NATIONAL MISSION FOR SUSTAINING THE HIMALAYAN ECOSYSTEM (NMSHE)

WILDLIFE WATCH

IN THE INDIAN HIMALAYAN REGION

2016-2017

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

SERIES III

WILDLIFE WATCH

IN THE INDIAN HIMALAYAN REGION

Citation

Sathyakumar, S., Mathur, V.B. (eds) 2017. Wildlife Watch – Series III. 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 are prepared by A. Arun Kumar and Sujata Upgupta.

SPECIES WISE CITATIONS

Mammals

Pal, R., Thakur, S., Arya, S., Bhattacharya, T., Sathyakumar, S.2017. Kashmir Markhor, *Capra falconeri*. *pp.* 1 In: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series III. A user guide for monitoring wildlife species in the Indian Himalayan Region. Wildlife Institute of India, Dehradun, 62 p.

Pal, R., Thakur, S., Arya, S., Bhattacharya, T., Sathyakumar, S.2017. Takin, *Budorcas taxicolor*. *pp.* 5 In: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series III. 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., Sathyakumar, S. 2017. Snow Patridge, *Lerwa lerwa*. *Pp* 9 In: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series III. 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., Sathyakumar, S. 2017. Black francolin, *Francolinus francolinus*. *Pp* 13 In: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series III. A user guide for monitoring wildlife species in the Indian Himalayan Region. Wildlife Institute of India, Dehradun, 62 p.

Herpetofauna

Patel, N., Das, A. 2017. Himalayan Pit Viper, *Gloydius himalayanus*. *Pp* 17 In: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series III. A user guide for monitoring wildlife species in the Indian Himalayan Region. Wildlife Institute of India, Dehradun, 62 p.

Patel, N., Das, A. 2017. Himalayan Rock Skink, *Asymblepharus himalayanus*. *Pp* 21 In: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series III. 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. 2017. Indian Hill Trout, *Barilius bendelisis*. *Pp* 25 In: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series III. 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 III

S. Sathyakumar
& V.B. Mathur
Editors

Sharma, A., Dubey, V. K., Johnson, J.A., Sivakumar, K. 2017. Spiny Eel, *Mastacembelus armatus*. *Pp* 29 In: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series III. A user guide for monitoring wildlife species in the Indian Himalayan Region. Wildlife Institute of India, Dehradun, 62 p.

Insects

Bhardwaj, M., Das, S., Uniyal, V.P. 2017. Atlas Moth, *Attacus atlas*. *Pp* 33 In: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series III. A user guide for monitoring wildlife species in the Indian Himalayan Region. Wildlife Institute of India, Dehradun, 62 p.

Bhardwaj, M., Kashyap, P., Uniyal, V.P. 2017. Common Blue Apollo, *Parnassius hardwickei*. *Pp* 37 In: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series III. A user guide for monitoring wildlife species in the Indian Himalayan Region. Wildlife Institute of India, Dehradun, 62 p.

Flora

Rai, I.D., Bhattacharya, P., Talukdar, G. Rawat, G.S. 2017. Sacred Saussurea, *Saussurea obvallata*. *Pp* 41 In: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series III. A user guide for monitoring wildlife species in the Indian Himalayan Region. Wildlife Institute of India, Dehradun, 62 p.

Rai, I.D., Bhattacharya, P., Talukdar, G. Rawat, G.S. 2017. Gerard Joinfir, *Ephedra gerardiana*. *Pp* 45 In: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series III. A user guide for monitoring wildlife species in the Indian Himalayan Region. Wildlife Institute of India, Dehradun, 62 p.

Rai, I.D., Bhattacharya, P., Talukdar, G. Rawat, G.S. 2017., Himalayan marsh orchid, *Dactylorhiza hatagirea*. *Pp* 49 In: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series III. 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 interactions, 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 Ecoystem, (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 second 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 III; 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 two years with every 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. Mr. Intisar Suhail, Mr. Dhritiman Mukherjee, Dr. Anwaruddin Choudhury and Dr. G.S. Bhardwaj are also thanked for providing pictures for use in this publication.

Editors

Mammal

1
Markhor

5
Takin

Bird

9
Snow Partridge

13
Black_Francolin

Herpetofauna

17
Himalayan Pit Viper

21
Himalayan Rock Skink

CONTENTS

Fish

25
Indian Hill Trout

29
Spiny Eel

Insects

33
Atlas Moth

37
Common Blue Apollo

Flora

41
Sacred Saussurea

45
Spotted Heart Orchid

49
Gerard Jointfir

MARKHOR
Capra falconeri falconeri

Vernacular/other names

flare horned markhor, Astor markhor, PirPanjal markhor, Kashmir markhor

Taxonomy

Order: *Cetartiodactyla*

Family: *Bovidae*

Genus: *Capra*

Species: *falconeri*

Sub-species: *falconeri*

Conservation status

IUCN: *Near threatened*

IWPA: *Schedule I*

Size ▸ *Head to body length:* ***132-186 cm***

Distribution:

Markhor prefers most steep and precipitous mountain terrain. They are found in areas with open woodland and scrubland such as pine forest, fir forest, birch and juniper patches in the vicinity of rocky cliffs and steep slopes.

Kashmir markhor is mainly found in Pakistan, PoK, Afganistan and the state of Jammu and Kashmir in India. Historically, in India it was distributed more or less continuously from Banihal pass in the PirPanjal range to Shamshabari range north of the river Jhelum. Current distribution is restricted to three discrete populations in Kazinag (Limbar, Lachipora and Naganari), PirPanjal (Hirpora and Poonch) and Boniyar- Gulmarg, Jammu & Kashmir.

Description

Markhor is the biggest of all the wild goat species. Males weigh 80- 110 kg, and females 32- 40 kg. It has long fur, a dark brown beard and has spiraling corkscrew horns. Females are half the size of an adult male and have a smaller beard and smaller horn with single outward twist. Males have reddish grey fur and lower legs are white with a dark patch below the knees. They have a short (8 to 14 cm) bushy tail which is naked on the underside.

Shoulder height: ***65-115 cm***	*Weight:* ***80-110 kg (male); 32-40 kg (female)***	*Horn Length:* ***160 cm (Male), 24 cm (Female)***

Vulnerability to climate change

The distribution range of markhor is restricted to a small portion of the North-Western Himalaya which is continuous to the neighboring country of Pakistan. In Pakistan, unusual death of Markhor yearlings from diseases related to climate change has been reported from Chitral Wildlife Sanctuary (see web link below).

Monitoring protocol

Scanning from vantage points and camera trapping are the most suitable methods for monitoring Markhor groups in the steep terrain. Occupancy surveys using pellet groups and other signs as presence indicators were also carried out in the markhor habitats.

Key threats

- *Trophy hunting*

Reproduction and life cycle

Gestation period:
155 days

Rutting:
November- December

Young per birth:
1- 2

Sexual maturity:
18- 30 months

Life span:
12- 13 years

Key field identification features

- The Astor markhor has horns with the widest flare or outward twist.

Important web links

http://www.iucnredlist.org/details/3787/0
https://pamirtimes.wordpress.com/2011/04/14/wildlife-official-sees-climate-change-behind-the-death-of-7-markhors-in-chitral/

TAKIN
Budorcas taxicolor

Vernacular/other names

Takin (Adi), Takang (Idu Mishmi), Sebing (Nyshi), Kemya (Monpa)

Taxonomy

Order: *Cetartiodactyla*

Family: *Bovidae*

Sub Family: *Caprinae*

Genus: *Budorcas*

Species: *Taxicolor*

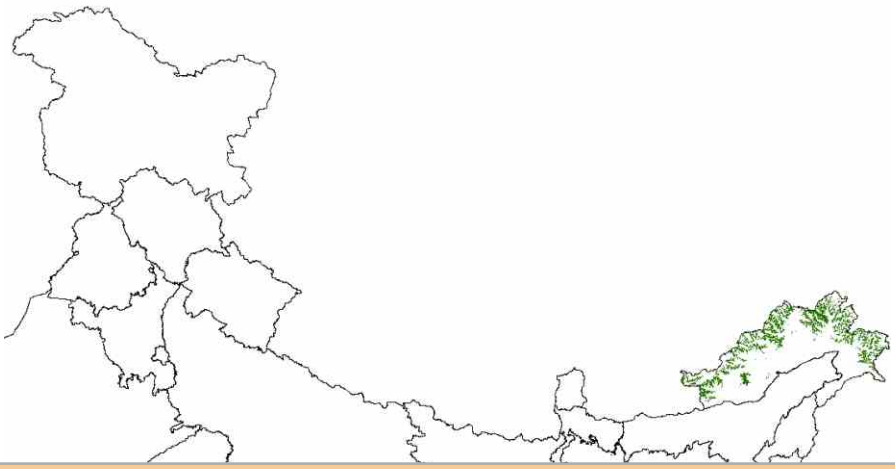
Conservation status

IUCN: *Vulnerable*

IWPA: *Schedule I*

CITES: *Appendix-I*

Size ▸ *Head to body length:* ***170-237 cm***



Distribution

Northern and North Eastern Arunachal Pradesh and once reported from Kyongnosla alpine and Pangolakha wildlife sanctuary of Sikkim. The animal found mostly in tropical forest, dense bamboo and rhododendron forest. The animal is distributed in the eastern Himalaya pine shrub, subtropical forest and possibly temperate forests in Tibet and China. Mainly between 2,000 and 3500 m. Altitudinal migration has also been reported with variation in seasons (1000 to 4000),however the species occurs in scattered population throughout the forested and unforested mountain slopes along Indo –Bhutan border

Description

Takin is a bulky animal with Dark face and thick neck. The animals are taller at the shoulder than the rear end. A dark dorsal stripe runs from the head to short bushy tail. Body color ranges from dark brown to golden yellow. The horns are short cones curving up and the tip of the horns always pointed outwards. The females are smaller with smaller horns and pale body color. Body length varies from 170-237cm with shoulder height up to 110 cm.

