

Status Survey of Endangered Species

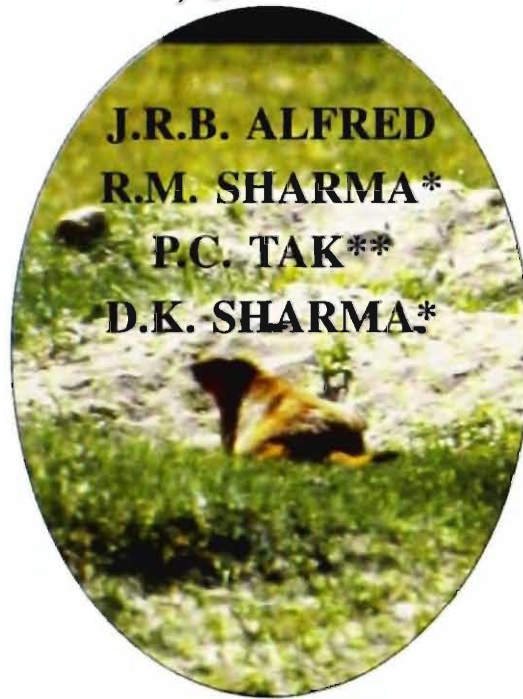
Status of Himalayan Marmot
***Marmota himalayana* (Hodgson, 1841)**
in Eastern Ladakh, Jammu & Kashmir, India

J.R.B. ALFRED
R.M. SHARMA
P.C. TAK
D.K. SHARMA

ZOOLOGICAL SURVEY OF INDIA

Status Survey of Endangered Species

**Status of Himalayan Marmot,
Marmota himalayana (Hodgson, 1841),
in Eastern Ladakh, Jammu & Kashmir, India**



**J.R.B. ALFRED
R.M. SHARMA*
P.C. TAK**
D.K. SHARMA***

Zoological Survey of India, M-Block, New Alipore, Kolkata - 700 053

**Zoological Survey of India, High Altitude Zoology Field Research Station, Solon - 173 211*

***Zoological Survey of India, Northern Regional Station, Dehra Dun - 248195*



**Zoological Survey of India
Kolkata**

CITATION

Alfred, J.R.B.; Sharma, R.M.; Tak, P.C. and Sharma, D.K. 2006. *Status Survey of Endangered Species, Status of Himalayan Marmot, Marmota Himalayana (Hodgson, 1841), in Eastern Ladakh, Jammu & Kashmir, India, : 1-19.* (Published by the Director, *Zool. Surv. India, Kolkata*)

Published : August, 2006

ISBN 81-8171-116-5

© *Govt. of India, 2006*

ALL RIGHTS RESERVED

- No part of this publication may be reproduced stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without the prior permission of the publisher.
- This book is sold subject to the condition that it shall not, by way of trade, be lent, resold hired out or otherwise disposed of without the publisher's consent, in an form of binding or cover other than that in which, it is published.
- The correct price of this publication is the price printed on this page. Any revised price indicated by a rubber stamp or by a sticker or by any other means is incorrect and should be unacceptable.

PRICE

Indian Rs. 150.00

Foreign : \$ 10; £ 8

Published at the Publication Division by the Director Zoological Survey of India, 234/4, AJC Bose Road, 2nd MSO Building, 13th floor, Nizam Palace, Kolkata 700020 and printed at Power Printers, New Delhi - 110 002.

CONTENTS

1.	INTRODUCTION	1
2.	DISTRIBUTION	2
3.	TAXONOMY	2
4.	PHYSICAL FEATURES	2
5.	STUDY AREA	4
6.	METHODOLOGY	7
7.	OBSERVATIONS	8
	i. Habits and habitat	8
	ii. Behaviour	10
	Vocalization	10
	Food and feeding	10
	Burrowing	11
	Grooming	13
	Social	14
	Mating	15
	Parental	15
	iii. Marmot population in Eastern Ladakh.....	15
	iv. Predators	17
8.	CONSERVATION STATUS	17
	Habitat status	17
9.	THREATS	18
10.	REMARKS	18
11.	ACKNOWLEDGEMENTS	18
12.	REFERENCES	18

1. INTRODUCTION

The Himalayan marmot, (*Marmota himalayana*) is categorized as an IUCN Data Deficient (DD) species and is listed under Appendix III of CITES (Wilson and Reader, 1993). It features in Schedule II (Part II) of the Indian Wildlife (Protection) Act 1972, amended up to 2002 (Molur *et al.* 2005). Barring sporadic information available on the World Wide Web (www.napak.com/marmots_of_the_world.html) almost nothing is known about this species from wild. No captive stock is known to exist at least in India.

Since, there is no consolidated information available on this widely distributed species, an attempt is made here to provide comprehensive account on the population status and distribution of this species in Eastern Ladakh, where its sizable but fragmented populations exist.

