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Ecological status of Indian golden rock gecko, *Calodactylodes aureus* (Beddome, 1870) in lakhari valley wildlife sanctuary and around Mahendragiri hills of South Odisha, India

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Abstract
The Indian Golden Gecko *Calodactylodes aureus* (Beddome 1870) is an endemic reptile species largely confined to the Eastern Ghats of India distributed in Tamil Nadu, Andhra Pradesh and Odisha. We conducted the study to evaluate the habitat patches in suitable areas in South Odisha. This endangered species of lizards conserved as Scheduled I category protected animal under wildlife protection Act 1972 and is listed as "Least Concern" in IUCN Red list. The animal occupies more suitable patches near water body with big stones to adhere the mass nesting eggs. Temperature and humidity pattern is a factor for population distribution along with altitudinal variation in spatial distribution. The habitat suitability in Odisha part of Eastern Ghats of Ganjam district depends on the land use pattern within *C. aureus* habitat. Our results also reveal that the distribution beyond northern portion of the River Rushikulya is poor. However, there are habitat patches in upper regions in and around Lakhari valley sanctuary. The upper Rushikulya river basin in old Phulbani district in Mandsaur biodiversity hot spots is the northern most part for *C. aureus* distribution in Odisha. More research is required to co-relate environmental parameters that sustains its conservation in changing climatic eras and conservation of the species.

Keywords: distribution, conservation, habitat patch, golden gecko, south Odisha, protected areas, rushikulya, Mahendragiri, lakhari valley wildlife sanctuary (LWS)

Introduction
The golden gecko *Calodactylodes aureus* (Beddome 1870) [3] is one of the key species of lizards that distributed in south Odisha region including the Lakhari valley sanctuary. This lizard is less concerned to general conservationists in the region. The Eastern Ghats are isolated hill ranges spreading across states of Andhra Pradesh, Odisha, Tamil Nadu and Karnataka in Peninsular India and covers an area of about 1750 km. It lies in 11◦ 30′ to 210 0 N Latitudes and 77◦ 22′ to 85◦ 20′ E Longitudes. The Deccan plateau is one of the biologically richest biogeographic zones of India (Rodgers *et al*., 2008) [18].

Golden Geckos are distributed throughout the world and belong to the family Gekkonidae under the Genus Calodactylodes. The Genus Calodactylodes consists of two species namely, Indian Golden Gecko, *Calodactylodes aureus* (Beddome, 1870) [3] and Sri Lankan Golden Gecko, *Calodactylodes illingworthorum* (Deraniyagala, 1953) [7]. The Indian Golden Gecko was discovered by Beddome, 1870 [3] and Boulenger, 1890 and it was rediscovered after 115 years in Tirupati Hills, Chittoor District, Andhra Pradesh by Daniel and Bhusan (1985). The Golden Gecko inhabits rocky area with deep stream valleys and has been found to occurs in elevation between 50 to 1000 meters. Present study reveals that current status along with its conservation, ecology, threats and recent distribution patterns in Eastern Ghats of Gajapati and Ganjam district of Odisha. The study was designed to throw light on (i) present status and distribution of Indian Golden Gecko in undivided Ganjam district and (ii) recent threat and conservation needs of Indian Golden Gecko in Eastern Ghats of Ganjam- Gajapati region. The range extension of Golden gecko (*Calodactylodes aureus*) is said to be endemic to Eastern Ghats of India. A viable but small population of the species were recorded in most part of south Orissa (Karlapat, Niyamgiri, Mahendragiri) extending its continuous distribution in Andhra Pradesh. Mahendragiri hill and its surrounding areas are recognized as a biodiversity hot spot due to numerous medicinal plants and other species that are found here. A haven for medicinal plants, Mahendragiri hills, which is part of the Eastern Ghats, is home to over 600 flowering plants. The faunal diversity of the region is huge and particularly known for being a herpetofaunal hotspot. The Ministry of Environment and Forests, GoI had proposed the State Government of Odisha in 1986 to declare the Mahendragiri hill as a Biodiversity Hotspot area. An expert committee of the Forest and Environment Department has also recommended that the bio-diversity hotspot Mahendragiri Hills should be declared as a Biosphere Reserve in 2014. Assessing the status, pattern and range distribution is a challenge, especially when a species is cryptic, shy, nocturnal

as well as semidiurnal in nature. However, it is essential to more precisely determine the distribution of a species in the wild, particularly when it is an endemic and threatened by deforestation, habitat fragmentation and anthropogenic exploitations (Kumara *et al*. 2009).

