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Observation on Microhabitat Use, Activity Patterns and Feeding Habits in *Eutropis Carinata* (Squamata: Scincidae) in Similipal National Park, India: Conservation Implication

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ABSTRACT

The study was conducted to examine and analyze the microhabitat use, activity patterns and feeding habits of *Eutropis carinata* over two consecutive years in Similipal National Park, Mayurbhanj, Odisha, India. Reptilian species present in different geographical areas. Among reptiles lizards perched above the ground, mainly on herbaceous vegetation, soil areas, cracks and crevices and small shrubs/bushes. During morning and late afternoon, the lizards like herbaceous vegetation and during early afternoon used a variety of microhabitats including shrubs/bushes, cracks and crevices, and root of the trees. Lizards were sighted in large numbers during morning and late afternoon and less in early afternoon. Daily activity patterns of *E. carinata* involved in basking in the morning hours followed by foraging, moving and other activities. 130 specimens of *E. carinata* were examined (juvenile=32, immature adult=50, adult lizard=48). Of this total, 124 specimens had prey/food in their stomach and 6 with empty stomach. The most frequent prey consumed were Formacidae (33.99%), Lepidopteran larva (20.71%), Pentatomidae (16.04%), Termittidae (15.7%); Gastropoda (0.34%) and Syrphidae (0.26%) were less consumed. There were no significant differences observed between the numbers of prey consumed by either males or females. But seasonal variation is observed in the diet of *E. carinata.*

Keywords: Scincidae, Activity pattern, microhabitat use, feeding habit, diet, *Eutropis carinata.*

Introduction

Many reptilian species in India are sparsely distributed across a variety of habitat types but because of inadequate research some are endangered though in reality they are still abundant in parts of their distribution (Shanbhag et al., 2003). To assess changes in species abundance it is necessary to monitor populations in their natural habitat by surveying a large number of sites. Knowledge of their activity patterns and breeding season can potentially help in assessing changes in species abundance (Zuiderwijk and Smith, 1993; Zuiderwijk et al., 1998). Animal activity in arid environments can be spatial and temporally variable (Rosenzweig 1968).Mobile vertebrates such as birds and some mammals can move long distances to escape drought struck areas (Schodde 1982; Davies 1984;Dickman et al. 1995), while sedentary species may reduce activity during dry periods and seek shelter in moist refugia or deep underground (Heatwole 1984; Cloudsley-Thompson 1991).

Lizards are considered to be particularly well adapted to arid environments because of their low energy and water requirements (Pough 1980; Bradshaw 1986, 1997), ability to aestivate during periods unfavourable for activity, dietary opportunism and in some species, ability to store fat (Case 1976; Whitford and Creusere 1977; Planka 1986; James 1991a, 1991b). In the case of reptiles, habitat and microhabitat use can provide knowledge of a species's physiological process (Huey, 1991), population dynamics (Holt, 1987; Pulliam and Danielson, 1991) and community interactions (Morris, 1988; Rosenzweig, 1991). Studies on habitat selection and activity pattern are predominantly of temperate-zone lizards (Heatwole and Taylor, 1987; Zug et al., 2001). Huey (1982) and Pianka (1986) demonstrated that many reptiles thermoregulate behaviorally by selecting appropriate habitats, microhabitats and activity times. Lizards that live in xeric patches of the tropics subject to large diurnal variation in ambient temperature are of great interest. Reptile activity patterns vary among species and with environmental conditions (Grant and Dunham, 1988; Ellinger et al., 2001; Klukowski et al., 2004). Lizard communities may achieve resource partitioning among species, through spatial or temporal separation in activity patterns, microhabitat use, food availability and thermal ecology (Davis and Verbeek, 1972; Schoener, 1977; Heatwole and Taylor, 1987; Leal and Fleishman, 2002). In reptiles, daily activity patterns range from nocturnal to diurnal with various intermediate conditions, and in some cases activity rhythms are not encountered (Bauwens et al., 1999; Winne and Keck, 2004). Activity patterns may be unimodal or bimodal. These patterns may differ between populations of the same species living in different climatic conditions and geographic locations (Heatwole and Taylor, 1987). Rajkumar et al. (2005) reported that the daily activity pattern of *Psammophilus dorsalis* (Agamidae) of both sexes typically involves basking in the morning hours followed by other activities such as foraging, moving, and searching for mates and oviposition sites during the breeding season.

