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POPULATION ESTIMATION OF GOLDEN JACKAL (*CANIS AUREUS*) USING DIFFERENT METHODS IN VARIOUS HABITATS OF CACHAR DISTRICT, SOUTHERN ASSAM

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ABSTRACT

Golden jackal (*Canis aureus*) is one of the top carnivores distributed in different habitats in Cachar district, Assam (India). Survey was conducted in the three representative habitats of Cachar district, Barak Valley, Assam (India), viz. Reserve Forest, Tea garden and unprotected forests from January to June, 2013 for estimation of minimum population by both direct (sighting) and indirect (howling and active den) survey methods. From the study, more number of jackals were documented by howling survey (n=89), followed by direct sighting (n=22) and active den survey (n=14). Among the different population survey, jackal density was also found more in howling survey (1.85 per km^2) followed by sighting survey (0.46 per km^2) and in active den survey (0.29 per km^2). In sighting survey, from all areas sampled, the species was sighted. Highest number of individuals in total was sighted in tea gardens (n=8) followed equally by reserve forest (n=7) and unprotected forest (n=7).

Key words : Active den, Density, Golden jackal, Howling, Minimum population, Sighting.

Introduction

Indian jackal or golden jackal (*Canis aureus*, Linnaeus, 1758) is a wide spread medium-sized canid occurring in northern and eastern Africa, the Middle East, central and southern Asia, and south-eastern Europe (Krystufek *et al.,* 1997; Macdonald and Sillero-Zubiri, 2004; Jhala and Mohelman, 2008). In eastern and central Europe, expansion of golden jackals is ongoing (Arnold *et al.,* 2012). Abundance of jackals in southern Europe is not clear for many areas. The jackal is listed as an ''Extinct'' native species in the Hungarian Red Data Book, because it disappeared from Hungary at the beginning of the 20th century as a result of changes to its natural habitats and the more general persecution of carnivores (Szabo *et al.,* 2009). They occupy semi-desert, short to medium grasslands and savannas in Africa; and forested, mangrove, agricultural, rural and semi-urban habitats in India and Bangladesh (Poche *et al.,* 1987). Golden jackals also inhabit National parks, non-protected cultural forests and the associated pastoral areas. In the Serengeti National Park, jackal density is as high as four adults per km^2 (Moehlman, 1969). In Thailand, they are found densely in non-protected traditional forests that showed the presence of adequate resource to the Asiatic jackal (Wongpadkan *et al.,* 2007). In India, jackal populations achieve high densities in pastoral area such as Kutch, Maharastra, Rajasthan and Haryana (Jhala and Mohelman, 2004). Jackal densities in the semi-arid Velavadar National Park were estimated between one and two jackals per km^2 habitation at night feeding on garbage.

The species is included in CITES Appendix II (in India). Jackals feature on Schedule III of The Wildlife (Protection) Act, 1972 of India and are afforded the least legal protection (mainly to control trade of pelts and tails). Studies on this species have been very poor, due to its secluding behavior. In Cachar district of Southern Assam, the study on golden jackal is less except in some literature where only the presence of golden jackal was documented (Forest work manual, Govt. of Assam, 1952). The Golden jackal is among the top carnivore found in Cachar district and distributed in different habitat. Golden jackal may play an important role in the ecosystem of the area. It was reported that golden jackal was killed by the local people for many purposes which may lead to exterpiration of the species. With this in the backdrop, it is very important to count the population to know the status and distribution of golden jackal in different habitat in Cachar district, Assam (India).

Materials and Methods

Study Site

Cachar district is situated in the southern part of the Assam having the geographical area of 3,786 Km^2. The district is bounded by N C Hills in the north, Mizoram in the south, Karimganj and Hailakandi districts in the

More number of jackals were documented by howling survey method (n=89) followed by direct sighting (n=22) and active den survey method (n=14).

westand a part of Meghalaya state and Manipur state in the east (Fig. 1). The district lies between 92°24' E and 93°15' E longitude and 24°22' N and 25°8' N latitude. The climate of the district is warm in humid where humidity ranges from 85 to 90% during summer and 90 to 100% in winter. The District receives about 2700-2800 mm rainfall during the year.

