Status and conservation of Eastern Hoolock Gibbon *Hoolock leuconedys* in Assam, India

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Abstract: A field survey was conducted in 2010 from March to May in the reserve forests of Sadiya sub-division, in the Tinsukia District of Assam, India, to investigate the status of the Hoolock Gibbon. The data were collected using modified line-transect and call-count methods. We recorded 10 groups of gibbons in three reserve forests, through direct sighting. Of the 33 individuals recorded through direct sighting 63.6% were adults, 21.2% juveniles and 15.2% infants. The average group size of the sighted groups was 3.3 individuals, with an adult sex ratio of 1:1.1. We also recorded 10 groups of Rhesus Macaques in the area. Anthropogenic pressures included encroachment, felling of trees and inadequate infrastructure, and these were the major threats for Hoolock Gibbon and other wildlife in the region. Notably, the gibbons of Sadiya have been identified as the Eastern Hoolock Gibbon *Hoolock leuconedys* and this is the first report of the species from Assam.

Keywords: Conservation, Eastern Hoolock Gibbon, *Hoolock leuconedys*, Sadiya, status, threat.

INTRODUCTION

Assam, one of the seven states in northeastern India, supports a rich biodiversity, with primates forming an important component. Out of the 25 species of non-human primates in India, nine species—Slow Loris *Nycticebus bengalensis*, Rhesus Macaque *Macaca mulatta*, Assamese Macaque *Macaca assamensis*, Pig-tailed Macaque *Macaca leonina*, Stump-tailed Macaque *Macaca arctoides*, Capped Langur *Trachypithecus pileatus*, Golden Langur *Trachypithecus geei*, Phayre's Langur *Trachypithecus phayrei* and Western Hoolock Gibbon *Hoolock hoolock*—are present in Assam. The Western Hoolock Gibbon is so far the sole ape recorded from Assam. Several studies have already been carried out on the status and distribution of Hoolock Gibbon in Assam (Mohnot 1995–2001; Das et al. 2005; Chetry et al. 2007; Choudhury 2006, 2009; Kakati et al. 2009). Sadiya is a subdivision of Tinsukia District of Assam and it is the extreme eastern boundary of the state. Administratively, Sadiya is a part of Assam, yet the area has no land connection with any other part of the state, and the landmass of Sadiya is continuous with the Lower Dibang Valley District of neighbouring Arunachal Pradesh. There are six reserve forests in the subdivision of Sadiya range of Doomdooma Forest Division of eastern Assam circle. The reserve forests are Hallowgaon, Kukuramara, Kundil Kalia, Sadiya West Block and Sadiya North Block, covering 125.12km^2 of forest. Studies were carried out from time to time to understand the primate diversity of the state, including Sadiya. The Indo-US Primate project first did an extensive primate survey in Sadiya

range during 1994 (Mohnot 1995–2001), followed by another survey of primates in Sadiya (Sharma & Sinha 2007). Western Hoolock Gibbon occurred in the area in each study, but the unique geographic location of the area stimulated us to give a second thought about the identity of the gibbons of Sadiya. Discovery of the Eastern Hoolock Gibbon *H. leuconedys* in the Mehao Wildlife Sanctuary, and its adjacent Kornu Reserve Forest in Arunachal Pradesh (Chetry et al. 2007, 2008, 2010; Chetry 2009) also made us reconsider the identity of the gibbons of Sadiya. Considering the land continuity of Sadiya with the Lower Dibang Valley District of Arunachal Pradesh, we hypothesised those gibbons of Sadiya to be Eastern Hoolock. Hence, to verify our hypothesis, we carried out a fresh survey of Hoolock Gibbons in the Sadiya area, after we confirmed here, for the first time, the occurrence of Eastern Hoolock Gibbon in Sadiya and, for that matter, in Assam (Chetry & Chetry 2010) (Image 1). We also report the anthropogenic pressures on the species and its habitats, so that effective conservation measures can be developed for Eastern Hoolock Gibbon in the study area in future.