Few dietary specialist groups appear to exist among lizards (Meyers and Herrel, 2005). Several investigations of lizard's foraging behavior have supported the basic pattern (Herrel et al., 1995) but also identify significant variation in feeding movement patterns even in some families (Schwenk and Throckmorton, 1989; Kra-klau, 1991; Urbani and Bels, 1999; Delheusy and Bels, 1992; McBrayer and Reilly, 2002). Foraging mode in lizards has been linked with ecological and life history characteristic including prey types and predators (Huey and Pianka, 1981), energy utilization and diet (Bennett and Gorman, 1979; Anderson and Krasnov, 1981), re-production (Colli et al., 1997; Vitt, 1990), relative clutch mass (Vitt and Price, 1982; Vitt and Congdon, 1978), habitat preference and locomotor's capacity (Moermond, 1979; Huey et al., 1984), predator escape modes (Vitt, 1983), and chemosensory behavior (Coo-per, 1995; 1997). There are two types of foraging modes in insectivorous lizards such as ambush foraging in which the lizards waits immobile to detect prey, and active foraging in which the lizard wandering movements through its habitat while searching for prey (Cooper and Whiting, 2000). The foraging behavior varies with the availability of resources such as prey density and distribution (Huey and Pianka, 1981; Greeff and Whiting, 2000). Several publications indicate that the day length and environmental temperature acts upon the activity of ectotherms, especially in the active foragers (Pietruszka, 1986; Belliure et al., 1996). In addition, foraging activities may vary between sexes in the reproductive season, when males are more active than females (Butler, 2005).

At our study site, *Eutropis carinata* uses habitat which differs in many ways from forest, with a dense canopy dominated by *Teak* trees and many garden plants with great variability in humidity and high mid-day ambient temperature. Presenting this study, data on the microhabitat use activity pattern and feeding habit of a tropical population of *Eutropis carinata* during two contrasting climatic year on the Similipal National Forest, Orissa, India are presented.

MATERIAL AND METHODS

Study area

Fieldwork was conducted in the Similipal National Park (20 17' to 22 ^{0}34'N latitude and 85^{0}40' to 87^{0} 10'E longitude) in the District of Mayurbhanj, Orissa, India (Rout S.D. 2008). This Forest is a 2,750 sq km (1,060 sq mi) area and declared by the Government of Odisha as a national park in 1980. It lies in the Eastern Highlands moist deciduous forests ecoregion, with tropical moist broadleaf forest and tropical moist deciduous forests with dry deciduous hill forest and high level Sal forests. The park vegetation composed of 1076 species of plants belonging to 102 families. 96 species of orchids have also been identified here. The forests also have medicinal and aromatic plants with planted Eucalyptus (Jena M.S., 2005). The floras include 3 species of endemic orchids, 8 plants which have endangered status, 8 plant species with vulnerable status, and 34 rare species. Endemism is high among tree ferns, orchids and medicinal plants (Anon, 2003). The vegetation composition is primarily Sal (*Shorea robusta*), Tamarind (*Tamarindus indica*), Karanja (*Pongamia glabra*), Polanga (*Calophyllum inophyllum*), Neem (*Azadirachta indica*), *Eucalyptus* sp., and *Acacia* sp. Under shrubs include *Pandanus* sp., Adhatoda (*Adhatoda vasica*) etc. The medicinal plants include *Asparagus racemosus, Boerhavia diffusa, Dioscorea* sps., *Helicteries isora, Litsea monopetala, Rauvolfia serpentine, Smilax macrophylla*, etc. (Pandey and etl., 2002). Lizard species *Eutropis carinata* living sympatrically with *in* the Sanctuary are: *Lygosoma punctata*, *Eutropis bibroni*, *E. macularia*, and *Calotes versicolor*. The summers (April-July) are very hot with temperature around 45^{0} C (113^{0} F) where as the temperature during winter (November-February) can be as low as 5^{0} C (41^{0} F). The rainfall ranges from moderate to heavy.

Field observation

In the sanctuary surveys were conducted in various habitat patches from 07:00 to 16:00 from October 2013 to September 2015. We look for all habitat types in the sanctuary to find out potential areas for lizards only where they were likely to be very common in their natural habitat. Focal observations were photographed from a distance of 3 – 5 m. Lizards were caught by hand, placed in a plastic jar, sexed and snout-vent length (SVL) and tail length (TL) measured with digital calipers. Time of capture and microhabitat use was recorded when first sighted/ captured. Lizard sex and age were classified using previously determined characteristics (Pal et al., 2007; 2008). All individuals were returned to their original place of capture within 2 h. All locations were visited only once to avoid sampling the same individual twice.

Foraging Mode

Focal observation was conducted on foraging mode about 8-10 ha. area per day (7:00-16:00) during the first week in each month over the study period. We passed through the habitat slowly to look deeper the area for activity. Upon detecting a lizard, the observer stopped moving to minimize any disturbance to the lizard. Whenever possible, observations were made from a minimum distance of 5 – 10 m away from the lizard. We observed each lizard continuously 5 – 10 min if possible more (mean time ± S.E.) but sometimes less because lizards were lost from sight in vegetation, holes or crevices. Care was taken to avoid observations of the same individual more than one time. For each focal observation we recorded lizard sex, date, observation time and behavior. Foraging behaviors recorded were % of time spent moving, feeding attempts (successful and unsuccessful) and foraging distance.

