NATIONAL MISSION FOR SUSTAINING THE HIMALAYAN ECOSYSTEM (NMSHE)

Wildlife Watch in the Indian Himalayan region

WILDLIFE WATCH

IN THE INDIAN HIMALAYAN REGION

2015-2016

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

SERIES II

WILDLIFE WATCH

IN THE INDIAN HIMALAYAN REGION

BY NC ND

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MAMMALS

Pal, R., Thakur, S., Arya, S., Bhattacharya, T., Sathyakumar, S. 2016. Kashmir stag or hangul *Cervus elaphus hanglu*. pp. 1-4. IN: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series II. A user guide for monitoring wildlife species in the Indian Himalayan Region. Wildlife Institute of India, Dehradun, 55p.

Pal, R., Thakur, S., Arya, S., Bhattacharya, T., Sathyakumar, S. 2016. Red panda *Ailurus fulgens*. pp. 5-8. IN: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series II. A user guide for monitoring wildlife species in the Indian Himalayan Region. Wildlife Institute of India, Dehradun, 55p.

BIRDS

Chaudhuri, S., Iyer, B., Bhattacharya, T. Ramesh, K, Singh, P., Sathyakumar, S. 2016. Cheer pheasant *Catreus wallichii*. pp. 9-12. IN: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series II. A user guide for monitoring wildlife species in the Indian Himalayan Region. Wildlife Institute of India, Dehradun, 55p.

Chaudhuri, S., Iyer, B., Bhattacharya, T. Ramesh, K, Singh, P., Sathyakumar, S. 2016. Blood pheasant *Ithaginis cruentus*. pp. 13-16. IN: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series II. A user guide for monitoring wildlife species in the Indian Himalayan Region. Wildlife Institute of India, Dehradun, 55p.

HERPETOFAUNA

Patel, N., Das, A. 2016. Himalayan trinket snake *Orthriophis hodgsoni*. pp. 17-24. IN: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series II. A user guide for monitoring wildlife species in the Indian Himalayan Region. Wildlife Institute of India, Dehradun, 55p.

Patel, N., Das, A. 2016. Himalayan toad *Duttaphrynus himalayanus*. pp. 21-24. IN: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series II. A user guide for monitoring wildlife species in the Indian Himalayan Region. Wildlife Institute of India, Dehradun, 55p.

FISH

Sharma, A., Dubey, V., Johnson, J.A., Sivakumar, K. 2016. Brown trout *Salmo trutta fario*. pp. 25-28. IN: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series II. A user guide for monitoring wildlife species

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S. Sathyakumar
& V.B. Mathur
Editors

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Sharma, A., Dubey, V., Johnson, J.A., Sivakumar, K. 2016. Common carp *Cyprinus carpio*. pp. 29-32. IN: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series II. A user guide for monitoring wildlife species in the Indian Himalayan Region. Wildlife Institute of India, Dehradun, 55p.

INSECTS

Bhardwaj, M. Kashyap, P., Uniyal, V.P. 2016. Common yellow swallowtail *Papilio machaon*. pp. 33-36. IN: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series II. A user guide for monitoring wildlife species in the Indian Himalayan Region. Wildlife Institute of India, Dehradun, 55p.

Das, S., Bhardwaj, M., Uniyal, V.P. 2016. Pied Paddy skimmer *Neurothemis tullia*. pp. 37-40. IN: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series II. A user guide for monitoring wildlife species in the Indian Himalayan Region. Wildlife Institute of India, Dehradun, 55p.

FLORA

Rai, I.D., Kumar, D., Bhattacharya, P., Priyadarshani, S., Talukdar, G., Rawat, G.S. 2016. Willow-leaved sea buckthorn *Hippophae salicifolia*. pp. 41-44. IN: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series II. A user guide for monitoring wildlife species in the Indian Himalayan Region. Wildlife Institute of India, Dehradun, 55p.

Rai, I.D., Kumar, D., Bhattacharya, P., Priyadarshani, S., Talukdar, G., Rawat, G.S. 2016. Tibetan sea buckthorn *Hippophae tibetana*. pp. 45-48. IN: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series II. A user guide for monitoring wildlife species in the Indian Himalayan Region. Wildlife Institute of India, Dehradun, 55p.

Rai, I.D., Kumar, D., Bhattacharya, P., Priyadarshani, S., Talukdar, G., Rawat, G.S. 2016. Common morel *Morchella esculenta*. pp. 49-52. IN: Sathyakumar, S., Mathur, V.B. (eds.) Wildlife Watch – Series II. A user guide for monitoring wildlife species in the Indian Himalayan Region. Wildlife Institute of India, Dehradun, 55p.


Manish Bhardwaj

Preface

The Indian Himalayan Region (IHR) is one of the rich biodiversity regions of the world with over 18,000 plants, 428 mammals, 2,000 birds, 227 herpetofauna, more than 200 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 II; 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 three 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. Dr. Aishwarya Maheshwari, Dr. Lalit Kumar Sharma and Dr. Rajarshi Chakrobarty are also thanked for providing pictures for use in this publication.

Editors

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KASHMIR STAG OR *HANGUL*

Cervus elaphus hanglu

Vernacular/other names

Hangul (Hindi),

Honglu (Kashmiri)

Taxonomy

Order: Cetartiodactyla

Family: Cervidae

Genus: Cervus

Species: elaphus

Sub-species: hanglu

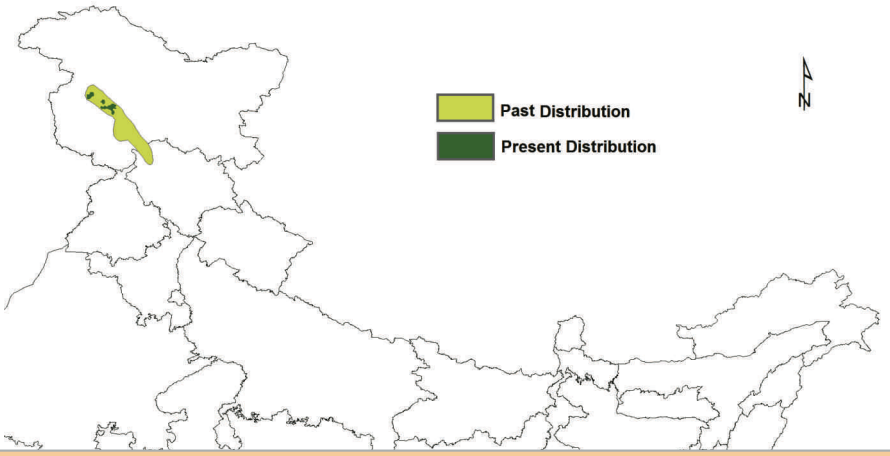
Conservation status

IUCN: Least concern (separate assessment for this subspecies underway)

IWPA: Schedule-I

CITES: Appendix-I

Size ▸ Head to body length: 190-205 cm (male); 180-195 cm (female)



At present occurs only in the Dachigam National Park and adjoining Conservation Reserves and forests and also in a few isolated pockets in Jammu and Kashmir State of India. In the past, it was distributed in mountains of Kashmir and in Chamba District of Himachal Pradesh. *Hangul* inhabits subalpine forests, temperate broad leaved oak and conifer mixed forests, riverine forests, grasslands and scrub habitats.

Description

A subspecies of the red deer of Europe that is distinctly different in body size, colour, and unlike red deer, the antler bay tine is normally larger than brow and has much of cup. In *Hangul*, 10-point head is the normal one and any greater number of points is far more usual than in case of red deer. The coat colour ranges from light to dark brown, fading to dingy white on lips, chin, underparts and anal region. The white rump patch extend just a little bit above the tail and is divided by a broad median stripe extending down to the base of the tail and sometimes to its extremity. Coat colour fades during summer, but tones up with denser coat in winter, which in big males is very dark or rufous brown. Fawns are spotted. Old females may show white flecks. Antlers in adult males grow up to 1m.

Shoulder height: 125-145 cm (male); 110-120 cm (female)	Weight: 150-240 kg (male); 110-170 kg (female)	Antler length: 1 m

Vulnerability to climate change

The distribution of the sub species is largely confined to only Dachigam National Park and adjoining Conservation Reserves which also serves as the only source population of the subspecies. Rapid alterations in the vegetation structure and community composition due to climate change pose a threat for the survival of this subspecies. The impact of climate change on other red deer subspecies in Europe is evident as they are showing a shift in their breeding activity. As the entire population depends on the survival prospect of some breeding animals inside Dachigam National Park, any change in their physiology and reproductive performance would likely impact the survival prospect of this subspecies in India.

Monitoring protocol

As in practice since 2004, the *hangul* population could be monitored using line transects in different blocks of its distribution range during late winter (mid February to early March) every year. Relative abundance indices could be used for monitoring based on scan counts, dung counts, camera trapping, and rutting calls for males. Non-invasive, DNA based population estimation from dung/hair is also a good option to estimate the abundance of *hangul* in a particular habitat.