Marmots belong to the family Sciuridae of the order Rodentia (Mammalia). They are the largest ground-dwelling squirrels in the world. The genus *Marmota* is represented by the following 14 valid species in the world, of these, eight are found in the Old World and six in the New World (marked with an asterisk), (Wilson and Reeder, 1993) :

1. *Marmota baibacina* Kastschenko, 1899
2. *Marmota bobak* (Muller, 1776)
- *3. *Marmota broweri* Hall and Gilmore, 1934
- *4. *Marmota caligata* Eschscholtz, 1829
5. *Marmota camtschatica* (Pallas, 1811)
6. *Marmota caudata* (Geoffroy, 1844)
- *7. *Marmota flaviventris* (Audubon and Bachman, 1841)
8. *Marmota himalayana* (Hodgson, 1841)
9. *Marmota marmota* (Linnaeus, 1758)
10. *Marmota menzbieri* (Kashkarov, 1925)
- *11. *Marmota monax* (Linnaeus, 1758)
- *12. *Marmota olympus* (Merriam, 1898)
13. *Marmota sibirica* (Radde, 1862)
- *14. *Marmota vancouverensis* Swarth, 1911

2. DISTRIBUTION

These extremely vocal and non-flying (Non-volant) small mammals are found only in the Northern Hemisphere, particularly in parts of Europe, Asia and North America.

In Indian limits two species occur, *i.e.* The Long-tailed/Red-/Kashmir Marmot, *M. caudata* and the Himalayan Marmot, *M. himalayana*. The former is a common resident of central and western Ladakh, between 3500 and 5000 m, occasionally also seen in the lower valley slopes. While the latter inhabits a restricted zone ranging from 3500 m to the timberline/cold desert (5200 m) in the mountains of Nepal, parts of Tibet (China), Pakistan and parts of India (Ladakh, Kashmir, Garhwal and Sikkim). Thus, it is one of the highest living rodents in the world. The extent of occurrence and area of occupancy of *M. himalayana* in India is estimated to be >20,000 sq km and >2000 sq. km respectively (Molur *et al.*, 2005).

Within Eastern Ladakh it is seen in upper Markha valley, the Rupshu and Changthang plains including Puga valley, Tsomoriri (Tak & Sharma, 2003), Chumur, Hanle, Chushul, Parma valley and Tangtse to Lukung (Pfister, 2004) and present survey of Zoological Survey of India in August-September, 2005 (Map 2, Table 2).

3. TAXONOMY

Kingdom ANIMALIA
 Phylum CHORDATA
 Class MAMMALIA
 Order RODENTIA
 Family SCIURIDAE
 Genus *Marmota*

Species *himalayana* (Hodgson, 1841)

Synonymies : *Arctomys himalayanus* Hodgson, 1841; *Marmota bobak himalayana* (Hodgson, 1841); *Arctomys hemachalanus* Hodgson, 1843; *Arctomys hemachalana* (Hodgson, 1843); *Arctomys tibetanus* Gray, 1847.

4. PHYSICAL FEATURES

The Himalayan Marmot or '*Phia*' or '*Mirgot*', as called locally, is also known by its alternative names such as: 'Bobak', 'Baibak', 'Mountain mouse' or 'Tibetan snow

pig', 'Karakoram Marmot' 'Shikpa' It can grow up to 80 cm in length with body measurements as follows :

HB : 58-60 cm (Head and Body Length)

TL : 13-15 cm (Tail)

This large marmot species has pale tawny body and limbs much mixed with black on dorsal side; dark brown face/forehead and terminal third of the tail; black eyes;



long whiskers; flat and triangular head; comparatively short neck; small rounded ears; and short stocky limbs with strong claws on all the fingers and toes except thumbs mainly used for digging. It is as large as the Long-tailed Marmot, but distinguished by its shorter tail (*ca* 13 cm, which is slightly less than one fourth of its total

Photo 1. An adult Himalayan marmot.

Head and Body length) (Prater, 1971; Pfister, 2004) (Photo 1 & 2).

Its reported longevity is 8–10 years. Juveniles resemble adults; they are fully grown at 2 years and attain sexual maturity at the age of 3 years. The sexes look alike and weigh about 4–5 kg in spring or up to 8 kg in autumn.



Photo 2. An adult Himalayan marmot front view.

