

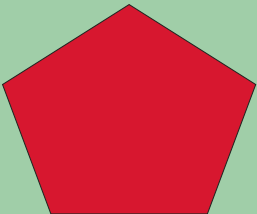


NATIONAL MISSION  
FOR SUSTAINING  
THE HIMALAYAN  
ECOSYSTEM (NMSHE)

# WILDLIFE WATCH

IN THE INDIAN HIMALAYAN REGION

2018-2019



भारतीय वन्यजीव संस्थान  
Wildlife Institute of India

SERIES V



# WILDLIFE WATCH

IN THE INDIAN HIMALAYAN REGION



 Shashank Arya



#### Citation

Sathyakumar, S., Mathur, V. B. (eds) 2018. Wildlife Watch Series IV, A user guide for monitoring wildlife species in the Indian Himalayan region. Wildlife Institute of India, Dehradun, 62 p.

All the Species potential distribution maps prepared by A. Arun Kumar and Sujata Uggupta.

**Publication coordination-** Soumya Dasgupta

## SPECIES WISE CITATIONS

### Mammals

Pal, R., Bhattacharya, T., Sathyakumar, S., 2018. Himalayan Brown bear, *Ursus arctos isabellinus*. pp.1 In: Sathyakumar, S., Mathur, V. B. (eds) 2018. Wildlife Watch Series IV, A user guide for monitoring wildlife species in the Indian Himalayan region. Wildlife Institute of India, Dehradun, 62 p.

Pal, R., Bhattacharya, T., Sathyakumar, S., 2018. Himalayan mouse hare (Royle's Pika), *Ochotona roylei*. pp.5 In: Sathyakumar, S., Mathur, V. B. (eds) 2018. Wildlife Watch Series IV, A user guide for monitoring wildlife species in the Indian Himalayan region. Wildlife Institute of India, Dehradun, 62 p.

### Birds

Bhattacharya, T., Ramesh, K., Singh, P., 2018. Grandala. *Grandala* spp. pp.9 In: Sathyakumar, S., Mathur, V. B. (eds) 2018. Wildlife Watch Series IV, A user guide for monitoring wildlife species in the Indian Himalayan region. Wildlife Institute of India, Dehradun, 62 p.

Bhattacharya, T., Ramesh, K. Singh, P., 2018. Ibisbill. *Ibisbryncha struthersii*. pp.13 In: Sathyakumar, S.,

Mathur, V. B. (eds) 2018. Wildlife Watch Series IV, A user guide for monitoring wildlife species in the Indian Himalayan region. Wildlife Institute of India, Dehradun, 62 p.

### Herpetofauna

Patel, N., Das, A., 2018. Himalayan blotched pit viper. *Protobothrops himalayanus*. pp.17 In: Sathyakumar, S., Mathur, V. B. (eds) 2018. Wildlife Watch Series IV, A user guide for monitoring wildlife species in the Indian Himalayan region. Wildlife Institute of India, Dehradun, 62 p.

Patel, N., Das, A., 2018. *Amolops himalayanus*. pp.21 In: Sathyakumar, S., Mathur, V. B. (eds) 2018. Wildlife Watch Series IV, A user guide for monitoring wildlife species in the Indian Himalayan region. Wildlife Institute of India, Dehradun, 62 p.

### Fish

Sharma, A., Dubey, V. K., Johnson, J. A., Sivakumar, K., 2018. Stone Loach. *Schistura rupecula*. pp.25 In: Sathyakumar, S., Mathur, V. B. (eds) 2018. Wildlife Watch Series IV, A user guide for monitoring wildlife species in the Indian Himalayan region. Wildlife Institute of India, Dehradun, 62 p.



**WILDLIFE  
WATCH**  
IN THE INDIAN HIMALAYAN REGION

## Series V

S. Sathyakumar  
& V.B. Mathur  
Editors

Sharma, A., Dubey, V. K., Johnson, J. A., Sivakumar, K., 2018. Gangetic Mystus. *Mystus cavasius*. pp.29 In: Sathyakumar, S., Mathur, V. B. (eds) 2018. Wildlife Watch Series IV, A user guide for monitoring wildlife species in the Indian Himalayan region. Wildlife Institute of India, Dehradun, 62 p.

### Entomofauna

Das, S., Uniyal, V. P., 2018. Red Veined Darter. *Sympetrum fonscolombii*. pp.33 In: Sathyakumar, S., Mathur, V. B. (eds) 2018. Wildlife Watch Series IV, A user guide for monitoring wildlife species in the Indian Himalayan region. Wildlife Institute of India, Dehradun, 62 p.

Singh, A. P., Uniyal, V. P., 2018. Tiger Beetle. *Calomerachloris*. pp.37 In: Sathyakumar, S., Mathur, V. B. (eds) 2018. Wildlife Watch Series IV, A user guide for monitoring wildlife species in the Indian Himalayan region. Wildlife Institute of India, Dehradun, 62 p.

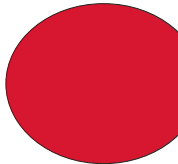
Ms. Ankita Sinha is thanked for her contribution on Ibisbill. Mr. Nilanjan Chatterjee, Dr. Tawqir Bashir, and Dr. Kamal Poudyal are thanked for providing species and habitat photographs of Ibisbill, Grandala, and Sikkim Rhubarb respectively.

### Flora

Rai, I.D., Rawat, G. S., 2018. Himalayan Fir. *Abies spectabilis*. pp.41 In: Sathyakumar, S., Mathur, V. B. (eds) 2018. Wildlife Watch Series IV, A user guide for monitoring wildlife species in the Indian Himalayan region. Wildlife Institute of India, Dehradun, 62 p.

Rai, I.D., Rawat, G. S., 2018. Himalayan Yew. *Taxus wallichiana*. pp.45 In: Sathyakumar, S., Mathur, V. B. (eds) 2018. Wildlife Watch Series IV, A user guide for monitoring wildlife species in the Indian Himalayan region. Wildlife Institute of India, Dehradun, 62 p.

Rai, I.D., Rawat, G. S., 2018. Sikkim Rhubarb. *Rheum nobile*. pp.49 In: Sathyakumar, S., Mathur, V. B. (eds) 2018. Wildlife Watch Series IV, A user guide for monitoring wildlife species in the Indian Himalayan region. Wildlife Institute of India, Dehradun, 62 p.









## Preface

The Indian Himalayan Region (IHR) is one of the rich biodiversity regions of the world with over 10,000 plants, 420 mammals, 900 birds, 250 herpetofauna, 250 fishes, several species of invertebrates and micro-organisms, many of which have global conservation significance. Despite its significant ecological, hydrological and biological values, the fragile mountain ecosystems in the IHR are seriously threatened due to increasing anthropogenic pressures mainly development. In the IHR, wildlife species are threatened due to poaching for meat, illegal wildlife trade, human-wildlife conflicts, habitat loss, habitat fragmentation and degradation due to developmental activities and natural resource use by humans. These have led to decline in wildlife populations, reduction in distribution range and in some cases, local extinction of species.

Climate change/climate variability is the recent threat to wildlife and their habitats in the IHR. The effects of climate change are pronounced in places such as the Himalaya where the network of snow-clad mountains, ice-peaks, high intensity drainage and precipitation characterises the bio-social landscape. Evidence suggests that responses of species to impacts of climate change are inter-alia manifested in changes in phenology, earlier onset of spring, migration, changes in behaviour or activity patterns, and lengthening of growing seasons. Therefore, it is very appropriate that scientific investigations are carried out to assess impacts of climate change/climate variability on wildlife species and their habitats in order to formulate and apply directed management strategies for long-term conservation in the IHR.