Key threats

- Major threats are habitat loss and fragmentation; habitat degradation
- Movement of livestock herders /grazers during the breeding season

Reproduction and life cycle

Gestation period:
6 months

Rutting:
Late autumn to early winter

Young per birth:
one

Weaning:
7 months

Sexual maturity:
2.5 years (f) 2 years (m)

Life span:
12- 15 years

Key field identification features

- One metre long 10 point head antlers
- White rump patch excluding the tail
- Very dark or rufous brown coat in winter

Important web links

http://www.iucnredlist.org/details/summary/41785/0

RED PANDA
Ailurus fulgens

Vernacular/other names

Oakdonga (Bhotia), Saknam (Lepcha), WahdonkasaknaYe /NigalyaPoonya (Nepalese)

Taxonomy

Order: Carnivora

Family: Ailuridae

Genus: Ailurus

Species: fulgens

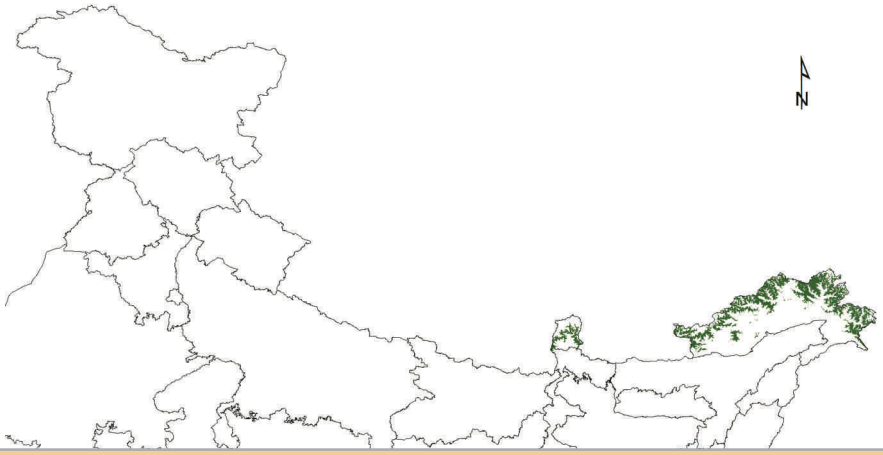
Conservation status

IUCN: Endangered

IWPA: Schedule-I

CITES: Appendix-I

Size ▸ Head to body length: 50-64 cm



Red Panda occurs in India, Nepal, Bhutan, Myanmar and China within a narrow altitude band of 2,500-4,000 m. However, occasional reports below and beyond this range (such as in Meghalaya) are also there and occupied altitude varies seasonally across the range. In the Indian Himalayan Region, Red Panda occurs in Sikkim, northern West Bengal and Arunachal Pradesh. Red Panda is closely associated with montane forests (oak mixed; mixed broad-leaf conifer; and conifer) with dense bamboo-thicket as understorey. They favour dense forests on gentle slopes in close proximity to water sources.

Description

Red panda are about 50 to 64 cm long, with relatively long (28-59 cm), furry, non-prehensile tails marked with about 12 alternating buff and red rings. The round head is featured with shortened rostrum and large, pointed and erect ears. The upper part of the body is covered by reddish brown, long, coarse guard hairs and the glossy black undercoat is soft, dense, and woolly. The white face has reddish-brown "tear" marks under the eyes. The legs are black and the soles of its feet are densely covered with white hair. There is no sexual dimorphism in colour or size between males and females. Red Panda is largely arboreal and consume primarily young leaves and shoots of bamboo. The diet of Red Panda also includes fruit, roots, succulent grasses, acorns, lichens, birds' eggs and insects.

Shoulder height: 60 cm	Weight: 3.7 to 6.2 kg (Male); 3 to 6 kg (Female)	Tail length: 28-59 cm

Vulnerability to climate change

Red Panda generally occurs within a narrow altitude band and specialized on the diet comprising mainly bamboo leaves. Bamboo rarely reinstate after flowering in degraded and deforested areas. Old-growth primary forests are preferred by red panda and it is very unlikely that they will take refuge in the new-growth forests during habitat shifts owing to climate alteration. A warming trend may also lead to more degradation and fragmentation of the red panda habitat as anthropogenic pressure in terms of agriculture, NTFP collection, and intensive livestock grazing would increase. As habitat becomes fragmented, connectivity between core areas could become lost, isolating populations and compromising their viability. If a warming trend allows new predators such as mongooses to move into higher elevations, predation pressure on red pandas could increase. However, as no physiological studies of red pandas are available, the potential consequences of climate change on their physiology are not known.

Monitoring protocol

As an elusive mammal of the old-growth forests of eastern Himalaya, monitoring of this rare species is a challenging job. Moreover, this arboreal species prefers specialized habitats in dense primary forests of mostly inaccessible areas. Detection of presence can be done through sign survey in primary forests with substantial undergrowth of bamboo. Scats can indicate the presence of red panda in a particular habitat. Non-invasive, DNA based population estimation from scats is also a good option to estimate the abundance of red panda in a particular habitat.

Key threats

- Major threats are habitat loss and fragmentation; habitat degradation; and physical threats
- Red Panda trade (skins and other body parts)
- Movement of cattle herders/grazers during the breeding season
- Predation by shepherd dogs and feral dogs

Reproduction and life cycle

Gestation period:
4-5 months

Rutting:
Late May to early August

Young per birth:
one or two

Weaning:
18 months

Sexual maturity:
2 years

Life span:
12- 14 years

Key field identification features

- Long, furry, non-prehensile tails marked with alternating red and buff rings
- White face with reddish-brown "tear" marks under the eyes and pointed ears
- Dark green scat usually on lower branches of a tree or at the base, or on the ground in dense bamboo thicket

Important web links

http://www.iucnredlist.org/details/714/0
http://redpandanetwork.org/
http://www.redpanda.org.np/

CHEER PHEASANT
Catreus wallichii

Vernacular/other names

Chair, Phukran,Chir, Chihir (Garhwali, Kumauni), Bunchil, Herril (Pahri-N.W.Himalaya), Chaman(m), Chamani(f) (Himachali-Chamba), Tana (Shimla/Pandrabis), Reear, Rehar (Kashmiri)

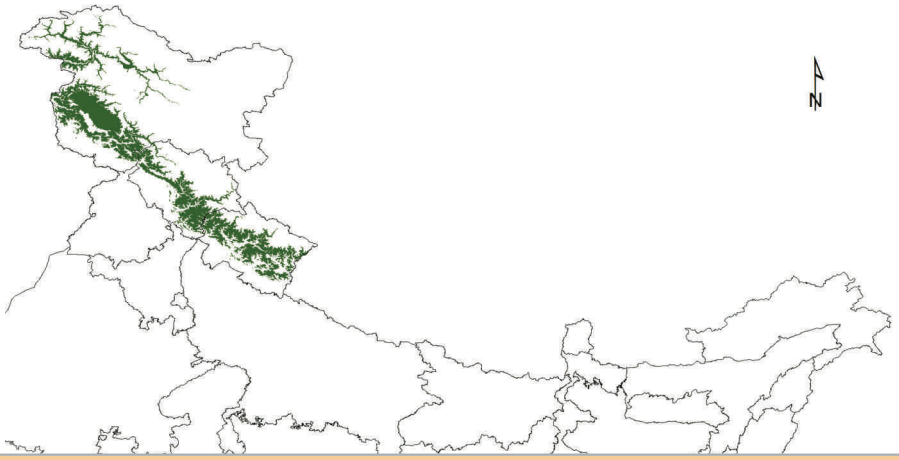
Taxonomy

Kingdom: Animalia
Phylum: Chordata
Class: Aves
Order: Galliformes
Family: Phasianidae
Subfamily: Phasianinae
Genus: Catreus
Species: wallichii

Conservation status

IUCN: Vulnerable
IWPA: Schedule-I
CITES: Appendix-I

Size



It is resident and uncommon. Distributed as fragmented populations in the north-western and western Himalaya (Jammu & Kashmir, Himachal Pradesh, Uttarakhand) between 1,500-3,050m. Inhabits precipitous, often craggy hillsides with scrub and stunted trees and dissected by wooded ravines or with some scrub and grass cover; village grazing lands and recently cleared areas with secondary growth. Strongly favours early successional habitats.

Description

A long-tailed Himalayan pheasant with a long narrow backward projecting brown crest on head, red facial skin, and body in buffy white and pale rusty, closely barred with black. When on flight, the buff, grey and brown body coloration and long broadly banded tail are the characteristic features for identification. The male has unmarked greyish throat and neck, heavily barred buff-and-black mantle and back, rufous rump barred with black, and greyish breast becoming more buffish on belly and flanks. Tail has broad buffish white banding and with black-edged chestnut bands across outer feathers, and black-mottled grey-brown bands across central feathers. The female is similar to male, but has more prominent upperparts, with shaft streaking. It is more heavily barred on breast, and has rufous brown lower breast and belly scaled with buff, grey-brown rump mottled with black and buff, and narrower buff bands across tail.