5. STUDY AREA

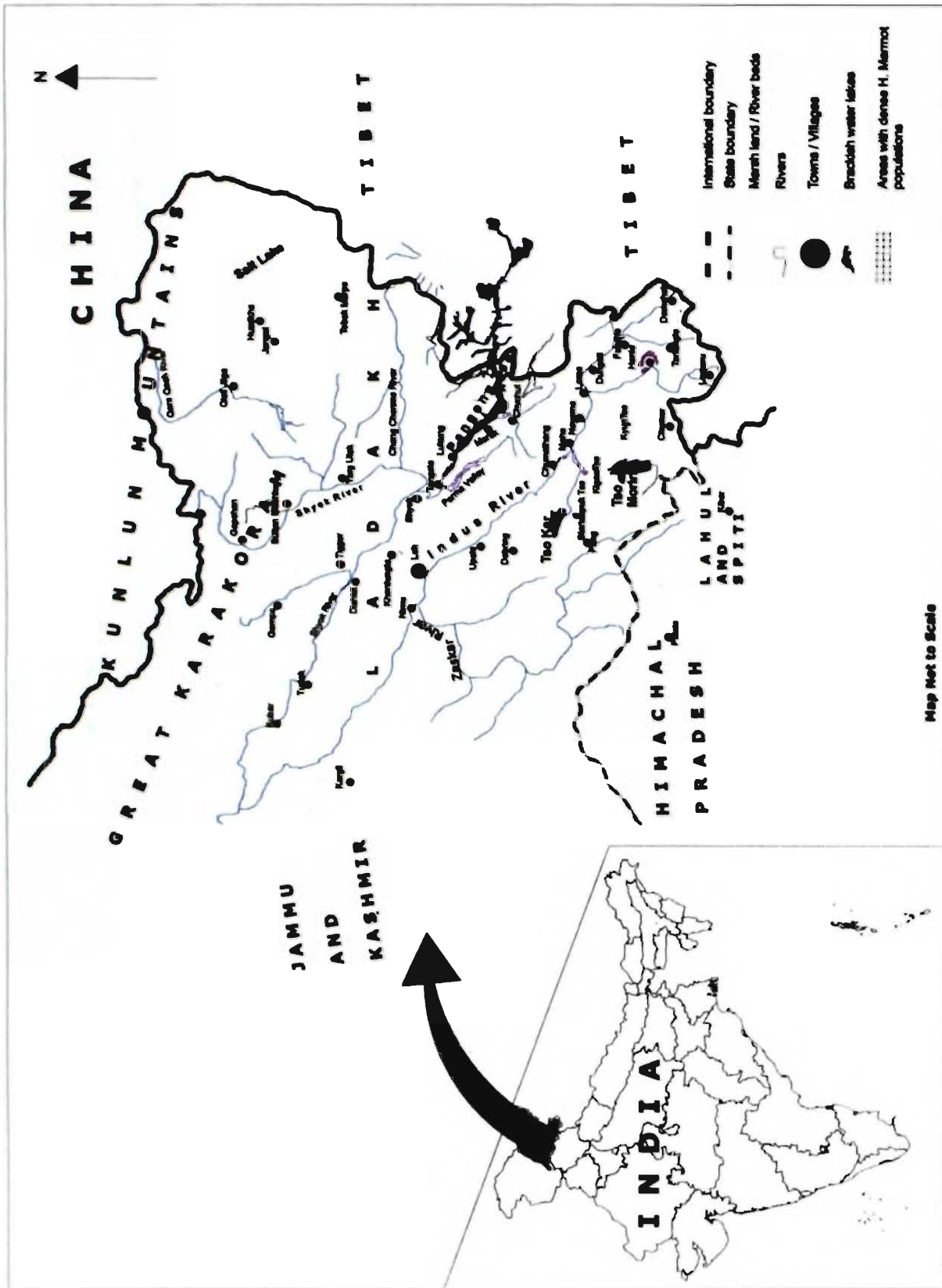
Pfister (2004) defines the Eastern Ladakh: from Upshi up the tributary valley to Taglang-La (Manali road); along the 'upper Indus' through Chumathang (3950 m) and Mahe (4050 m) to Loma (4200 m) and the Tibetan border; the Rupchu from Taglang-La (5400 m) along Manali road (the Moore plains) to Pang, Tso-Kar (4600 m), Puga/Sumdo (4300 m) and Tsomoriri (4600 m) plains with adjoining areas; and the Changthang from Chumur (4450 m) eastwards via Hanle (4350 m) to the Tibetan border and north to Chushul (4450 m) with Pangong-Tso and Tangtse (3800 m) to the west (Map 1).

Changthang Wildlife Sanctuary (CWLS) (34°79' and 33°79' N and 78° and 79° E) is biogeographically classified under the zone 1A or 'Ladakh Mountains' (Rodgers *et al.* 2000). With an area of about 4000 sq km was notified in 1987, which forms a part of the proposed 'High Altitude Cold Desert National Park' Physiographically, it is a southwest extension of the Tibetan plateau. The terrain of the sanctuary is rugged with sandy plains, sporadically dotted with vast marshes and surrounded by barren mountains. Its altitude varies from 4000 to 7000 m asl.