Shoulder height: ***110 cm***	*Weight:* ***150-400 kg***	*Horn length:* ***upto 64 cm***

Vulnerability to climate change

As no corroborated information is not available regarding impact of climate change on takin, their response to the warming and the change in habitat is yet to be known. However, marked changes in the habitat of takin, particularly the upward shift of Rhododendron forests in Arunachal Pradesh has been reported. These habitat alterations may pose threat to the survival of this habitat specific animal.

Monitoring protocol

Monitoring takin in the intricate landscape of Eastern Himalaya is challenging as the conventional monitoring of transect walk or scanning from vantage points may not be appropriate. The most feasible option is sign survey followed by camera trapping. Presence of pellet groups indicate takin presence and analysis of the DNA material obtained from the fresh pellets can lead to population estimation. Radio collaring may also indicate about the habitat use and ranging pattern of takin.

Key threats

- *hunting and habitat loss*

Reproduction and life cycle

Gestation period:
8 months

Rutting:
July-August

Young per birth:
one

Weaning:
18 months

Sexual maturity:
2.5

Life span:
15-20 years, 19 years and 7 months in captivity

Key field identification features

- Bulky body with dark face and dorsal stripe

Important web links

http://www.iucnredlist.org/details/3160/0

SNOW PARTRIDGE
Lerwa lerwa

Vernacular/other names

Quir or Kurmonal (Garhwali), Janguria (Kumauni), Barf katitar (Himachali-Kullu), Biju (Himachali-Chamba), Lerwa (bhotia)

Taxonomy

Kingdom: *Animalia*
Phylum: *Chordata*
Class: *Aves*
Order: *Galliformes*
Family: *Phasianidae*
Subfamily: *Perdicinae*
Genus: *Lerwa*
Species: *Lerwa*

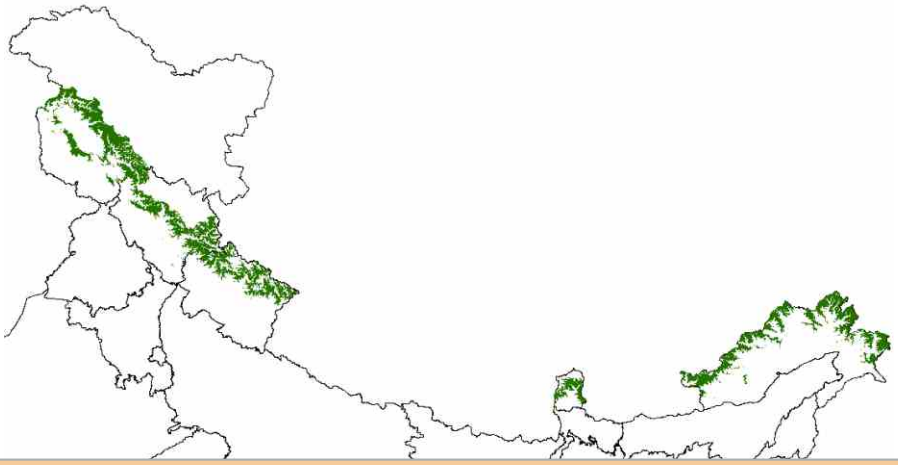
Conservation status

IUCN: *Least Concern (although population trend is decreasing)*

IWPA: *Schedule IV*

CITES: *not listed*

Size *Body length:* ***38 cm***



Distribution & Habitat

This species is found along the high ranges of Himalayas from Pakistan to Arunachal Pradesh (Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and Arunachal Pradesh) ranges between 4,000 and 5,000m and down to 3,050 m with variation in seasons, but never lower to 2,500 m. Inhabits in alpine pastures and open grassy hillside above the treeline, on steep rocky or grassy slopes interspersed with scattered dwarf Juniper or Rhododendron bushes, lichens, mosses and fern, but never in stony or bare ground like Himalayan snowcock.

Description

A densely-barred partridge with bright red legs and bill. The upperparts are closely barred black and white, the underparts are largely deep chestnut, broadly streaked with whitish on abdomen and flanks, streaked with black and white tipped while under tail coverts are chestnut. While in flight, shows a narrow white trailing edge to the wings. Both the sexes are alike but males have a spur on their tarsus while female lacks spur, chicks of snow partridge resembles with chicks of blood pheasants. The breeding season is May to July and the clutch size is usually 3 to 5 eggs.

Weight: ***454-709 g***	*Altitude range:* ***3,000-5,500 m***	*Habitat :* ***steep rocky/grassy slopes with juniper or rhododendron scrub near snowline***

Behaviour

During spring, it usually found in pairs and later in family groups of up to 30 birds. It is very tame in areas where not hunted, standing on rock to watch the observer, rather than flying away. When flushed, the flock disperses, first raising up silently for a metre or two then plunging quickly downhill scattering without calling, but with a great whirring and clattering of wings.

Vulnerability to climate change

As snow partridge is a typical alpine species, alteration in the present habitat conditions due to climate change may threaten the survival of the species in the altered, warmer condition.

Monitoring protocol

Snow partridge groups can be found in rocky areas above the alpine meadows, thus trail walks through the alpine meadows and rocky habitats can help to generate relative abundance estimates such as encounter rates (#/km walk). Camera trapping in the alpine areas may also help to generate indices such as photo-capture rates (#/100 trap nights).

Key threats

- *Higher levels of disturbance, grazing in high altitude alpine areas.*
- *Many populations lie outside the protected area network and hence are vulnerable to illegal trapping and hunting*

Reproduction and life cycle

Call : ***harsh frequently repeated whistle***

Breeding:
May-July

Nest site/type:
well hidden under rock or grass clump

Clutch size:
3 to 5

Incubation Period:
unknown

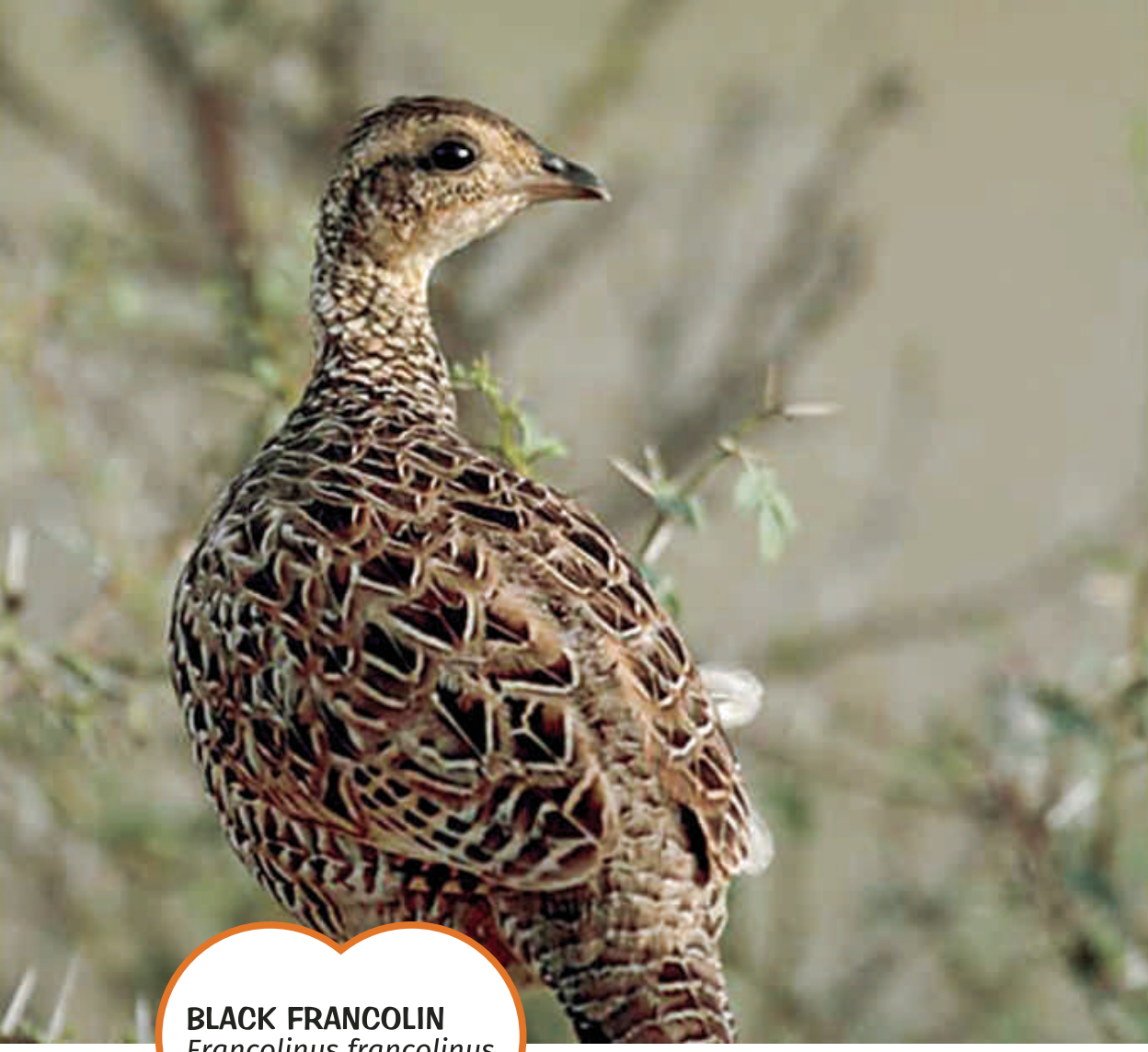
Key field identification features

- Barred body with red beak and legs. Male and females look similar, but males have a spur on thier tarsus.