Types of Areas Surveyed

Tea Garden (TG) : These are monoculture area where mostly tea plantation is done. Tea gardens are acquired large areas (more than 2 km^2 on an average) in enormous hilly tops. The areas are bisected by road for transportation of private cars for management of the garden and also for public cars. Tea gardens are private ownedland, where garden workers stay in villages adjacent to the respective tea gardens. More than hundred tea gardens are present in the district located all over area. Among the tea gardens four gardens were selected for sampling which include Dwarbandh TG, Kumbhirbagan TG, Dewan TG (Near Pailapool), and Lakhipur TG (Fig. 2).

Reserve Forest (RF) : It is a protected area with natural forest. In RF both closed and open forest are found.

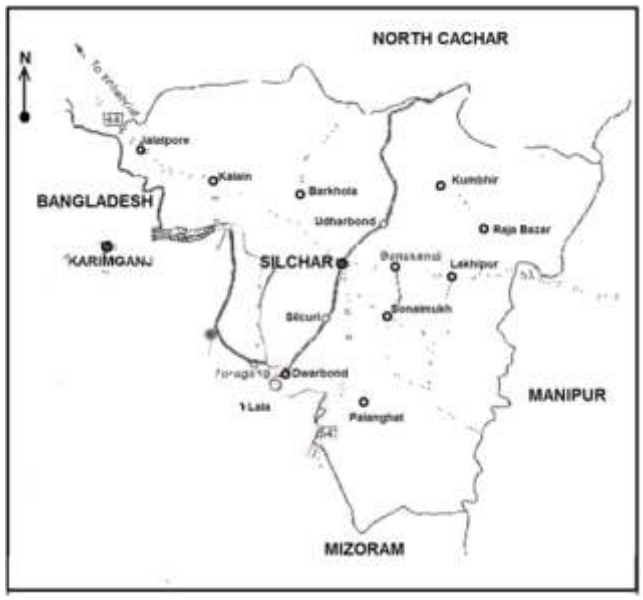

Fig. 1: Map of Cachar District

Within the RF area forest villages exist. In the peripheral area agricultural practice like rice, sugarcane, vegetable, etc. are grown by the local people. They also access the forest produce, especially non-timber forest product (NTFP). Different types of animals and plant species are