Food and feeding habitat

Lizards were collected by hand from October 2013 through September 2015. We euthanized specimens removing their stomachs and preserved the animal and its stomach in 10% formalin. This was done immediately upon capture in the field to prevent further breakdown of the stomach contents. We categorized stomach contents by lizard size classes: juveniles (SVL = 20 mm-35 mm), immature adults (SVL =36 mm-45 mm) and mature adult (SVL ≥ 46 mm).

Heideman's (2002) protocol was followed for stomach contents analysis of lizards. We identified the stomach contents of each specimen with the aid of a dissecting microscope in the laboratory. Plant material was dried in an oven prior to microscopic examination. Each type of prey was identified up to its order after examining under a stereoscopic microscope. The maximum length and width of any intact prey consumed by the lizards were measured using a millimeter scale eyepiece on the stereoscopic microscope. The square root of the product resulting from multiplying the maximum prey length with its maximum width was used as an index of the "standard prey length" (Magnusson et al., 1987). The volume of each prey was estimated using the ellipsoid Equation (1) (Magnusson et al. 2003):

$$V = \frac{3}{4} \times \pi \times L/2 \times 2\ (W/2)^2 \qquad (1)$$

Where V = volume, L = length and W = width

We also calculated occurrence (the percentage of stomachs containing a given category of prey) and the numerical and the volumetric percentage of each prey category. To determine the contribution of each prey category in the diet of these lizards, we calculated the important index (I) (Powell et al., 1990) using the equation (2):

$$I = (N\% + V\% + F\%) / 3 \qquad (2)$$

Where N = number, V = volume and F= frequency of occurrence

RESULT

Microhabitat study. The habitat in the study area was characterized by soil, borrows, root of the trees, garden plants, small shrubs bushes, leaf litters and wide cracks towards the road side that serves as abode for the lizards. In the morning (7:00 – 12:00), they emerged when direct sunrays fell upon the respective sites. A total of 252 ha (9 ha/day) of observation was made and 523 (mean 43.58± 18.18) number of *E. carinata* was recorded and we found positive correlation there closer to 1 indicating that the change in two variables is in the same direction. In the morning (7:00 – 12:00) 306 number of Lizards, in the early afternoon (12:00-14:00) 80 number of lizards and in late afternoon 137 number of lizards are observed. Lizards were preferably perched in trees & tree roots , green herbaceous vegetation , shrubs bushes , open soil areas , borrows or cracks and crevices , and others around the forest over two consecutive years (Table 2-a,b). The frequency of microhabitat used by *E. carinata* in each microhabitat type is shown in Fig. 1*a*. As shown in Fig. 1*b*, lizards were most frequently observed in green vegetation areas during morning hours (7:00 – 12:00) in comparison to the other time of the day and lizard predominantly used this microhabitat when foraging along with other activities such as basking and moving. During morning the number of lizards observed in trees & tree roots , green vegetation , shrubs & bushes , soil area , burrows, cracks & cervices and others .During the early afternoon, the number of lizards observed in green vegetation declined being found less frequently in shrubs bushes or borrows or cracks and crevices , trees & tree roots and in others probably due to an increase in ambient temperature (>37°C) and lizards retreating to shady areas. In late afternoon when ambient temperature came down (= 37°C), the lizards returned to green vegetations , tree & tree roots , burrows, cracks & cervices , soil areas , shrubs bushes along with other activity sites which reflected lizards once again busy in foraging activity. Interestingly, we did not observe any sex wise and size class differences in daily basis and seasonal variation in microhabitat use by *E. carinata* in this habitat

Abundance and activity pattern. There was no daily variation in the timing of emergence and retreat among the groups of juvenile, male and female except cloudy days in rainy season (data not shown). Lizards returned to their refuge site during evening hours when direct sunlight no longer falls upon the activity sites. We did not find any sex wise variation of daily emergency and retreat of *E. carinata*. The total number of lizards sighted varied greatly with respect to the time of the day in different months of our field observations (Fig. 2). The daily pattern of lizard activity was strongly bimodal. The mean number of lizards sighted during morning hours (07:00 – 12:00) was greater than for the afternoon or late afternoon recordings (Fig. 3) when the air temperature was less than 37°C. The number of sightings declined from 12:00 to 14:00 (Fig. 3) when the air temperature was more than 37°C. In late after-noon hours (14:00 – 16:00), the number of lizards sighted again increase (Fig. 3), but the number of lizards sighted during evening hours was less than that observed in the morning hours (Fig. 3). During the afternoon they moved between trees, shrubs bushes, and other garden plants mostly feeding on insects.