The Gekkonidae family are the most primitive living saurian and the genus Calodactylodes consists of large, distinctive geckos endemic to rocky habitat in peninsular India and Sri Lanka. The genus Calodactylodes can be identified on the basis of derived digital structure, the presence of Para-phalanges, bright yellow gular patch (in adult males) and distinctive vocalization. The Golden Gecko is of special interest to herpetologists worldwide as it represents one of the two known species in the genus Calodactylodes, which are considered as Gondwanan relics (Bauer & Das 2000) [2]. It is unclear how extensive the range of *C. aureus* is, but the few localities known suggest that it is widespread in the southern portion of Eastern Ghats. It is expected to occur wherever appropriate rocky habitats are present. The portion of the Eastern Ghats inhabited by *C. aureus* is relatively xeric and the vegetation is dominated by dry deciduous and thorn scrub (Legris & Meher-Homji 1982). Diet mainly consists of small insects and larval forms. In the Ganjam habitats it was observed that it also feed on grasshoppers, termites and other small insects. Locally the golden gecko is known as "Pathuria Jhitipiti" (rock living lizards) and the tourists and priests of the shrine area do not harm to this beautiful animal. It is protected as sacred species in Mahuri Kalua region in Ramaguda reserve forest of Berhampur range. The species seem to be in healthy condition and happy with more insect foods and cool ness in rock caves during rainy season. They are both came to outside of the stone cracks even during day time. There is no detailed observation were done in different months with changing seasons of the years.

Assessing the status, pattern and range distribution is a challenge, especially when a species is cryptic, shy, nocturnal as well as semidiurnal in nature. However, it is essential to more precisely determine the distribution of a species in the wild, particularly when it is an endemic and threatened by deforestation, habitat fragmentation and anthropogenic exploitations (Kumara *et al*. 2009).

Range description *Calodactylodes aureus* is endemic to peninsular India and is known from Orissa, Andhra Pradesh and Tamil Nadu. It is fairly common in Eastern Ghats of Andhra Pradesh and Orissa. Since 2000 several new records have been reported (Dutta *et al.* 2005, Javed *et al.* 2007, Chettri and Bhupathy 2010, Sreekar *et al.* 2010, P. Mohapatra pers. comm. February 2011) [8, 10, 4, 19]. This species occurs at elevations between 50 to 1400 MSL.

Known distribution

Calodactylodes aureus is distributed along the coastal hills of Andhra Pradesh, southern Odisha and northern Tamil Nadu regions of Eastern Ghats, India (Bauer & Das 2000; Dutta *et al*. 2005; Javed *et al*. 2007; Chakrapani *et al*. 2014) [2, 8, 10].

Outside Odisha

The Golden Gecko Calodactylodes aureus were recorded from Tirupati hills, Chittor District, (Daniel *et al*., 1986); in Araku valley (Chettri & Bhupathy, 2010) [4] recently from Sheshachalam and Velikonda ranges (Guptha *et al*., 2012) and also reported from Perantalapally (Papikonda hills) in Khammam District (Javed *et al*., 2007) [10], Maredumill hills in Rajamundry district, Ananthagiri hill in Vishakhapatnam district, Andhra Pradesh (Sreekar *et al*., 2010) [19]; It has been reported and photographed from Castle rock, Karnataka; Balamadi hill, Vellore and Vellore hill fort, North Arcot district, Tamil Nadu; Valli Malai and Sathgar hill in Vellore district, Shyed Basha Malai in Krishangiri district from Tamil Nadu (Kalaimani & Nath, 2012). There have been several reports of discovery (unpublished) and photography of a gecko similar to C. aureus from Castle Rock, north Karnataka (Bauer & Das 2000) [2] which suggest either a wider peninsular distribution for C. aureus or the occurrence of a new species in the northern Western Ghats. Whereas, Chettri & Bhupathy (2010) [4] mentioned that these reports from northern Western Ghats are erroneous. However, in a very recent development this gecko was recorded for the first time from the state of Karnataka (Srinivasulu *et al*. 2014) which further strengthens the claims of wider distribution than known range within India. *Calodactylodes aureus* is of special interest to herpetologists worldwide due to its unique toe morphology and breeding habits (Javed *et al*. 2007; Sreekar *et al*. 2010) [10, 7, 19].