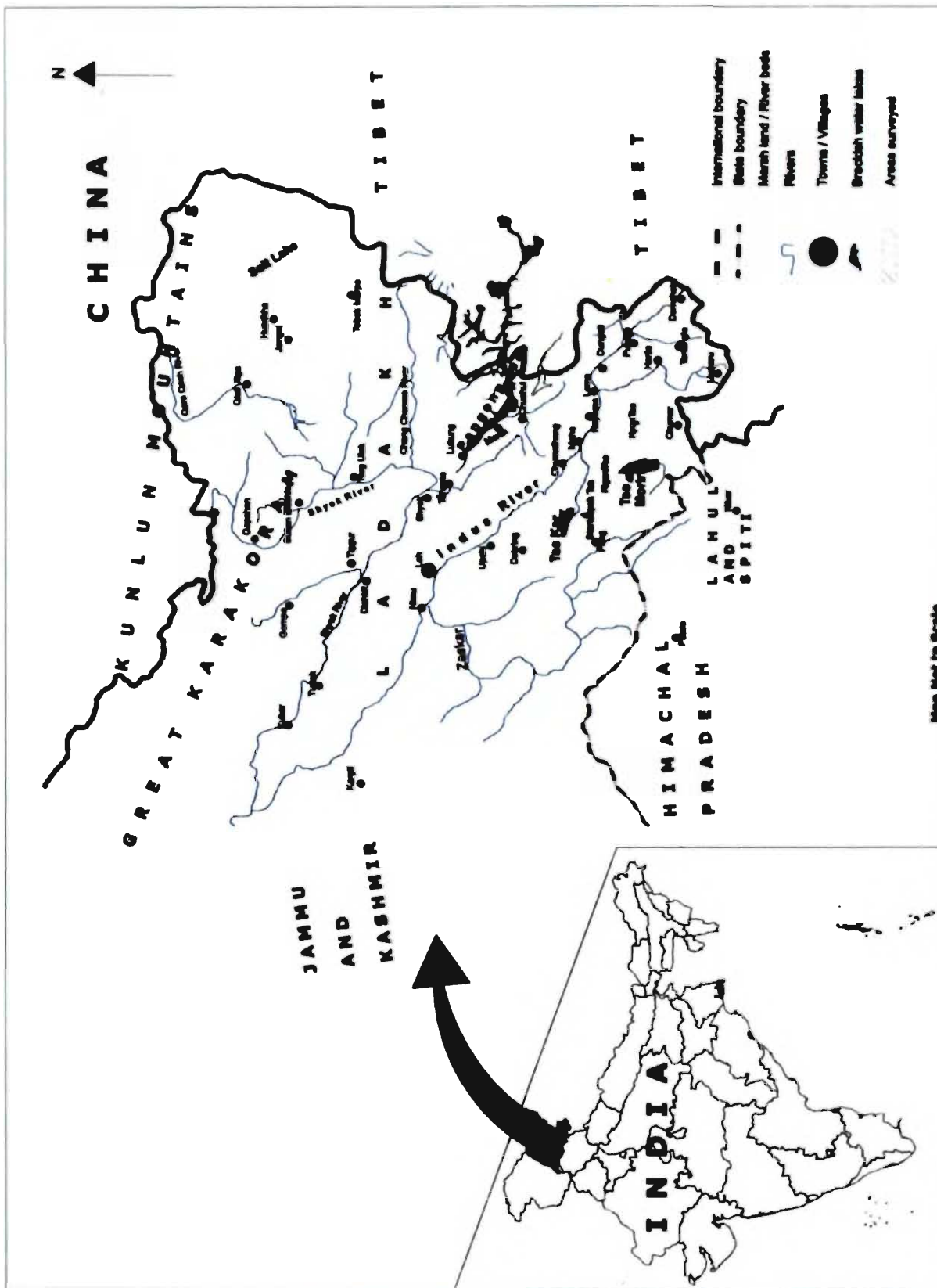
The climate is extremely dry and cold, approaching arctic conditions. Average annual rainfall varies from 6 to 8 cm. Snowfall is not uniform as large tracts even remain snow-free during the winter. Daytime temperature in summer rises to 35°C but in winter, it remains below the freezing point. Minimum temperature during winter may be as low as -40°C. In early summer, besides the river Indus, its tributaries are drained by a number of glacial streams emanating from the melting snow. The sanctuary area also embraces many important brackish and freshwater lakes, namely, Tsomoriri (Ramsar Site No. 1213), Tso Kar, Pangong Tso, Tsogul Tso (Chushul Marsh) etc, which are situated between 4000 and 5000 m. The vegetation of the sanctuary area is composed of 'Alpine Desert Flora' dominated by scrubs, shrubs and sedge-grasses interspersed with (*Loricera spinoides*, *Hippophae rhamnoides*), Tibetan furze (*Caragana* sp.) and a variety of grasses (*Festuca* sp. *Carex* sp., *Artemisia* spp., *Draba* sp., etc.).

However, some high altitude vegetation is composed of grazeophil communities, which means the vegetation evolved as a result of grazing by wild and domestic herbivores and tolerate grazing (Rawat & Rodgers, 1988).

During the course of faunistic surveys conducted in eastern Ladakh in 2002 and 2005 the authors made observations on this species in the Changthang wilderness areas in eastern Ladakh and also in Leh -Khardungla -Diskit sector outside eastern Ladakh.



Map 1. Areas surveyed for Himalayan Marmot in Ladakh.