Image 1. Eastern hoolock Gibbon from Sadiya

MATERIALS AND METHODS

The Sadiya subdivision is located at 95^{0}40'1''E & 27^{0}45'02''N, covering an area of 789.95km^2 (Image 2). We conducted a field survey in 2010 from March to May in the reserve forests of Sadiya sub-division, in the Tinsukia District of Assam, India. The topography is a flat plain, gradually sloping from north to south. The vegetation in this area has been described as Assam valley tropical wet evergreen forest (Champion & Seth 1968). The forests in the study area have an upper canopy of *Michelia champaca*, *Shorea assamica*, *Terminalia myriocarpa*. The middle canopy is mostly dominated by *Vatica lanceaefolia* and *Mesua ferrea*, along with *Bombax ceiba*, *Terminalia belerica*, *Canarium resinifesum*, *Terminalia chebula*, *Eugenia jambolana*, *Sapium baccatum*, *Dillenia indica* and *Bischofia javanica.*

(i) Direct method

We followed modified line transect method (Burnham et al. 1980; NRC 1981) for the survey, depending on the habitat and the forest condition. We laid the transects in a stratified random manner to cover all representative areas of the park (Mueller-Dombois et al. 1974; Kent et al. 1994). The total length of the transects was 212km. Three observers walked randomly through existing forest trails and occasionally forest tracts without trails covering an average of 10–12 km/day. We initiated the walk transects in the morning (0600h) and terminated in the evening (1500h). The observers walked slowly along the transect pausing at regular intervals of 500m. On sighting the gibbon, we recorded the GPS (Global Positioning System) location, the group structure and individual details, such as age, sex and number of individuals. At 500m intervals, and at each location where the gibbon was encountered, the observers estimated tree height and canopy cover within an area of 10m radius and also took note of the evidence and degree of grazing and logging in the study area.

(ii) Indirect method

A. Call-count method: This involved recording hoolock gibbon calls. Whenever calls were heard in the absence of sightings, the distance of the call was estimated and recorded along with time, direction, duration and GPS co-ordinates of the observers.

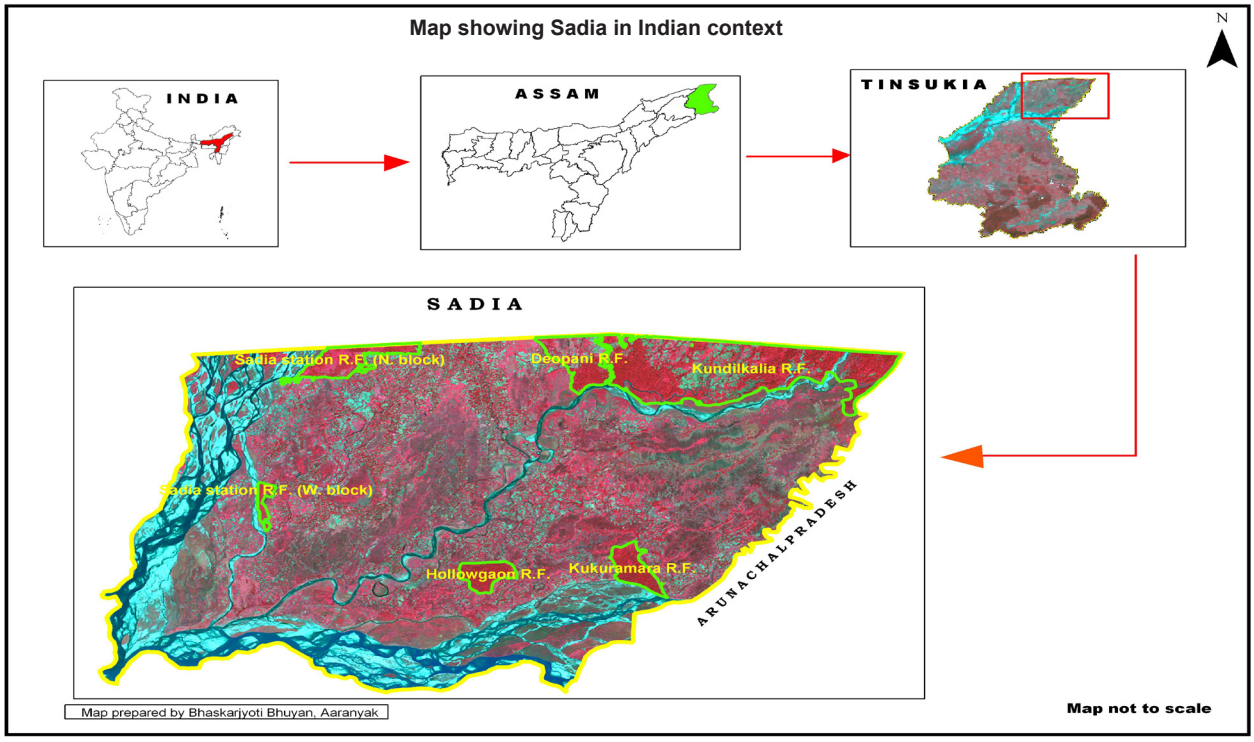

Image 1. Map of study site

B. We also recorded some secondary information relevant to the study, such as information about hunting and traditional beliefs, through informal interaction with forest field staff, local guides and elderly people.