Important web links

http://datazone.birdlife.org/species/factsheet/snow-partridge

http://www.xeno-canto.org/species/lerwa-lerwa



BLACK FRANCOLIN
Francolinus francolinus

Vernacular/other names

Kala teetar (Hindi)

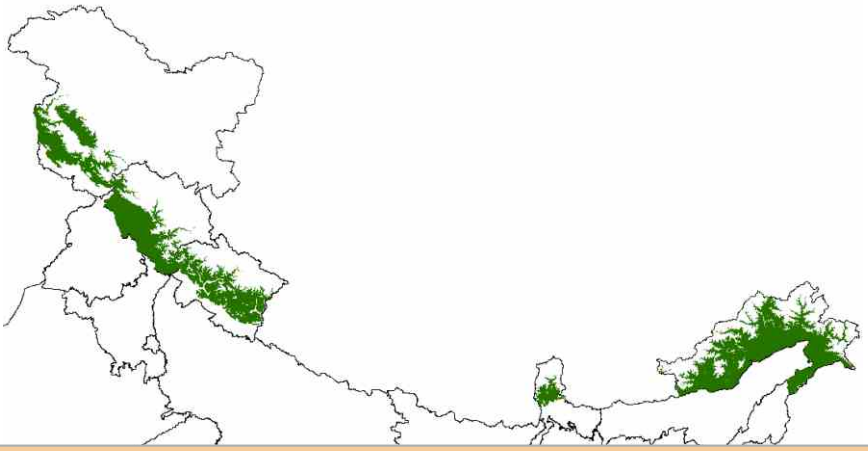
Taxonomy

Kingdom: *Animalia*
Phylum: *Chordata*
Class: *Aves*
Order: *Galliformes*
Family: *Phasianidae*
Subfamily: *Perdicinae*
Genus: *Francolinus*
Species: *Francolinus Linnaeus 1766*

Conservation status

IUCN: *Least concern*
IWPA: *Schedule IV*
CITES: *not listed*

Size ▸ *Body length:* ***34 cm***



Distribution & Habitat

Resident and common in the lower Himalayas (Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim & Arunachal Pradesh) up to 2,100m, plains of northwest, east and northeast India. The species inhabits in cultivated areas, tea estates, tall grass and scrub, especially near rivers and canals, as it requires good ground cover and water.

Description

A plump, stub-tailed galliformes where the male is unmistakable with white ear-covert patch on otherwise black face, rufous collar, black upper mantle spotted with white, and black underparts with flanks boldly spotted with white. The female is paler and browner, with no white cheek patches or chestnut collar, only a dull chestnut patch on nape. Below, chin and throat are buffy white; rest of the underparts and flanks are heavily barred with black. Vent and under tail-coverts are chestnut.

Weight: ***227-566 g***	*Altitude range:* ***upto 2,500 m***	*Habitat :* ***Clutivated areas, tall grass and scrub, especially near rivers and canals, tea gardens***

Behaviour

Found solitary, in pairs or in groups of up to 5 birds. It roosts in thick ground cover such as tall grass clumps or sugarcane fields and leaves for more open crops and grassland for feeding. It is active in early morning and late afternoon, returning into cover during mid-day. When disturbed, escapes by running away swiftly, but otherwise flushes easily, flying off strongly and at great speed. During the breeding season, calls at any time of the day often from a tree or stump. Call is loud, penetrating and a curious blend of the harsh and the musical and has a peculiar far reaching ventriloquistic quality. The call is repeated at intervals of 15 seconds or so, several birds answering one another from all directions.

Vulnerability to climate change

Black francolin is very common in low to mid elevation agriculture and forest interspersed landscapes. The temperature in the higher areas of the mountains are soaring as an impact of climate change and the agricultural fields are being curved out from the forest patches of mid to high elevation areas. As a result this species may move upwards in distribution.

Monitoring protocol

Black francolin can be monitored by using the call count technique as the male can be very easily detected through the call and the number of other answering males can also be determined. Camera trapping in the agricultural areas may also help to generate indices such as photo-capture rates (#/100 trap nights).

Key threats

- *Hunting and loss of habitat due to removal of plantations along the agricultural fields.*

Reproduction and life cycle

Call:
kar- kar, kee, ke-kee

Breeding Season:
March-October

Nest Site/ Type:
Among grasses, dense scrub or agriculture fields

Clutch Size:
6 to 9

Incubation Period:
18-19 days

Key field identification features

- Unmistakable bright colour, bright red orbital patch, crimson splashes on breast, tail-coverts and in tail

Important web links

www.birdlife.org/datazone/species/factsheet/22679144
http://www.xeno-canto.org/species/Ithaginis-cruentus

HIMALAYAN PIT VIPER

Gloydius himalayanus

Vernacular/other names

Pohur(Kashmiri);Harfa afi (Urdu)

Common English Name: Himalayan Pit Viper

Synonyms

Halys himalayanus GÜNTHER 1864: 303
Ancistrodon himalayanus BOULENGER 1896
Ancistrodon himalayanus – SMITH 1943: 495
Agkistrodon himalayanus – WELCH 1994: 11
Gloydius himalayanus – MCDIARMID, CAMPBELL & TOURÉ 1999: 305
Gloydius himalayanus – GUMPRECHT et al. 2004
Agkistrodon himalayanus – SHARMA 2004
Agkistrodon himalayanus – MURTHY 2010
Gloydius himalayanus – WALLACH et al. 2014: 310

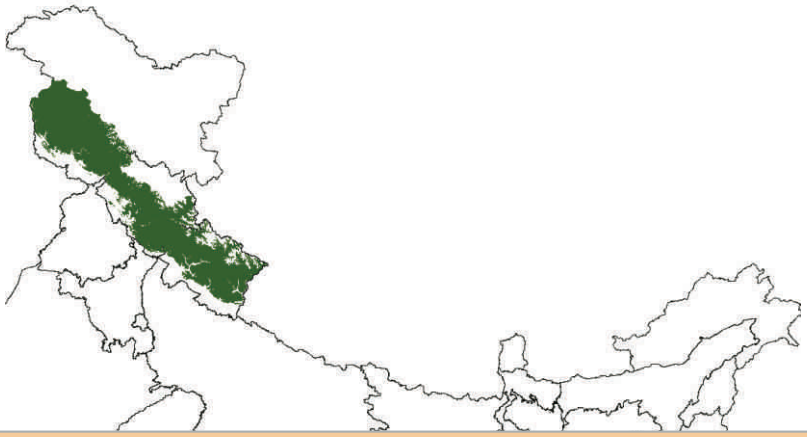
Taxonomy

Class: *Reptilia*
Order: *Squamata*
Suborder: *Serpentes*
Family: *Viperidae*
Genus: *Gloydius*
Species: *Himalayanus (GÜNTHER, 1864)*

Conservation status

IUCN: *Not evaluated*
IWPA : *Schedule-IV*
CITES: *Not listed*

Size ▸ 860mm



Distribution & Habitat

Himalayan Pit Viper is distributed from Northern Pakistan, Nepal, China, possibly Afghanistan and India (Jammu and Kashmir, Himachal Pradesh and Uttarakhand). This species is commonly found between 1500 to 4876m from Dharmsala Glacier in Himachal Pradesh. Himalayan Pit Viper is high altitude specialist species. It prefers dry coniferous forest. It also inhabits alpine grassland with dispersed bush vegetation and near the riparian vegetation. Sometimes in walls and boundaries of the cultivated area. This viper hideout under boulders, fallen wooden logs and leaves and in crevices in the walls of the agricultural fields.

Description

Body moderate, Head triangular with large shields. A greyish-brown snake with broad bands down the length of its upper body. Deep sensory pits between eye and nostril. Total length ranges from 420 to 600 mm. Venom of this snake is hemotoxic in nature but bite is not fatal to man. Dorsum brown, with darker patterns, typically with 23-45 cross-bars demarcated by their darker edges; Sometimes indistinct; the spots sometimes confluent to form a festoon on each side of the vertebral line; the inter-space between the cross-bars sometimes whitish; a dark temporal stripe from the eye to the angle of the mouth, some-times extending on the neck; upper lip light brown with dark spots; brown below, uniform or speckled with black and white.

Maximum Length: 860mm

Behavior

The snake basks in open areas with nearby vegetation and rocks, and in sunny places on grassy mountainsides. It feeds primarily on mice and skinks and other small sized pray. In disposition, it is quiet and timid, not attempting to bite when handled. The snake is viviparous and give birth to 5 to 7 young at a time.

Reproduction and Life cycle

Mode of reproduction: Ovoviviparous

Mating season: Probably April to May

Clutch size: 5 to 7

Vulnerability to climate change

Climate change can influence range shift and change in activity pattern in snakes. If the warmer habitat becomes drier then it will lead to decrease the snake activity and behavioral changes related to dehydration and impacts on prey population. Upslope movement of the lowland species could affect the species response due to climate change. Climate related change in human land use pattern may lead to conflict situation and increase persecution of this species.

Monitoring protocol

Opportunistic observation, (Visual encounter search, rescue, dead snakes, museum and published literature records) can help gather presence record and grid based distribution of the species. Any effort to record this species should be done when the snake is most active.

Key threats

- *Rampant Killing by people*
- *Habitat destruction*
- *Forest Fire*

Key identifying features

- Large shields on the top of the head
- Loreal pit present
- Scales strongly keeled

Important web links for more information

http://reptile-database.reptarium.cz/species?genus=Gloydius&species=himalayanus

Key reference

Smith, M. A., & Smith, M. A. (1976). Fauna of British India Reptilia and Amphibia. Today and Tomorrows Printers and Publishers.

Gloyd, H. K., & Conant, R. (1990). Snakes of the Agkistrodon complex: a monographic review. St. Louis, MO.: Society for the Study of Amphibians and Reptiles.