Under the Government of India's 'National Mission for Sustaining the Himalayan Ecosystem (NMSHE)', the Department of Science and Technology (DST) has identified the Wildlife Institute of India (WII) for coordination of the Task Force on Micro Flora & Fauna, and Wildlife and Animal Populations. The thematic areas identified under the research project are (A) Terrestrial Ecosystem, (B) Aquatic Ecosystem, (C) Human Ecology, and (D) Spatial Ecology; and include assessments of (a) animal species/communities diversity, distribution, abundance; (b) wildlife habitats, ecosystems, and ecosystem services; (c) anthropogenic and climate change impacts



on wildlife and ecosystems through scenario building and visualization; (d) vulnerability of species/habitats to climate change; and (e) prioritization of species/taxa and sites for monitoring.

In order to sensitize all stakeholders on the importance of monitoring selected endangered or indicator wildlife species in the IHR, this publication 'Wildlife Watch in the Indian Himalayan Region' - A User Guide for Monitoring Wildlife Species in IHR has been conceptualized and developed. This is the forth publication in this series. The selection of species for 'Wildlife Watch' is based on evaluation and scoring of criteria such as (a) the status (endangered/threatened) based on IUCN and Indian Wildlife (Protection) Act, 1972 (b) functional role (apex predator/ key stone species), (c) values (charismatic, cultural, umbrella/flagship species), (d) detectability in the wild, (e) sensitivity to climate change or climate variability, and (f) invasive species as negative indicators.

Using the above criteria, we have selected 13 species for Series IV; two species each representing mammals, birds, herpetofauna, fishes, invertebrates and three species for flora. We have plan to bring out the Wildlife Watch for the next year with another Series dealing with 12 to 15 species representing the various faunal/floral groups.

For every species, we have presented information on their taxonomic status, local/vernacular names, their physical attributes, elevation range, habitats they occur, some key field identification features, the probable distribution map of the species in the IHR, species photographs, and illustrations of tracks/signs which will come handy for the user, all at one glance. The key references used for compiling the information for the species are presented at the end of the user guide. This user guide can be used by all stakeholders, both amateur as well as trained. For an amateur, creating awareness and reporting of presence only based on visual encounters and signs as part of wildlife monitoring are envisaged. Most of the local community members, pilgrims, tourists, and school/university students would fall in this category. For trained biologists, managers, frontline staff of Forest/Wildlife Departments, field staff of the defence and para-military forces, trained Nature Club members, would fall in the second category from which we envisage reporting more information as per data format provided at the end of this user guide. In order to facilitate easy reporting back to WII, we have provided a mobile number for SMS/Whatsapp or phone call and an email ID as well. Any additional information could be provided in remarks and sent to WII. All the information with source will be stored in a database at WII for future monitoring. This publication will eventually be translated in all major vernacular languages spoken in the IHR and also hosted in our website.

It is hoped that substantial interest would be generated on Wildlife Watch in the IHR through this publication and it would be of great use for Wildlife monitoring by different stakeholders. This user guide has been published with the funds received from DST under the NMSHE project.

## Editors

**Mammal**



1  
Tibetan Argali



5  
Asiatic Black Bear

**Bird**



9  
Hill Partridge



13  
Himalyan Griffon

**Herpetofauna**



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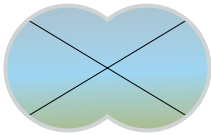


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**TIBETAN ARGALI**  
*Ovis ammon hodgsoni*

 camera trap/WII

**Reproduction and life cycle**

**Gestation period:** 150-160 days

**Rutting:** Peak for about 15 days in Nov to Jan (varies between years and regions)

**Young per birth:** 1, rarely 2

**Weaning:** 4-6 months

**Sexual Maturity:** Females at 2 years

**Life span:** 10- 13 years

**Taxonomy**

**Order:** Cetartiodactyla

**Family:** Bovidae

**Genus:** Ovis

**Species:** Ovis ammon

**Conservation status**

**IUCN:** Near threatened

**IWAP:** Schedule I

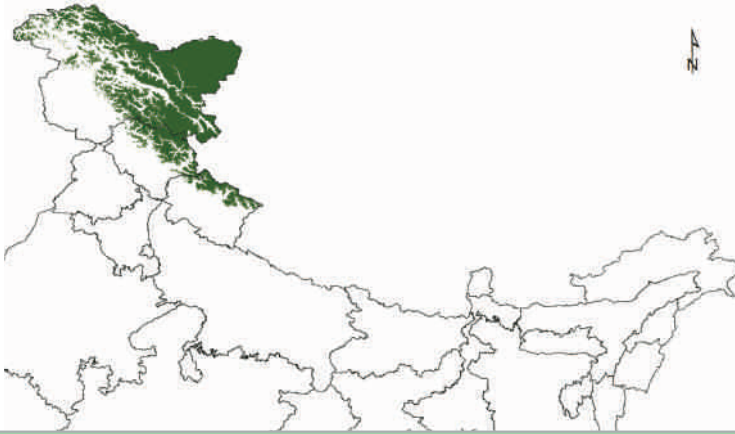
**CITIES:** Appendix II

**Vernacular names**

Nyan (Ladakhi)

**Size** ▶ Body length: 120-200 cm





## Distribution:

Argali are widely distributed across the high altitude areas of Central Asia. They are found generally above 4500m to 6100m habitats characterized by rolling slopes, plateaus and grassy steppes, avoiding steep cliffs. In India, they are reported from Ladakh in Jammu Kashmir; the Spiti area of Himachal Pradesh; Nelang valley of Uttarkhand and North Sikkim. The range is highly fragmented and very few large, connected populations remain. Their range is mostly across international border and animals are known to move between countries in the course of seasonal or altitudinal migrations.

## Description

Argali is the largest sheep in the world. They have long limbs with a prominent whitish, large rump patch. Their coat color is greyish brown or buff and creamy white underparts. The tail is short and black-tipped. Both sexes have dark brown line running along spine, and a broader horizontal line along the flanks. Adult males carry two huge, ribbed horns, which turn upwards, back, down and then forward and outward. Females have small and thinner horns. Argali are gregarious and are found in herds. Females with young and sub adult males congregate in groups, while the mature males stay in small groups, except during the rutting seasons, when they join females.

Shoulder height: 90-120 cm

Weight: 65-180 kg (Male 110 kg, female 68 kg)

Horn length: Male 145-190 cm

Female: 25-30 cm



## Vulnerability to climate change

Potential effects on argali habitat of warmer temperatures and increased precipitation include melting permafrost, longer growing seasons and upward shifts in vegetation zones. Such changes would also affect human land use and patterns of livestock grazing, with potential indirect impacts on argali.