Body length: 90-118 cm	Weight: 1.25-1.7 kg	Altitude range: 1,500-3,050 m

Habitat

Cheer pheasant inhabits precipitous, often craggy hillsides with scrub, grass cover & stunted trees, wooden ravines and recently cleared areas with secondary growth.

Vulnerability to climate change

As depicted in various probabilistic models, due to climate change grasslands could become encroached by upslope forest migrations and habitat alteration may lead to competition with other forest dwelling species such as the Red Junglefowl (*Gallus gallus*) and Kalij pheasant (*Lophura leucomelanos*).

Monitoring protocol

As an inhabitant of grassland-forest mixed habitat, direct sightings of this elusive species is often very difficult. Professionals can do presence/ absence mapping in the edges of upper temperate mixed coniferous forests and temperate grasslands. Encounter rate can also be used as a measure of relative abundance as number of individual seen per unit effort. The unit effort could be time spent in intensively searching in an area or it could be the distance travelled in an area intensively searching for the bird. During breeding season, the pheasant makes distinct calls, which can be used in call count methods to estimate the relative abundance. During breeding season (April-May), males call during early morning hours (predawn period) and late evening hours to attract females and also to challenge rival males in the vicinity. Additional information on the group sizes during the breeding seasons will help in understanding the population size in an area. Use of camera traps to detect the presence of this elusive species and relative abundance estimation through photographic capture rate and occupancy estimation can also be used to monitor this species.

Key threats

- The fragmented specialised habitats may render the smallest isolated populations vulnerable to extinctions
- Higher levels of disturbance, grazing and the felling of wooded ravines pose a substantial threat
- Conversion of grassland to agricultural fields is reducing available habitat, as are schemes to plant mid-altitude grasslands with forest
- Nest disturbance by dogs has also been identified as a threat
- Many populations lie outside the protected area network and hence are vulnerable to illegal trapping and hunting

Reproduction and life cycle

Call :chir-a-pir, chir-a-pir, chir, chirchirwa, chirwa, chewewoo

Breeding:
late April to early June

Nest site/type:
no nest, eggs are laid in undergrowth on rough grounds

Clutch size:
9 - 14

Incubation Period:
26 days

Key field identification features

- Long broadly banded tail, red facial skin, distinct loud call

Important web links

http://www.birdlife.org/datazone/species/factsheet/22679312

http://www.xeno-canto.org/121425

BLOOD PHEASANT
Ithaginis cruentus

Vernacular/other names

Chilime (Nepalese), Same, Semo, Soomoong pho (Sikkim-Lepcha), Chiku (Arunachal-Mishmi)

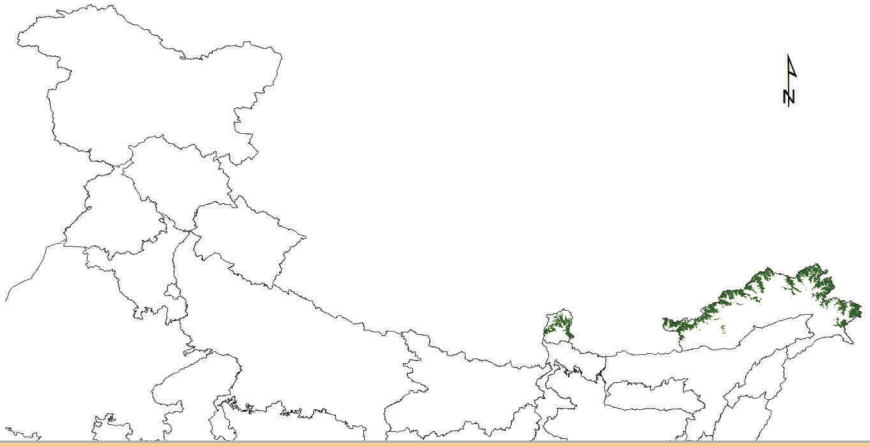
Taxonomy

Kingdom: Animalia
Phylum: Chordata
Class: Aves
Order: Galliformes
Family: Phasianidae
Subfamily: Phasianinae
Genus: Ithaginis
Species: cruentus

Conservation status

IUCN: Least concern
IWPA: Schedule-I
CITES: Appendix-II

Size



Blood pheasant is distributed in the Himalaya from Nepal through Tibet, Arunachal Pradesh into northern Myanmar to northwest China. It is resident and fairly common. Distributed from 3,200-4,700 m (down to 1,500 m in winter) elevation, it prefers open fir, rhododendron forest, birch forest and juniper scrub. Sometimes sighted near snow patches.

Description

Male is an unmistakable brightly coloured pheasant with lanceolate plumage. It has bright red orbital patch; black forehead and 'spectacles'; crimson–red chin and throat; blue-grey upperparts streaked with white (and with apple-green in wing-coverts); apple-green underparts streaked with pale yellow-green; and crimson splashes on breast, tail-coverts and in tail. The female has dark brown upperparts, and rufous-brown underparts. It has grey crest, nape and upper mantle, and rufous-orange forehead, face and throat.

Body length: 38 cm	Weight: 4.8-5.7 kg	Altitude range: 2,600-4,600 m (1,500 m)

Habitat

blood pheasant inhabits open fir and rhododendron forest, shrubberies of rhododendron, juniper and birch and moderate to dense bamboo clumps

Vulnerability to climate change

Change in distribution range has already been pointed out in Sikkim, where, Blood Pheasant was reported to occur as low as 1500 m during winter otherwise in summer it normally ranges between 2600 m to 4500 m (see Ali 1962) but recent observations in Sikkim depicted this species above 3300 m, both in winter and summer. Displaying a huge shift in lower elevation limits.

Monitoring protocol

During summers, blood pheasant inhabit stunted rhododendron growths in high altitude, very humid environment, regular monitoring of this species may require substantial efforts through intensive field expeditions in high altitude alpine areas as well as sub-alpine forests of eastern Himalaya. Trail sampling for the sign survey and direct encounter can generate information about presence of the species. Ridge walking can be one option to estimate encounter rate as relative abundance. Camera trapping may also help to estimate relative abundance of blood pheasant and monitorning.

Key threats

- The species is declining all over its range owing to habitat loss and degradation caused by forest produce extraction, overgrazing and agricultural conversion as well as hunting pressure for consumption

Reproduction and life cycle

Call:
Chuck, kzeuuk-cheeu-cheeu-cheeu

Breeding Season:
April-June

Nest Site/ Type:
Loose nest of leaves under bushes or bamboo

Clutch Size:
5 to 12

Incubation Period:
29 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 TRINKET SNAKE

Orthriophis hodgsoni

Vernacular/other names

Himalayan trinket snake, Hodgson's racer

Taxonomy

Class: Reptilia

Order: Squamata

Family: Colubridae

Genus: Orthriophis

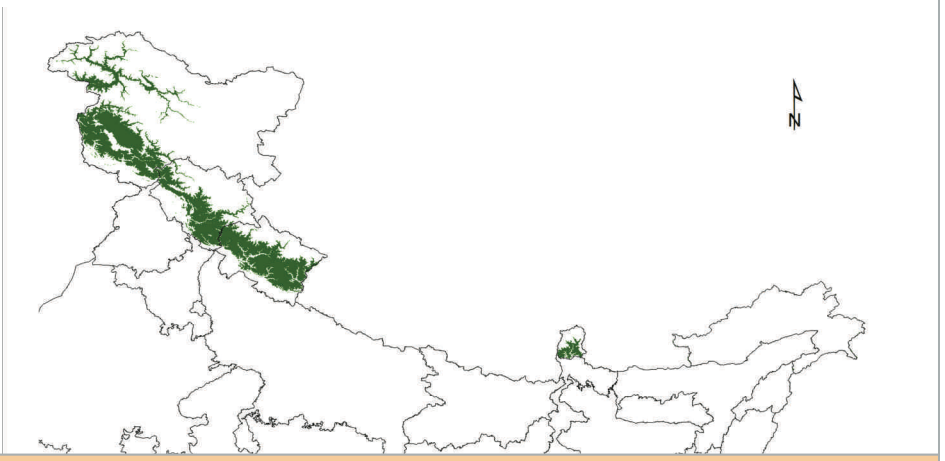
Species: hodgsoni

Conservation status

IUCN: Not evaluated

IWPA: Schedule-IV

CITES: Not listed



Type specimens are collected from Ladakh and Nepal. This species is known from China (Tibet), Nepal, India (Jammu and Kashmir, Northern Punjab, Himachal Pradesh, Uttrakhand and Sikkim). Record from Garo Hill (Meghalaya) needs verification.

In Northern India, the species is reported between 1,000-3,000 m. In Nepal, recorded from 5,000 ft (1,515 m) below Dulansa.