Frequency of basking, foraging and movements were greater from 07:00 to 12:00 compared to other times of the day (Fig. 3). Within the morning phase, the different activities varied. During early morning hours (07:00 – 08:00) when the ambient temperature was be-low 37°C, lizards were most often observed basking and rarely observed foraging activity or moving. During mid-morning (08:00 – 9:00 and 9:00 – 10:00), the lizards were mostly active, exhibited quick responses to human approach and the three recorded activities such as basking , foraging and moving were comparable in magnitude. After 11:00, when ambient temperature was high (>37°C), basking and foraging activity declined but overall movement of lizards increased greatly (Fig. 3). From 14:00 to 16:00, when the ambient temperature was >37°C, lizards retreated to shady areas (shrubs bushes), cracks and crevices, tree roots with very few observed in the open. By midafternoon (14.00 – 15:00 & 15:00- 16:00), when ambient temperatures were lower, more individuals were observed mostly foraging (Fig. 3). Sampling effort was uniform throughout the activity period over two years of our field observations. Most lizards emerged from 7.00 – 8:00 to bask. Foraging started after 8:00 and continued to 10:00 and again they showed after 14:00 and continued up to 16:00 (Fig. 3). The peak foraging time was observed in 8.00 – 10:00 for all three lizard size classes (Fig. 4). We did not observe any sex wise differences and seasonal variation in foraging time for *E. carinata a* and difference existed in three foraging parameters between groups of juveniles, females and males; % time spent moving, foraging attempts and foraging success where as juveniles foraged nearest to the retreats. We got negative correlation value when examine activity with time, closer to -1 in case of Basking indicating that the variables change in opposite direction, that is, as time passes number of basking decreases. Again found correlation value closer to zero in foraging and moving indicating no correlation.

The number of both sexes of lizards sighted in different times of the day varied between breeding (April – September) and post breeding (October – March) months throughout our observations in two years, the number of females were more than males in the morning hours of breeding sea-sons. The pattern was similar during morning hours of post-breeding seasons where the number of females and males were 33 (mean 2.75 ± 1.28) and 25 (mean 2.08 ± 0.90) respectively. During early afternoon the number of females were more than that of males in breeding seasons whereas, in post-breeding seasons the number of males were less than that of females . In the late afternoon hours, the number of females were more than males in both breeding and post-breeding seasons. In morning hours, the total numbers of lizards sighted was greater than in the post-breeding season than the breeding season and the pattern was also similar in afternoon hours; whereas in late afternoon hours, the greater numbers of lizards were sighted in the breeding seasons than the post-breeding seasons (Figure 4- a & b).

Out of 130 specimens of *E. carinata*, 124 had any food/prey in their stomachs while 6 had empty stomachs. There was not much difference between the proportion of males or females with empty stomachs. From stomach contents it is found that *E. carinata* mostly feeds upon arthropods. Hymenoptera (Formacidae, apidae, vespidae) represented the most important food item in terms of both total numbers and the number of stomachs examined, followed by Lepidoptera (lepidopteran larvae) and Isoptera (Termittidae). Among Hymenoptera, Formacidae were most frequently encountered, being present in 98% of the lizard stomach and corresponded to 33.99% of the total prey ingested and 60.89% of the total prey volume. The second most frequent diet was Lepidopterans (being present in 94% of the stomachs examinedand corresponding to 20.71% of the total ingested prey. The third most frequent dietary item was composed of termittidae, being present in 83% of the total stomachs examined and corresponding to 15.70% of the total ingested prey and 7.02% of the total volume. The importance index of of diet indicated Formacidans are the most important food item (I= 64.29), followed by Termites (I= 35.24) and Pentatomidans (I= 23.94) (as shown in Table 2). Lizards ate small orthopteran insect in winter and summer whereas gastropods and plant material only during the summer months. We got Oligochaeta in few stomachs in rainy seasons. We found many items that were probably incidentally ingested. These included small stones, sand particles, fragments of mollusk shell, and an unidentifiable amorphous substance. Juveniles (N = 32) consumed smaller prey items in comparison with immature and mature adults. Lepidopteran larvae, ants, and small crickets dominated their stomach contents. We found no gastropods or plant material among juvenile gut content. Immature adults (N = 50) had a diverse diet. No gastropods or plant materials appeared in the gut contents of immature adults. Most of the stomachs contained sand. Adult lizards (N = 48) fed on all types of prey. Hymenoptera, Isoptera, and Coleoptera were the dominant prey items with other arthropod orders less prevalent. There was no sexual dichotomy in stomach contents and reproductive state did not appear to alter diet composition. The amount of intact prey encountered was very low (N = 4), so it was not possible to determine any relationship between the average standard prey length and the SVL of the lizards.

We found seasonal variation in dietary composition of *E. carinata* as in *S. ponticeriana* (Pal et al. 2007). Arthropods were prominent components of the diet during monsoon months (July-October). There was no variation in the gut content of male, non-gravid, or gravid females in summer months. Ants (Formicidae), termites (Isoptera), and larvae (Lepidoptera) were major food item in rainy season. In winter caterpillar larvae, ants, crickets and beetles represented the major dietary components. In summer, lizards fed on termites, ants and occasionally crickets, gastropods, and plants.