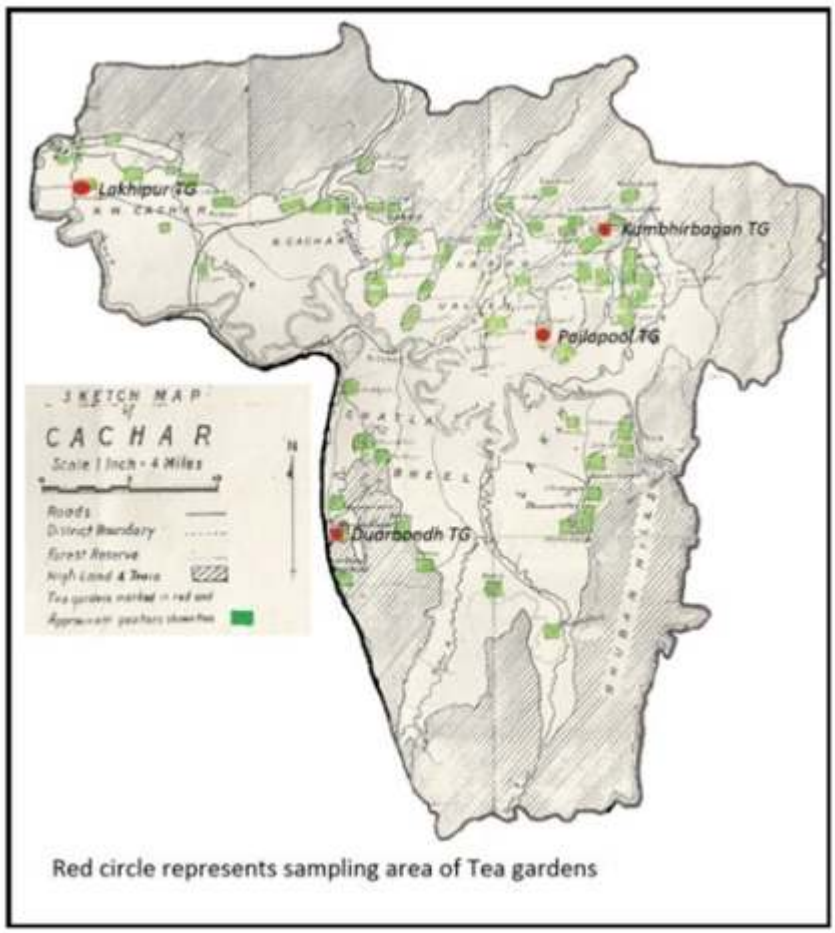

Fig. 2: Tea gardens of Cachar District

Fig. 3: Reserve forests in Cachar district

found in the RF. These areas are maintained and protected by the Government forest officials. Among the six numbers of RF in Cachar district, four RF have been taken for sampling, namely Inner-line RF, Sonai RF, Barak RF, Lower Jiri RF. Besides these, Upper Jiri RF and katakhal RF are also in the district along with one wildlife sanctuary i.e. Barail wildlife sanctuary (Fig. 3).

Unprotected Forest (UF): Unprotected natural forests are generally open and degraded forests are also found in the Cachar district. Number of trees is scanty, dominated mainly by scrub jungles, herbs, etc. Local people stay in and around the forest area. Continuous access and harvest of forest produce are done by the local people, which may cause the vegetation and wildlife of disturbance. Agricultural practices are done in and around the forest area. The land area may belong to private or government. Sampling were done near unprotected forests of Dorgakona, Harinagar, Katigora and Amraghat village.

Population Survey

Survey was done in the three categories of habitats viz. Reserve Forest, Tea garden and unprotected forest from January to June, 2013. Pilot survey was also done in different categories of habitat in the study site. One unit area (2×2 Km^2) taken from each sampling plot from every categorized habitat. For the estimation of minimum population of Golden jackal, both direct and indirect survey methods were used. For the direct method, direct sighting was done on the human trail after dusk time. In indirect method, howling survey in dusk time and active den survey at day time were done in the pre-breeding season (February-June). One sampling unit was visited thrice. Golden jackals are mostly nocturnal animal and simultaneous communal howling done during the night time in different slots, for which it is easy to count the minimum number of jackal present in the area by howling survey. For each group howling only two numbers of jackals are listed to minimize the repetition of individuals. After howling survey random walk was done on the human trail for direct sighting survey as also for ensuring the presence of golden jackal.

Active den survey was done in day time on the basis of howling concentrates area and also the help of local people who are mostly familier with to the area in pre-breeding season. For the conformation of jackals den, indirect sign survey was also done, such as, presence of hair, scat, pugmark and direct sighting by the local people. In active den survey abandoned den of golden jackal were documented. If any den group was/were found, it was counted as a single den, with the presumption that a single den or den group belong to one individual golden jackal.

Analysis

The maximum number of individuals thus obtained from three observations per sampled plot was taken as minimum population count. The minimum

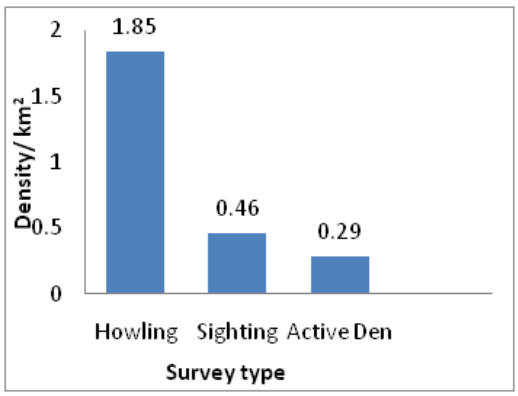

Fig. 4: Golden jackal density/ Km^2 found in different survey methods in Cachar District

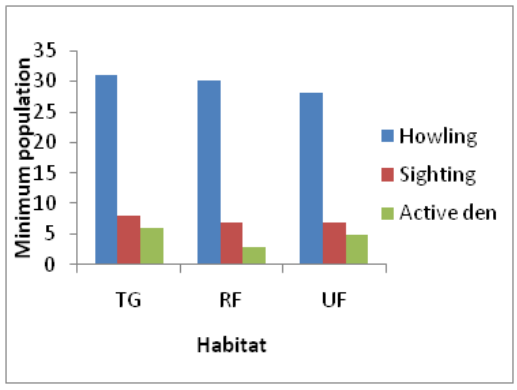

Fig. 5: Minimum population count from Tea Garden (TG), Reserve Forest (RF) and Unprotected Forest (UF) in Cachar.

Table 1: Minimum population count from sampled plot in Cachar.