This is a montane species and inhabits moist oak forest, dry coniferous forest, moist deciduous forest, edges of agricultural fields in the vicinity of water. One specimen was observed while it was roosting among overhanging vegetation of a stream at night. Hu et al. (1987) reported the species from urban areas in the immediate vicinity of a water house. Known to feed on rodents. toads and skinks. July and August is main activity period for this species. Known to live upto 27 years in captivity. Males (140 cm) are larger in length than female (130 cm).

Description

Head distinctly wider than long slightly distinct from neck, snout rounded, eyes distinct with round pupil; eye diameter almost 15% of the head length; nostril is located closer to snout than to eye, parietal width is almost equal to the distance between eye to nostril; frontal height is slightly less than the eye to nostril distance; prefrontal slightly longer than wide, internasal wider than high; supraocular almost equal to parietal width. Loreal squarish and longer than high.

Post ocular: 2/2; Pre Ocular: 1/1; Temporal 2+2 or 2+3; Supralabial: 8/8, 4th and 5th touch eye, 6th highest, 7th longest; Infralabial: 10/10, 5th touches anterior genial, 5th and 6th touch posterior genial, 6th largest. Dorsal scale rows 21:21(23): 17; Ventral 228-247, ventral with lateral keel, Anal 2; Subcaudals 72-90; Scales edge with black, ventral uniform white; Snout to vent length VL: 855 mm: TL: 230 mm. Maximum length is reported up to 2100 mm.

Live coloration

Top of head with a black mark, Irish blue, Tongue brown, lip scales are yellow, yellowish olive coloured back, dorsal scales are edged with black or white that produce a mesh like pattern. Ventral is uniform cream; the subcaudals yellowish but may be brownish, reddish or black. A specimen with two brown dorso-lateral stripes, which become more evident towards tail is also described.

Vulnerability to climate change

Climate change can influence range shift and change activity pattern in snakes. Climate related impact on its dietary niche may be studied. Climate related change in human distribution pattern may lead to conflict situation and increase persecution of this large growing species.

Monitoring protocol

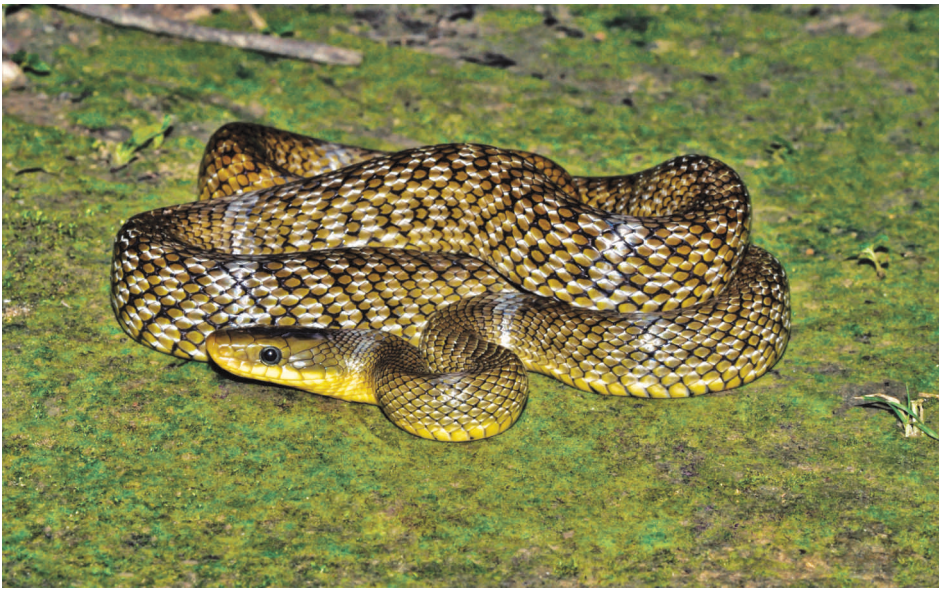
Opportunistic observation (visual encounter search, rescue, dead snakes, museum and published literature records etc.) can help gather presence record and grid based distribution mapping for the species. Any effort to record this species should be done when the snake is most active (dawn and dusk and during July-August). For long term monitoring of the species population, mark recapture studies can be employed using PIT tag or ventral scale clipping technique. Radiotelemetry studies may help gathering hitherto unknown information on movement, activity pattern and habitat use. Additional temperature sensor will help to understand thermal budgeting of this high altitude snake which will help in climate change monitoring.

Key threats

- Pollution and modification of its freshwater breeding habitats
- Road kill of adult individuals during breeding migration and juveniles during dispersal

Key field identification feature

- Head much wider than long, snout rounded not protruding
- Tympanaum is indistinct, paratoid gland prominent and elongated
- Back and flank with large glandular warts
- Males develop nuptial pads on three fingers
- Toes half or two thirds webbed, subarticular tubercles prominent
- Outer metatarsal tubercles prominent
- Adult males attain only 70% of female body size



Important web links

http://www.reptiledatabase.reptarium.cz/species?genus=Orthriophis&species=hodgsoni&search_param=%28%28genus%3D%27Orthriophis%27%29%29

HIMALAYAN TOAD
Duttaphrynus himalayanus

Vernacular/other names

Himalayan toad

Taxonomy

Class: Amphibia

Order: Anura

Family: Bufonidae

Genus: Duttaphrynus

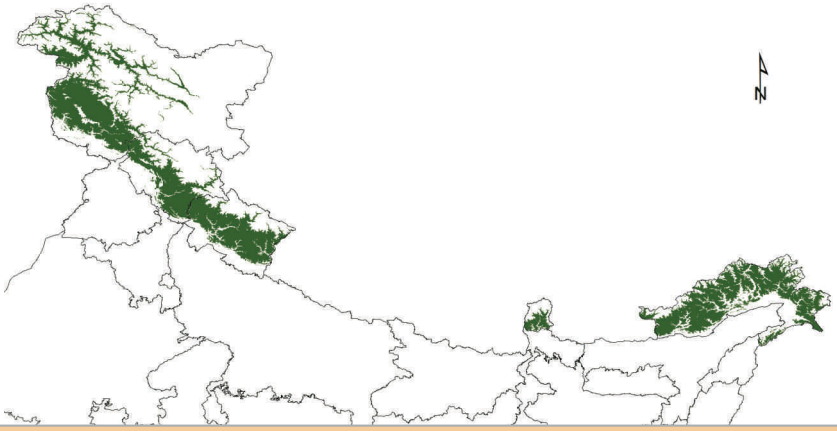
Species: himalayanus

Conservation status

IUCN: Not evaluated

IWPA: Not listed

CITES: Not listed



Species is widely distributed along the mid elevation areas of Himalaya between 1,000-3,500m elevation. In India it is reported from Jammu and Kashmir, (Kashmir), Himachal Pradesh, Uttarakhand, Sikkim, Darjeeling, Arunachal Pradesh Meghalaya, Elsewhere it is known from Pakistan, China (Tibet), Nepal and possibly in Bhutan.

Duttaphrynus himalayanus is nocturnal. During day time they take refuge under large rocks or rotten logs, in earth holes or wall crevices often near human habitation. In the evening it can be encountered in clearings, fields and along roads, around human habitation and also in montane forest floor. Breeding takes place in hill streams, small pools and puddles where the larvae also develop. Man made pools/water bodies is also observed to be occupied by toads for breeding and spawning. Hybrids are reported between *D. melanostictus* and *D. himalayanus*.

Description

Toad is uniformly greyish brown to dark brown from dorsal region with diffuse large dark spots or without spots. Individual under rotten log or rock attain dark colouration. Venter is yellowish to dark grey. Dark grey spots on venter may be in some specimens. Spots on ventral side are small in size. Dorsally the spots are larger and diffuse.

Reproduction

Preferred breeding sites are stagnant water bodies that are exposed to the sun such as slow brooks, ponds on pastures, temporary puddles and small pools near streams. Breeding activity starts from March to June. Calling males aggregate around water bodies after first few showers of the season. Amplexus is axial. Female lays long strings of eggs coated within gelatinous sheath. Tadpoles are dark, heavily pigmented. Metamorphosis takes place in 6-10 weeks between June-August.

Vulnerability to climate change

Factors related to climate change are known to affect body size, breeding behaviour and range shift. Rapid shift in climate can influence patterns of cloud formation. Hence, it may lead to change in water availability and effect amphibian life cycle. Climate related drought situation may lead to few and far located wetlands. Accessing those habitats for migrating adults and dispersing juveniles may be difficult and dangerous and may lead to road related mortality. Being anamniotes, amphibian eggs are susceptible to UVB radiation.

Monitoring protocol

Visual encounter survey (VES) can be used to determine relative abundance of the species over long period of time. The call count method is used for mapping distributions and estimating relative abundance of calling toads. Counting calling male toad along the strip transect (Audio strip transect) can be effective way to inventory species composition, to provide first approximation of species composition and to determine the breeding habitat. The automated recording of anuran vocalization is a relatively simple but effective way to know their presence and temporal calling pattern. Here, population can be sampled aurally (adult males) or visually (adults and larvae under certain condition).Hitherto unknown information of movement ecology can be studied by tagging individual by Visual elastomers tags or PIT tags. Radio telemetry study will help in dispersal and migratory behaviour of adult frogs. For juvenile dispersal studies pitfall sampling can be done. We recommend that temperature and humidity data should be collected with each observation as amphibian activity and reproductive biology are so closely tied to local weather patterns. Relative abundance estimation and sampling in occupancy framework may help in long time monitoring in species population and assess any climate change impact on the species.