HIMALAYAN ROCK SKINK

Asymblepharus himalayanus

Vernacular/other names

Jalad(Kinnauri);
Barfani
baahmani(Urdu);
Lemchhi (Gharwali)

Himalayan Rock Skink

Synonyms:

Eumeces himalayanus GÜNTHER 1864: 86
Euprepes blythi STEINDACHNER 1869
Mocoa himalayanus - STOLICZKA 1872
Mocoa himalayana – BLANFORD 1875: 19
Lygosoma himalayana - BOULENGER 1887
Leiolopisma himalayanum - SCHMIDT 1926
Leiolopisma himalayanum – SMITH 1935
Scincella himalayanum – MINTON 1966
Scincella himalayana – GREER 1974: 7
Scincella ladacensis himalayana – NANHOE & OUBOTER 1987
Asymblepharus himalayanus – EREMCHENKO et al. 1998
Scincella himalayana – KHAN 2002 (pers. comm.)
Scincella himalayana – SHEA & GREER 2002: 156
Asymblepharus (Asymblepharus) himalayanus – EREMCHENKO 2003
Asymblepharus himalayanus – SINDACO & JEREM ENKO 2008
Scincella himalayanus – MURTHY 2010

Taxonomy

Class: *Reptilia*

Order: *Squamata*

Suborder: *Lacertilia*

Family: *Scincidae*

Genus: *Asymblepharus*

Subgenus: *Himalblepharus*

Species: *himalayanus*

(GÜNTHER, 1864)

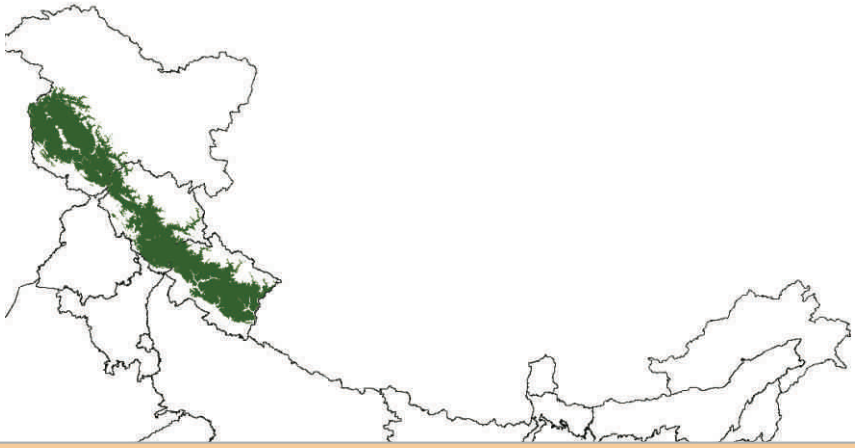
Conservation status

IUCN: *Not evaluated*

IWPA : *Not listed*

CITES: *Not listed*

Size



Distribution & Habitat

India (Kashmir, Himachal Pradesh, Uttrakhand). Pakistan, Nepal and southern Turkistan. The species prefers damp areas or open grass lands between 600 to 4000 meters. This species also found in lake sides, banks of rivers and gardens. They are insectivorous and viviparous (produces 3 or 4 young at a time).

Description

This is small to medium sized skink. Lower eyelid is with transparent disk. Snout is bluntly pointed. Ear-opening is oval in shape and as large as the eye opening. Distance between the end of the snout and the fore-limb contained one and a half to one and three-quarter times in the distance between axilla and groin. body scales are smooth. Color somewhat variable. It is a bronze or brownish olive colored skink, with small dark brown or black spots. Sometime numerous small golden spots are present on the dorsal region often with a dark dorsolateral stripe along its upper flank. A light dorsolateral stripe present or absent along dorsolateral stripe. The lower half of the flank is pale white or orange along the upper part of the neck and flank a dark stripe, often edged below by a white stripe. Ventral region is grayish below.

Total Length: ***155 to 160 mm*** | *Body Length (Snout to vent length):* ***65 mm*** | *Tail Length:* ***93 mm***

Behavior:

Males develop a lateral stripe of orange or red along the body below the dark brown lateral stripe. This These skinks are ovoviviparous in nature producing up to 3 to 4 young at a time. Annandale observed female containing eggs in the in the month of May.

Vulnerability to climate change

Skinks are ectothermic and depended on microclimatic factors for their physiological demands. Range shift is one of the impacts on skink population, but evolving risk of changes in forest fire regime, altered plant community, and invasive species can affect the species adversely. The forest fire may increase threats to this animal affecting their refugia, reducing ground cover and expose animals to predation risk. High altitude skinks have a very narrow time window for breeding. Unfavorable climate may affects the breeding behavior leading to reproductive failure.

Monitoring protocol

Visual Encounter Survey (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 (ARs/ACOs). 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 method for permeant marking. Photo-identification can be further tested as a marking pattern.

Key threats

- *Forest fire*
- *Changes in the land use pattern*
- *Introduced predator like cats and domestic chickens*

Key identifying features

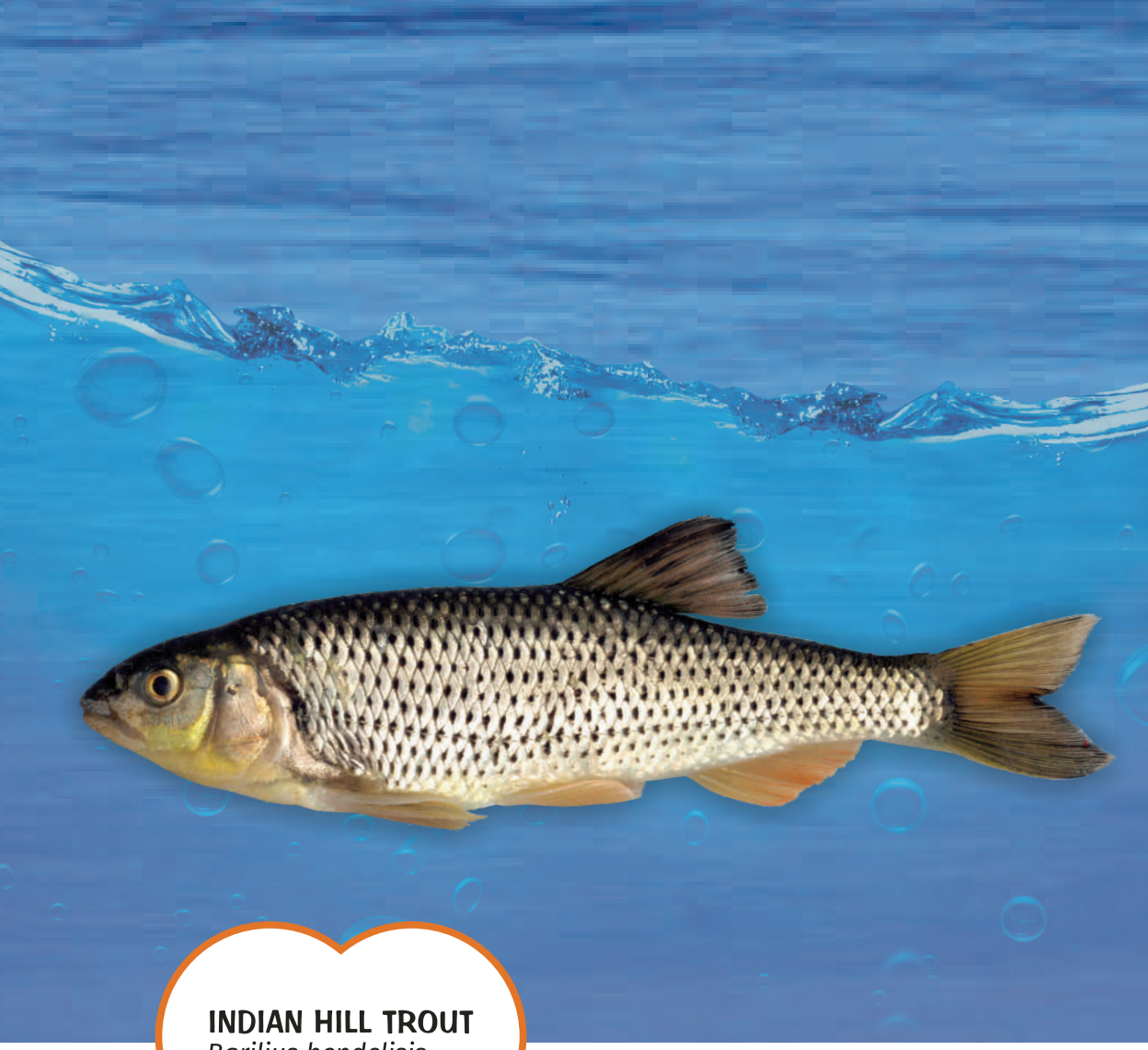
- Dorsum bronze-brown, with dark flecks and scattered
- 'clear window' in lower eyelid
- A single row of scales on the dorsal surface of the digits
- 26-30 scales around the midbody

Important web links for more information

http://reptile-database.reptarium.cz/species?genus=Asymblepharus&species=himalayanus

Key reference

Smith, M. A., & Smith, M. A. (1976). Fauna of British India Reptilia and Amphibia. Today and Tomorrows Printers and Publishers.



INDIAN HILL TROUT
Barilius bendelisis

Vernacular/other names

Hamilton's Barila, Indian Hill Trout (English Name) Korang (Assam), Khoksa and Joia (West Bengal), Bhareli (Himachal Pradesh), Pathrill-chaahl (Jammu)

Taxonomy

Class: *Actinopterygii*

Order: *Cypriniformes*

Family: *Cyprinidae*

Genus: *Barilius*

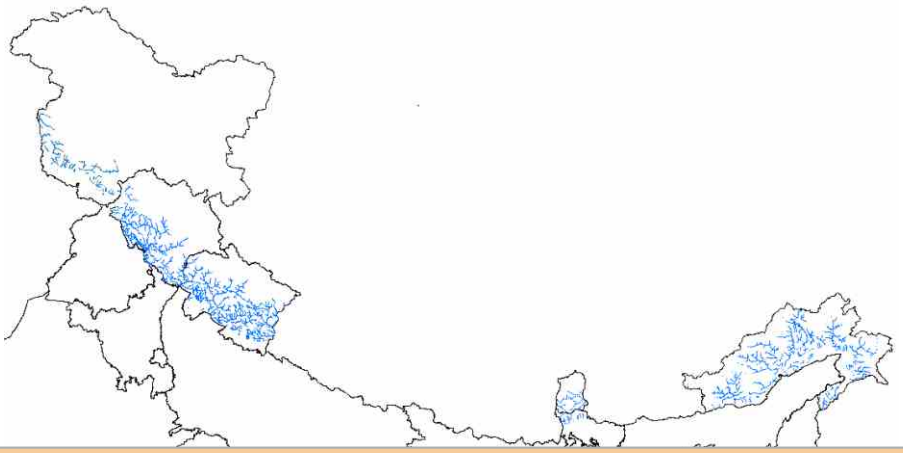
Species: *bendelisis*

Conservation status

IUCN: *Least concern*

CITES: *Not Listed*

IWPA (1972) : *Not Listed*



Distribution Map of Barilius bendelisis in Indian Himalaya

Habitat/Distribution

This fish inhabits well-oxygenated fresh waters with a low-to-high gradient. Prefers moderate to fast-flowing rivers and streams with a dominant substrate of gravel, cobbles, larger boulders and exposed bedrock. It is found to inhabit sandy and pebbly substrates in the streams and rivers at the foothill of Himalaya. It is reported from Assam, Tripura, Arunachal Pradesh, Manipur, Himachal Pradesh, Uttarakhand, West Bengal and is prevalent in the Gharwal and Kumaon regions of the Himalaya. This fish is bentho-pelagic, therefore, opportunistic to feed in both the column as well as bottom of the streams. They are omnivorous and feed mostly on aquatic insects such as ephemeropterans and dipterans. They prefer clean water with a pH range of 6.0-8.0, hardness of 36-268 ppm and temperature range of 18°C - 26°C.