## Monitoring protocol

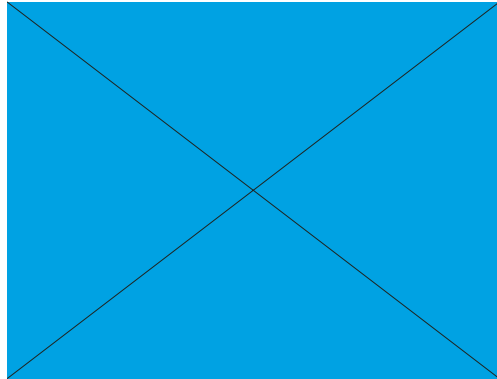
Scan counts from vantage points, double observer surveys and camera trapping are the most widely used methods for monitoring argali population. DNA extracted from fecal pellets (in mark-recapture framework) were also carried for estimating population of Argali.

 camera trap/WII



### Key threats

Poaching  
Habitat loss and degradation due to grazing competition with livestock  
Diseases transmission



 camera trap/WII



 camera trap/WII

### Website

<https://www.iucnredlist.org/species/15733/5074694>

<https://www.cms.int/en/document/international-single-species-action-plan-conservation-argali-ovis-ammon-0>

<https://argalinetnetwork.wordpress.com/about/>





**ASIATIC BLACK BEAR**  
*Ursusthibetanus* G.Cuvier

 Nikhil S Kahera

**Vernacular name:**

*Haput (Kashmiri),  
reech, kala bhalu  
(Hindi), .....*

**Taxonomy**

**Phylum:** *Chordata*

**Class:** *Mammalia*

**Order:** *Carnivora*

**Family:** *Ursidae*

**Genus:** *Ursus*

**Species:** *Ursusthibetanus*

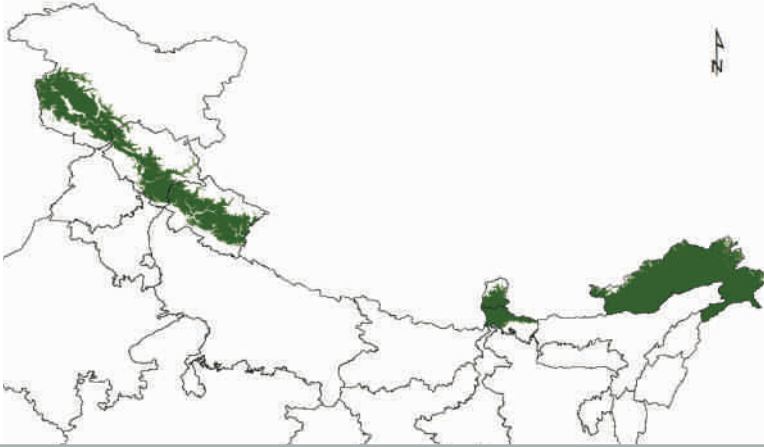
**Conservation status**

**IUCN:** *Vulnerable*

**IWPA:** *Schedule II  
part A/1*

**CITES:** *Appendix I*





## Distribution

Asiatic Black bear is a large bear that is found in the forested habitats of the Himalayan region and in the hills of northeast India. The altitudinal distribution range of black bear in the western Himalayas is from 1000m to tree line (ca. 3300m) and in the eastern Himalaya and north east hills from 70 m to tree line (ca. 4300m).

## Description

Asiatic black bear has black coat with a distinct crescent shaped white patch on the chest. They have bell shaped ear and larger and mobile lips and nose. It is lightly built when compared to brown bear and limbs were slender. Although a carnivore, the black bear feeds mostly on fruits, acorns, montane bamboo, grasses, herbs, insects and scavenge on dead wild ungulates. They also prey on domestic livestock. They are the most bipedal of all the bears but due to their semi arboreal nature they can climb a great extent with their strong forelimbs and upper body. Due to the synanthropic nature they often depend on shared food preferences of humans resulting in conflicts throughout their distribution range..

**Size** ▶ Body length: 130-190 mm | Weight: 60-200 kg (Male), 40-125 kg (Female)



## Vulnerability to climate change

The distribution range of Asiatic black bear marginally overlaps with that of the Himalayan brown bear in the higher elevations (>3000m) in the Western Himalaya and lower elevation with sloth bear in along the foothills of the Himalaya. As their major food includes oak acorns, , any changes in their production and availability due to climate variability may severely impact black bears and consequently their movements into human habitations in search of food. Due to erratic and poor winter precipitation, the hibernation period of black bear is reported to be reduced and consequently an increase in human - bear conflicts during early winter in the northwestern and western Himalaya.

## Monitoring protocol

Sign surveys and camera trapping are the two methods that could be used for effective in monitoring of black bears..

 Nikhil S Kahera



**Key threats**

Poaching for bear parts, retaliatory killings to reduce conflicts, and habitat degradation are the major threats for long term conservation of the species.

**Reproduction and life cycle**

*Gestation period:*  
6-8 months (200-240 days)

*litter size*  
1 to 4

*Weaning:*  
4-6 months

*Sexual Maturity:*  
after 4 years

*Life span:*  
up to 25 years in wild,  
maximum 44 years in captivity

**Website:**

<https://www.iucnredlist.org/species/22824/114252336>

<https://www.bearbiology.org/bear-species/asiatic-black-bear/>

<http://www.bearconservation.org.uk/asiatic-black-bear/>



 S. Sathyakumar

 Nikhil S Kahera





**HILL PARTRIDGE**  
*Arborophilatorqueola*  
*Valenciennes*

 Tawqir Bashir

**Vernacular/other names:**

*Peura, Ban teetar*(Hindi, Garhwali, Kumauni), *Roli, Ramchukra*(Himachali), *Duboi*(Assamese-Nowgong), *Dao bui*(Assamese-Cachar), *Kohumbut*(Sikkim-Lepcha), *Pao-er*(Arunachal-Mishmi), *Wogam, Gam toung*(Mainpuri-Kachin), *Inrui whip* (Naga)

**Conservation Status**

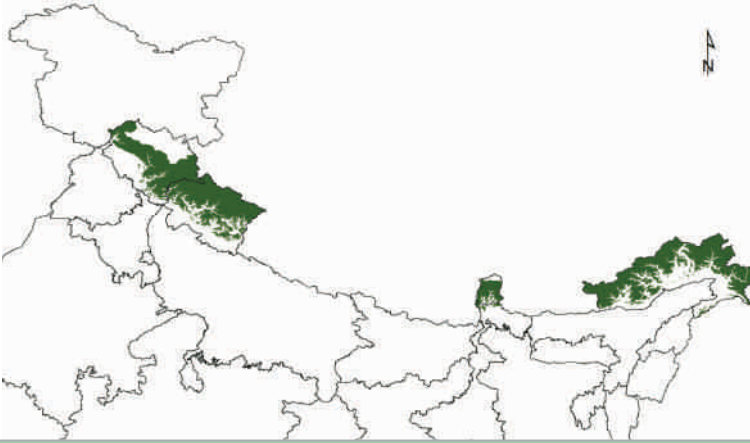
**IUCN:** *Least concern*

**IWPA:** *Schedule IV*

**CITES:** *Not listed*

**Size** ▶ *Body length: 28 cm* | *weight: 228-400 gm*





## Distribution & Habitat

Hill partridge is a fairly common pheasant of the Himalaya, distributed in the forested habitats (1830-3050m) from Himachal Pradesh in the west to Arunachal Pradesh in the east and northeast hills. Hill partridge inhabits ravines and slopes in the undergrowth of moist, dense oak and other evergreen broad-leaved forests.

## Description

Hill partridge is a stout, short-tailed olive-brown partridge. Males have rufous crown and nape, black eye-patch and eye-stripe, white neck sides streaked with black, and white half-collar separating throat from breast. Female is rufous-throated and could be distinguished by buff supercilium, absence of black border between rufous-orange fore neck and gray breast, blackish barring to olive-brown mantle, diffuse rufous-buff fringes to breast. Legs and feet are dark (red in other *Arborophila* partridges).