Key threats

- Pollution and modification of its freshwater breeding habitats
- Road kill of adult individuals during breeding migration and juveniles during dispersal

Key field identification features

- Head much wider than long, snout rounded not protruding
- Unlike *D. melanostictus* and *D. stomaticus* its tympanum is indistinct, paratoid gland prominent and elongated, cranial ridges (canthal, preorbital, supraorbital) absent
- *D. himalayanus* do not have two parallel rows of dorsal keratinized warts on dorsum like *D. melanostictus*
- Back and flank with large glandular warts, males develop nuptial pads on three fingers.
- Toes half or two thirds webbed, subarticular tubercles prominent, Outer metatarsal tubercle present, maximum snout to vent length 12.7 cm
- Adult males attain only 70% of the female body size

Important web links

http://research.amnh.org/vz/herpetology/amphibia/Amphibia/Anura/Bufonidae/Duttaphrynus/Duttaphrynus-himalayanus

BROWN TROUT
Salmo trutta fario

Vernacular/other names

Brown trout, Trout

Taxonomy

Class: Actinopterygii

Order: Salmoniformes

Family: Salmonidae

Genus: Salmo

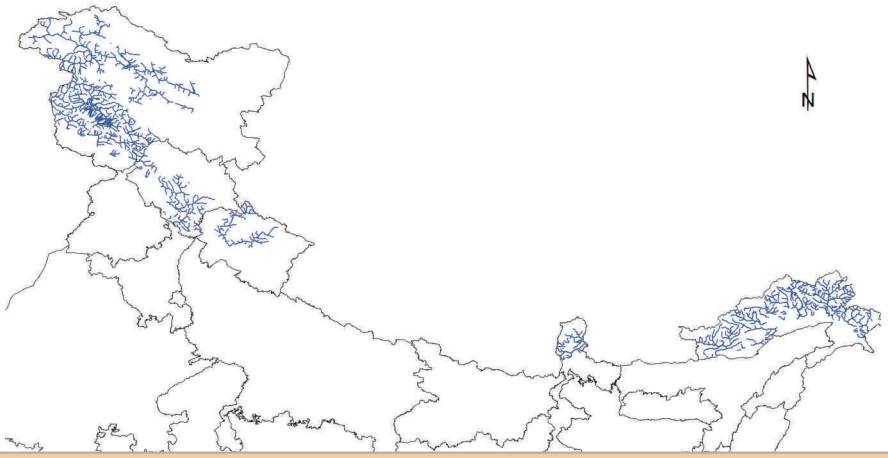
Species: trutta

Conservation status

IUCN: Least concern

IWPA : Not listed

CITES: Not listed



This fish inhabits cold streams, rivers and lakes and spawns in rivers and streams with swift water. Lacustrine populations migrate to tributaries and lake outlets for spawning, which are usually characterized by downward movement of water into gravel. Brown trouts largely forage in pelagic and littoral habitats. At present, brown trouts are stocked in several Himalayan states including Jammu & Kashmir, Uttarakhand, Himachal Pradesh and North Eastern Hill region. In Uttarakhand, this species distributed in Asi Ganga and Pindar rivers and Dodital lake, where they breed.

Description

It is a deep brown coloured fish with green or blue hues. Flanks with black and reddish spots which are surrounded by light coloured area. The spots may be less in number in juveniles. Body of this fish is strong, torpedo shaped and moderately compressed. Mouth is wide and scales are minute. Dorsal fin with 3-4 spines and 9-11 rays, Pectoral fin with 1 spine and 12 rays, Ventral fin with 1 spine and 8 rays and Anal fin with 3 spines and 7-8 rays.

Vulnerability to climate change

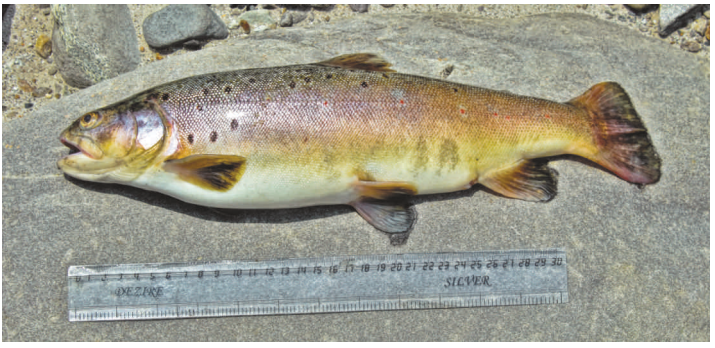
Being an inhabitant of the cold mountain streams with high oxygen content, brown trout is well adapted for high altitude climate conditions. Anticipated changes in flow regime, water temperature and turbidity of the Himalayan streams due to climate change will result in adverse effect on this species. Being an invasive species, brown trout is one of the major threats to native aquatic fauna of the Himalaya. Invasive brown trout was also found to be expanding its range in the exclusive snow trout zone, possibly due to climate change or changes in the environmental flow or barrier effect caused by existing hydroelectric power plants.

Ecological and socio-economic benefits of monitoring

The Brown trout constitutes one of main trout fisheries in the streams, lakes and reservoirs in the Himalaya. Although this species is well known for its recreational value in sport angling, it is now considered as one of worst invasive species in the river wherever it has been introduced. This species is native to western Europe and was introduced in many parts of the world, including Himalaya, in 1899 and 1901 from United Kingdom for game fish angling. Being a carnivore, it is known to survive on fry and juveniles of native fish species. Therefore, monitoring this species as a threat is crucial to better understand the impact of climate change on other aquatic fauna of the Himalaya.

Key field identification features

- Compressed body with fine scales.
- Greenish or brownish body with many coloured spots.



Important web links

http://www.fishbase.org/Summary/SpeciesSummary.cfm?genusname=Salmo&speciesname=trutta%20fario ;

http://www.bbc.co.uk/nature/species/Brown_trout

http://www.arkive.org/brown-trout/salmo-trutta-fario/image-A22150.html

http://www.iucnredlist.org/details/19861/0;http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T19861A9050312.en

COMMON CARP
Cyprinus carpio

Vernacular/other names

Carp, Common carp

Taxonomy

Class: Actinopterygii

Order: Cypriniformes

Family: Cyprinidae

Genus: Cyprinus

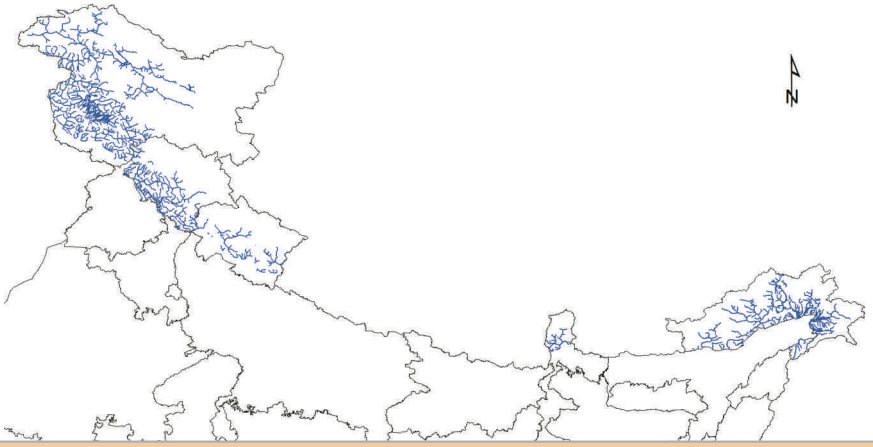
Species: carpio

Conservation status

IUCN: Vulnerable

IWPA: Not listed

CITES: Not listed



This fish inhabit still or slowly flowing waters, lakes and permanent wetlands, commonly with silt bottoms. Adults often undertake considerable spawning migration to suitable backwaters and flooded meadows. Larvae survive only in very warm water among shallow submerged vegetation. Benthopelagic fish inhabiting a pH range of 6.5-9.5 and temperature range of 3°C - 35°C. This European species was introduced in several wetlands of Himalaya. This species cultured in several parts of Himalaya including Jammu & Kashmir, Himachal Pradesh, Uttarakhand and North Eastern Hill region.

Description

Common Carp, referred as an old world carp, a heavy-bodied minnow ray finned fish with a long dorsal fin containing 17-21 rays, stout, saw-toothed spines at front of both dorsal and anal fins, and two barbels on each side of upper jaw. Back and sides brassy olive, belly yellowish-white. Scales of back and sides prominently dark-edged, giving a crosshatched effect. Fins dusky, often overlain by reddish tinge on tail fin and yellow or orange on lower fins. Maximum length is 120 cm; common length is 31.0 cm; maximum published weight: 40.1 kg; maximum reported age: 38 years.