Description

This Indian Hill Trout is a cold water fish with many names, it has a moderately elongated, compressed and sub-cylindrical body with a round abdomen and a sharply pointed head. *B. bendelisis* is mostly silver with a greyish back and 8-12 dark bands going down the length of its body. These bands become less prominent as they grow. Their fins are yellow with an orange tinge and their dorsal fin is in greyish along its edges. This fish exhibits sexual dimorphism, male being larger, stouter and courser than the female and their fins are larger and more fan-like (particularly their pectoral fins). During the breeding season, the males display their spine like tubercules on their jaws to attract females. Maximum recorded length is 22.7 cm TL (male). It attains sexual maturity at a length of 7.0-7.5 cm.

Vulnerability to climate change

At present, this is one of most common species in Himalaya. This species was known to present throughout its historical range without any fragmentation but due to various manmade structures such as dams, weirs etc the populations of this species have been threatened. Additionally, climate change is likely to have a growing impact on habitats of this species especially in Himalaya, including a likely increase in flow-variations and water temperature. The critical thermal maximum and minimum extremes of these fishes vary largely with different seasons. As such a minute drop or rise in the temperature can lend the species vulnerable. Water temperature, pH and dissolved oxygen are strongly related to the critical temperature which shows a tendency of seasonal acclimatization of the species. Multiple environmental variables together control the viability of this species that modulates the thermal tolerance, oxygen consumption, respiratory burst activity and status of ani-oxidative potential in its native environment. Any modulation in these environmental factors due to climate change can negatively affect the species metabolism and distribution.

Ecological and Socio-Economic Benefits of Monitoring

The Indian Hill Trout grows up to 23 cm. In Himalaya regions, this species is used as food as well as ornamental fish. Due to their abundance at the foot hills of Himalaya, these fishes are largely captured for livelihoods. Therefore, monitoring of this fish species is important as it being of commercial importance, any adverse effect of the climate change on this species would in turn affect the livelihood of many local people in the region. Further, this is one of indicator species to monitor health of streams. Moreover, monitoring of this species is easy due to its colouration (8-12 dark bands on its body) and habitat preference (occur in shallow and low flowing streams).

Key threats

- *Habitat destruction*
- *Destructive fishing methods*
- *Point and non-point sources of pollution*
- *Over exploitation for food as well as aquarium trade*

Key field identification feature

- Body silvery black with descending incomplete bars towards lateral line
- Caudal fin forked with lower lobe slightly longer
- Fins with black tips
- Each scale on the body with a black spot

References:

1. http://www.seriouslyfish.com/species/barilius-bendelisis/
2. http://www.iucnredlist.org/details/166594/0
3. http://www.moef.nic.in/sites/default/files/Report-I.pdf
4. http://indiabiodiversity.org/species/show/231755
5. http://en.bdfish.org/2011/07/hamilton%E2%80%99s-barila-barilius-bendelisis-hamilton-1807/
6. Hamilton, F., 1807 - T. Cadell and W. Davies, London: i-iv + 1-479 A journey from Madras through the countries of Mysore, Canara, and Malabar, performed under the orders of the most noble the Marquis Wellesley, governor general of India, for the express purpose of investigating the state of agriculture, arts, and commerce; the religion, manners, and customs; the history natural and civil, and antiquities, in the dominions of the rajah of Mysore, and the countries acquired by the Honourable East India company (1807).
7. Talwar, P.K. and Jhingran, A.G., 1991. Inland fishes of India and adjacent countries (Vol. 2). CRC Press.
8. Jayaram, K.C., 2010. Freshwater fishes of the Indian region. Narendra Pub. House.
9. Sharma, N.K., Akhtar, M.S., Pandey, N., Singh, R. and Singh, A.K., 2015. Seasonal variation in thermal tolerance, oxygen consumption, antioxidative enzymes and non-specific immune indices of Indian hill trout, Barilius bendelisis (Hamilton, 1807) from central Himalaya, India. Journal of thermal biology, 52, pp.166-176.

SPINY EEL
Mastacembelus armatus

Vernacular/other names

Spiny Eel, Tiretrack eel (English Names)

Bami, Bam, Bahm, Sal baim, Araa (Common Names)

Taxonomy

Class: *Actinopterygii*

Order: *Synbranchiformes*

Family: *Mastacembelidae*

Genus: *Mastacembelus*

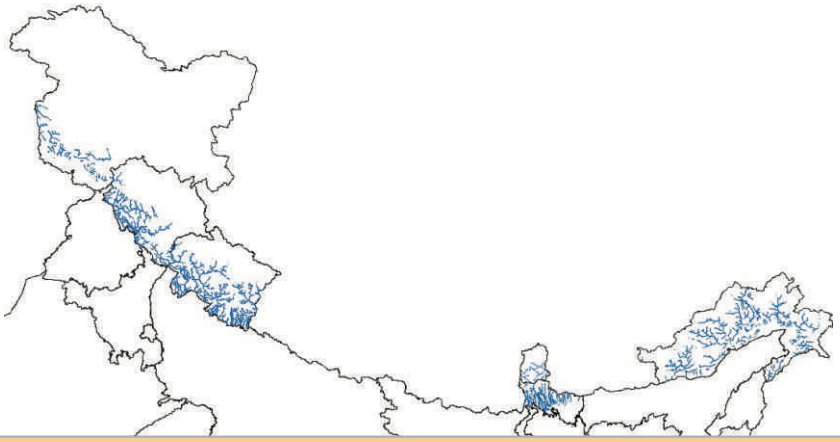
Species: *armatus*

Conservation status

IUCN: *Least concern*

IWPA (1972): *Not listed*

CITES: *Not Listed*



Distribution Map of Barilius bendelisis in Indian Himalaya

Habitat/Distribution

Bami or Spiny eels dwell in the mud at the bottom of water bodies such as rivers, streams, lakes and ponds. They bury themselves in the mud in case the water dries up or threat. It is a predator fish and feed exclusively on insects and crustaceans when they are juveniles, but they switch over to fish and tadpoles as their foods when grown i.e. adults. They occur in both lotic and lentic water bodies that has rocky bottoms. This species is a nocturnal and more active at night including for foraging. It occurs all over India. In Himalaya, it occurs from Jammu and Kashmir, Uttarakhand, West Bengal, Himachal Pradesh, Tripura and the Gharwal and Kumaon regions. This omnivorous fish inhabits a pH range of 6.0-7.0 and temperature range of 24°C - 28°C.

Description

Bami or Spiny eel is snake like fish, which is relatively slender, elongated and slightly compressed. Long dorsal and anal fin is confluent with the caudal fin. Colour is dark brown usually with zigzag lines, yellowish beneath. There is an undulating black band from eye to caudal fin and a similar lighter parallel band running below it. A row of black spots are found along the base of soft dorsal fin. Eyes have black stripes running through them. Maximum recorded length is 91 cm. It has a lifespan of 8-18 years. Breeds during summer (May to June) and pre winter (November).

Vulnerability to climate change

Climate change implications on the inland fishes would be greatly 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 *M. armatus*. This species would not be able to adapt to changing habitat availability due to rise in water depth in Himalayan glacier fed rivers and streams apart from the flood affected change in habitat. A rise in the temperature might affect its distribution range and would end up leading this species into a competition for niche with other benthic fishes. Also, the temperature fluctuations might affect the viability of this fish in wild with respect to its critical thermal maximum. Water temperature, pH and dissolved oxygen are strongly related to the critical temperature, which shows a tendency of seasonal acclimatization of the species. Multiple environmental variables together control the viability of this species which modulates the thermal tolerance, oxygen consumption, respiratory burst activity and status of anti-oxidative potential in its native environment. Any changes in these environmental factors due to climate change can negatively affect the species metabolism and distribution.

Ecological and Socio-Economic Benefits of Monitoring

Spiny eel is one of most common fish that occur in all kind aquatic habitats of Himalaya provided these habitats are not polluted or degraded. Important food species in the foot hills of Himalaya where their abundance is comparatively higher than higher altitudes. This species of eel is a preferred food fish in many states of the Indian Himalayan Region, especially West Bengal, where a fresh catch is a delight. This fish also used in aquarium. Presence of good populations of spiny eel is an indicator of water bodies with good substratum. Therefore, monitoring this species will help us to understand the health of a water body in Himalaya. Such food fishes are of higher commercial significance to the local fish community who is dependent on these for their livelihood therefore, any effect of the climate change on this fish would in turn affect their socio-economy. As this species prefers a low flow and depth with an exposed river bed, monitoring this fish species is of great ecological value as it would help monitoring the changes in the water flow and turbidity. Also monitoring of this species is easy due to its preference of streams at the foothills of Himalaya with lesser flow which are easily accessible and its distinct morphology.