Map 2. Sightings of Himalayan Marmot in Ladakh.

Four distinct ecosystems can be recognised in the CWA (Kitchloo, 1994) :

- i) Riparian habitat with marshy lands along Indus River and its catchments (18%);
- ii) Aquatic habitat in Pangong Tso, Tso Moriri and other lakes (6%);
- iii) High altitude pastures (20%);
- iv) High altitude cold desert (55%) including agricultural land (1%).

6. METHODOLOGY

The surveys were conducted by vehicle. The vehicle was driven at a slow speed (15-20 km/hr) to record the Himalayan Marmot sightings. During the survey period it was observed that marmots were seen along the green grassy undulating riverbeds very close to water and their distribution was not continuous. So, it was decided that wherever such potential habitats were seen during the survey along the valleys, roughly half an hour was spent in the vehicle quietly to count the marmots, which were seen either basking or feeding. On foot inspection of such patches was also done to ascertain the presence of live burrows. Due to hostile weather, high altitude conditions, and serpentine marshy riverbeds it was very difficult to standardize transect strip length and width. After assessing four to five good marmot inhabited patches, it was decided that small strip of 150 m length and 16 m breadth would be sufficient to count the live marmot burrows to record height and width of the entrance (Table 1, Photo 3). Behavioural observations and actual counts of the individuals out of the burrows were



Photo 3. Methodology adopted to measure burrow entrance.

made with the aid of 10x50 power prismatic field binoculars. Two to three observers validated counts in each patch during bright day light hours and the time spent in each patch was kept constant through out the study area. The photographs were taken using 500 mm Zoom lens of Sigma fitted to a Canon camera.

To assess the population and distribution of Himalayan marmot in Eastern Ladakh the following sectors/segments were surveyed :

- 1) Pang–Taglang La (Moore Plains)
- 2) Chumathang–Mahe
- 3) Nyoma–Loma
- 4) Mahe–Nyoma
- 5) Loma–Chushul
- 6) Chushul–Thakung–Lukung (Pangong Tso)
- 7) Chushul – Tangtse (Parma Valley)
- 8) Tangtse–Lukung
- 9) Loma–Dungti–Tigermala (Dumchok) (Upper Indus)
- 10) Loma–Hanle (Neelamkhul Plains)
- 11) Mahe–Tso Moriri
- 12) Sumdo–Tsokar
- 13) Leh–Khardung La

7. OBSERVATIONS

i. Habit and Habitat : Marmots usually live in large colonies and excavate deep burrows in open fields on grassy gentle mountain slopes and among rocks where soil surface can easily be dug up for burrows.

Like other marmots Himalayan Marmot is diurnal, fossorial and a true hibernator, whose body temperature drops to only a few degrees Celsius in winter and arouse every so often before returning into a deep torpor. They retreat from about 6-7 month's of hibernation by early October and once in a month they awake to defecate/urinate (Pfister, 2004). The animals loose about half of their body weight during hibernation period.

In the study area the Himalayan Marmots were encountered in family groups of 10-15 animals in steppes, lush meadows and soft open, grassy, tone-strewn slopes. They were seen occupying territories of about 0.2–0.3 ha which were marked daily with a



Photo 4. Burrow entrance plugged with stones.

slimy secretion from the chin gland. When threatened or attacked a foul stinky substance is ejected from the anal gland. The burrow entrances are tightly plugged with soil, grass and stones possibly to maintain the temperature within the burrow and also to avoid intruders and predators (Photo 4).

The observations on abundance and distribution of Himalayan Marmot in eastern Ladakh reveal that the species is not uniformly distributed or in other words population is fragmented. Most of the sightings were made along the riverbeds and slopes with lush green ground cover, as it appears that the marmots prefer the areas with green cover and water around (Photo 5 & 6).



Photo 5

Photo 6



Photo 5 & 6. A typical marmot habitat in Parma and Lukung-Tangtse sector (Eastern Ladakh).

ii. Behaviour

Vocalization : The basic purpose of vocalization in animals is to communicate with other individuals of their own kind. Marmots communicate by physical contacts as well as vocally. When alarmed by predators, all marmots emit their own species-specific alarm calls (whistles and chirps). On the slightest provocation they tend to be quite vocal and produce loud whistle or chirp. Therefore, the common name of North America's Yellow-bellied Marmot is the "whistle pig", while woodchucks tend to be pretty silent. Some species of Eurasian marmots vary in the rate at which they whistle as a function of terrain. Studies have shown that marmot living in areas with more vertical relief and broken sight lines call faster, while those inhabiting the steppes tend to call more slowly (www.napak.com/marmots_of_the_world.html).



Photo 7. An alert Himalayan marmot.

The Himalayan Marmot on the slightest suspicion or sound becomes alert giving a high-pitched alarm call and run for the nearest available cover (Tak and Sharma, 2003) (Photo 7). A short, carrying, shrill whistle, repeated insistently when alarmed (Pfister, 2004).