*Habitat: Ravines & slopes in undergrowth of moist dense forest of oak and other evergreen broadleaves.*

*Altitude: 400-4000 mm*



## Behaviour

Hill-partridges are more often heard than seen. They are usually in pairs but sometimes gregarious. They dig for food among litter and humus on the forest floor. When disturbed, usually moves away on foot; if flushed, flies strongly, following zigzag movement around the trees, and usually settles after less than 100 m. Roost in parties on trees. Its call is a single, mournful, drawn-out whistle, repeated 2 or 3 times, followed by 3 to 6 double whistles.

## Vulnerability to climate change

Little is known about their possible responses to the future climate. But in general, as a galliforme, the species might be vulnerable to climate change because of their low dispersal ability. As a result of climate change, they might move upwards in distribution leading to range shifts.

## Monitoring protocol

Camera trapping would be ideal for monitoring this species. Encounter rates (#/km walk) can help to generate relative abundance estimates and the numbers could be based on direct evidences (sightings) or indirect evidences such as calls.

 Tawqir Bashir



**Key threats**

*Habitat loss: Poaching for meat, habitat loss and habitat degradation are the major threats for this species..*

**Reproduction and life cycle**

*In India, hill partridges generally breed between April to June, although early breeding is common in at low altitudes. The average clutch size varies from 3 to 5 eggs, although as much as 9 eggs have also been recorded.*

*Call : whistle (see ENVIS galliformes issue and write the notes for call)*

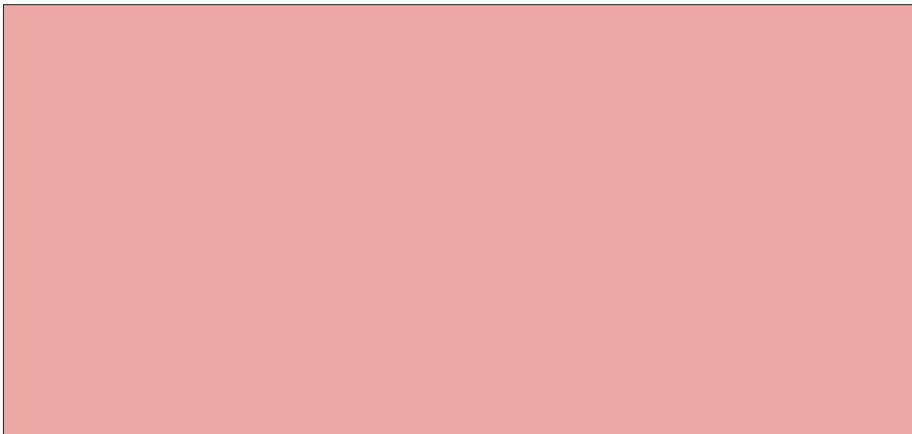
*Breeding season : April-July*

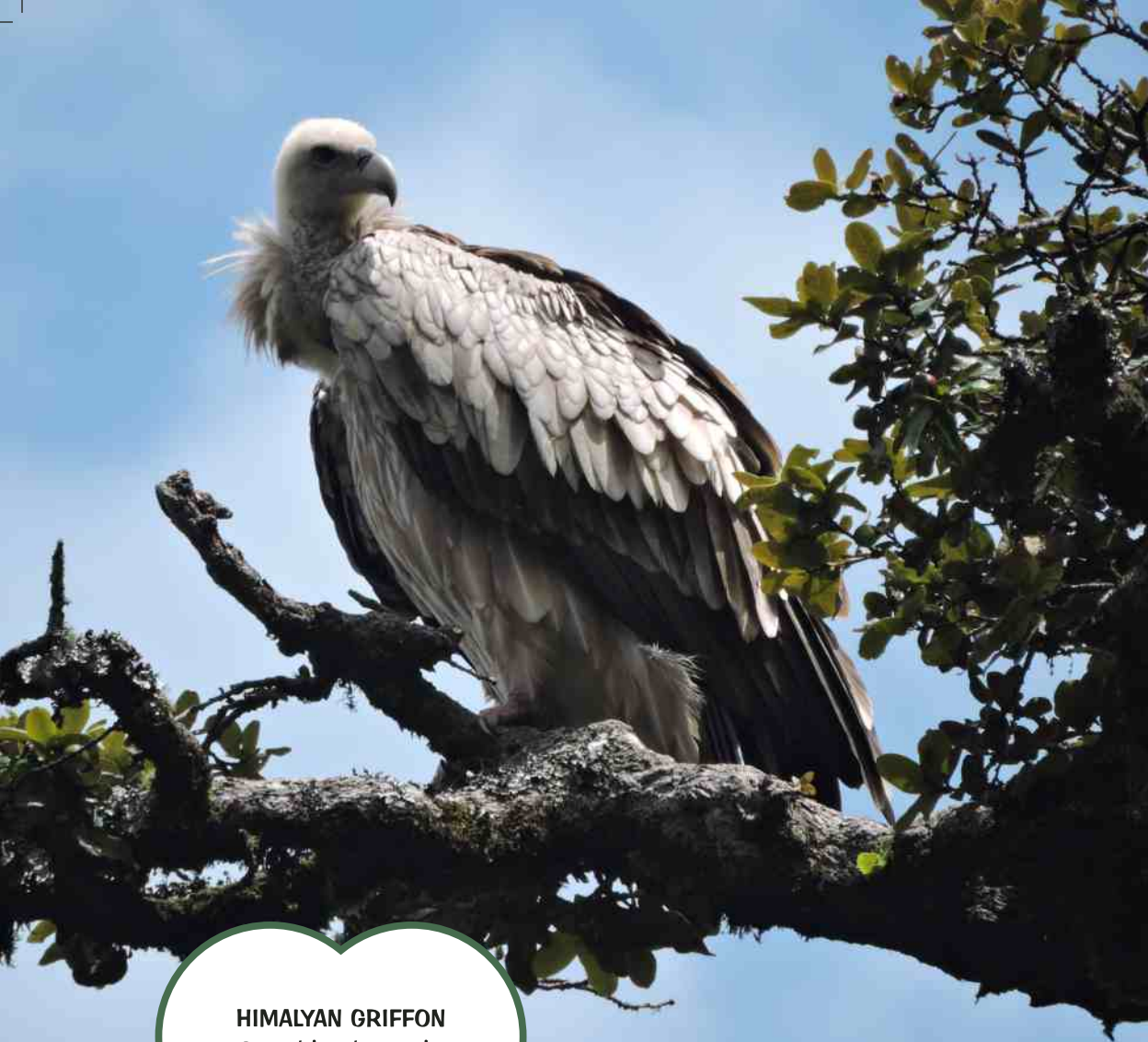
*Nest Site/ type : forest or scrub jungle*

*Clutch size : 3 to 5*

**Key field identification features:**

Distinct white collars in males. Females have blackish barring to olive-brown mantle. Dark legs and feet. Call is a single, mournful, drawn-out whistle, repeated 2 or 3 times, followed by 3 to 6 double whistles.