Key threats

- *Urbanization and habitat loss*
- *Destructive fishing methods*
- *Point and non-point sources of pollution*
- *Over exploitation for food as well as aquarium trade*

Key field identification features

- Body elongated snake-like
- Body dull brown with 1-3 dark, longitudinal zigzag lines
- Ventral and anal fins fused with the caudal fin
- Upper jaw longer with a pointed snout

References:

1. Rayamajhi, A., Jha, B.R. & Sharma, C.M. 2010. Mastacembelus armatus. The IUCN Red List of Threatened Species 2010: e.T166586A6241626.
2. Editor-Director, 2006. Fauna of Sikkim, State Fauna Series, 9(Part-I), 1-214 (Published by the Director, Zool. Surv. India, Kolkata)
3. http://www.fishbase.org/FieldGuide/FieldGuideSummary.php?genusname=Mastacembelus &speciesname=armatus&c_code=356
4. http://indiabiodiversity.org/species/show/237765
5. http://en.bdfish.org/2010/02/tire-track-spiny-eel-mastacembelus-armatus/
6. Gurung, T.B., Wagle, S.K., Bista, J.D., Joshi, P.L., Batajoo, R., Adhikari, P. and Rai, A.K., 2005. Participatory fisheries management for livelihood improvement of fishers in Phewa Lake, Pokhara, Nepal. Himalayan Journal of Sciences, 3(5), pp.47-52.
7. Gupta, S., 1974. Observations on the reproductive biology of Mastacembelus armatus (Lacepede). Journal of Fish Biology, 6(1), pp.13-21
8. Ali, M.Y., 1999. Fish resources vulnerability and adaptation to climate change in Bangladesh. In Vulnerability and Adaptation to Climate Change for Bangladesh (pp. 113-124). Springer Netherlands.
9. Hare JA, Morrison WE, Nelson MW, Stachura MM, Teeters EJ, Griffis RB, et al. (2016) A Vulnerability Assessment of Fish and Invertebrates to Climate Change on the Northeast U.S. Continental Shelf. PLoS ONE 11(2): e0146756.
10. http://www.seriouslyfish.com/species/mastacembelus-armatus/
11. https://en.wikipedia.org/wiki/Tire_track_eel
12. https://en.aqua-fish.net/fish/tire-track-eel
13. Talwar, P.K. and Jhingran, A.G., 1991. Inland fishes of India and adjacent countries (Vol. 2). CRC Press.
14. Jayaram, K.C., 2010. Freshwater fishes of the Indian region. Narendra Pub. House

ATLAS MOTH
Attacus atlas

Vernacular/other names

Atlas Moth

Taxonomy

Phylum: *Arthropoda*

Class: *Insecta*

Order: *Lepidoptera*

Family: *Saturnidae*

Genus: *Attacus*

Species: *Attacus atlas Linnaeus, 1758*

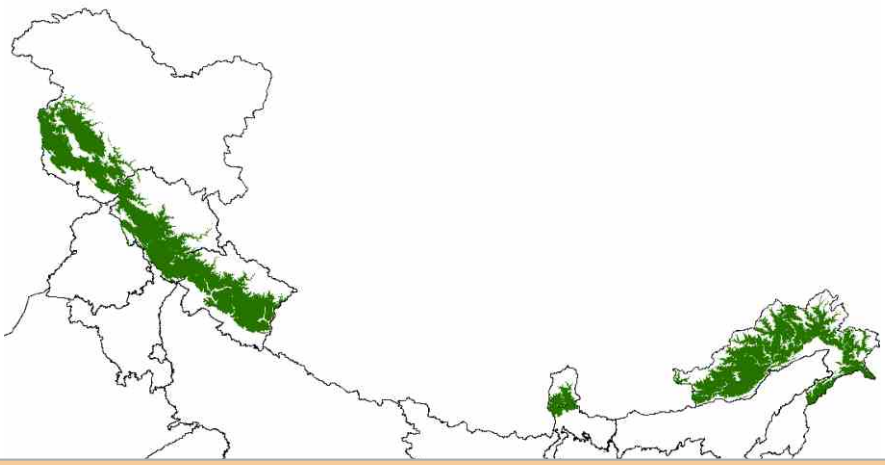
Conservation status

IUCN: *Not Evaluated*

IWPA : *Not listed*

CITES: *Not listed*

Size



Atlas moth is a large Saturniid moth found in the tropical and subtropical forests of the IHR and Southeast Asia and is most common across the Malay Archipelago. Females are appreciably larger and heavier than the males. It is found upto 3500 m in the Himalayan region. In India, Atlas moths are cultivated for their silk in a non-commercial capacity; unlike that produced by the related silkworm moth (Bombyx mori), Atlas moth silk is secreted as broken strands.

Description

Atlas moths are the largest species of moth in the world belonging to family Satuniidae. The females have bigger, heavier bodies than males and larger wingspans too, ranging from 25 to 30 cm (10 to 12 inches), with a surface area of at least 400 cm^2 (62 sq in).

The Atlas Moth has a wingspan of 25-30 cm and the largest wings of all moths covering about 400 cm^2. Males are smaller and are provided with broad, comb-like antenna. The body is disproportionately small compared to the wings. Fore and hind wing have a similar pattern being reddish-brown with black, white, pink and purple lines and a typical, triangular scale-less window bordered in black. Forewings have protruding apical edges. The underside is paler. The caterpillars are greenish white in color with soft spines on their back. They almost look a bit powdered. On the side of the last feet the caterpillars have a red and blue spot.

Wingspan: 25-30 cm | *Altitude range:* ***upto 3500 m***

Females are sexually passive, releasing powerful pheromones which males detect and home in on with the help of chemoreceptors located on their large feathery antennae. Males may thus be attracted from several kilometres downwind. Atlas moths are unsteady fliers, and the female does not stray far from the location of her discarded chrysalis: she seeks a perch where the air currents will best carry her pheromones.

Despite their huge size, the moths do not eat anything once they hatch from their cocoons. Both males and females lack fully-formed mouth parts; they rely on the sustenance they build up as caterpillars, for stored energy. They only live as hatched moths for two to three weeks.

It is not entirely certain where the atlas gets its name from: it could be from its huge size, with reference to atlas of Greek mythology, or it could refer to the patterns on its wings, which resemble maps in an atlas. In Hong Kong, the Cantonese name for it is “snake's head moth”. This refers to the snake-like shape of the pattern on the top wing tips.

The habitat is primary tropical and subtropical dry broadleaf forests and shrublands but secondary forest is also utilised. They do not fly far from where they hatch, since they are very inelegant fliers and do not have enough energy stored for long journeys. They live purely to breed, so the fact that they do not venture far from their hatching area, allows for easy mating to occur. The Atlas Moth flies throughout the year but is most abundant from November to January.

Vulnerability to climate change

Their patchy distribution and restricted migration makes them vulnerable to the effects of genetic drift and considerable colour variations can exist in individuals from different regions. Lepidopterans have relatively short generation times and are ectothermic organisms, meaning that their population dynamics may respond to temperature changes more directly and more rapidly. With warmer temperatures butterfly emerge earlier in the year, and their active flight season occurs earlier. They might emerge before the food plants they feed on and die. Its elevational range shifts has also been observed in the Himalayan region.

Monitoring protocol

The species may be monitored through transect count and point count methods. Opportunistic records with GPS locations are also helpful in monitoring. Specific location records may be helpful in understanding current habitat and distribution of the species.

Life cycle

Larva:

Once mated, the female lays a number of spherical eggs 2.5 mm in diameter on the undersides of leaves. Dusty-green caterpillars hatch after about two weeks and feed voraciously on the foliage of certain citrus and other evergreen trees. The caterpillars are adorned with fleshy spines along their backs which are covered in a waxy white substance.

Pupa:

After reaching a length of about 115 millimetres (4.5 in), the caterpillars pupate within a papery cocoon interwoven into desiccated leaves. The adult moths emerge after about four weeks.

Adult:

Adult Atlas moths do not have mouths, and as such only live for a few days.

Food plants:

Anacardium, Spondias, Annona, Schefflera, Berberis, Bischofia, Carpinus, Dillenia, Glochidium, Phyllanthus, Sapium, Teucrium, Cinnamomum, Erythrina, Lagerstroemia, Michelia, Swietenia, Ardisia, Embelia, PsidiumMalus, Citrus, Salix, Schleichera, Clerodendrum.

Key field identification features

- The Atlas moth can easily be identified with its large size (25-30 cm).
- The snake-like shape of the pattern on the top wing tips.
- The caterpillars are greenish white in color with soft spines on their back.

Important web links

http://ftp.funet.fi/pub/sci/bio/life/insecta/lepidoptera/ditrysia/bombycoidea/saturniidae/saturniinae/attacus/#atlas

http://eol.org/pages/385381/overview

References

Holloway, J.D. (1987). The Moths of Borneo, part 3: Lasiocampidae, Eupteroptidae, Bombycidae, Brahmaeidae, Saturniidae, Sphingidae. Southdene Sdn. Bhd., Kuala Lumpur.

Robinson, G.S., Ackery, P.R., Kitching, I.J., Beccaloni, G.W., Hernández, L.M. (2001). Hostplants of the moth and butterfly caterpillars of the Oriental Region. Southdene Sdn. Bhd., Kuala Lumpur & The Natural History Museum, London.

