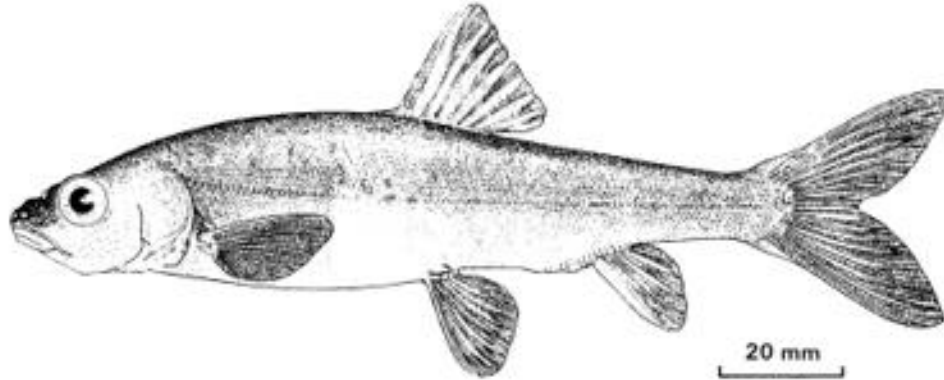
Lateral line scale more than 90

Minute elliptical scales

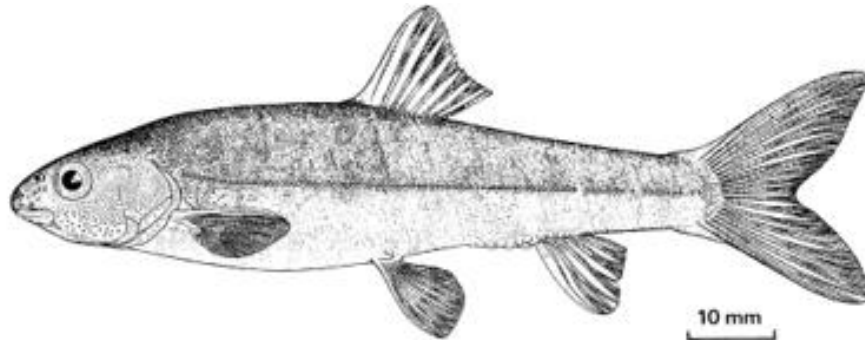
Endemic species of Rara Lake



Schizothorax raraensis



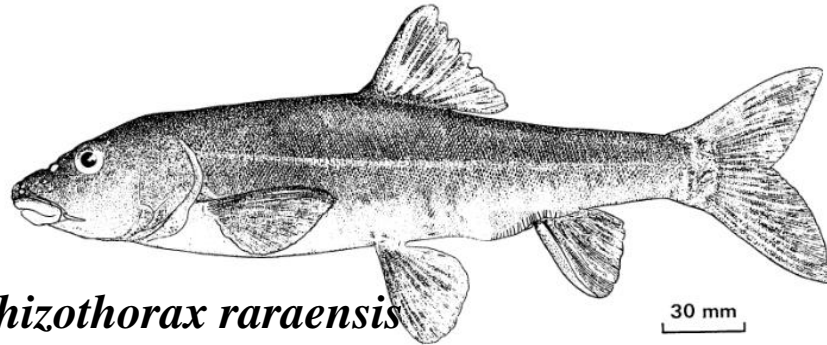
Schizothorax macrophthalmus



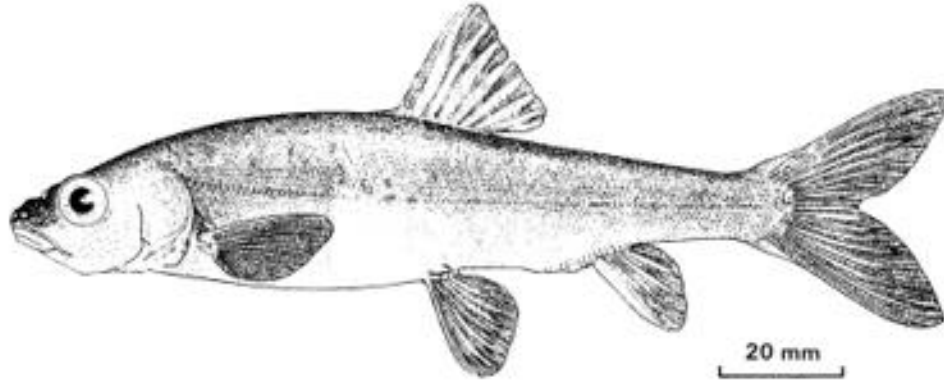
Schizothorax nepalensis



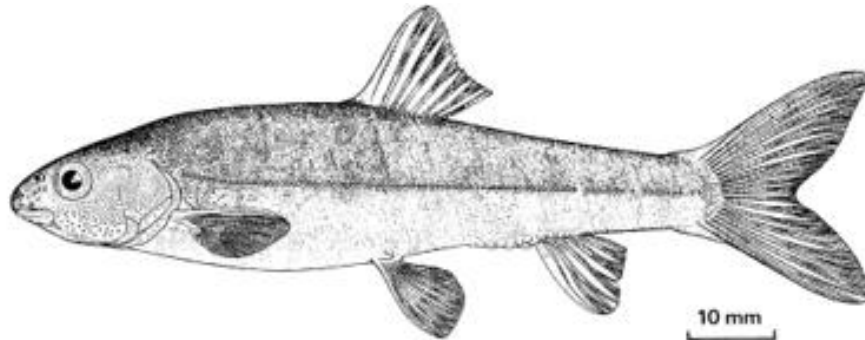
Endemic species of Rara Lake



Schizothorax raraensis



Schizothorax macrophthalmus



Schizothorax nepalensis

Schizothorax raraensis (Terashima, 1984)

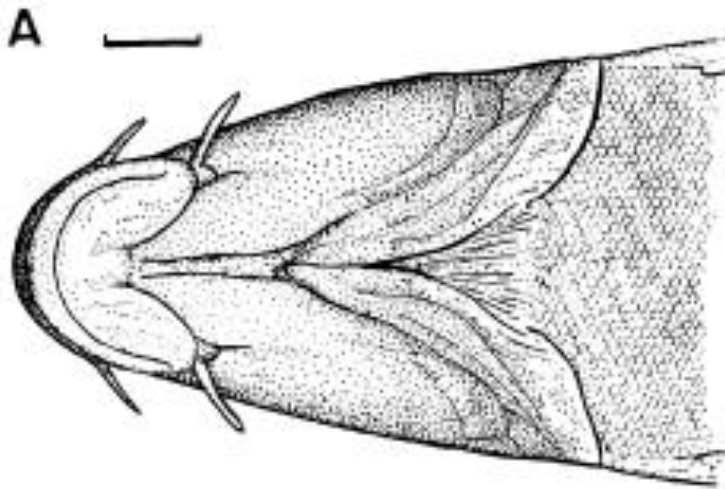