Vulnerability to climate change

In Himalaya, temperature, pH and turbidity are important factors for spatial distribution of native fishes and macrophytes. It is expected that the climate change would alter these factors that might favour invasive common carp that has already been introduced in Himalayan wetlands to expand its range. *C. carpio* is the third most frequently introduced species world-wide. Wherever, it has been introduced it has reduced water quality and degraded aquatic habitats. In shallow aquatic ecosystems, common carp can affect benthic communities and is known to damage aquatic macrophytes. Therefore, it may pose a threat to wetlands that are used by many native fish as spawning and nursery habitats. Climate change that would favour the invasive species could further deteriorate the aquatic ecosystem and its biodiversity.

Ecological and socio-economic benefits of monitoring

Carps have long been the main aquaculture production system used in Himalaya. Further, carps are important in aquarium culture as companion or show species, including ornamental varieties and carps are also important for commercial wild harvesting and as recreational fishing species in Himalaya. But, the introduction of common carp in Kashmir and in the Kumaon Himalaya is also debated in connection with its potential impact on native schizothoracines that were declined drastically wherever common carps present. The feeding pattern of common carp and schizothoracines is almost identical, with many of the lacustrine species of schizothoracines feeding on detritus and benthos. In spite of the common carp being the most common food fish in the Himalaya, schizothoracines are still the consumer's first preference. Therefore, monitoring this species as a threat to native fishes would help to take precautionary measures to prevent or minimize the impact of this species on native species that are already threatened by climate change.

Key field identification features

- Body greenish to blackish coloured, robust and more or less compressed
- Fleshy lips with upper jaw projectile. Very long dorsal fin

Important web links

http://www.mnfishfinder.com/common-carp-9-fish.html
http://mdc.mo.gov/discover-nature/field-guide/common-carp
http://www.fao.org/docrep/003/x2614e/x2614e00.HTM
http://www.iucnredlist.org/details/6181/0
http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T6181A12559362.en
http://www.invasive-species.org/default.aspx
http://fishbase.org/summary/Cyprinus-carpio+carpio.html;

COMMON YELLOW SWALLOWTAIL
Papilio machaon

Vernacular/other names

Common yellow swallowtail

Taxonomy

Phylum: Arthropoda

Class: Insecta

Order: Lepidoptera

Family: Papilionidae

Genus: Papilio

Species: machaon

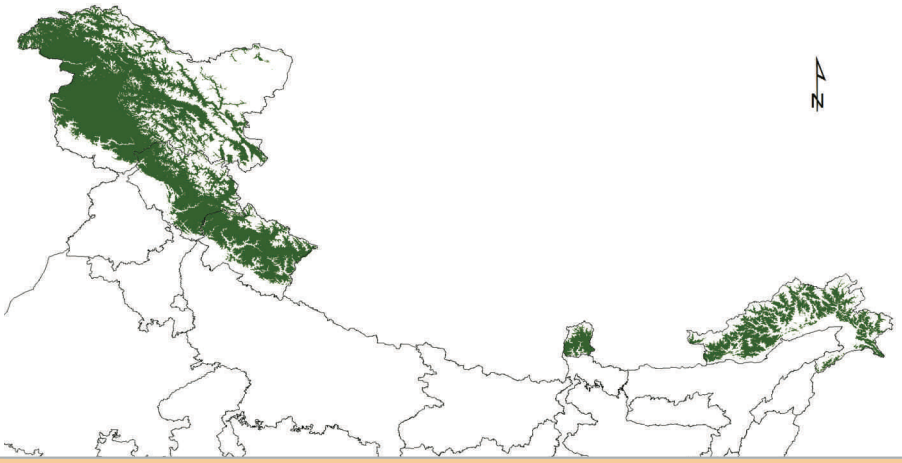
Conservation status

IUCN: Not evaluated

IWPA: Schedule-II

CITES: Not listed

Size



Common Yellow Swallowtail butterfly is a widespread Palaearctic species distributed throughout Europe and Asia. In the Himalayan region it is distributed from Jammu Kashmir to Arunachal Pradesh between 1,200-4,800 m. In eastern Himalaya it is not found below 2,800 m. At lower elevations it flies from March-September but may occurs beyond this period. On warm sunny days, it may be commonly seen hill-topping around subalpine-alpine areas around morning and noon time to find their partners.

Description

The Common Yellow Swallowtail butterfly is an old world species and a member of family Papilionidae which are also commonly known as Swallowtails. It is tailed, black and yellow, a fast flier, frequently interrupted by visits to low growing flowers over which it rests. It has relatively large compound eyes that are most important sensitive organ of the Swallowtails for orientation. Several subspecies are found in the Himalayan region.

Upperside: Body and wings are patterned in black and yellow with wing span of 75-90 mm. Forewing with ground colour, black dusted with yellow scales, rest of cell yellow with a black bar and another bar at its end. Discal area is yellow with black veins. Marginal area is black with a complete series of regular small yellow spots near border.

Wingspan: **75-90 mm** | Altitude range: 1,200-4,800 m

Hindwing basal half is creamy yellow with black veins, outer half black with series of diffused blue spots and marginal series of creamy yellow large crescent spots. Inner margin of upper hindwing below base has a red spot. Hindwing outer margin is ridged. Each hind wing has one tail.

Underside: The underside is somewhat paler cream in colour. Forewing has two transverse short bands across the cell. Hind wings also have one red and six blue spots each. Hindwing veins are prominently black.

Life Cycle

The Yellow Swallowtail butterfly may have 1-5 broods in a year depending on ambient temperature and resource availability. The spherical yellow eggs are laid singly on the food plant. The brown, beige or green chrysalis is attached to the substrate with a silken belt. The species overwinters as pupa. The caterpillar is green with black strips and red spots. It is green or brown. Young caterpillars look like bird droppings to camouflage from predators. In defence the larvae can protrude an orange, fleshy, smelling fork behind their heads called Osmeterium.

Larval food plants : *Daucus carota, Heracleum* spp. *Selenium* spp., *Ferula jaeschkeana* and *Angelica* spp. (Apiaceae)

Vulnerability to climate change

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 may 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.

Key threats

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

Key field identification features

- The butterfly cannot be mistaken with others because of its creamy yellow and black colour
- Black antennae, head thorax and abdomen are creamy coloured with black line
- Abdomen beneath with narrow lateral ill-defined black lining
- It may be commonly seen hill-topping around alpine meadows

Important web links

http://www.learnaboutbutterflies.com/Britain%20-%20Papilio%20machaon.htm
http://www.inaturewatch.org/climate-change-butterflies.php

PIED PADDY SKIMMER
Neurothemis tullia

Vernacular/other names

Pied paddy skimmer

Taxonomy

Class: Insecta

Order: Odonata

Family: Libellulidae

Genus: Neurothemis

Species: tullia

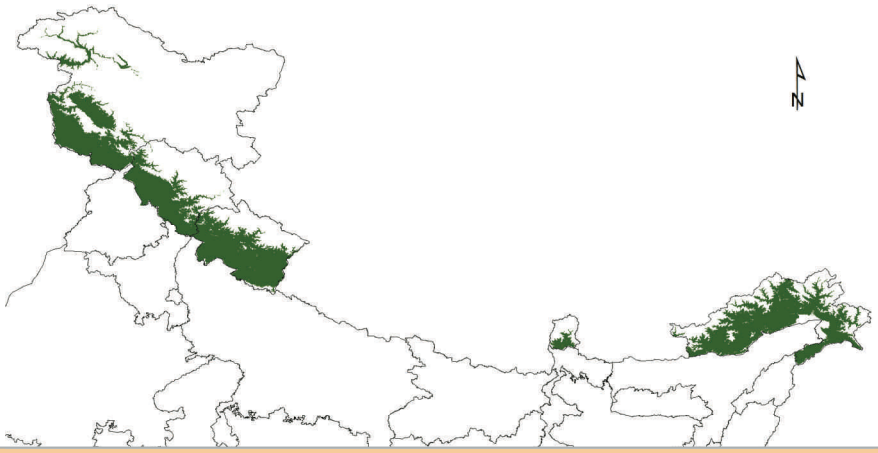
Conservation status

IUCN: Least concern

IWPA: Not listed

CITES: Not listed

Size



This species of dragonfly breeds in still or slowly flowing waters, such as wetland edges, weedy marshes, marshes sub-ordinate to paddy fields, well vegetated pond. Adults often undertake considerable spawning migration to suitable backwaters and flooded meadows. This species is found all over the Himalaya states from West to North to North-east, in the altitudinal range from 200-2,400 m.

Description

Pied Paddy Skimmer is a very widespread and common Oriental species, occurring throughout the mainland tropical and sub-tropical Asia. A medium sized pied dragonfly unmistakable with black and white wings; female is distinct from male but the colouration pattern of wings is much paler in color. Perches low near wetlands, edge of the paddy field, weakly flutters away to nearby perch on being disturbed.