Sample area	Survey method		
	Howling	Sighting	Active den
Tea Garden			
Dwarbandh	8	2	3
Dewan (NearPailapool)	8	2	2
kumbhir bagan	8	2	1
Lakkhipur	7	2	0
Reserve Forest			
Inner Line	7	2	0
Sonai	10	2	1
Lower Jiri	6	1	2
Barak	7	2	0
Unprotected Forest			
Dorgakona	10	2	3
Amraghat	6	2	0
Harinagar	6	2	1
Katigora	6	1	1
Total	89	22	14

population was added from four surveyed plot of each single categorized habitat to know the difference of population between three different habitats in Cachar district. Chi-square test was done to know the significance difference and association of population between the habitats. Kruskal-Wallis test was done for sighting rate per night in different habitats. Total minimum population was counted by adding maximum population found in every surveyed plot of different habitats. To know the variation, standard deviation was done.

Result and Discussion

The present study documented more number of jackals by howling survey (n=89), followed by direct sighting (n=22) and active den survey (n=14) (Table 1). Among the different population survey, jackal density was also found more in howling survey (1.85 per km^2) followed by in sighting survey (0.46 per km^2) and in active den survey (0.29 per km^2) (Fig. 4).

In howling survey, from all sampled habitats howling of golden jackals were heard (range=6-10). By this method also, effort was to document the minimum number of individual golden jackal. The presence of minimum number of individual jackal found was 28 in unprotected forest (UF), 30 in reserve forest (RF) and 31 in tea garden (TG) (Fig. 5). Population difference was not significance (^{2}=0.157, p<0.05) among the different habitat. From the howling survey, tea garden has 7.75 (±0.5) average number of minimum individuals which was highest followed by reserve forest, 7.5 (±1.73) and unprotected forest, 7 (±2) (Table 2). The density was more in tea garden (0.5 per km^2), followed by reserve forest (0.44 per km^2).

Linnell *et al*. (1998) mentioned that the most

Table 2: Average number of Golden jackal found in different habitat in Cachar.

Survey method	Habitat		
	TG	RF	UF
Howling	7.75 (±0.5)	7.5 (±1.73)	7 (±2)
Sighting	2	1.75 (±0.5)	1.75 (±0.5)
Active den	1.5 (±1.29)	0.75 (±0.96)	1.25 (±1.26)

widespread methods for estimating carnivore density have come under the categories of minimum counts. These methods attempt to count individual large carnivores through either direct observation, or by isolating their location using tracks. Using various decision-making rules to avoid counting the same individual twice, a minimum number of individuals within the surveyed area is determined. The methods make no effort to calculate the number of animals that were present but not detected by the survey.

Many species of social carnivore like wolves, coyotes, jackals and spotted hyenas use sound as a means of communication (Laundre, 1981; Harrington and Mech, 1982; Jaeger *et al.,* 1996; Mills, 1996; Rose and Polis, 1998). The direct howling survey, howling of golden jackal was found in each habitat. Maximum human hearing distance on windless nights from a vantage point in open terrain with no background noise was determined at 1.8-2 km (Giannatos *et al.,* 2005). The jackal-howling technique must be surely considered a useful tool in monitoring of Italian golden jackal populations; however, at the present low population levels, it should be applied only on the basis of other objective evidences, and integrated by defined field methods (photo-trapping, field tracing, genetics, etc.) (Lapini *et al.,* 2011). Among the different types of habitat, the minimum number of individual recorded from tea garden followed by reserve forest and unprotected forest which was not significance. The minimum population status of jackal is not associatedwith different

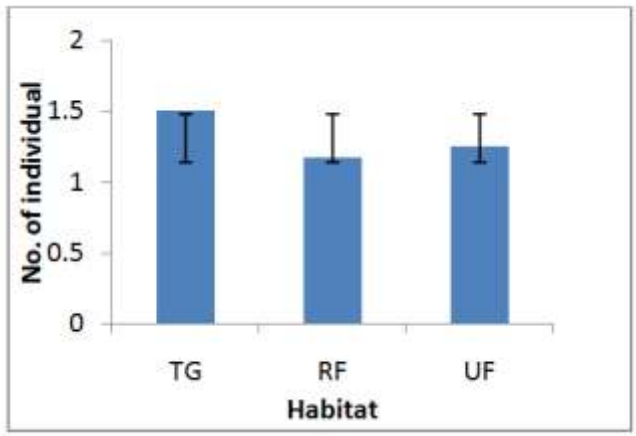

Fig. 6: Per night sighting of Golden jackal in different habitat, Tea Garden (TG), Reserve Forest (RF) and Unprotected Forest (UF).