In Odisha

Niyamgiri hill ranges of Rayagada district, Kalahandi district of Odisha (Dutta *et al*., 2005) [8]. Mandsaur forests in Phulbani division of Kandhamal district and Mahuri hills in Berhampur division of Ganjam district (Pers. Com with Pratyush P. Mohapatra 2012). The sites like Sanakalua and Ghodahada Dam sites in Berhampur division, Lakhari valley wildlife sanctuary and Mahendragiri hills of Gajapati district were studied along with tiger monitoring works.

Materials and Methods

The Golden Gecko (*Calodactylodes aureus*, Beddome 1870) [3] is a Scheduled -I (part-II) species protected under Indian wildlife Protection Act 1972. The survey was carried mainly based on occurrence, nesting density data and climatic and topographic conditions of the habitat patches. We used random sampling method in suitable areas where *C. aureus* sighted. A detailed survey work was carried in and around Lakheri valley wildlife sanctuary along with tiger monitoring works. There is poor documentation on distribution and status of the rare lesser known lizard species in Odisha A random sampling was done in carnivore sign survey areas having suitable habitat with huge rocks for golden gecko presences. The habitats with old or newly pasted eggs and partial egg shells are detected and remarked as habitat patches. The entire sanctuary was surveyed for carnivore and herbivore survey and additional data was generated for the rare lizards in the Sanctuary area along with peripheral area in the Berhampur and Paralakhemundi forest divisions. Night observations are done after the evening hours with binoculars, torch light, well protected cloths for mosquito bite and protecting stick for encountering snakes like bamboo pit vipers.

Study area

Study was carried out in and around Mahendragiri hills and

Lakhari Valley wildlife sanctuary during my all India Tiger monitoring survey in 2014. The study was carried during the summer months from February to April each year from 2014-May 2018. The finding sites are Ghodahada dam sites in Digapahandi range; Sanakalua, Badakalua (Mahuri hills or Kerandimal hills) and Ambagada hills in Berhampur range, Singharaj and Tumba Reserve forests in Samantiapalli Ranges, Mahendragiri hills in Mahendra range. The sites inside the Lakhari valley sanctuary are Mahulamelani, Sitajaran, Chandiput tiger census transect 1800m plot area Balliganda carnivore sign survey no 1 track area are well surveyed for the finding of golden lizards and their nests.

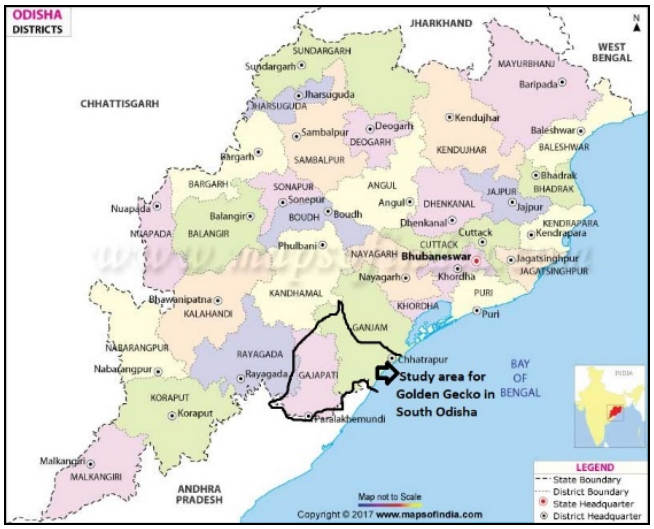

Fig 1: Study area in Odisha

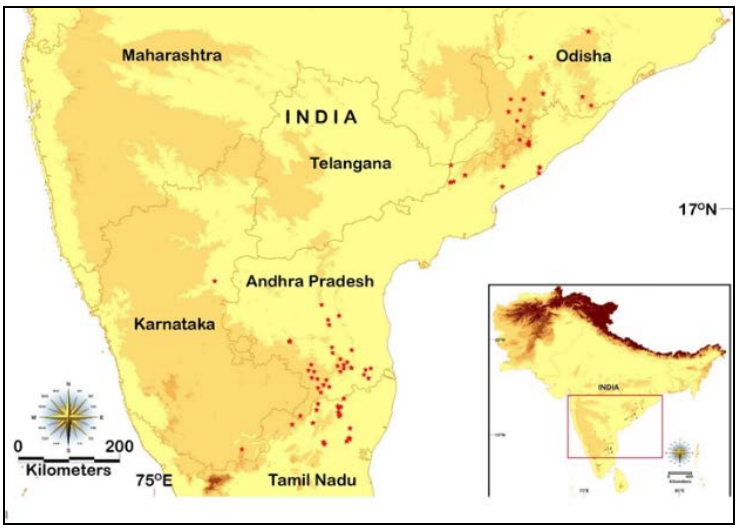

Fig 2: Distribution map in Peninsular India.