Food and Feeding : The Himalayan Marmot feeds predominantly on grasses and herbs, intense feeding takes place in the mornings and afternoons throughout the summer months, and it does not store food for the winter. Although they are vegetarians but during breeding season their diet may vary, consisting of herbs, fruits, sprouts, meat,



Photo 8. Himalayan marmot basking.



Photo 9. Himalayan marmot basking.

bugs, grubs, grasshoppers and other insects. Marmots often bask during midday and retreat into the burrows for the night (Photo 8 & 9). It appears marmots fulfill their water requirement from the water content of the plants they consume (Photo 10).



Photo 10. Marmot feeding.

Marmots lick the salty soil particularly during the springtime. This could possibly to fight against diarrhea brought in by their first intake of vegetation in the spring. They make use of external latrines close to the main burrow (www.napak.com/marmots_of_the_world.html).

An important part of a marmot's dietary regime is auto-caecotrophy, or re-ingesting its own pellets. The animal sits on its hind legs and removes its coecal content as it comes out of the alimentary canal. These pellets are different from regular faeces as they contain larger quantities of untreated proteins. Animals that are deprived of caecotrophs have their immune systems suppressed and disease resistance reduced.

Burrowing : Young marmots dig up burrows, which obviously require an exceptional amount of energy and time. There are different types of burrows: hibernation burrows, secondary burrows and burrows that function as shelters. Marmot families live together in these communal burrows and use them for successive generations. (www.napak.com/marmots_of_the_world.html).



Photo 11 & 12. Marmot burrows showing a single and two entrances.

The burrow of the Himalayan Marmot usually has one entrance but there could be even more than two entrances. (Photo 11 & 12). It is 20–100 m long and descends 4–6 m in to the ground, ending in large chambers. Nearby, some smaller and shallower shelter burrows are dug out to serve as a hiding place in case of danger (Photo 13 to 16).

The Marmots collect, transport and store dried herbs to provide bedding in their burrow system. This is done usually at the beginning and end of the day. This material absorbs marmots' waste products and is replaced twice yearly- in spring and autumn (www.napak.com/marmots_of_the_world.html).



Photo 13. Shelter burrows for hiding.



Photo 14. Marmot hiding in the burrow.



Photo 15 & 16. Marmots outside the burrow.

The survey conducted by ZSI in Eastern Ladakh during August-September, 2005 a total of 64 Himalayan marmot burrows were measured for height and width (Photo 17) of the entrance in Parma valley, Tangtse-Lukung and Puga valley (Table 1). Data suggests that in Parma Valley burrows measured as 24.24 ± 3.36 cm wide and 20.75 ± 2.58 cm in height. Burrows in Tangtse-Lukung region were measured with a maximum width of 28.9 ± 5.96 cm and 21.96 ± 2.09 cm height. In Mahe-Tso Moriri stretch, Himalayan marmots dig their burrows with entrance as 24.64 ± 5.99 cm wide and 18.50 ± 4.08 cm height (Table 1).

In a stretch of 150x16 m, maximum number of burrows were counted in Tangtse-Lukung sector as compared to Mahe-Tso Moriri stretch. Whereas, the maximum

number of Marmots were sighted in Parma valley followed by Tso-Moriri and Tangtse-Lukung segment. The possible reason for the variation in marmot sightings and presence of marmot burrows in the surveyed stretches may be, Parma valley is broad, flat and provide vast habitable grounds for Himalayan marmots whereas Tangtse-Lukung and Mahe-Tso Moriri valleys are comparatively narrow and marmot populations were more or less concentrated at a few places. Food was observed *ad libitum* in all the three valleys, though. It means that food is not a limiting factor for their lower/higher concentration.

Grooming : The Himalayan marmot indulge in a great deal of mutual grooming practices, which are generally considered soothing to all the individuals involved. The daily grooming-routine of marmots consist of stretching, scratching, licking, sun basking by lying down on their back on a rock or other hard surfaces, dust bathing, cleaning, etc. In the act of grooming they become so engrossed that they loose their balance and also seen fall on to their sides or some times on back.

Table 1. Average height and width of the entrance of Himalayan marmot burrows in Changthang wilderness areas.

Date	Sampled Stretch	Longitude and Latitude	Sampling Strip size	Width (m±SD) (In cm)	Height (m±SD) (In cm)	Number of measured (N)
20.8.2005	Chushul-Tangtse (Parma Valley)	34° 53' 36.5" 78° 16' 47.7"	5x5 m	24.24±3.76	20.75±2.58	4
21.8.2005	Tangtse-Lukung (I)	34° 00' 47.9" 78° 17' 29.9"	150x16m	28.9±5.96	21.96±2.09	25
21.8.2005	Tanstse-Lukung (II)	34° 02' 33.3" 78° 15' 50.3"	150x16m	24.76±5.42	19.48±3.24	25
27.8.2005	Mahe-Tso Moriri (Puga Valley)	33° 03' 42.9" 78° 16' 41.9"	150x16 m	24.64±5.99	18.50±4.08	12

Social : As already stated that marmots live in their territorial family groups of 10-15 individuals. Such groups usually consist of a pair of adults and younger marmots from succeeding litters, which are further made up of a couple of adults and still young marmots from succeeding litter. Common social behavioural traits include—play motions and social games.