Image 1: Active den of Golden jackal in Dwarbandh Tea Garden, Cachar

characteristics of habitat in the Cachar district, Assam (India).

In sighting survey, from all sampled area, the golden jackal was sighted. The highest number of individuals in total was sighted in tea gardens (n=8) followed equally by reserve forest (n=7) and unprotected forest (n=7). There was no significant difference between the total individual number of jackal (^{2}=0.09, p<0.05) in sighting survey. Highest average sightings were found in tea garden, (2) followed by reserve forest (1.75) (±0.5) and unprotected forest; (1.75) (±0.5). The total number of sightings of golden jackal was found more in tea garden (n=18) followed by unprotected forest (n=15) and reserve forest (n=14). Per night sighting was also more in tea garden, 1.5 (±1.45), followed by unprotected forest, 1.25 (±0.87) and reserve forest, 1.17 (±1.27) (Fig. 6). Per night sighting was not significantly different (Kruskal-Wallis test: H(2)=0.325826, p<0.05). In case of density, from the sighting survey was high in tea garden (0.38 per km^2) followed by unprotected forest (0.19 per km^2) and reserve forest (0.31 per km^2).

From direct sighting survey, the minimum number of jackal found less than direct howling survey method, 24.72% of howling survey. In Israel, population of jackal from direct sighting was less than the howling survey (Macdonald, 1979). Sighting of jackal in night is difficult. Golden jackals run with medium speed. It's generally sighted when they come to walk on road for searching food near road-side and while crossing the road. The presence of large animal and human can be distinguished easily by jackal and thus they manage to hide themselves in the bushes, which is the reason why the direct sighting of jackal was less. During the present study, the minimum of one, and maximum two jackals were sighted in the areas surveyed. Presences of some sympatric carnivore species were also documented during the direct sighting

Image 2: Skin and skull of killed Golden jackal (Spotted near Dorgakona village, Cachar)

survey. These include, one jungle cat (*Felis chaus)* and two numbers of small Indian civet cat (*Viverricula indica)*. In each habitat, per night sighting rate was not associated with different habitats.

In active den survey, except four sampled area, active den was found in all sample plot (Table 1/ Image 1). Documented active den was more from tea garden (n=6) followed by unprotected forest (n=5) and reserve forest (n=3). The number of active den in different sampled area also not significant (^{2}=0.99, p<0.05). A total number of 22 abandoned dens were found in the study area expect two sampled area.

Fox's den dependence has become a useful tool for ecologists, as den surveys can give good estimates of reproductive success in a population. For arctic foxes, it is a widely used method for population estimates (Elton, 1924; Macpherson, 1969; Angerbjorn and Isakson, 1995; Tannerfeldt, 1997). From active den and den group survey, the number of jackal is found less compare to direct howling survey i.e., 15.73%. Among 12 surveyed areas, in only eight areas at least one active den was found. Except two surveyed area, abandoned den were located in all areas. The absence of active den does not mean the absence of jackal, because in every surveyed area the presence of golden jackal is estimated by the

direct howling survey. In every area at least six numbers of jackals in three different groups were found. There were difficulties to locate active den in the close forest areas, dominated scrub, shrub and herb dominated areas. Maximum den were found on the basis of concentrated jackal howling site along with day sighting of jackal, local people information, scat and scavenged objects, etc.