Male: Face is black. *Eyes:* Blackish brown above, vialaceous below. *Thorax*: Black with mid-dorsal cream stripe. *Legs*: Black. *Wings*: Basal half is opaque blue black which is bordered by a milky white patch towards the tip. The wing tips are transparent. *Wing spot*: Dull brown. *Abdomen*: Black with a broad mid-dorsal creamy white stripe on the upperside.

Female: Differs significantly from the male in body markings and colouration. The face is

Wingspan: **16-20 mm** | Abdomen: **19-23mm** | Altitude range: 200-2,400 m

olivaceous yellow. *Eyes:* Pale brown above, which fade to pale olivaceous towards the sides and below. *Thorax*: Greenish yellow with a bright yellow mid dorsal stripe. This stripe is broadly bordered with blackish brown throughout. *Legs*: The outer surface of legs is yellow and the inner surface is black. *Wings*: Base of the wings bright amber yellow. Front edge of the wing is blackish brown, broadening into a very large blackish brown spot. This spot extend to the rear edge of the wing. In hind-wings this spot is irregular or sickle shaped. Tips of all wings are broadly blackish brown. *Wing spot*: Dull brown. *Abdomen*: Bright yellow with a broad black band above. Underside is black.

Vulnerability to climate change

They do not appear to have any global threats at present. But in Himalayas, temperature, pH, turbidity, aquatic vegetation cover, herbs and shrubs cover are important factors for spatial distribution of these semi-aquatic insects. Larval stages of these insects are ectothermic, so their different instar periods may responds to temperature and would cause early emergence or inappropriate emergence which leads to death of an individual which may affects their population trends.

Monitoring protocol

This medium sized dragonfly can easily located near low perches near wetlands, edge of the paddy field, weakly flutters away to nearby perch on being disturbed. Species can be monitored through transect counts and opportunistic sampling near agricultural field up to 2400m elevation range in Himalayas.

Key field identification features

- Wing spot dull brown
- Eyes pale brown above, and Olivaceous below

Important web links

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

WILLOW-LEAVED SEA BUCKTHORN

Hippophae salicifolia

Vernacular/other names

Amesh (Garhwal),
Dhur Chukh (Kumaon),
Badri Phal

Synonyms

Hippophae rhamnoides subsp. salicifolia

Taxonomy

Family: Elaeagnaceae

Genus: Hippophae

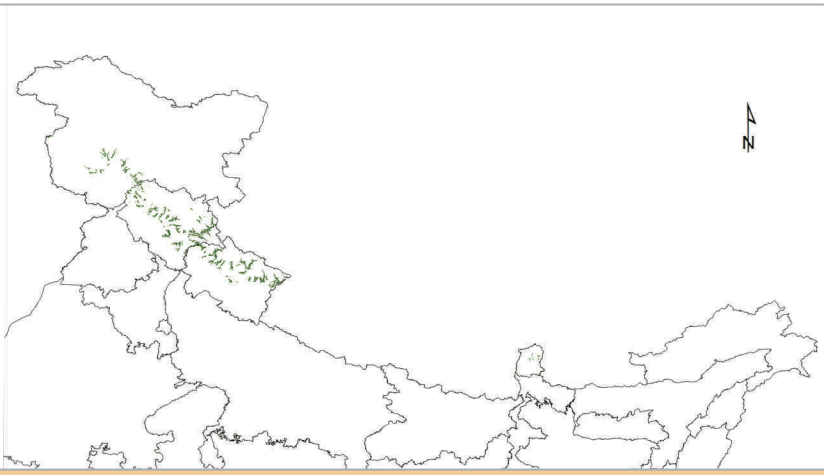
Species: salicifolia

Conservation status

IUCN: Least concern

IWPA : Not listed

CITES: Not listed



Hippophae salicifolia is a non-leguminous nitrogen fixing plant that grows mostly along alluvial banks of Himalayan rivers (on gravels and sandy soils) between 2,500-3,500 m. Due to its wider adaptability, drought resistance, strong root system and capacity to fix atmospheric nitrogen through symbiotic association with genus *Frankia*, the plant has been widely planted to control soil erosion and reclamation of degraded lands. In India it is distributed in Jammu and Kashmir, Himachal Pradesh, Uttarakhand and Sikkim. Best growth of the species occurs in deep, well drained, sandy loam soil.

Description

Shrubs or small trees upto 8 m tall. Petiole 2-3 mm; leaf blade whitish underneath with usually reddish brown midrib, linear-oblong, 4.2-6.2×0.6-1.2 cm, upper surface stellate-hairy, margins slightly curved. Male flowers 2.5-4 mm; anthers 2-2.5 mm. Female calyx ca. 2 mm. Peduncle 1-4 mm. Fruit orange-yellow to greenish brown or yellow to deep red, globose, terete, 5-7 × 5-7 mm. Endocarp easy to separate from seed. Seed broadly ellipsoid to ovoid, 2.8-5.2 mm long.

Use and trade

The fruit has intense sour taste, sharp lemon flavor and contains 60 to 80% juice rich in sugar, organic acids, amino acids, tannins and vitamins. The fruit contains 3 to 5% of pulp oil and 8 to 18% of seed oil. The fruits are rich source of vitamin A, carotenes, vitamin E and several other tocopherols and flavonoids. The concentration of vitamin C in Sea buckthorn fruits ranges from 100–300mg/100g fruit, is higher than strawberry, kiwi, orange, tomato and carrot. The leaves as well as fruits have high nutritional and medicinal value. High content of bioactive substances makes it a suitable species for pharmaceutical, cosmetic and food industry. Sea buckthorn oil is attributed with most important pharmacological functions like anti-inflammatory, antimicrobial, pain killer, and promoter in tissue regeneration, and also popular in cosmetic preparations. Numerous sea buckthorn products, such as tea from leaves, beverages and jam from fruits, fermented products from pulp, and animal feeds from leaves, pulp, and seed residues are in use. The fruits are also used for polishing gold and silver.

Vulnerability to climate change

Hippophae salicifolia usually grows as a primary colonizer and forms early seral stage in the riverine succession especially along alluvial banks of Himalayan rivers. Heavy loss of habitats in the recent decades due to anthropogenic pressures along riverine areas has led to heavy population loss. Deficit in snow fall and extreme weather events such as hailstorm during early summer or increased temperature could affect its phenology, flowering, seed production and regeneration.

Monitoring protocol

Permanent plots (20×20 m) may be laid within the distribution areas (3300–3500 m) in the landscape. Phenology, regeneration status and population structure of the species along with other associated plants and direct and indirect evidences of faunal species may be monitored.

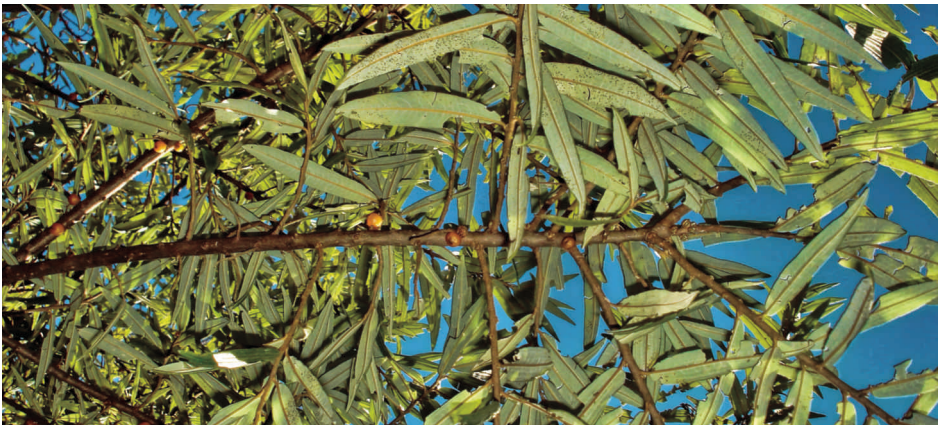
Phenology: *Flowering*: May-June, *Fruiting*: October-November

Key threats

- Habitat loss
- Over exploitation for fuel wood and timber

Key field identification features

- Shrub or small tree
- Leaves 4-6 cm long, linear-lanceolate, softly white tomentose beneath



Important web links

http://www.rufford.org/files/04.05.06%20Manual%20Guide_0.pdf

http://www.pfaf.org/user/Plant.aspx?LatinName=Hippophae+salicifolia

TIBETAN SEA BUCKTHORN
Hippophae tibetana

Vernacular/other names

Chhota Amish (Garhwal), JohariChuk (Johar Valley, Kumaon), Chha Tuan (Spiti, Himachal Pradesh)