Figure 1, 2 details: Distributional ranges of Golden Lizard (*Calodactylodes aureus*, Beddome 1870) [3] in Eastern Ghats of India including South Odisha.

Opportunistic searches were carried out during day and night and included slow walking among the rock boulders along all the habitats over a vast area. Both vertical and horizontal crevices in rock boulders were searched intensely for recording the presence of golden geckos. Even silence observation for recording and delectating call sounds are included for presence of golden geckos in habitats. Every rock boulder was searched from all around corners and cracks, cervices, dilapidated stones are verified for the presence of geckos and number of geckos. Mobile camera photo and digital photos are taken for nesting site study and other observations were noted down. We state clearly that no specific permissions were required for these locations/activities because the species is also sighted in and around the public places and outside the protected area. But we have allowed in the Sanctuary as own resource persons by the knowledge of the local forest staff and the park authority along with other faunal survey works like that on tiger, leopard and other herbivore survey. It is currently not listed as an Endangered or Threatened species. No specimen was collected and set free in wild after photography.

The taxonomic classification or systematic position of Indian Golden Rock Gecko (*Calodactylodes aureus*, Beddome 1870) [3] is given bellow.

Phylum- CHORDATA, Sub Phylum- Vertebrata, Class – Reptilia, Order –Squamata, Sub order –SAURIA, Family – Gekkonidae, Genus Calodactylodes, Species *Calodactylodes aureus* (Beddome, 1870) [3], Common Name: Indian Golden Gecko, Oyiya Name: Suneli Jhittipiti, Local Name:- Pathuria Jhitipiti

Brief Description of the Lizard

Head is large with a broad rounded snout with a distinct somewhat rounded canthal ridge; ear-opening is an oblique slit; eye is large, with a vertical pupil, head is covered above with small granular scales, which are largest on the snout in the portion of canthal ridges. Upper labials 12-13 and as many lower labials; mental is a small shield, generally smaller than the adjacent labials; post-mental shields are not present; rostral is two times broader than high; a pair of inter-nasal is available. Dorsum is with small, granular scales intermixed with numerous larger rounded tubercles; ventrum is with large, fiat, smooth, squarish, juxtaposed scales; the anterior gular region is with small polygonal scales. The hind-limb reaches up to axilla; digits are slender at the base, with squarish scales beneath, with two large trapezoidal expansions, one at the base, the other at the free extremity of the terminal phalanx, the lower surface of each expansion covered by two large plates separated by longitudinal grove; all the digits are clawed, the claw is retractile between the distal plates; inner digit is with a distal expansion only. Tail is much longer than the head and body, depressed, oval in section, tapering to a point, segmented, covered above with small squarish scales, below with large, squarish, juxtaposed scales. Males are devoid of preanal and femoral pores. Standard length 85 mm.; tail length 100 mm (Tikader, B. K. ZSI 1993).

Results and discussions

I came across the attached eggs both post hatched and un hatched egg clusters in the rocks where there are less human interferences and beyond human approach. The golden gecko habitats also detected and represent some of the interior patches with or without human disturbances. We came across

few of the habitat close to picnic spots, temples and villages. The alarming calls confirmed about the presence of golden gecko even before detecting the actual nesting sites in thorny areas. The calls are mainly coming from the adult individuals.
The golden lizards exhibit remarkable ecological diversities and represent a most primitive and ancient group of animals. These creatures have a great role in the ecological balance and in the conservation of nature and most of the lizards are the strong predators on the insect pests of agriculture and as such bear an indirect but most useful impact on the economy of our country. Studies on the Indian lizards started in the middle of the last century, and intensive studies have been taken up recently. However, the results published through various journals in India and abroad are scattered and are not easily accessible to majority of workers.

Fig 3: Golden gecko inhabited Mahuri hills and 2 Landscape of Habitat.