**HIMALYAN GRIFFON**  
*Gyps himalayensis*

 Nilanjan Chatterjee

**Vernacular/other names**

*Gidh, bada, gidh, sakun*  
(Hindi)

**Taxonomy**

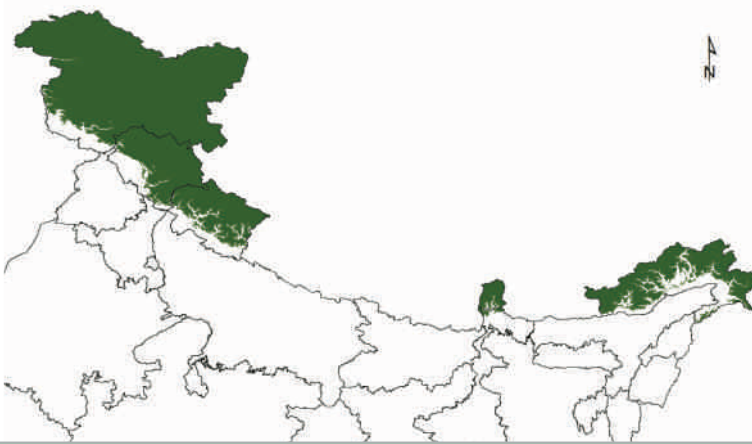
**Kingdom:** Animalia  
**Phylum:** Chordata  
**Class:** Aves  
**Order:** Accipitriformes  
**Family:** Accipitridae  
**Genus:** *Gyps*  
**Species:** *himalayensis*

**Conservation status**

**IUCN:** *Near threatened*  
**IWPA:** *Schedule I,*  
**CITIES:** //

**Size** ▶





## Distribution & Habitat

The species is well distributed all along central Asian uplands. In India they are found in the Indian Himalaya from Jammu and Kashmir in the west to Arunachal Pradesh in the east ranging from 600m to 6000 m and also found to be in plains in central India during winters. Breeds in high Mountains(upto 4500m) preferably rocky cliff of mountains with subtropical and temperate forests.

## Description

A huge and bulky vulture, bigger than others sparsely feathered ruff a short tail and very large wing span. Their upperparts usually vary between cream and blackish colour, juveniles are white to dark brown and a whitish head. Both sexes are alike. They have robust and stout bill and wingspan of 270-300 cm.

95-130 cm

Weight: up to 12 kg

Altitude range : 600-6000m

Habitat : Rocky cliffs, river valleys, high mountains.



## Behaviour

They are diurnal, nomadic and social, they prefer nesting usually solitary or sometimes also in small colonies of 4-5 breeding pairs. They are highly mobile foragers and generally stay away from human settlements. They spend long time in soaring high up in sky for the search of food and known to feed on carrion of large mammals.

## Vulnerability to climate change

As Himalayan griffon is typically a mountain species and already in less in population, alteration in the present habitat condition due to climate change may threaten the survival of the species.

## Monitoring protocol

Himalayan griffon vultures are found nesting on high rocky cliffs thus scanning these cliffs can generate relative abundance estimates.

 Nilanjan Chatterjee



### Key threats

- *Use of Diclofenac in Veterinary medicines is one of the threats to this species.*

### Reproduction and life cycle

*They are Monogamous and return to same nesting site every year and breeding season is Dec To March followed by longest hatching time which last for 6 to 7 months. female lay 1 egg per breeding season.*

*Breeding ;  
Dec to March*

*Nest site type:  
rocky high cliffs*

*Clutch size:  
1*

*Incubation period:  
5 to 7 months*

### Key Field Identification Features:

Large body size, large creamy white wings with dark grey or black colour on the ventral side, clearly visible when on flight, sparsely feathered ruff and long bill. They can be seen basking sometimes on mountains in groups.




### Important websites :

- <http://save-vultures.org/conservation/safe-zones/>
- <https://www.icbp.org/icbp-vulture-conservation/>
- <https://www.birdlife.org>





## *Amolops monticola*

 Naitik G.Patel

### Taxonomy

**Class:** Amphibia

**Order:** Anura

**Family:** Ranidae

**Genus:** *Amolops*

**Species:** *Monticola*

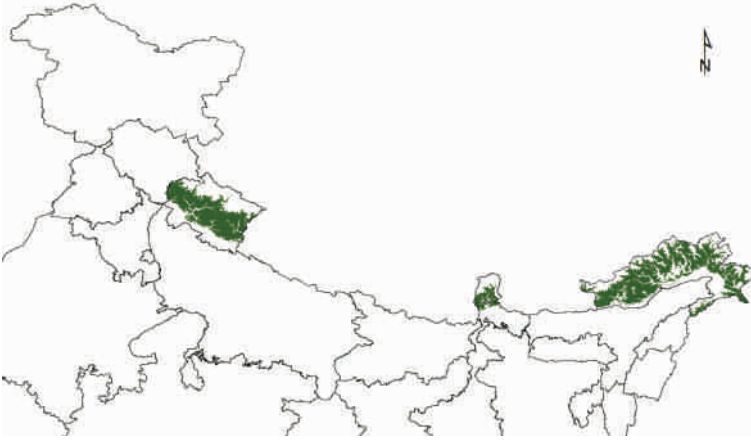
### Conservation status

**IUCN:** *Least concern*

**IWPA:** *not listed*

**CITES:** *not listed*





## Distribution & Habitat

*Amolops monticola* is a frog (Anuran) that is reported from mid-elevation (1000m to 2000m) areas of Himalaya (Uttarakhand, Darjeeling, Arunachal Pradesh and Nagaland), Nepal and southeastern Xizang province (Bomi, Medog, Cona and Chayu), China. The type locality of *Amolops monticola* is Darjeeling Himalaya. The species is known to inhabit fast flowing streams and known to occur on to the rocks and twigs around the torrent stream. The larvae of the species are unique, in having a gastrozymous sucker and are known to occur in rheophilous habitat clinging on to the rocks.

## Description

*A. monticola* differs in external adult morphology from other species in the genus by having the combination of smooth skin, the side of head dark with a light-colored upper lip stripe extending to the shoulder, and a dorsolateral fold. Fingers slender, First finger shorter than second. A new fieldwork and re-evaluations of existing specimens in natural history collections, suggests that species diversity in this group is now being realized. There are around 15 species that have been identified in *monticolagro* up and more species are likely to be discovered in this group.

Dorsal region gray or brown, A black stripe runs from the tip of snout to the anterior corner of the eye along the lower edge of canthus rostralis, and the stripe continues from the posterior corner of the eye along the dorsolateral fold to the pelvis, A white lip-stripe is present from the tip of the snout to the anterior joint of the shoulder on each side. Lateral surfaces of the body are gray with olive yellow, scattered with some darker mottling. Dorsal surfaces of the limbs are rufous, darker on the hind limbs with dark crossbars. Ventral is off-white in color.

**Size** ▶ Male: 41 mm, Female: 65mm



## Color in life

Dorsal body and tail are olive with reddish and transverse bands across the body and tail, Head is uniformly dark brown from dorsal side and yellow. A red brown stripe laterally in adult. Eye coloration from bright brown to reddish brown. Ventral side of the head body and tail are grayish white. In juvenile, the body coloration is uniformly light brown with transverse bands across the body and tail. Dorsal head with dark brown markings; A red brown stripe on the lateral side of the head.

## Behavior

*A. monticola* inhabits torrent streams at mid elevation and nocturnal in nature. They undergo winter sleep (November to February). Eggs are deposited on aquatic plants, and in stone crevices at the edge of streams. The species is known to be sympatric with *Nanoranaleibigii*, *Amolopshimalayanus*, *Amolopsmarmoratus*, and *Megophryssanu* and *Megophrysrobusta*.

## Vulnerability to climate change

Climate change known to affect body size, breeding cycle, gaseous exchange and geographical ranges of amphibian species. However, such information is grossly lacking from Indian context. Obligate stream frogs may be more vulnerable to climate change scenario.

## Monitoring protocol

Nocturnal visual encounter search, mark recapture may provide hitherto unknown population trend. Visual Implant elastomer tags can be used for population studies on tadpoles and froglet.