The golden jackal occurs in a wide range of different habitats covering a variety of ecosystems (Mitchell-Jones *et al.,* 1999). Presence of golden jackal in three different habitat shows that jackal can survive in different types of habitat. The adaptation of golden jackal in different type of habitat leads to occurrence in each sampled area. The feeding habit can influence the inhabitance of carnivore mammals. Golden jackals are carnivorous as well as omnivorous, thus are opportunistic foragers, and their diet varies according to season and habitat (Jhala and Mohelman, 2008). Due to their tolerance of dry habitats and their omnivorous diet, the golden jackal can live in a wide variety of habitats. In all categorized habitat studied, human inhabitation exist. In tea garden, reserve forest and unprotected forest, jackal gets food from the households and others natural food from the area. Prater (1980); Poche *et al. (*1987) mentioned that additional type of food resources such as dead and survive livestock (goat, hen, duck, pups of dogs, etc.) are also available from the forest villages in the entire different habitat. This has also been observed during the present study. Golden jackals are able to exist in close proximity to humans, obtain suitable day time cover and food materials from agro-ecosystems. Golden jackals occur in intensively cultivated and human dominated areas in Bangladesh (Poche *et al.,* 1987). Annual access to an area with suitable cover and a diet mainly of rodents are important factors influencing local abundance in the major agro-ecosystems (Jaeger *et al.,* 2007). The livestock depredation by golden jackal in day time also heard. The number of dens were found but the number of active dens were less because of difficulty in searching in some of the areas. The jackal densities in the sampled area in Cachar district were estimated between one and two jackals per km^2.

Conclusion

In Cachar district, Assam (India), population of golden jackalare facing threat emanating from anthropogenic sources. This is on the rise, which may lead to a situation, not conducive for their survival in the area. Human activities such as new settlements, area wise increase the agricultural practices on natural land, jhum (slash and burn) cultivation and the like. This type of indirect activity leads to exert stress on the diet and breeding space of the golden jackal. Besides, some people who occasionally enter within natural forest with the motive of illegal harvesting occasionally kill jackal in their den site using smoke and also by addition of poison in food provisioning and traps for many purposes such as meat, medicines and monetary income (Image 2) and also for recreational aspects. As retaliation, jackals are also killed. It's happen for livestock depredation by golden jackal.

The present study has opened up avenues to work on many aspects of study, hitherto in accessed areas of Barak Valley, Assam. Studies on human jackal conflict, diet analysis, breeding ecology, habitat characteristics, etc. can be taken up. All these will help in improving their prospect of conservation in the area under reference and in their entire habitat at large.

Acknowledgment

The authors are thankful to Mofidul, Anisur and all local people of the areas adjacent to study sites, who have cooperated during the field study. The help and support of officials of state forest department is also sincerely acknowledged.

दक्षिणी आसाम के कैचर जिले के विभिन्न वासस्थलों में विभिन्न पद्धतियों द्वारा सुनहरे गीदड़ (*कैनिस औरस*) की आबादी का आकलन

डी. देवनाथ तथा पी. चौधरी

सारांश

सुनहरा गीदड़ (*कैनिस औरस*) आसाम (भारत) के कैचर जिले के विभिन्न वासस्थलों में वितरित उच्चकोटि का मांसभक्षी है। इसके एकांत व्यवहार के कारण इस प्रजाति के आबादी आकलन और सर्वेक्षण पर बहुत कम अध्ययन किया जा सका है। सुनहरे गीदड़ की न्यूनतम आबादी से उसकी स्थिति और वासस्थलों में उपस्थिति का पता चलता है। जनवरी से जून 2013 के बीच आसाम (भारत) के कैचर जिले बराक घाटी में तीन प्रतिनिधि स्थलों यथा: आरक्षित वन, चाय बागान और अनारक्षित वनों में सर्वेक्षण किया गया। न्यूनतम आबादी का पता करने के लिए प्रत्येक दर्शन तथा गुफाओं और शोर करने की पद्धतियों का प्रयोग किया गया। अध्ययन करने पर अधिक गीदड़ों को प्रलेखीकृत किया गया जिनमें शोर सर्वेक्षण से एन-89, प्रत्यक्ष दर्शन से एन-22 तथा सक्रिय गुफा सर्वेक्षण से एन-14 गीदड़ों का पता चला। विभिन्न आबादी सर्वेक्षणों में शोर सर्वेक्षण से सर्वाधिक 1.85 वर्ग कि0मी0, प्रत्यक्ष दर्शन सर्वेक्षण से 0.46 प्रति वर्ग कि0मी0 तथा गुफा सर्वेक्षण से 0.29 प्रति वर्ग कि0मी0 गीदड़ घनत्व का पता चला। प्रत्यक्ष दर्शन

सर्वेक्षण में सभी क्षेत्रों से लिए गये नमूनों में यह प्रजाति देखी गई। चाय बागानों में सर्वाधिक एन–8 गीदड़ों को देखा गया जिसके बाद आरक्षित वनों में एन–7 तथा अनारक्षित वनों में भी एन–7 को देखा गया।

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