Nesting Behaviours. The dark brownish adult females only lay two fresh elliptical shape soft coated and sticky materials that helps to attach the eggs in down faced stone surfaces, the fresh eggs became harder and possibly the hardest calcified egg membranes in any other reptilian species. It is so hard that the old unhatched brownish putrefied damaged eggs could not teared or broken with medium strokes from right hand index finger nails. The hatched eggs beautifully orifice at centre either by the hatchlings or by the lower labial stroke of the head of the female or male parents. From undisturbed safe distant observations through binocular confirms that the both the sexes exhibit parental care by stay laying over the eggs in thorax region. There is no detailed study on parental care and thermoregulation by the parent lizards over the eggs and the interaction of developing embryos and pre-hatched matured hatchlings inside the egg shell membrane and its parents. It is observed that the male parents also embraced over the eggs lay its most of the times the hind limbs and digits and occasionally the hind limbs and digits over the eggs. Bothe the sexes exhibit parental care to nests and hatchlings. The adult male and female gecko also lied the tail, ventral, limbs over the eggs and stay in a defensive posture and feed the incoming insects over to the nests. The female plays a greater affection to the eggs than the males, it does not mean that the males do not care for the nests and hatchlings.

Fig 4: The Golden gecko nests in different sites and stages of eggs in the study area as bellow.

Photos of Calodactylodes aureus (Beddome 1870) [3] (photo Male of prominent golden colour Female little darker colouration with golden patches). Total body length 17.5cm (175mm)

Fig 5: The Golden gecko individuals in their Natural Habitat nests in different sites s in the study area. (Photo- 7-12)

Field Notes

It has pronounced yellowish or dark brown colour with large oviform head distinct from neck and a strong, rounded supraorbital and canthal ridge. Limbs are long and slender. Head covered with small granules. Digits are slender and clawed. Tail is long cylindrical and slender covered with square scales. The tail is totally distinct from other geckos having wrinkle rounded skin rings as that in rat tails. Both male and female have distinct colouration. Male have more golden colouration than female which are darker and shorten in body length. The females have two gestational eggs during breeding season which are visible through body membrane tissues outside from ventral abdominal portion. Calodactylodes aureus possess a unique pattern of para-phalangeal cartilages and paired structures occurring lateral to the joints in the digits of the geckos (Russell & Bauer 1989) [16]. This gecko generally prefers riparian habitat with boulders and dense vegetation. It also has a very unique breeding plan or behaviour; lays eggs under the roof of the boulders and more than one female laid eggs at same site as a case of egg laying site fidelity. The clutch size varies from five to several eggs with very tough egg shell (Maqsood Javed S. M., Mithun Raj & Sunil Kumar 2017) [11].

Conservation status

Taking consideration of different aspects of ecology and biology of the Indian golden gecko, Calodactylodes aureus is placed in Schedule I (Part II) of the Indian Wildlife Protection Act, 1972, and is listed as “Least Concern” in IUCN Red list. However, key factors like, typical toe morphology, breeding habit, threats to its habitat and restricted known current distribution strongly makes a case of elevating the status of C. aureus to an “Endangered” species under IUCN Red list.

Habits and habitat

These gekkonids prefer to live in dark shady ravines or crevices in rocks. It prefers huge rocks where human interferences are less and also associated with presence of other rock calottes and hemidactylus lizards.

Habitat ecology

Calodactylodes aureus has been observed along streams, among rocky areas, and in human habitations. This species forages by ambushing the prey and is active during both day and night. It has been observed to feed on spiders, and moths and other flying insects are captured by adapting a mid-air twirl for which its long limbs have been adapted. It lays eggs in clusters attached to the ceiling of human habitation or walls and ceilings of caves and other rocky surfaces (Sreekar *et al*. 2010) [19].

Description of the Habitat patches in Study area.

1. **Ambagada hill:** The study reviled that the Ambagad village hill is the eastern front of the golden gecko distribution area in Ganjam district. The hill has elevation of 34 meters above mean sea level. The GPS location of the site is N 19◦ 20′ 29.63′′ E 084◦ 42′ 43.86′′ and elevation is 34 meter. The location is This is just 2km western fringe of Berhampur town and all human activities like collection of fire wood, goat grazing is done around the huge rocky habitat patches. This situated near Berhampur town this hill has moderate to hot climate the annual rainfall is around 1050mm. The hill comprises of khondalites. The villagers well protect the rocks from decorative rock extraction by lease process. The forest comprises of tropical dry deciduous type and the vegetation can be classified broadly into mixed deciduous, scrub forests. This small hill was covered with thorny shrubs Mahua, Teak, Figs, Ankula and Tendu as major vegetation. I recorded Golden Gecko alarms before confirming the nests over top stones. The maximum population is around 8 numbers. This habitat is around 14 kms away from the shore line of Bay of Bengal. Other nearby hillocks like Ambagaon, Kanisi, Mandiapalli and Chhatrapur hills are surveyed but it was confirmed that there are no presence of Golden gecko in the hills east part of National Highway no -5 (now no 16). Maximum care was taken during survey for bear presence and bamboo pit vipers in the scrubs at dusk. I crossed the stone cervices when a bear was in sleep in the cave during noon hours in Ambagada hills. But luckily the bear has not disturbed, and I returned from the top stones in another way which measures a little more distance from my bike point.
2. **Badakalua (Mahuri Kalua) Hill:** This one of the major habitat sites for Golden Gecko and the top of the hill is accessible and easily surveyed due to cemented steps up to