The play fighting to test the strength is common among marmots. For example, two individuals will stand erect on their hind paws, grip each other and then push each other away with their palms, in doing so they frequently cling to each other with their teeth (www.napak.com/marmots_of_the_world.html). They often throw their heads backward and look straight up at the sky. They try to bite each other and emit loud shouts and growls. Such fights sometimes may lead to death of one of the protagonists. The antagonistic behaviour decreases markedly, as the season progresses, perhaps, as a preparation for hibernation.

Rough-and-tumble type motions often follow a boxing match. The animals jump on each other and roll around on the ground. Racing or chasing is very common among other play motions. The chased individual stops and waits for the other to catch up. They also play with objects they come in to contact with and can stay engrossed in such behaviours for quite some time. The objects could be stones or blades of grasses.

A variety of tail postures in marmots indicate different levels of excitement. For example; when the tail is raised up and down it indicates excitement; while the flicking



Photo 17. Measurement of burrow entrance.

of tail indicates a heightened level of excitement; whilst the arched back tail with its erected hairs and strong flicking together indicate that the marmot may be confronted with a threat.

Mating : It is difficult to observe the mating behaviour of marmots because it takes place within the burrow systems. Moreover, it occurs usually for a short time after their

emergence from hibernation, when the climate is still harsh. However, typically the mating ritual follows the same basic pattern :

male courtship

the male chases the female

the male approaches the female

genital sniffing ensues

male–female play fighting

mounting attempts

female adopts a body posture and behaviour conducive to mating.

Once the female accepts the male advances, male grasps the female with its forelegs, catches hold of the female by the scruff of its neck and bites its fur. Mating can then occur when the female arches her tail and holds it to one side.

The non-reproductive females are comparatively less tolerant to male sexual behaviour. For example, there is less number of genital sniffing by males which lead to attempted mounts when the non-reproductive females are considered.

Parental : Care mainly occurs within the burrow system itself since newly born young ones are helpless and needs protection from predation. Suckling occurs within the burrow before the young are weaned. Young carrying is occasionally witnessed but in first few days of emergence, the mother can be seen pushing the young pups back into the burrow with her nose.

iii. Marmot population in Eastern Ladakh

We traveled approximately 700 km in Changthang wilderness areas covering almost all the potential marmot habitats (Table 2). During the period (August 2005) a total of

136 marmots were sighted. The data suggests that Chushul-Tangtse stretch is quite rich in the marmot population. In this stretch ten patches harbouring considerably rich population of about 62 (6.2 ± 3.32) individuals, were sighted (Table 2). Although the distance we traveled in this stretch is about 85 kms but marmots were sighted only after crossing Kongta La (c 5500m), between Parma TCP camp (Lol Yogma) and Tangste town. To be precise most of the sightings were made before and after Harong La.

With a total of 34 (3.09 ± 1.44) individuals per patch, Mahe-Tso Moriri is the region where maximum marmots were sighted after Parma valley (Table 2). Tak and Sharma (2003) have also reported about 42 marmots in the Puga Valley (Tso Moriri). The

Table 2. Sightings of Himalayan marmot in different habitat types in Changthang Wilderness area.

Date	Surveyed Stretch	Marmots	Mean \pm SD sighted	Number of Sightings (n)	Distance Travelled
14.8.2005	Pang-Tanglung La	0	0	0	35
27.8.2005	Chumathang-Mahe	8	2 ± 0.816	5	22
22.8.2005	Nyoma-Loma	0	0	0	23
25.8.2005	Mahe-Nyoma	0	0	0	18
22.8.2005	Loma-Chushul	0	0	0	72
19.8.2005	Chushul-Thankung-Lukung	3	1 ± 0	3	56
20.8.2005	Chushul-Tangtse (Parma Valley)	62	6.2 ± 3.32	10	74
23.8.2005	Loma-Dungti	0	0	0	17
24.8.2005	Loma-Hanle	2	2 ± 0	1	52
27.8.2005	Mahe-Tso Moriri (Puga Valley)	34	3.09 ± 1.44	11	70
21.8.2005	Tangtse-Lukung	27	2.07 ± 1.60	13	35
28.8.2005	Sumdo-Tsokar	0	0	0	35
31.8.2005	Leh-Khardungla	2	2 ± 0	1	40

sightings in this stretch were made at the low-lying valleys very close to water streams on both sides of the Namshang La (4800 m). The third highest concentration of marmots was encountered in Tangtse–Lukung stretch, which is almost a flat valley. One third of this stretch towards Pangong Tso was very dry and sandy where not a single sighting was made. As evident from the data and ground realities very few marmots were sighted in rocky, sandy and dry areas with little grass to feed on e.g. Chushul-Thankung-Lukung where only three sightings were made ($n=3$, 1 ± 0 individuals). To our surprise, except two sightings in Hanle marsh not a single individual was sighted along this long stretch of 71 kms. Though considerably long and green grassy patches exist in the area like Hanle marsh and Mankhang plains.