RESULTS

Population status

For the first time the occurrence of Eastern Hoolock Gibbon from the Sadiya subdivision of Assam is reported. A total of 32 individuals in 10 groups were recorded, based on direct sighting from three reserve forests in Sadiya (Table 1). Again, based on call count, the occurrence of another 16 groups was estimated (Table 2, Image 3).

Population distribution

The survey covered 212km of transects in various parts of the reserve forests and hoolock gibbons were found within an altitudinal range of 100–176 m.

Group size and age composition

The group structure and composition of the sighted groups are shown in Table 1. The average group size was three with individuals ranging from 1 to 5. Most of the groups were observed with either 2 (4 groups) or 4 (2 groups) individuals. The adult sex ratio was 1:1.1. Age classification shows that, of the total sighted population, 63.6% were adults, 21.2% juveniles and 15.2% infants.

Sighting time and call time

Of the 10 groups sighted directly, sighting time of all groups (10 groups) was before 1200h. All gibbon calls were recorded before 1200h, of average duration 15.25 minutes, with a range between 10–25 minutes.

Primate diversity of Sadiya

During the survey period we recorded the occurrence of only Rhesus Macaque *Macaca mulatta* besides the Eastern Hoolock Gibbon in Sadiya. We sighted 120 Rhesus Macaques in 10 groups.

Local extinction of hoolock gibbon

We interacted with the local people of all six reserve forests to know about the past status of gibbons in the areas. All these interactions have led us to conclude that gibbons were common in all forests of Sadiya in the past. Only 50 years ago all the reserve forests

Table 1. Sighting records of Eastern Hoolock Gibbon

	Location		Altitude	Locality	Time	AM	AF	J?	I?	Total
1	N 27°50'39.2"	E 95°45'52.9"	122m	Hallawgaon	0925	1	2	1	1	3
2	N 27°50'54.9"	E 95°45'30.9"	120m	Hallawgaon	0650	1	1			2
3	N 27°50'46.2"	E 95°50'28.3"	121m	Kukurmara	0820	1	1			2
4	N 27°50'42.6"	E 95°50'18.8"	120m	Kukurmara	1030	1	1	1		4
5	N 27°57'05.1"	E 95°50'04.8"	133m	Kundil Kalia	0807	1	1	1	1	4
6	N 27°56'56.6"	E 95°50'.21.7"	140m	Kundil Kalia	0830	1	1			2
7	N 27°57'06.9"	E 95°50'.049"	140m	Kundil Kalia	0830	1	1	1	1	4
8	N 27°57'07.1"	E 95°50'.21.6"	176m	Kundil Kalia	0930	1	1			2
9	N 27°57'07.2"	E 95°50'.21.5"	176m	Kundil Kalia	0930	1	1	1	1	4
10	N 27°57'07.6"	E 95°50'.21.6"	156m	Kundil Kalia	1000	1	1	2	1	5
TOTAL						**10**	**11**	**7**	**5**	**32**

AM - Adult male; AF - Adult female; J? - Juvenile unidentified; I? - Infant unidentified

Table 2. Records of call count

	Location		Altitude	Locality	Duration in mins
1	N 27°50'54.9"	E 95°45'30.9"	120m	Hallawgaon	0900-0915h = 15
2	N 27°50'38.2"	E 95°45'5.7"	122m	Hallawgaon	1022-1038h = 16
3	N 27°50'53.3"	E 95°51'03.4"	122m	Kukurmara	1010-1020h = 10
4	N 27°50'42.0"	E 95°51'04.1"	100m	Kukurmara	1100-1110h = 10
5	N 27°50'44.4"	E 95°50'10.9"	122m	Kukurmara	0615-0634h = 19
6	N 27°50'52.2"	E 95°50'50.1"	120m	Kukurmara	0708-0725h = 17
7	N 27°57'06"	E 95°49'46.9"	139m	Kundil Kalia	1147-1200h = 13
8	N 27°57'16.6"	E 95°49'27.9"	136m	Kundil Kalia	0920-0930h = 10
9	N 27°57'10.6"	E 95°49'46.9"	138m	Kundil Kalia	1000-1010h = 10
10	N 27°57'18.2"	E 95°49'19.5"	144m	Kundil Kalia	0900-0910h = 10
11	N 27°57'17.9"	E 95°49'47.6"	135m	Kundil Kalia	0604-0625h = 21
12	N 27°57'07.1"	E 95°50'04.0"	141m	Kundil Kalia	0730-0750h = 20
13	N 27°57'07.1"	E 95°50'04.0"	141m	Kundil Kalia	0750-0800h = 10
14	N 27°57'05.1"	E 95°50'04.8"	160m	Kundil Kalia	0715-0730h = 15
15	N 27°57'06.9"	E 95°50'21.6"	140m	Kundil Kalia	0830-0853h = 23
16	N 27°57'16.8"	E 95°49'27.8"	133m	Kundil Kalia	0720-0745h = 25