 Naitik G.Patel



### Key threats

- *Loss of habitat to urbanization*
- *The species is also threatened by dam construction, Collection for medicinal use*

### Reproduction and life cycle

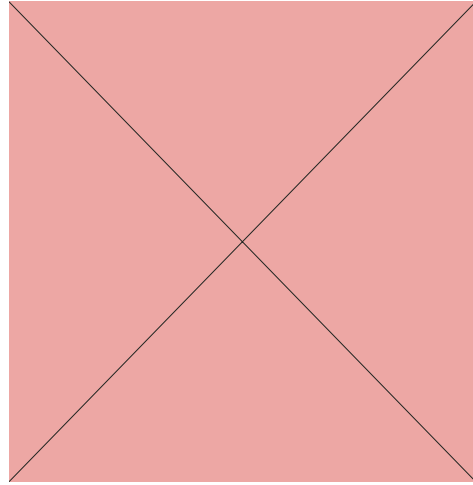
*Breeding takes place post monsoon (August to October) where the eggs are laid in clutches under the boulders near fast flowing torrent streams. The upper section of the clutch is above the waterline while the lower section of the clutch is either resting on the water surface or partially submerged.*

### Key identifying features

Smooth skin

Side of head dark with a light-colored upper lip stripe extending to the shoulder

A prominent dorsolateral fold



### Important web links for more information

<https://amphibiaweb.org/species/4657>

<https://www.iucnredlist.org/species/58222/11751822#>

<http://research.amnh.org/vz/herpetology/amphibia/Amphibia/Anura/Ranidae/Amolops/Amolops-monticola>

### Key references

Heyer, R., Donnelly, M.A., Foster, M. and McDiarmid, R. eds., 2014. Measuring and monitoring biological diversity: standard methods for amphibians. Smithsonian Institution.

Stuart, B. L., Bain, R. H., Phimmachak, S., & Spence, K. (2010). Phylogenetic systematics of the Amolopsmonticola group (Amphibia: Ranidae), with description of a new species from northwestern Laos. *Herpetologica*, 66(1), 52-66.

Yang, D.-t. 1991. Phylogenetic systematics of the Amolops group of ranid frogs of southeastern Asia and the Greater Sunda Islands. *Fieldiana. Zoology. New Series* 63: 1-42.





## Japalura kumaonensis

 Naitik G.Patel

### Vernacular/other names

*Kumaon Mountain  
Lizard, Kumaon forest  
agama*

### Taxonomy

**Class:** Reptilia  
**Order:** Squamata  
**Family:** Agamidae  
**Genus:** *Japalura*  
**Species:** *kumaonensis*

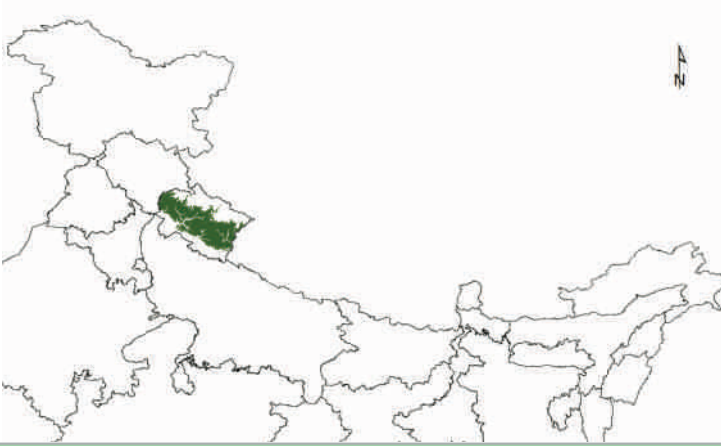
### Synonyms

*Acanthosaurakumaonensis* ANNANDALE  
1907: 152  
*Acanthosaura major* ANNANDALE 1914  
(not of JERDON; fide SMITH 1935)  
*Japalurakumaonensis* - SMITH 1935: 171;  
SWAN & LEVITON 1962; WERMUTH 1967:  
66; DAS 1996: 44; Wang et al. 2018  
*Oriotariskumaonensis* - KÄSTLE et al.  
2013: 425

### Conservation status

**IUCN:** *not assessed*  
**CAMP:** *not assessed*  
**IWPA:** *Not listed in  
any schedule*  
**CITES:** *not assessed*





## Distribution & Habitat

It has been reported from mid elevation from 1000m to 3000m of Himalaya from Nainital, Mussoorie and some parts of western most Nepal. *J. kumaonesis* inhabits the evergreen vegetation belt of rhododendron-coniferous forest, open grassy patches in the forest and roadside vegetation with exposed rocks.

## Description

A small sized agamid lizard with somewhat compressed body. Tail long, dorsum grayish brown with inverted V- shaped marks. Throat fold absent, forehead has a dark crossbar, The crest is not prominent and not much differentiated among male and females.

**Size** ▶ Body Length (Snout to vent length): 48.7 mm | Tail: 109.6 mm (male),



## Behavior


It prefers dark retreats. The low temperature requirements make long exposures to insolation unnecessary and allow a prolonged stay in retreats if the lizards are not hungry. Basking on a bare rock is reported, but largely thermoconformer which occasionally basks and shifts between sunny and rather cool places. Climbs well and run with moderate speed.

## Vulnerability to climate change

Lizards are ectothermic and depended on microclimatic factors for their physiological demands. Range shift is one of the impacts on *Japalura* population, but evolving risk of changes in plant community, invasive species and altered forest fire regime can affect the species adversely. The forest fire may increase threats to these animals affecting their refugia, reducing ground cover and expose animals to predation risk. *Japalura* have a narrow window for breeding as they inhabit in high altitudes. Unfavorable climate may affect the breeding behavior leading to reproductive failure.

## Monitoring protocol

Visual Encounter Search (VES) can be carried out for their relative abundance data. Species can be located by turning rocks or fallen timber on the ground or by using Pitfall traps and artificial retreats or Cover Objects. For Mark-recapture, paint pen marks can be used for short-term studies as paint washes away and lizards do shed their skin regularly. For long term monitoring, Toe clipping, Pit Tags are the reliable methods for permanent markings. Photo-identification can be further tested as a marking pattern.

 Naitik G.Patel

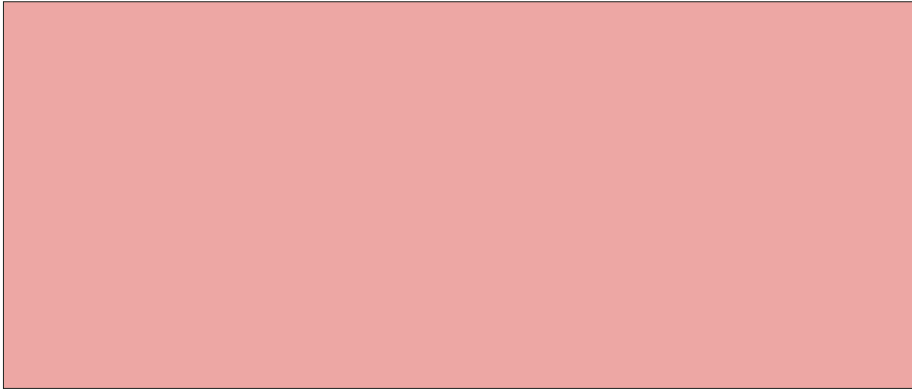


### Key threats

- *Collection for human consumption*
- *Introduction of exotic fish species*

### Key identifying features

Discontinuous dorsolateral ridges on the dorsum  
 Distinctively keeled head scales  
 Distinct Pale buff dorsolateral stripes,  
 Distinct Burnt Umber to Jet Black triangle patches,  
 and a Beige background coloration of head and body.  
 No transverse gular fold, the scales on the throat  
 being nearly as large as ventrals  
 Fourth toe as long as tibia  
 The hind limb reaches to the ear or the eye