Although the ideal conditions do exist along Chumathang–Mahe stretch but the population observed was very scanty (Table 2). This may be due to very hard and rocky landscape; narrow river valley, high Indus river current and heavy vehicular disturbance in the area. Also, marmots seem to be very sensitive to demographic and anthropogenic pressures thus avoid colonizing in such areas.

Other than Eastern Ladakh, we sighted two marmots near South Pullu camp before crossing Khardungla pass (5,578 m). In Nubra valley (Khardungla–Diskit–Turtuk sector) not a single sighting of Himalayan marmots could be made.

iv. Predators

Mainly the snow leopard, wolf, lynx, fox, wild dog and golden eagle are natural predators of marmots (Pfister, 2004).

8. CONSERVATION STATUS

Himalayan Marmot is listed under Appendix III of CITES. Included in Schedule II (Part II) of Indian Wildlife (Protection) Act 1972, amended up to 2002. **C.A.M.P.** (IUCN Ver. 3.1 & 3.0) **LEAST CONCERN in South Asia. National Status** (IUCN Ver.3.0) **India : Least Concern**, widely distributed species with a few major threats but not serious to be categorized as Near Threatened (Molur *et al.*, 2005).

Habitat status : Quantitative and qualitative decline at the rate of 20-50 % in past 40 years and a similar trend predicted in next 10 years due to human interference and live stock grazing (Molur *et al.*, 2005). The rapidly growing attraction of western tourists to eastern Ladakh, together with developmental activities has greatly altered the habitat of this species. We recommend regulated tourist activities in the areas inhabited by Himalayan Marmot before it is too late. Habitat destructive due to anthropogenic activities.

9. THREATS

This species is hunted for food and medicinal purposes. Entanglement in nets, natural disasters such as landslides, natural and domestic predation, civil unrest, competition with livestock for food are some of the potential threats. Threat is also due to habitat destruction because of increasing anthropogenic activities.

10. REMARKS

Since marmots are fossorial, therefore conducting studies on census and their breeding and behaviour biology is rather difficult. If taken up on priority some light can be thrown on hidden life of these highest living small mammals. Studies on habitat management, monitoring, and taxonomic research are some of the aspects, which need to be addressed in future.

11. ACKNOWLEDGEMENTS

We are thankful to the Deputy Commissioner, Leh for issuing inner line permission to conduct the faunistic surveys in eastern Ladakh. We are indebted to the authorities of the State Forest and Public Works Departments, Jammu and Kashmir for various courtesies. We thankfully acknowledge the full support and co-operation extended by the party members throughout the survey period. We are also thankful to Shri Rati Ram Verma, Publication Production Officer, Zoological Survey of India, Kolkata for quality production and accomplishing the publication of this document in time.

12. REFERENCES

- Kitchloo, N.A. 1994 (Unpublished). *Unified ecosystem management plan for the Changthang Wilderness Area, Ladakh*. Department of Wildlife Protection, Jammu & Kashmir Government.
- Marmots of the World Article Archives (www.napak.com/marmots_of_the_world.html).
- Molur, Sanjay, Srinivasulu, C., Srinivasulu, B., Walker, S., Nameer, P.O. and Ravikumar, L. 2005. *Status of South Asian Non-volant Small Mammals : Conservation, Assessment and Management Plan (C.A.M.P.) Workshop Report*. Zoo Outreach Organization/CBSG-South Asia, Coimbatore, India, : 1-618.
- Pfister, Otto. 2004. *Birds and Mammals of Ladakh*. Oxford University Press, New Delhi : 1-361.
- Prater, S.H. 1971. *The book of Indian Animals*. Bombay Natural History Society, Bombay, : 1-324.

- Rawat, G.S. and Rodgers, W.B. 1988. Alpine meadows of UP Himalaya : An ecological review. *Proc. Nat. Rangeland Symp.* Jhansi, India. November 9-12, 1987 : 119-137 IGFRI, Jhansi, India.
- Rodgers, W.A., Panwar, H.S. and Mathur, V.B. 2000. *Wildlife Protection Area Network in India—A review (Executive Summary)*. Wildlife Institute of India, Dehra Dun, : 1-44.
- Tak, P.C. and Sharma, R.M. 2003. A note on abundance of Himalayan Marmot, *Marmota himalayana* (Hodgson), in Puga Valley, Eastern Ladakh, Jammu & Kashmir State, India. *Annals of Forestry*, **11**(1) : 141-142.
- Wilson, D.E. and Reeder, D.M. 1993. *Mammal Species of the World*. A Taxonomic and Geographic Reference. Smithsonian Institution Press, : 1-1206.