had populations of gibbons, but at present there are no gibbons in any of them (Table 3). This indicates that the species has become locally extinct from these three reserve forests. It has been assumed that about 40–45 years ago the species was wiped out by large-scale clearing of forest for human settlement and agricultural practice.

Threats

During the survey we also tried to identify the threats for hoolock gibbon and other wildlife of the area. Based on our observation we have identified the following threats:

Status of the forest: It is evident that Eastern Hoolock Gibbon occurs in the reserve forests of Sadiya. Reserve forests, unlike sanctuaries or national parks, do not enjoy strong legal protection. Additionally, this status makes the reserve forests more vulnerable to various types of exploitation.

Hunting: There was no direct evidence of hunting, but indirect information supports the occurrence of the hunting of hoolock gibbon and other wildlife in Sadiya.

Encroachment: Massive encroachment of

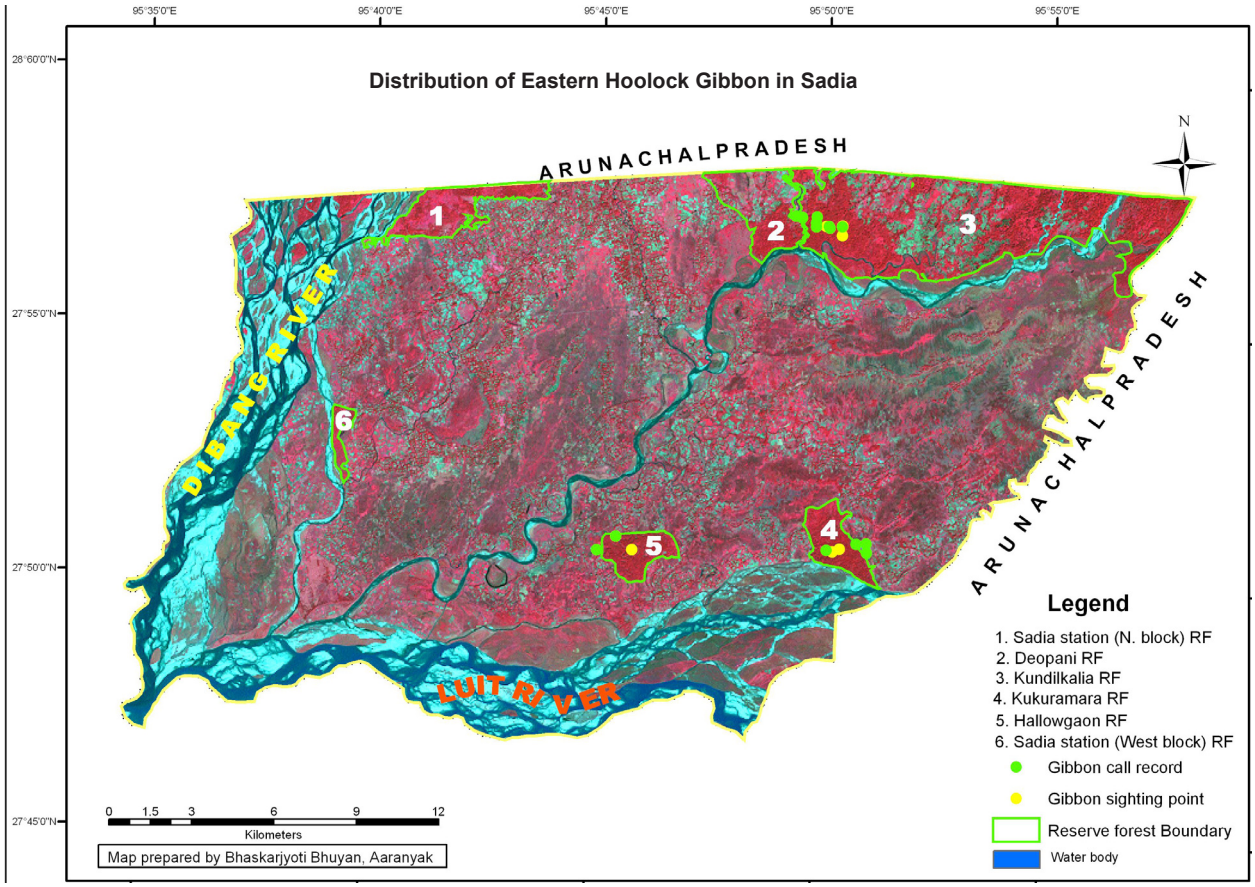

Image 3. Distribution of Eastern Hoolock Gibbon in Sadiya

Table 3. Reserve forest, encroachment and extinction

Sno	Reserve Forest	Area in sq.km	Encroachment area in sq.km	Eastern Hoolock Gibbon	Locally extinct	Years of Extinction
1	Hollowgaon	3.71		+		
2	Kukuramura	3.65		+		
3	Kundil Kolia	72.84	40.00	+		
4	Sadiya North Block	23.31	7.20	-	+	1970
5	Sadiya West Block	5.41		-	+	1970
6	Deopani	16.20	13.50	-	+	1995
		125.12	**60.70**			

forestland for human settlement and for agricultural activities was observed during the survey. A total of 60.70km^2 of forestland is under encroachment out of 125.12km^2 (Table 3).

Selective logging: Illegal felling of selective trees, such as Uriam *Bischoffia javanica*, Simalu *Bombax ceiba*, Halak, Tita sopa *Michelia champaca*, was also observed during the survey.

Collection of non-timber forest products: Extraction of non-timber products, such as cane, bamboo and medicinal plants, is a common practice among the local community. Cane *Calamus* spp., bamboo *Bambusa* spp., *Musa* spp., fern species and Tora *Alpinia* spp. are also extracted commercially from the forests.

Grazing pressure: There is high grazing pressure from the surrounding villages, as well as from the cattle farms.