Synonyms

Hippophae rhamnoides subsp. tibetana

Taxonomy

Family: Elaeagnaceae

Genus: Hippophae

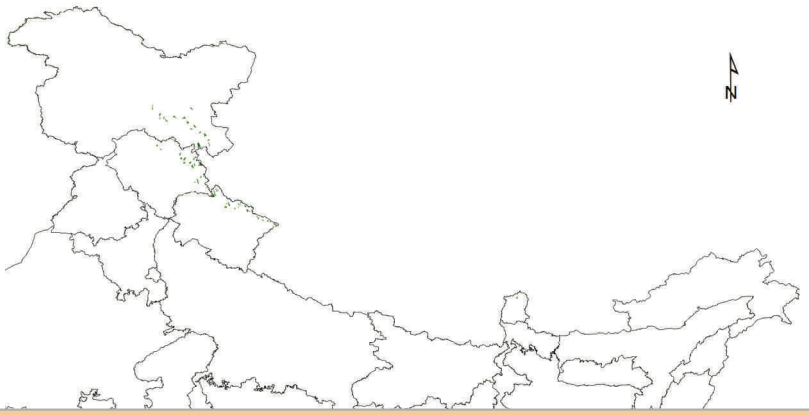
Species: tibetana

Conservation status

IUCN: Least concern

IWPA : Not listed

CITES: Not listed



Hippophae tibetana forms dense thickets (stunted scrub) in terminal moraines and open glaciated valleys between 3,300-4,500 m. In India it is distributed in the trans-Himalayan regions of Jammu and Kashmir, Himachal Pradesh, Uttarakhand and Sikkim. The species colonizes as a pioneer species in the gravelly or stony river beds after the glacial recession forming almost pure stands. It is gradually replaced by other shrubs such as *Lonicera spinosa, Caragana versicolor, Berberis jaeschkeana* and *Juniperus indica*.

Description

Small, deciduous shrub, 10-80 cm tall. Older stems dark gray, thick, with regularly spaced scars of deciduous leafy branches; leafy stems slender, unbranched, spine tipped. Leaves mostly in whorls of 3; petiole ca. 1 mm long; leaf blade whitish underneath, greyish on upper surface, linear-oblong, 1.2-2 × 0.25-0.4 cm. Lower surface dotted with scattered reddish brown scales. Leaf margins flat. Flowers unisexual. Male flowers ca. 2 mm across; anthers ca. 1.5 mm long. Peduncle 1-2 mm. Fruit yellowish green, globose to elliptic 8-11 × 6-9 mm. Endocarp difficult to separate from seed. Seed somewhat flattened, 4-5.6 × 1.9-2.8 mm.

Use and trade

Dried fruits are crushed and boiled in water to prepare a decoction. The decoction obtained is taken to cure jaundice.

Vulnerability to climate change

Hippophae tibetana is an important species in the riverine area in the alpine region that plays significant role in stabilization of river banks and soil enrichment. Frequent soil erosion induced by livestock grazing and other anthropogenic reasons coupled with climate change associated erratic and extreme weather events may cause rapid loss of habitat. Deficit in snow fall, lack of snow cover in winters and resulting freezing exposure as well as extreme weather events such as hailstorm or increased temperature could affect its phenology, flowering, seed production and regeneration. This species serve as pioneer colonizer in the succession and changing climate may favour other species which may eventually replace this in certain localities. In many parts of Himalaya, this species is being uprooted for fuel by the seasonal migratory communities which may cause population decline and shrink in habitat.

Monitoring protocol

Permanent plots (20×20 m) may be laid within 3,300–4,000 m in observed areas. Phenology, regeneration and population structure of this and other associated plants may be monitored. Changes in the habitat quality and status of disturbances may be monitored.

Phenology: *Flowering*: June-July, *Fruiting*: August-September

Key threats

- Habitat degradation

Key identifying features

- Dwarf shrub, less than 1m tall; leafy stems spine tipped
- Leaves less than 2.5 cm long, scaly on both surfaces
- Fruits orange-yellow

COMMON MOREL, MOREL MUSHROOM, SPONGE MOREL

Morchella esculenta

Vernacular/other names

Guchhi (Uttarakhand, Himachal Pradesh), Chunchuru (Himachal Pradesh).

Synonyms:

Phallus esculentus

Helvella esculenta

Morchella rotunda

Taxonomy

Kingdom: Fungi

Phylum: Ascomycota

Class: Pezizomycetes

Order: Pezizales

Family: Morchellaceae

Genus: Morchella

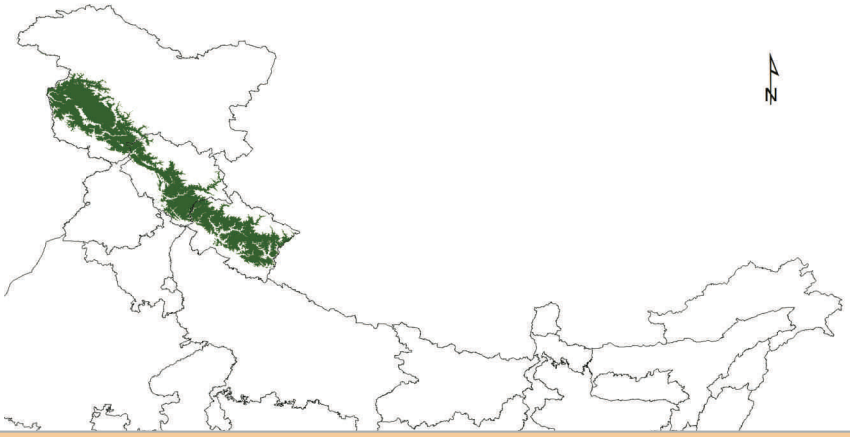
Species: esculenta

Conservation status

IUCN: Not listed

IWPA : Not listed

CITES: Not listed



Morchella esculenta grows between 1,200-3,500 m on calcareous or nutrient rich soil with high humus under various forests including broadleaved deciduous and evergreen forest, coniferous forest, stream sides, grassy slopes and alpine grasslands. Though it grows in a wide range of habitats, the montane coniferous forest dominated by deodar and spruce are best habitat for the species. In the montane forests high snowfall favors the production of this mushroom. This species is known to occur in Jammu and Kashmir, Himachal Pradesh and Uttarakhand.

Description

The fruiting bodies are variable in size and shape, 10-15 cm high but often larger, comprising a stalk and fertile upper part or head (cap) rounded, hollow, sometimes elongated to conical, often unicolor, dull yellowish to yellowish brown, outer surface with irregular fertile pits and ridges, yellowish, greyish-brown at maturity. Stipe 4-6.5 cm long, creamish, wrinkled, often granulose, hollow, slightly expanded at the base with an obvious depression. The spore deposit is deep cream to yellowish, and spores are broadly ellipsoid, smooth and lacking internal oil drops.

Use and trade

Morels are a prized culinary delicacy, one of the few edible larger fungi to appear in spring. They are considered one of the best of the edible fungi, sought-after and commercially harvested in north America and elsewhere. The fruiting bodies are considered quite nutritious, containing high-quality protein, and being rich in minerals and low in calories. *Guchhi* have several medicinal properties, including anti-tumor effects, immune-regulatory properties, fatigue resistance, and antiviral effects. Extracts from the fruiting bodies have antioxidant properties. It also has been shown that the polysaccharides from *M. esculenta* mycelia have antioxidant activity and it is also used in traditional Chinese medicine to treat indigestion, excessive phlegm and shortness of breath.

Demand for morel mushroom is very high especially in the local markets of Mandi and Kullu in Himachal Pradesh. The price of morel mushroom has gone up to Rs. 12,000-14,000/kg in recent years where local as well foreign traders are much involved in its trade. Morels also have various medicinal uses, particularly in parts of Asia. For example, in traditional Chinese medicine they have been used to treat indigestion, excess phlegm, croup, and shortness of breath. Bioactive compounds have also been reported in *Morchella*, based on study of cultured mycelia, including some with anti-tumour, antioxidant, and anti-inflammatory activity. Compounds linked to immune-system enhancement have also been reported.

Vulnerability to climate change

Fruiting phenology of this macrofungi is changing in many parts of the world and the average fruiting season is extending, though for some species it is unpredictable. Due to warming experiences the fungal emergence may be earlier in the warmer years as well as extended in the autumn. Yields from the fruiting bodies may vary dramatically from year to year; the amount, duration and frequency of fruiting are influenced by numerous environmental factors. Soil moisture and temperature are important factor for the growth of the *Morchella esculenta* and extreme weather events such as low snow cover in winters, chilling exposure to the mycelia present in the soil and low soil moisture in the years of low snowfall may reduce the production of the fruiting bodies and annual yields.

Monitoring protocol

Permanent plots (20×20 m) may be marked along the elevation between 1,400 to 3,500 m in the areas of *Morchella* distribution. Emergence time and number of fruiting bodies across different habitat types may be monitored.

Phenology: *Sprouting of fruiting body*: March-May

Key threats

- Loss of habitat
- Over exploitation for commercial purpose

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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

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Government of India

NMSHE NATIONAL MISSION FOR SUSTAINING THE HIMALAYAN ECOSYSTEM

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