the top of the Kalua Goddess shrine. The entire area is conserved as Ramaguda reserve forests having 2950 ha area. In the compartment no 1 there are maximum numbers of golden gecko was encountered. The GPS location of the site is N 19◦ 08′ 14.19′′ E 084◦ 23′ 56.22′′ and elevation is 154 meter. The elevation is 164mtrs and the foot hill is only 25mtrs near the Kalua Siva temple picnic spots. a) the top patches probable has 4pairs of adults in top patches (1 ha area) b)6 pairs in middle flat stone caves in the steppes to shrine area and another c) 8 pairs in tourist sitting cave spot in lower stepps in the entrances to shrine area. The geckos in the upper part of the shrine area alarmed to down site inmates about our presence and putting torch light for photography. Distance observation through binocular was practiced observing the male- female interaction and care to the nests. In the east side abandoned stone quarry area there are about 7pairs of golden gecko was encountered. A total 25 pairs of golden geckos were encountered in this site.

3. **Sanakalua Hill (Near Mahurigarah):** This one of the major habitat sites in Mahuri Kalua hill regions. Golden Gecko lizard nests and live individual are encountered during night visits to the site just behind the temple. The GPS location of the site is N 19◦ 15′ 35.2′′ E 084◦ 42′ 47.17′′ and elevation is 84meter. The top of the hill is accessible and easily surveyed due to steps up to the top of the Kalua Goddess shrine. The elevation of the nesting sites is only 65mtrs and the foot hill is covered with agricultural fields. This is a sacred groove sit well protected religiously since princely ruled periods. This is a lower disturbed area with picnic spots and movement of vehicles and humans to the shrine area than the Badakalua sites. The site is full of termite mounds and the golden geckos can get termites as easy foods in the bottom of the nesting rocks. The pilgrims even cook in the base of the huge rocks where the nests are found in top portion of the rock. The golden geckos inhabited here are more scare and photography in night is difficult with limited flashlight of Mobile phones. The area goes under compartment 4 of Ramaguda RF. This is suitable habitat with water facilities and attracts insects with electrified lights for lizards. The approximate population is 7pairs of adults within the surveyed area of 1 ha area i.e, 100 metre length wise square plot.
4. **Ghodahada Dam site:** This is an important site close to the rest house and inspection bungalow of the water resources department in Ghodahada dam reservoir site. The GPS location of the site is N 19◦ 08′ 14.19′′ E 084◦ 23′ 56.22′′ and elevation is 123meter. This is a undisturbed site as most of the approachable trails are covered with high flood line water of the reservoir and undisturbed as prohibited area near the sluices. The site is more moist and cool place during summer than other sites in the study area, the rain fall is around 1400 mm and the ambient air temperature is 15- 35°C and relative humidity is always above 65 percentage. The same rocks are also used for nesting sites of swallow birds and wasps. The base of the rocks also used as occasional shelters for bear. The eggs counted are 168 and 12 individuals are sighted but the area have nearly 30 pairs that means more than 60 individuals.
5. **Mahulamelana Road near Balliganda (inside Lakhari WLS):** Nature of Terrain: It comprises of hilly terrain with undulating topography Elevation: The hill had elevation of 750 meters above mean sea level. Climate: It is moderate and pleasant. Temperature: 15-41°C Rainfall range: The annual rain fall is 1450 mm. Type of Vegetation: The hill comprises of grasses, charanockites and khondalites. The GPS location of the site is N 19◦ 21′ 16.7′′ E 084◦ 19′ 42.73′′ and elevation is 686meter. The forest comprises of tropical moist deciduous and tropical dry deciduous type and the vegetation can be classified broadly into four types -Sal, mixed deciduous, Bamboo and scrub forests. Population size 7pairs. The caves in the rock boulders is used as den for leopards. The urine spray of the leopard is seen in the rocks and the smell is achieved from a distance during carnivore sign survey inside the sanctuary. More numbers of Scats are encountered around the leopard den. After assurance of leopard absence in the spot I along with the staff surveyed the spot closely. There is also pitted alarm calls after we leave the spot with forest staff and the golden gecko convey the distant inmates in the vicinity about our interferences within their safety peripheries. The sites like Sitajharan and Naringi are the other best sites for golden gecko and these area is not properly surveyed.
6. **Chandiput transect site:** This site comprises of gentle slopes with undulated sal forest patches. The tiger census transects at site near 1600 metre marking survey plot area there is an elevated landscape after crossing the nullah the rock boulders examined during vegetation survey of 2018 April month. The GPS location of the site is N 19◦ 22′ 15.82′′ E 084◦ 16′ 32.22′′ and elevation is 570 meter. The population is thin but 6 pair of fresh eggs located in this site, the old nests are also detected in the same round shaped huge rock. The field assistances are very cute and accustomed with the nests over the rock that they can indicate from a considerable distance with naked eye observations. No lizards are sighted or alarming calls are noticed but fresh eggs clarifies the presence. There are chances of findings a greater number of nesting sites of the Golden gecko in the Sanctuary and all the peripheral area of the forest but within stipulated time and human resources the area within Lakhari valley sanctuary is not properly surveyed.
7. **Mahendragiri sites:** Mahendragiri Hills Nature of Terrain: It comprises of hilly terrain with undulating topography Elevation: The hill had elevation of 1500 meters above mean sea level. Climate: It is moderate and pleasant. Temperature: 16-45 degree Centigrade. Rainfall range: The annual rain fall is 1551.6 mm. Type of Vegetation: The hill comprises of grasses, charanockites and khondalites. The forest comprises of tropical moist deciduous and tropical dry deciduous type and the vegetation can be classified broadly into four types-Sal, mixed deciduous, grasslands and scrub forests. This is the highest occupied land scape in Odisha for Golden Gecko and other faunal distribution and altitudinal variation in population is well observed in this hill. The GPS location