- Dorsal profile almost straight from tip of snout to nape, from nape to caudal fin somewhat arched.
- ventral profile somewhat curved.
- Maxillary barbels 3.6 % slightly longer than rostral 3.3% barbels

Schizothorax macrophthalmus

- Dorsal profile arched, ventral profile less curved.
- Maxillary barbels 2.7 % slightly longer than rostral 2% barbels

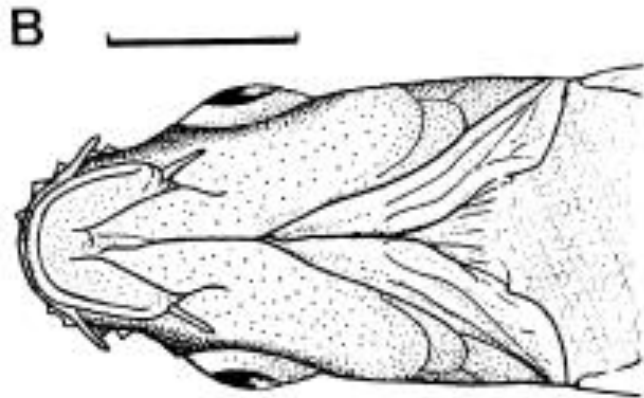
Schizothorax nepalensis

- Dorsal profile somewhat arched, Ventral profile less curved.
- Maxillary barbels 2.4 % slightly longer than rostral 1.9% barbels