### Important web links for more information

<http://reptile-database.reptarium.cz/species?genus=Japalura&species=kumaonensis>


### Key references

Ka?stle , W., Rai, K. &Schleich, H.H. 2013. FIELD GUIDE to Amphibians and Reptiles of Nepal. ARCO-Nepal e.V., 625 pp.  
 Smith,M.A. 1935. The fauna of British India, including Ceylon and Burma. Reptiles and Amphibia, Vol. II. Sauria. Taylor and Francis, London, 440 pp.  
 Wang, Kai; Ke Jiang, V. Deepak, Das Abhijit, Mian Hou, Jing Che, and Cameron D. Siler 2018. On the Occurrences of Japalura kumaonensis and Japalura tricarinata (Reptilia: Sauria: Draconinae) in China. Herpetologica 74 (2): 181-190.





*Vagra baril* (*Barilius vagra*)

 Vineet k Dubey

**Vernacular Names/Other Names**

*Vagra baril* (English Name)

*Gheur, Glar, Dudhnea, Dheeru, Korang* (Common Names)

**Taxonomy**

**Class:** Actinopterygii

**Order:** Cypriniformes

**Family:** Cyprinidae

**Genus:** *Barilius*

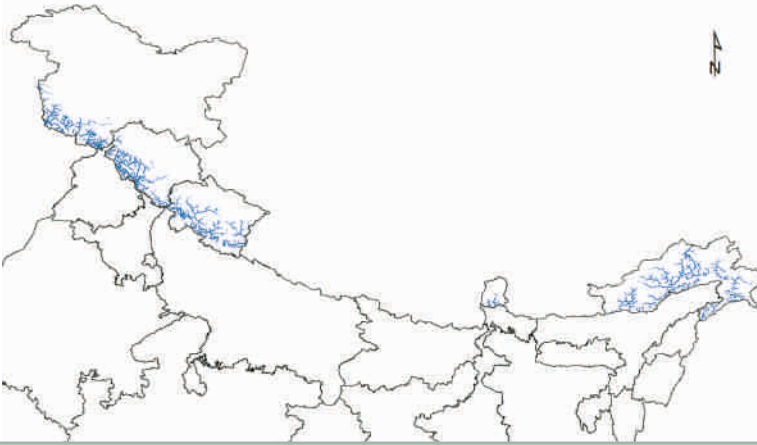
**Species:** *vagra*

**Conservation Status**

**IUCN:** *Least concern*

**CITES:** *Not listed*





## Habitat/Distribution

This fish live near the surface or in the water column, found in hill streams with cobbles and pebbles as a major substrate. It is an insectivore, preferring drifted macroinvertebrate nymphs and larvae and drifted terrestrial insects. Moderately cold, fast flowing streams and areas of shallow to moderate depths are the preferred habitats of this species. It is reported from Indus, Ganga and Brahmaputra drainages of Himalaya, showing a widespread distribution across, Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and Arunachal Pradesh.

## Description

It has an elongate body, which is moderately compressed and cylindrical attaining up to 15.6 cm in standard length. Eyes are relatively large and superior, visible when seen from the underside of head. Upper jaw is longer than the lower. Caudal fin is deeply forked. Body is pale yellowish with vertical bands above the lateral line, 10-14 in number. Scales minute, with lateral line scales from 33-44. Body depth 5.5-7.4 times the standard length.

**Size** ▶ *Maximum Length: 67mm*



## Vulnerability to climate change

The climate change impacts on the fishes of the Himalayan region are higher as its glaciers melt at a six-time higher pace than the rest of the world. In such changing environmental conditions, native species like the *Barilius vagra* are highly vulnerable. This owes to the co-evolution of the *B. vagra* with the gradually changing geo-morphology and hydrology patterns. But the paced up hydrological changes inflicted by the climate change would favor the invasive fishes to a greater degree due to their higher resilience. Climate change implications on the inland fishes would be enhanced due to the unpredictable dry and wet seasons apart from the unpredicted floods/droughts due to apparent glacial melts and changes in the surface water temperatures which would in turn affect the microhabitat of the species like *B. vagra*. A rise in the temperature might affect its distribution range and niche competition other benthopelagic fishes. Also, the temperature fluctuations might affect the viability of this fish in wild with respect to its critically maximum thermal tolerance level. Multiple environmental variables govern the viability of this species which modulates the thermal tolerance, oxygen consumption and respiratory burst activity along with its anti-oxidative potential in its native environment. Slightest modulations in these environmental factors afflicted by climate change can affect the species metabolism and distribution.

## Ecological and Socio-Economic Benefits of Monitoring

Monitoring of the wild fish fauna is of utmost importance to strengthen the database of known distributional records and habitat preferences. Involving the public-participation would enhance the knowledge on these wild species apart from generating interest amongst the common mass for the fish fauna of Himalaya. Studying fish biodiversity is important for monitoring the river health as well as formulating the future conservation policies. *B. vagra* is of less fishery importance and is rather more of an ornamental fish due to its banded body and attractive morphology. But it plays significant role in cleaning the water by removing contaminants such as dead and drifted insects. Thus, any effect of the climate change on this fish would in turn affect the locals as well as the ecosystem health. As this species prefers a low flow and depth, monitoring this fish species is of great ecological value as it would help monitoring the changes in the water flow and turbidity. Also monitoring this species is easy by local people due to its distinct morphology and unique characters.

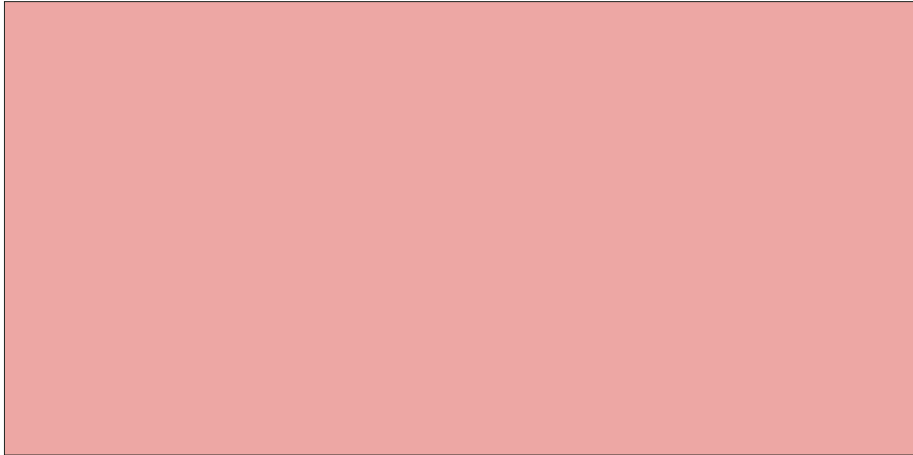


### Key threats

1. *Habitat destruction and un-sustained resource utilization through dredging and sand-mining*
2. *Destructive fishing methods*
3. *Point and non-point sources of pollution*

### Key Identification Features

1. Vertical bands restricted above the lateral line, 10-14 in number
2. Dorsal side of the body is grey in colour, flanks silver colour with dark bluish bands
3. Body depth 5.5-7.4 times the standard length



### References:

1. Vishwanath, W. 2010. *Barilius vagra*. The IUCN Red List of Threatened Species 2010: e.T166555A6235461. <http://dx.doi.org/10.2305/IUCN.UK.2010-4.RLTS.T166555A6235461.en>. Downloaded on 19.6.2019
2. Nautiyal, P. and Negi, R.S., 2004. Population structure, dietary resources utilization and reproductive strategies of sympatric *Barilius bendelisis* and *Barilius vagra* in lesser Himalayan mountain streams. *21th Century fish research*, pp.43-68.
3. <https://www.fishbase.de/summary/Barilius-vagra.html>
4. <https://indiabiodiversity.org/species/show/231761>
5. Talwar, P.K. and Jhingran, A.G., 1991. Inland fishes of India and adjacent countries (Vol. 2). CRC Press.
6. Jayaram, K.C., 2010. Freshwater fishes of the Indian region. Narendra Pub. House.