of the site is N 18◦ 58′ 01.13′′ E 084◦ 21′ 55.96′′ and elevation is 1475 meter near the Vima temple. The highest point is 1506 meter in the rocky places 100meter south of the Vima temple. A maximum of 5 pairs of lizards are encountered during the survey at Sivaratri festive times. The Mahendragiri hill is not properly surveyed for Golden gecko and other lizard studies.

Table 1: Showing the number of individuals, nests and locality where Indian Golden Gecko sighted during survey in Ganjam and Gajapati district of south Odisha,

Sl No and name	Locality and Status of area	No. of Male	No. of Female	Period of visits	No. of eggs	Status of eggs
1. Ambagada (hill top rock clefts and bear caves)	N 19◦ 20′ 29.63′′ E 084◦ 42′ 43.86′′-34meter - Revenue hill	4	4	April 2018	16	Old and hatched
2. Badakalua (Mahuri Kalua) Hill	N 19◦ 08′ 14.19′′ E 084◦ 23′ 56.22′′- 154m. Ramaguda RF	14	12	July 2018	84 in 4 patches	Old and hatched
3. Sanakalua Hill (Near Mahurigarahn Shrine)	GPS location N 19◦ 15′ 35.2′′ E 084◦ 42′ 47.17′′ elevation- 84m, Ramaguda RF	7	7	March 2016	26 in two patches	Unhatched eggs
4. Ghodahada Dam site Near Irrigation IB	GPS location N 19◦ 08′ 14.19′′ E 084◦ 23′ 56.22′′ - 123meter protected as Reserve Forest	4	8	January 2017	28 eggs fresh	9eggs are unhatched
5. Mahulamelana Road Near Balliganda FRH	GPS Location N 19◦ 21′ 16.7′′ E 084◦ 19′ 42.73′′ and elevation-686meter. (Core area of Sanctary)	7	7	April 2014	68	12 un hatched, 8 rotten, 24 freshly hatched
6. Chandiput transect site. Near buffer are LWS (Near 1600 meter plot)	The GPS location of the site is N 19◦ 22′ 15.82′′ E 084◦ 16′ 32.22′′ and elevation is 570 meter. Buffer area of sanctuary	Not sighted	Not sighted	April 2014	Un hatched eggs found	6 pair fresh eggs and 14 hatched egg shells found
7. Mahendragiri hill top (Near vima temple)	The GPS location of the site is N 18◦ 58′ 01.13′′ E 084◦ 21′ 55.96′′ and elevation is 1475 meter near the Vima temple	5	5	Feb-2016	Hatched egg shells	Post hatched eggs shells are attached

Abbreviation: LWS–Lakari Wildlife Sanctuary, GPS- Geographical Positioning Systems. Mm- Rainfall in millimetre, MSL – elevation in meters above mean sea level. RF- Reserve forests, FRH- Forest rest house, IB Inspection Bunglow.