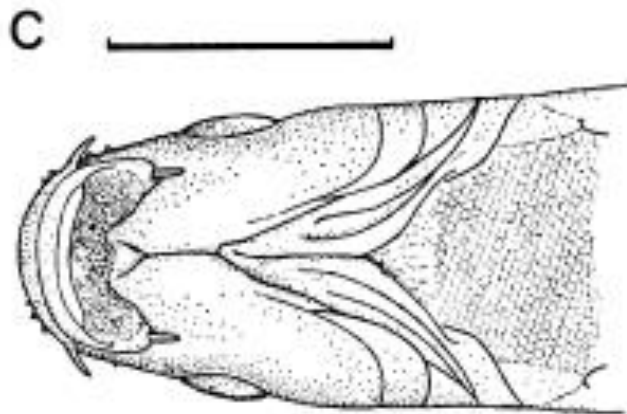
A. *Schizothorax raraensis*:

- Eye not visible from ventral side.
- Lower lip not papillate.



B. *Schizothorax macrophthalmus*:

- Eye large, visible from ventral side.
- Lower lip not papillate.



C. *Schizothorax nepalensis*:

- Eye visible from ventral side (small portion/partially).
- Lower lip papillate.

Schizothorax raraensis

- In life, top of head and back of body black, ventral surface of body blackish.



Schizothorax raraensis

Schizothorax macrophthalmus

- In life, top of head and back of body dark brown, ventral surface of body silver.



Schizothorax macrophthalmus

Schizothorax nepalensis

- In life, top of head and back of body dark brown, ventral surface of body silver.



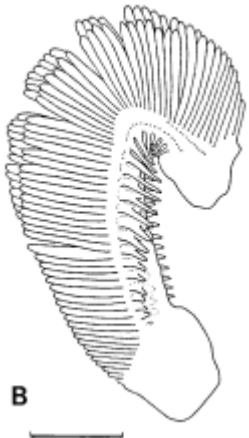
Schizothorax nepalensis

Photo credit: Rajkapur Napit



A. *Schizothorax raraensis*:

- Gill rakers (inside): 16 (H), 11-13 (P)



B. *Schizothorax macrophthalmus*:

- Gill rakers (inside): 26 (H), 22-24 (P)



C. *Schizothorax nepalensis*:

- Gill rakers (rakers): 21 (H), 24 & 28 (P)

Schizothorax richardsonii (Gray)

- The *Schizothorax richardsonii*, distinctively represents the Himalayan cold waters and potamodromous migratory behavior.
- Commercial and recreational value species and its presence in the high-altitude cold waters makes it a flagship species to conserve the Himalayan Rivers.
- Exposed to numerous anthropogenic stressors, the fate of snow trout population can be considered obviously at a higher risk in the Himalaya.

***Schizothorax richardsonii* (Gray)**

- Upper jaw longer than lower
- **The lower lip is modified to a hard labial plate with sharp horny edge**
- two pairs of barbels, which are comparatively smaller than the eye diameter
- dorsal spine strong and serrated behind
- dorsal fin insertion anterior to that of pelvic fin
- pectoral fin shorter than head
- Lateral line complete and arched
- two pairs of barbels, which are shorter than the eye diameter



S. Richardsonii,
Mardi River, Lumle,
Kaski, Acap area,
western Nepal,
Collected by A.
Rayamajhi. 13 Apr,
2014

- Among *Schizothorax* group the *S. richardsonii* and *S. sinuatus* can be differentiate with *S. curvifrons*, *S. niger* and *S. esocinus* in presence of strip of hard papillated structure at the chin. Whereas the strip of hard papillated structure behind the chin is absent in group B. *S. curvifrons*, *S. niger* and *S. esocinus*.
- Further required counting of meristic characters.

Fish group that are challenging to identify

Schizothorax is one of the most taxonomically difficult genera.

The most difficult part is counting of meristic characters. Such as lateral line scale, Ltr scale, predorsal scale, circumferential scale and caudal peduncle scale.

A thorough revision of the Genera of snow trout species is highly required at PCR based molecular level.

Studies of freshwater fishes of Himalayan waters (major river systems) of Nepal are limited to scattered works so far and are challenging.

Therefore, there is a great need to update a inventory of Himalayan Fishes in Nepal.



THANK YOU