COMMON BLUE APOLLO
Parnassius hardwickei

Vernacular/other names

Common Blue Apollo

Taxonomy

Phylum: *Arthropoda*

Class: *Insecta*

Order: *Lepidoptera*

Family: *Papilionidae*

Genus: *Parnassius*

Species: *Parnassius hardwickii Gray, 1831*

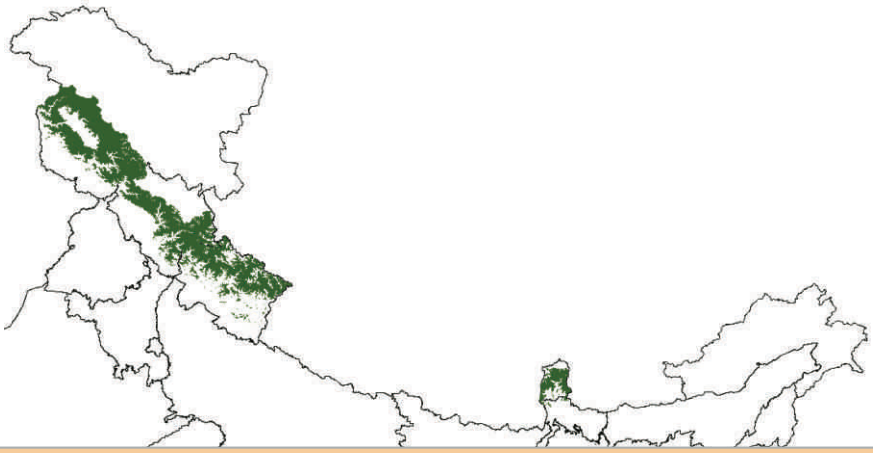
Conservation status

IUCN: *Not Evaluated*

IWPA: *Schedule II*

CITES: *Not listed*

Size



The common blue Apollo, is a high-altitude butterfly which is found in high-altitude areas of South Asia. It is a member of the snow Apollo genus (Parnassius) of the swallowtail family (Papilionidae). This butterfly is found from the Jammu and Kashmir to Sikkim and is found from 1,800 to 5,200 m, making it one of the most commonly encountered species of Apollo in the Indian subcontinent. The butterfly prefers grassy mountain slopes near snowline

Description

Male: Upperside creamy-white and stout. Upper forewing base dusted with black scales; a black bar across mid cell another at cell apex and a third on bearing red spots beyond apex; prominent curved outer discal series of dusky black spots. Underside appears glassy. Under hindwing has broad basal band of four spots, the lower three forming an oblique band. Wet season form is more brightly and heavily marked. Female more heavily marked and acquires a small balloon shaped pouch with longitudinal groove when fertilized. It is generally observed flying close to ground and frequently settles on flowers. More commonly observed in altitude between 3000-3500 m in alpine meadows at the edge of tree line on sunny days. Two sub species exist in the IHR.

Wingspan: 50-65 mm | *Altitude range: 1,800-5,200 m*

Female: Female similar; the dusky black irroration on the upperside of the forewing more extensive and formed into a narrow irregular band below the cell, which runs between the crimson spots beyond the cell-apex and the crimson spot in interspace. Underside similar to that of the male but all the red spots much larger and with white scaling in the centre. Antennae nearly black, with only a few white specks, head with brownish-yellow pubescence; rest of the thorax and abdomen covered densely with long white hairs which also clothe, more or less narrowly, the dorsal margin of the hindwing.

Vulnerability to climate change

Their patchy distribution and restricted migration makes them vulnerable to the effects of genetic drift and considerable colour variations can exist in individuals from different regions. Butterflies have relatively short generation times and are ectothermic organisms, meaning that their population dynamics may respond to temperature changes more directly and more rapidly. With warmer temperatures butterfly emerge earlier in the year, and their active flight season occurs earlier. They might emerge before the food plants they feed on and die. Its elevational range shifts has also been observed in the Himalayan region.

Monitoring protocol

The species may be monitored through transect count and point count methods. Opportunistic records with GPS locations are also helpful in monitoring. Distribution records beyond its general elevation range needs to be recorded.

Life cycle

Adult blue Apollo butterflies are seen on the wing in mid-summer, feeding on nectar produced by flowers. The females lay eggs, which over-winter and hatch in spring the following year. The resulting larvaefeed plants members of Saxifragaceae. When the caterpillar is fully-grown it will pupate on the ground, forming a loose cocoon from which the adult butterfly emerges following metamorphosis. The species occurs all thye year round. The wet season form, occurs from July to October, appears to hibernate in pupal stage.

Key threats

- *Habitat loss due to degradation and fragmentation*
- *Collection from the wild for illegal*

Key field identification feature

The butterfly cannot be mistaken with others because of its creamy-white colour, black antennae, head thorax and abdomen and prominent red spots on the wings. It may be commonly seen flying close to ground in alpine woodland and grasslands around morning and noon time on warm sunny days.

References

Haribal, M. 1992. The butterflies of Sikkim Himalaya and their natural history. Sikkim Nature Conservation Foundation, Gangtok, Sikkim, India.

Kehimkar, I. 2008. The Book of Indian Butterflies. Bombay Natural History Society, Mumbai.

Mani, M.S. 1986. Butterflies of Himalayas. Oxford and IBH, New Delhi.

Important web links

http://ftp.funet.fi/index/Tree_of_life/insecta/lepidoptera/ditrysia/papilionoidea/papilionidae/parnassiinae/parnassius/#hardwickii

http://www.ifoundbutterflies.org/sp/2148/Parnassius-hardwickei

HIMALAYAN MARSH ORCHID;
Dactylorhiza hatagirea

Vernacular/other names

Wanglak, Ambolakpa (Ladakh, J&K), Panja, Hath-Panja, Hatha Jadi (Uttarakhand, Himachal Pradesh), Salam panja (Kashmir, J&K), Salam Pamisri (Hindi)

Synonyms

Orchis hatagirea D.Don

Orchis latifolia non L

Taxonomy

Family: *Orchidaceae*

Genus: *Dactylorhiza*

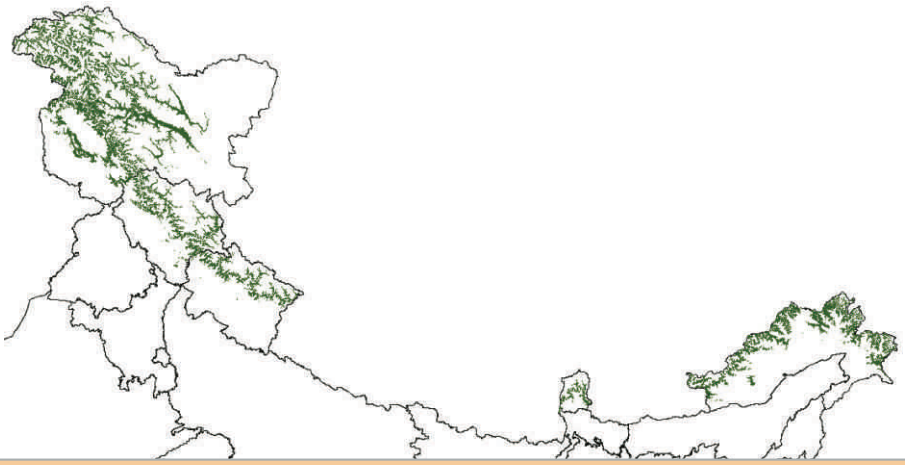
Species: *hatagirea D.Don Soó*

Conservation status

IUCN: *Least Concern*

WPA (1972): *not listed*

CITES: *Not listed*



Distribution & Habitat:

Dactylorhiza hatagirea is generally found in the moist/marshy habitats from subalpine to alpine regions between 2800 to 4000m. It grows well along ravines and marsh meadows. It is distributed from Jammu and Kashmir to Arunachal Pradesh. It is also distributed in China, Bhutan, Mongolia, Nepal and Pakistan.

Description

Terrestrial orchid, 10–40 cm tall. Tubers palmately 3–5 lobed. Stem erect, hollow in robust plants. Leaves erect or spreading, clustered and sub-opposite near base of stem, oblong to linear-lanceolate, apex obtuse or acuminate. Inflorescence 2–15 cm long, densely many-flowered. Bracts lanceolate.Flowers lilac to purplish pink. Sepals and petals lilac or purplish pink.Dorsal sepal erect, ovate-oblong, concave, 3-veined; lateral sepals ovate-lanceolate to ovate-oblong, 3–5-veined, apex obtuse. Petals erect, forming a hood with dorsal sepal, dark purple spots or lines; spur cylindric, nearly obtuse. Ovary slightly twisted, glabrous.

Use and trade

Tubers are collected in October, shade dried and powdered alongwith other medicinal plants such as Neem, Peepal, Anaar, Harad, Atis, Amla and mineral salt and consumed in small quantities in the form of tablets to treat fever in Ladakh. Local Amchis also use tuber roots for preparing health tonic. The tubers are considered to be energy boosters and help in improving health and vigour. The tuberous roots contain starch, mucilage, sugar, albumen and ash of potassium.Tuberous roots are used in a variety of local and Ayurvedic medicines including treatment of general weakness.

Its trade name is Salep. The collection from wild is banned. The rhizome is collected by nomadic shepherds and local villagers and sold to local traders. The whole plant is uprooted during October when the aerial parts start drying up and the rhizome is separated from the plant, which are dipped in hot water for about an hour, afterwards it is peeled and dried under the Sun. Crude drug markets located at Kishtawar and Udhampur in Jammu & Kashmir, Chamba and Kullu in Himachal Pradesh and Ramnagar and Tanakpur in Uttarakhand deal with this crude drug. The current market rate of the crude drug is Rs. 700 per kg but also sold by various e-commerce companies with cost of up to Rs. 10,000/Kg.

Vulnerability to climate change

Marsh meadows are one of the most threatened habitats due to habitat degradation and climate change. Long dry spell of climate may eradicate local population of the species. Excessive grazing in the alpine region and resultant nitrification of the soil coupled with atmospheric nitrogen deposition due to global warming in the high altitudes may cause rapid loss of its habitat.

Monitoring protocol

Permanent plots may be marked along the observed areas with *Dactylorhiza* population. Phenology, regeneration and population dynamics over the time and changes in associated plantsmay be monitored. Changes in the habitat quality and status of disturbances may also be monitored.

Phenology

Flowering / Fruiting-May to August.