Threat in study area patches

Majority of the suitable habitats in Ganjam and Gajpati districts of South Odisha are outside of the Sanctuary area with high anthropogenic pressures. Disturbances like light and sound pollution from tourism, picnic in temple sites, forest fire in podu cultivation areas and sounds from commercial decorative stone query and factory areas are common. The identified patches within the sanctuary is well protected and exempted from all sorts of human disturbances for this endangered lizard species. The major threat to the populations of Calodactylodes aureus in Odisha is Decorative Stone query, mining, podu and timber logging. In Orissa, mining is a major threat to populations at Niyamgiri and several places in Rayagada District. Logging of riverine forests observed in Phulbani. Shifting agriculture in Orissa and northern and eastern Andhra Pradesh is rampant (P. Mohapatra and Siba prashad Parida pers. comm. December 2014). Tthis species is threatened due to clearing of the egg clusters by the tourists and locals due to lack of awareness and maximum eggs likely to be attached unhatched and rotten due to changed climatic conditions, Per. Obs Feb 2012).

Conclusion

The recent surveys in Berhampur and Paralakhemundi forest division around the Mahendragiri region indicate the good population of this endangered golden lizards and in no means this habitat patches should be well protected from anthropogenic hazards like forest fire in around the rocky areas, picnic, pollution of the ground with polyethene, throwing the spate eatables in major tourist spots with within Golden gecko habitat. even creating high pitch sounds by stereos. The light pollution by making potable light till late evening which really hampers the diurnal and nocturnal biological activities including feeding and nesting habits. Excepted habitats and the huge rocks were scanned with naked eye for old nests presences and distance whitish patches by binocular. The lizards are active during night time and live individuals are photographed and numbered for population density estimations. The adult male is golden in colour whereas the females are darker in colourations. Both the individuals stay in one stony cervices. The lizard may have tittle parental care to their nests bur they stay and watch the nesting area and make sounds to alarm other individuals. And 15 spots are located with live fresh nests. The lizards are inhabited in the same location where other rock geckos, Rock lizards co- existed in some locations. in two locations the barn swallow nests are spotted along with the mass nesting site in same rocks. The golden gecko prefers to nest in horizontally parallel rocky surfaces above ground than the vertical open surfaces where rain water can wet the nesting surfaces.

Global climate change is responsible for changes in microhabitat conditions for many species leading to their local extermination, range shift, or even extinctions. About 90 percent of amphibian extinctions reported from all over the world in the last decade is attributed to climate change. Calodactylodes aureus and several similar species are found either in Andhra Pradesh and Odisha part of Eastern Ghats ranges of India. Their presence and discovery in south Orissa indicate that similar climatic and habitat features that are also found in some areas of Peninsular India. Hence, we consider these as indicator species of both climatic and physiographic factors of the habitat in Odisha. It is suspected that additional survey in Odisha will yield more such species, which will add new dimension to the existing knowledge on the herpetofauna

of India (Javed Maqsood S. M., Mithun Raj & Sunil Kumar 2017) [11].

Governments throughout the world, especially in tropical biodiversity-rich regions are gearing up to tackle the effects of climate change on nature by cutting down on human carbon footprint and taking steps to reduce deforestation and pollution. A decade-long study in Australia shows that reptiles are also affected negatively by global climate change. The recent study of the Intergovernmental Panel for Climate Change has indicated that the global average temperature would increase by up to 2 degrees Celsius throughout the world in the next 70 – 80 years – a number that seems small but can cause havoc on the environment. (Golden gecko will vanish due to climate change- THE HANS INDIA | Jul 22, 2016, 10:08 AM IST). More detailed study will be effective to explore more about the ecology, biogeography of C. aureus in Odisha. For long term study, there are need for research in new habitats patches in adjoining areas to Andhra Pradesh.

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