DISCUSSION

Eutropis carinata is invariably found throughout the state. The results of this study indicate that the skink is actively selecting microhabitats with increased leaf litter depth and diversity, higher ambient and soil humidity, reduced grass coverage and large numbers of refugia. However, there was no clear ontogenic or sexual separation in microhabitat use. The basis of this microhabitat selection remains unclear since a number of possible causes could explain these results including thermoregulation, dietary requirements and predator avoidance by the species. Thermoregulation is an important dictator of microhabitat use for lizards with eight out of nine Agamid species actively selecting microhabitats providing structural cmponents which aided thermoregulation (Melville and Schulte, 2001). The skink's small size and crepuscular activity suggests that passive thermoregulation may play a more important role in maintaining body temperature. Dietary requirements may be a determining factor in microhabitat use. The orange-tail skinks feed on arthropods (Greer, 2001) and Orthoptera spp. (Ross et al. 2008). But future work is necessary to confirm this. Predator avoidance is likely to be an important aspect of microhabitat choice despite the fact that no observations were made of predation events during the period of this study. However, according to Toby Ross (2008) skinks are consumed by green-backed heron (*Butorides striatus*) and the exotic Indian mynah (*Acridotheres tristis*). Smith and Ballinger (2001) demonstrated that at the individual level, the thermal proper-ties of an environment have a major influence on performance and in many cases, may be the most important factor in determining the consequences of using a particular habitat. Our results show that, there is no variation of habitat use all the year for all groups of lizards. In summer the cover of leaf litter in shrubs bushes or at the root plants has been considered more important because it is a refuge against predators and all other seasons these places a high density of invertebrate prey (Pal et al., 2007). Kästle (1998) reported ecological data on *S. sivalensis* of Nepal. It seems that the species from Nepal occupies similar habitat as that of *Eutropis carinata*.

The results of the present study reveal some interesting patterns of activity pattern of the lizard within a well-defined habitat of this national forest. Different methods are employed for the estimation of population size in reptiles (Dunham et al., 1988; Sutherland, 1996). Out of these the visual spotting is a good method for demographic studies on *E. carinata*. Data based on 24 months surveys done on every month from October 2013 to September 2015 in the same sanctuary gave consistent results, thereby suggesting the accuracy and reliability of the transect sampling method. Likewise, data were remarkably consistent with respect to the time of the day. The number of lizards recorded in the morning hours (7:00 – 12:00) was always the highest when air temperature below 37°C. Apparently to arrive at a realistic population size of the E. *carinata*, the hour's survey found suitable was before noon. During early afternoon (12:00 – 14:00), due to a rise in the ambient temperature (>37°C), the lizards sought shelter under crevices and shrubs bushes and were difficult to locate. Although late afternoon (14:00 – 16:00) temperature was comparable to that in the morning hours, the lower number of lizards sighted in the late afternoon suggests the possible influence of other unknown factors or diurnal activity pattern, if any. The daily activity pattern of the lizard in their natural environment has been shown to the bimodal activity pattern, a major peak in the morning phase (08:00 – 12:00) and a minor peak in the late afternoon (14:00 – 16:00) was evident in both sexes over two years of our observations. Our findings coincides with the findings of Shanbhag et al. (2003) in the fan-throated lizard observed in cotton field for less period of time and the findings of Rajkumar et al. (2005) in the Indian rock lizard, *Psammophilus dorsalis*. Our results over two consecutive years suggest that ambient temperature is the key factor controlling diurnal bimodal activity pattern in fan-throated lizards. Apart from that, several publications indicate that activity patterns in rep-tiles are influenced by both exogenous and endogenous factors (Rajkumar et al., 2005) and the exogenous factors such as food availability, humidity, ambient and soil temperatures (Heatwole and Taylor, 1987; Lillywhite, 1987). The endogenous factors include circadian clock and sex steroid profiles (Underwood, 1992; DeNardo and Sinervo, 1994; Klukowski et al., 2004). Moreover, Winne and Keck (2004) suggested that diurnal activity pattern is primarily controlled by circadian rhythm in *Aspidoscelis inornata* and *A. gularis.* However, the factors responsible for activity pattern of *E. carinata* are not known at present and additional studies are needed to elucidate in this direction. Foraging timing among the groups of juvenile, female and male were not significantly different and emerged to the environment long after sun rise. The amount of time spent for all groups of lizards moving in natural habitat during foraging was high and they spent most of the time for searching of prey. Whenever the lizard find an insect landed on or near to the garden plants, the lizard that had been stationary either crawled slowly towards the prey or run quickly to stick the prey. On some occasions, lizards took plant material and some other invertebrate prey items (Pal et al., 2007). These foraging observations in natural habitat support the assertion that *E. carinata* is not a sit and wait forager rather an active forager. In addition, the foraging attempts and foraging success among the group of juvenile, female and male individuals were not significantly different. We observed some males had a higher capture rate than females and juveniles but the mean % of foraging success were not significant in male then other groups. Foraging distance among the sex was not significantly different whereas juveniles foraged nearest their retreats. Several publications shows foraging period is regulated by humidity and most of the reptiles will adjust daily and seasonal activity to minimize water loss and they will seek humid or enclosed retreats such as crevices or borrows (Zug, 2001). Luiselli (2001, 2002) demonstrated that tropical reptiles shows peak activity in rainy season or when the humidity is high. In the present study, particularly in this forest, we observed the activity of *E. carinata* throughout the year. On the other hand, both sexes of the lizards did not exhibit a marked seasonal variation in activity patterns over two years of our observations. During breeding and post-breeding season, females were more frequently sighted from morning to after-noon hours whereas, in late afternoon hours, the numbers of female were more in breeding seasons than post-breeding seasons and such sex-specific activity pattern, especially during the breeding seasons, may be attributed to reproductive events