Lack of awareness: Lack of awareness among

the local community towards the conservation of wildlife in general, and the Eastern Hoolock Gibbon in particular, is a perennial problem.

Lack of patrol infrastructure: During the survey, we observed that there were neither staff quarters nor a forest department office in any reserve forest for monitoring or patrolling the forest. There are only eight forest staff in Sadiya subdivision to combat illegal activities in the forest.

DISCUSSION

The Eastern Hoolock Gibbon is reported for the first time from Assam, showing the extended distribution of the species in India. Earlier, Das et al. (2006) first reported Eastern Hoolock Gibbon from Lohit district of Arunachal Pradesh. Then, there was a report of Eastern Hoolock Gibbons from the lower Dibang Valley District of Arunachal Pradesh (Chetry et al. 2008; Chetry 2009; Chetry et al. 2010).

There were 26 groups of Eastern Hoolock Gibbons in three reserve forests, namely Halaugaon, Kukuramara and Kundil Kalia. With this finding, the Sadiya area is established as the single habitat pocket of Eastern Hoolock Gibbon in the state of Assam. According to Das et al. (2006), the average group size for the gibbon was 3.37, while Chetry et al. (2009) recorded an average group size of 3.14 in Mehao Wildlife Sanctuary. The average group size recorded in this study is 3.3. Variation in group size in different habitats may be due to the differences in the distribution, abundance and quality of food resources in the habitat. Regarding the altitudinal distribution range of the species, Groves (1971) reported that the Eastern Hoolock Gibbon is distributed at an altitude range of 1067–1219 m in Myanmar and China. Similarly, Das et al. (2006) recorded the species between 122–1075 m in Arunachal Pradesh. Again, Chetry et al. (2010) reported an altitude range of 142–1865 m in Mehao Wildlife Sanctuary in Lower Dibang Valley District of Arunachal Pradesh. In this study, it is shown that in Sadiya the Eastern Hoolock Gibbons are distributed between 100–176 m. This clearly shows that the species is distributed at much lower elevations than thought earlier. Simalu *Bombax ceiba*, Ajar *Lagerstroemia speciosa*, Halakh *Terminalia myriocarpa* and Lata jari *Ficus maclellandii* were the dominant vegetation in the reserve forests.