**DARK MAHSEER**  
*Naziritor chelynoides*

 Arvind Dwivedi

**Vernacular Names/Other Names**

*Dark Mahseer (English Name)*

*Dark Mahseer (Common Name)*

**Taxonomy**

**Class:** Actinopterygii

**Order:** Cypriniformes

**Family:** Cyprinidae

**Genus:** *Naziritor*

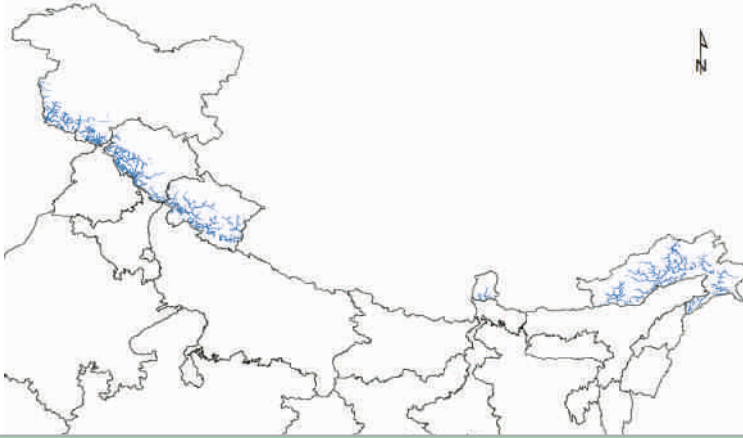
**Species:** *chelynoides*

**Conservation status**

**IUCN:** *Vulnerable*

**CITES:** *Not listed*





## Habitat/Distribution

This is a freshwater cyprinid, inhabiting fast to moderately flowing mountain streams. It prefers feeding on algae, diatoms or macroinvertebrates, thus an omnivore by diet. The percentage composition of food preferred changes seasonally coalescing with the phenology of the organisms constituting its diet. The Dark Mahseer prefers highly oxygenated streams with temperature preferences ranging from 10-26°C. It is distributed throughout the Himalayan states but mostly restricted to the headwaters of Ganga drainage till far east in Assam. They are sparsely distributed across the uplands and prefer foothills with an elevational range of 350-1300 masl.

## Description

The Dark Mahseer has elongated and moderately compressed body. Body scales are moderate in size and 32-37 scales present along the lateral line, which makes the species different from other mahseers. It is dark gray in colour, which is the etymology behind its name "Dark Mahseer". The scale count and color are the most distinctive identifying features on field. This fish has been reported to attain a maximum length of 30 cm. The mouth is terminal with a transverse cleft, mentum not developed and lips are covered with horny sheath to enable scraping of algae.

**Size** ▶ *Maximum Length: 400mm*



## Vulnerability to climate change

The Himalayan fishes are highly vulnerable to climate change due to hydrological alterations owing to a paced-up glacial retreat- six times higher than the glaciers worldwide. This would lead to unpredictable dry and wet seasons apart from the changes in surface water temperatures which would in turn affect the microhabitat of this species. In addition, various anthropogenic perturbations in the Himalayan streams caused by overexploitation of resources have led to wanton habitat destructions for this species. Climate induced alterations in suitable niches might mostly favor the invasive species in the Himalaya for which the native species would have to compete. Due to a narrow range of environmental preferences, the Dark Mahseer might not be able to migrate long distances in search of suitable habitat leading to their local extinctions. Also, multiple environmental variables like the dissolved oxygen, turbidity and temperature fluctuations might affect the viability of this fish in wild with respect to its critical threshold preferences, especially that of the temperature. Being a hill stream fish, the breeding phenology of Dark Mahseer is strongly linked to the monsoons and winters. Slightest of changes in these seasons would directly affect the breeding potential of this species, thus risking its future sustenance as the climate changes.

## Ecological and Socio-Economic Benefits of Monitoring

The Himalayan wild fish fauna is poorly studied in terms of the present distributional ranges. Monitoring this species would enhance the scientific database for better mitigation strategies for this fish in the future. This species is of less fishery importance in the Himalaya, owing to a sparse distribution, as such, its ecological information faces a deficit. As this species prefers a medium to fast flow and with a higher depth, monitoring this species is of great ecological value as it would help monitoring the changes in the water flow and turbidity. Also, the distinct morphology and unique characters identification features would help in easy identification of this species by the local people.

 Vineet k Dubey



### Key threats

1. Destructive fishing methods
2. Habitat destruction through dredging and over-exploitation of resources
3. Point and non-point sources of pollution

### Key Identification Features

1. Lateral line scales number from 32-37
2. Scales large, dark in coloration
3. Head width less than its height

### References:

1. Dahanukar, N. 2015. Naziritor chelynooides. The IUCN Red List of Threatened Species 2015: e.T166420A70080553. <http://dx.doi.org/10.2305/IUCN.UK.2015-1.RLTS.T166420A70080553.en>. Downloaded on 19 June 2019.
2. Shrestha, O.H. and Shreshta, J., 2008. Seasonal Food and Feeding Habits of Naziritor chelynooides (Mc Clelland) 1839 of Mardi Khola, Kaski, Nepal. *Journal of Natural History Museum*, 23, pp.98-107.
3. Joshi, K.D., 2007. Preliminary observations on rearing of the hill stream fish, *Naziritor chelynooides* (Mc Clelland) under pond environment. *Indian Journal of Fisheries*, 54(4), pp.423-425.
4. Pandey, N., Kumar, P., Ali, S., Vishwakarma, B.K. and Kumar, S., 2018. Role of small tributaries in ichthyofaunal diversity of rivers in Uttarakhand. *Coldwater Fisheries Society of India*, 1(1), pp.89-96.
5. Talwar, P.K. and Jhingran, A.G., 1991. *Inland fishes of India and adjacent countries* (Vol. 2). CRC Press.
6. Jayaram, K.C., 2010. *Freshwater fishes of the Indian region*. Narendra Pub. House.
7. Rajput, V., Johnson, J.A. and Uniyal, V.K., 2015. Evaluation of Fish Species as Potential Indicator Species for Long Term Monitoring: Askot landscape, Uttarakhand, Phase 1 Report, Wildlife Institute of India. pp. 42.
8. Husain, A., 2015. Fish Fauna of Asan River and Its Tributaries, Western Doon Valley, Dehradun (Uttarakhand), with Conservation Status of Species and Threats. In *Aquatic Ecosystem: Biodiversity, Ecology and Conservation* Springer, New Delhi. pp. 231-269.