The Keeled Indian Mabuya, *Eutropis carinata* is primarily insectivorous, though it feeds upon plant material as a seasonal dietary component. Our observations coincide with previous findings on the feeding ecology of *Sitana ponticeriana* (Pal et al. 2007). We speculate that juvenile diets lack plants because juveniles appear at the onset of the rainy season, when insects are widely available. So *E. carinata* mainly feeds upon insects, insect larvae and sometime oligochaeta in rainy season. These observations agree with Milstead (1965), who observed that insect and insect larvae abundance is directly related to the density of the vegetation cover, as plants help to maintain mesic environmental condition. Angelici et al. (1997) reported oligochaeta (annelids) as a dietary composition of the green lizard, *Lacerta bilineata* in central Italy. The immature adults are available until the end of March in winter. This season reflects the abundance of arthropod in the environment. We hypothesize that lizards utilize gastropods and plants as food due to the scarcity of preferred insect prey as the dry season advances the availability of insect larvae rapidly reduces (Pianka, 1970). Diong et al. (1994) reported the stomach content of *Calotes versicolor* and demonstrated that they consume mainly ants, larvae, adult insects and other small invertebrates. Santana et al. (2010) also reported Termites and insect larvae were consumed in very less amount in *C. ocellifer*, quite different from our study in *E. carinata*. Few individual (N=6) were found with empty stomach. It indicates that these are captured in early morning. So they are not able to take anything. The high proportion of male and female lizard stomachs was found with food. It seems to indicate high availability of diet in this environment.

In conclusion, at the individual level, the ambient temperature of an environment has a major key factor in determining the consequence of using a particular microhabitat and activity pattern of *E. carinata*. Definitely, we need more studies investigating the consequences of other habitat characteristics such as habitat structure, predator risk and food availability of same geographical area on individual's performance. The activity pattern of *E. carinata* is bimodal and appears to be active forager in their natural habitat. A variation in the number of lizards that could be spotted at different times of the day indicates a possible control of activity pattern by endogenous factor in *E. carinata*. It is essential to document dietary components in order to formulate effective conservation and management plans (Bury 2006). In *S. ponticeriana,* seasonal fluctuations in climate may influence food availability and therefore control dietary composition (Pal et al. 2007). In our study we found the same result in *E. carinata*. This result may be important for implementing land management practices that could impact insect communities or plant distribution during critical period, when these lizards are less in number.