In addition to the Eastern Hoolock Gibbon, reserve forests in Sadiya support only one other species of primate - *Macaca mulatta.* Regarding other primates we neither had any direct sighting nor any secondary information. This indicates that *Macaca assamensis*, *Trachypithecus pileatus*, and *Nycticebus bengalensis*, along with *Macaca arctoides* and *Macaca leonina*, which are sympatric to the Eastern Hoolock Gibbon in other habitats, are absent in Sadiya. This absence of all these species, particularly *Macaca assamensis*, *Trachypithecus pileatus*, and *Nycticebus bengalensis*, is significant.

With the addition of the Eastern Hoolock Gibbon *Hoolock leuconedys*, the primate diversity of Assam has been increased by another species and this has undoubtedly made Assam, the Indian state with the highest primate diversity.

Habitat loss and fragmentation resulting from encroachment for settlements and agricultural practices are posing a major threat, not only to the Eastern Hoolock Gibbon but also to other wildlife in Sadiya. Habitat loss and fragmentation have already been identified as the principal threats to gibbons in the entire distribution range in northeastern India (Chetry et al. 2007). Sincere efforts for conservation, involving the local community with long-term vision, are required, along with population monitoring and ecological study of the Eastern Hoolock Gibbon. Viewing Sadiya as the only Eastern Hoolock Gibbon habitat in Assam, the state forest department should take immediate steps to conserve this population. The state government can notify all the three reserve forests with Eastern Hoolock Gibbons into a sanctuary to provide more legal protection to the species and its habitats.

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Author Contributions: RC and DC collected the data in the field. PCB assisted in writing of manuscript.

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Assamese Abstract:

ভাৰতবৰ্ষৰ এখন অঙ্গৰাজ্য অসম। অসমৰ তিনিচুকীয়া জিলাৰ শদিয়া মহকুমাৰ অন্তৰ্গত সংৰক্ষিত বনাঞ্চল সমূহৰ হলৌ বান্দৰৰ স্থিতি সম্পৰ্কে জনাৰ উদ্দেশ্যে ২০১০ বৰ্ষৰ মাৰ্চ মাহৰ পৰা মে মাহলৈ এক ক্ষেত্ৰভিত্তিক জৰীপ চলোৱা হৈছিল। সংশোধিত ৰেখাপথ পদ্ধতি আৰু ধ্বনি গণনা পদ্ধতি অৱলম্বন কৰি যাৱতীয় তথ্যাবোৰ সংগ্ৰহ কৰা হৈছিল। তিনিখন সংৰক্ষিত বনাঞ্চলত আমি ১০ টা হলৌ বান্দৰৰ দল প্ৰত্যক্ষভাবে নিৰীক্ষণ কৰিছিলোঁ। চকুৰে প্ৰত্যক্ষ কৰা ৩০ টা সদস্যৰ ৬৩.৬ টা আছিল প্ৰাপ্তবয়স্ক, ২১.৩ টা আছিল কিশোৰ আৰু ১৫.২ টা পোৱালী অৰ্থা শিশু সদস্য। প্ৰত্যক্ষ কৰা দল বিলাকৰ গড় হিচাপত দলীয় আকাৰ আছিল ৩.৩ সদস্য যুক্ত। প্ৰাপ্তবয়স্ক মতা আৰু মাইকীৰ অনুপাত আছিল ১ঃ১১। জৰীপ কালত আমি মলুৱা বান্দৰৰ ১০ টা দলো প্ৰত্যক্ষ কৰিছিলোঁ। মানুহে সৃষ্টি কৰা সমস্যা, যেনে, গছ-গছনিৰ অবাধ ধ্বংস, বেদখল আৰু সীমিত বুনিয়াদী সা-সুবিধা আদিকে অঞ্চলটোৰ বিশেষকৈ হলৌ বান্দৰৰ প্ৰতি প্ৰধান ভাবুকি বুলি চিনাক্ত কৰা হৈছে। উল্লেখযোগ্য যে আমি শদিয়াৰ হলৌ বান্দৰখিনিক ইষ্টাৰ্ণ হুলক গিবন (হুলক লিউক'নৈদিছ্) বুলি চিনাক্ত কৰিছিলোঁ আৰু এইটোৱেই হৈছে অসমত প্ৰজাতিটোৰ প্ৰাপ্তি সম্পৰ্কত প্ৰথম প্ৰতিবেদন।