Key threats

- *Over exploitation*
- *Habitat loss*
- *Overgrazing*

Key field identification features

- Pink flower with purple blotch/spots
- Tubers palmately lobed with 3-5 lobes

Important web links

www.bsienvis.nic.in/CITES/Dactylorhiza%20hatagirea.pdf

GERARD JOINTFIR
Ephedra gerardiana

Vernacular/other names

Thayon, Tsepat, Chhapat (Ladakh), Tutgauntha (Garhwal), Sang Kaba (Sikkim), Somlata (Sanskrit, Hindi)

Taxonomy

Class: *Gnetopsida*

Order: *Ephedrales*

Family: *Ephedraceae*

Genus: *Ephedra*

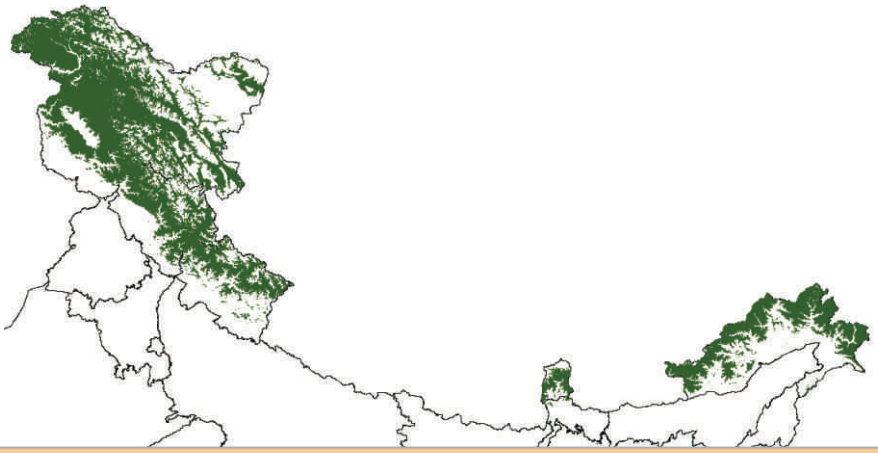
Species: *gerardiana Wall. ex Stapf*

Conservation status

IUCN: *Not assessed*

WPA (1972): *Not listed*

CITES: *Not listed*



GERARD JOINTFIR
46

Distribution & Habitat:

Ephedra gerardiana grows in the stony slopes, rich in calcium carbonate and gravel terraces in drier areas. It generally found in the entire Himalayan region from 1900 to 5000 m asl.

Description

Low shrub, upto 1m tall; woody stems buried and above ground stem scabrous, rarely smooth; branchlets dark green, becoming brown with maturity and longitudinally furrowed. Leaves opposite, 2–3 mm long, connate for two third of their length. Male cones solitary or 2 at nodes; staminal column exserted for half of its length, with 8 sessile anthers. Seed cones solitary, sessile or shortly pedunculate, subglobose, 5–7 mm in diam., red and fleshy. Seeds 1 or 2.

Use and trade

Stems are dried and powdered with seeds of pomegranate and rhizomes of Ginger to treat fever in Ladakh region. The roots, stems and branches are used as a tonic, for treatment of fever, hepatic diseases, rheumatism, bronchial asthma and for blood purification. It is also used as an important fuel and fodder during winters. The fruit and dried stem constitute a valuable drug 'Ephedrine' which is used to cure asthma.Liquid extract is used to control asthmatic paroxysms. Its tincture is cardiac and circulatory stimulant; stem and root decoction is a remedy for rheumatism and syphilis. Fruits are considered digestive. Plant juice is a cardiac stimulant; also useful in respiratory diseases, asthma, hay fever. Squeezed plant is mixed with bathing water to treat skin diseases.

Vulnerability to climate change

Over exploitation, collection of the plant for various purposes coupled with climate changes associated impacts on habitat may inhibit regeneration of the species as well as may cause habitat loss.

Monitoring protocol

Individual patches can be monitored as the species grows in isolated patches. Permanent plots of suitable size may be marked within the areas of occurrence. Regeneration status and habitat structure and composition may be monitored.

Phenology

Pollination:June-July; Seed maturity: August–September

Key threats

- *Loss of habitat*
- *Over exploitation*

Key field identification features

- A low growing tufted shrub
- Fruits red
- Jointed Stem

Important web links for more information

http://www.iucnredlist.org/details/163754/0

SACRED SAUSSUREA
Saussurea obvallata

Vernacular/other names

Hyun Kauni, Brahma Kamal (Uttarakhand); Brahma Kamal (Himalayan States),

.

Synonyms

Aplotaxis obvallata DC

Taxonomy

***Family**: Asteraceae*

***Genus:** Saussurea*

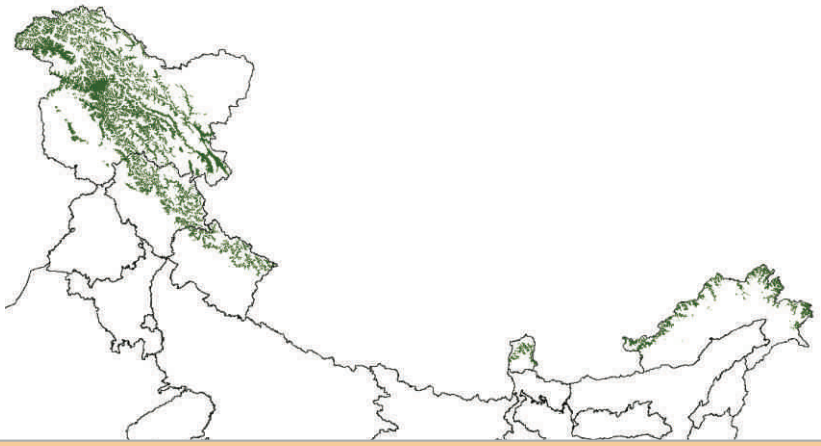
***Species**: obvallata (DC.) Edgew*

Conservation status

***IUCN:** Not assessed*

***WPA (1972) :** Not listed*

***CITES:** Not listed*



Distribution & Habitat:

It occurs in alpine meadows of the Himalaya, extending from Jammu and Kashmir to Arunachal Pradesh at altitudes between 3700 and 4600 m. It generally found in the glaciated slopes, scree or bouldery areas. Its global distribution extends to Nepal, Bhutan and China in the neighboring countries

Description

Herb, up to 80 cm tall. Stem solitary, erect, simple. Basal and lower stem leaves petiolate, ovate, elliptic-oblong, or obovate, both surfaces pilose and glandular hairy, margin sinuate-dentate, apex obtuse to acute; Middle and upper stem leaves sessile, membranous; upper most leaves modified into bracts enclosing synflorescence, both surfaces pale yellow. Heads terminal on stem, hemispherical.Phyllaries in 4 rows, abaxially pubescent and glandular hairy, margin blackish purple, apex acute. Pappus brown.

Use and trade

Saussurea obvallata has several medicinal uses. The ground roots are applied to cure cuts and wounds. Floral buds and roots are used as medicines in leucoderma, urinary troubles, bone fractures, wounds, cough and cold, hydrocele, reproductive disorder and digestive problems. Floral buds are also used in boils. Whole plant is used as veterinary medicine in haematuria. In Tawang, the dried powder or paste of the plant is used in the treatment of skin diseases. In the eastern Kumaun region of Uttarakhand the plant is also used to cure Jaundice.The plant is considered sacred. The inflorescences and the flowers are offered to local deities, Goddess Ganga and Lord Shiva. It is also used to decorate the temples in festive occasions in the temples of local deity and high altitude temples of Shiva viz. *Panch Kedars*.

Vulnerability to climate change

Over exploitation, collection of the plant for various purposes coupled with climate changes associated impacts on habitat may inhibit regeneration of the species as well as may cause habitat loss.

Monitoring protocol

Permanent plots (20X20m) may be laid and marked within the areas of occurrence above 4000m. Regeneration status and habitat conditions in terms of associated species composition and regeneration may be monitored.

Phenology: Flowering and fruiting: August – September.

Key threats

- *Loss of habitat*
- *Over exploitation for religious/ spiritual ceremonies*

Key field identification features

- Enlarged and modified leaf bracts
- Characteristic smell

Important web links

http://bsienvis.nic.in/writereaddata/Uttarakhand%20State%20Flower%20_Final__3_11.pdf

Wildlife Watch
in the Indian Himalayan region

Wildlife watch survey (record sheet)

1. *Species Name* _____

2. *Scientific Name (if known)* _____

3. *Number of Individual/s* _____

4. *Sex* *Male* _____ *Female* _____ *Unknown* _____

5. *Observation type:* _____

   O- Observed; F - Tracks/pugmarks; H-Hair/feather/skin; R- road kill; K- Kill; B- Bone/teeth; S- scat/pellet; V- Vocalizatiion

6. *Location/ Nearest Landmark* _____

7. *Altitude (approx.)* _____

8. *GPS Coordinates (if possible)* _____

9. *Any other Information* _____

_____

_____

_____

9. *Your Name* _____

10. *Your contact Number* _____

11. *Your email ID* _____

Please send the details of your record to wlw.nmshe@wii.gov.in or message/Whatsapp in +91 9410915297

Photo Credit as per appearance in the publication

Dhritiman Mukherjee,
Pages 1 and 5

Shaheed Dar,
Page 3

Intesar Suhail,
Page 3

Soumya Dasgupta,
Pages 7, 8 and 35

Ishwari Datt Rai,
Pages 9, 11, 12, 41, 43, 44, 45, 47, 48, 49, 51, 52

Ranjana Pal,
Pages 12

G. S. Bhardwaj,
Page no. 13 and 15

Naitik G. Patel,
Pages 16, 19, 21, 23 and 24

Anwaruddin Choudhury,
Pages 16

Abhijit Das,
Pages 17 and 20

J. A. Johnson,
Pages 25 and 29

Vineet K. Dubey,
Pages 27

Aashna Sharma,
Pages 31

V. P. Uniyal,
Pages 33

Shuvendu Das,
Pages 37 and 39

Under water photo,
Naitik G. Patel

Illustrations by
Tapajit Bhattacharya,
Pages 4 and 8

Department of Science & Technology
Ministry of Science & Technology
Government of India

NMSHE NATIONAL MISSION FOR SUSTAINING THE HIMALAYAN ECOSYSTEM

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

P.O. Box # 18, Chandrabani
Dehradun - 248 002 (Uttarakhand)
t. (0135) 2640111-115; **f.** 0135-2640117
w. www.wii.gov.in; **e.** wii@wii.gov.in

For more information, please contact: **m.** + 91 9410915297, **e:** wlw.nmshe@wii.gov.in

Xpressions: 9219552563
Doc. XPS0209l6696