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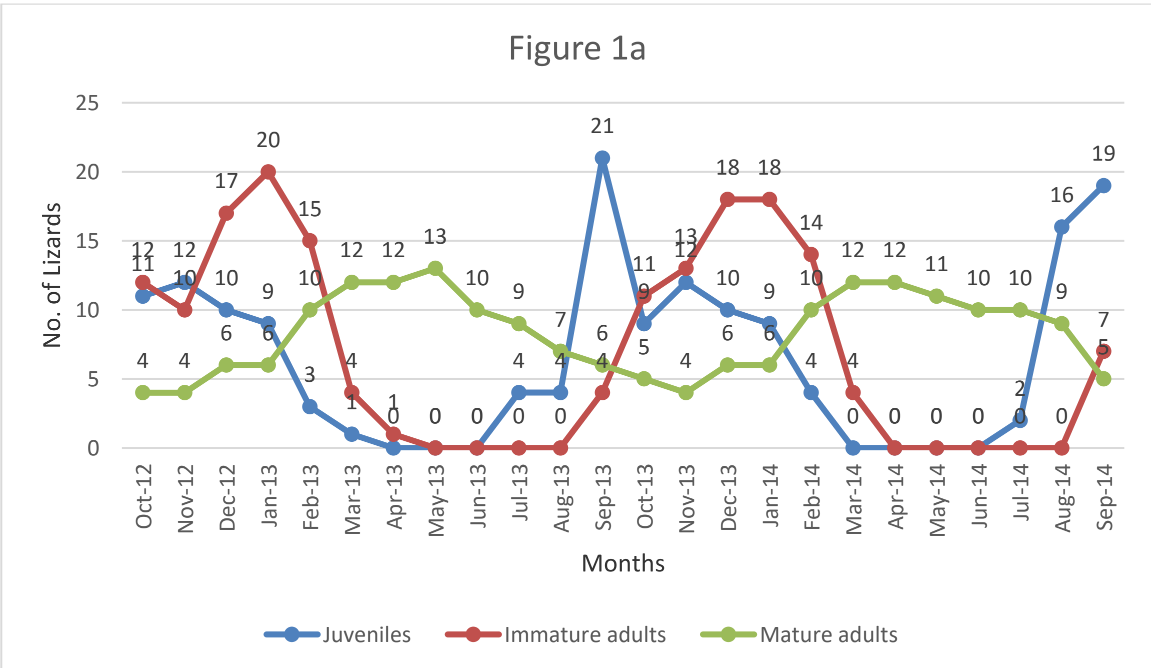
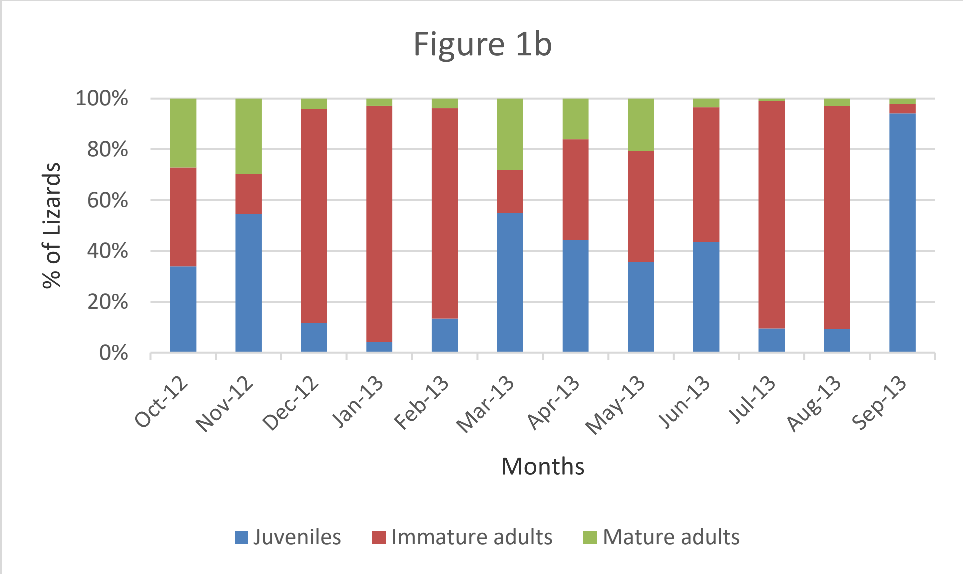
Fig.1(a-c) Number of lizards found in the microhabitat from October 2012- September 2014





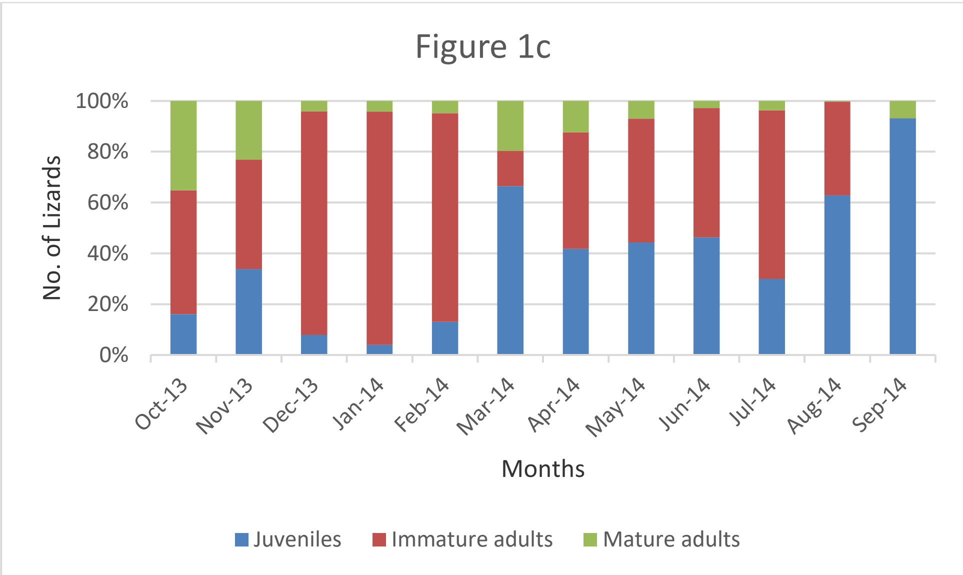
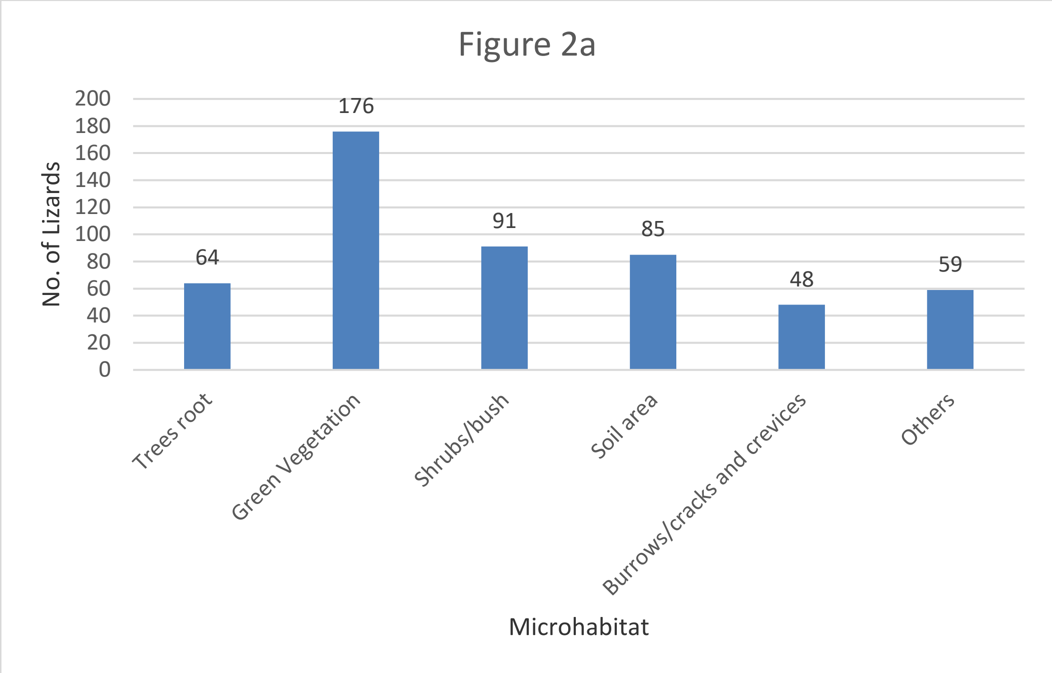


Fig 2a) Showing the number of Lizards found in the altered microhabitat b) lizards in three time bracket in altered microhabitat.



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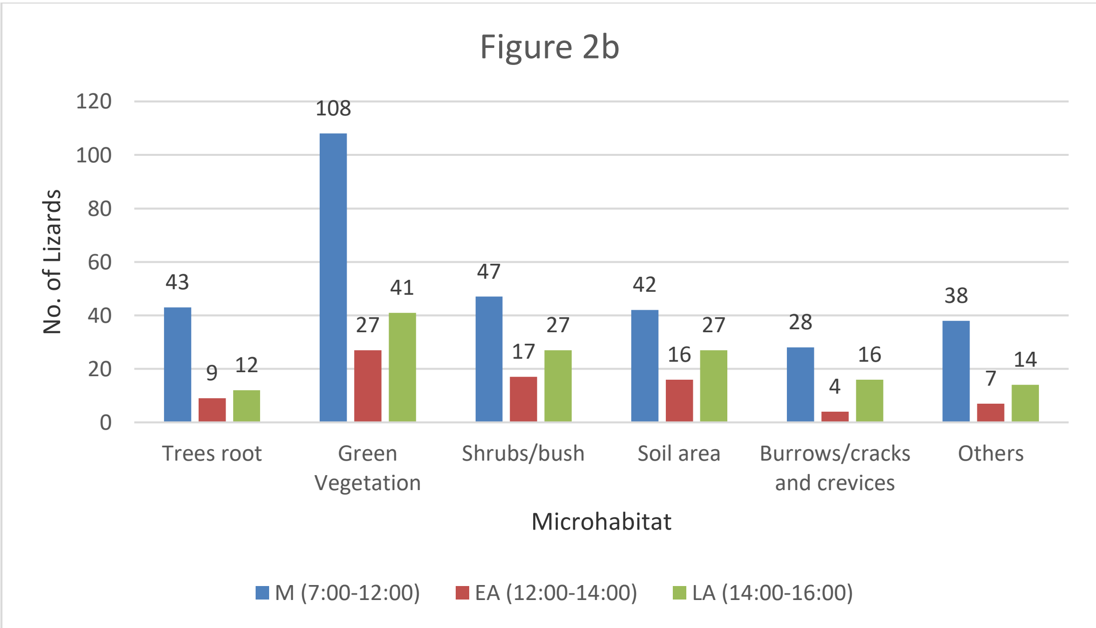

Fig 3 Showing the number of Lizards in different activity pattern from 7:00 am to 16:00 pm

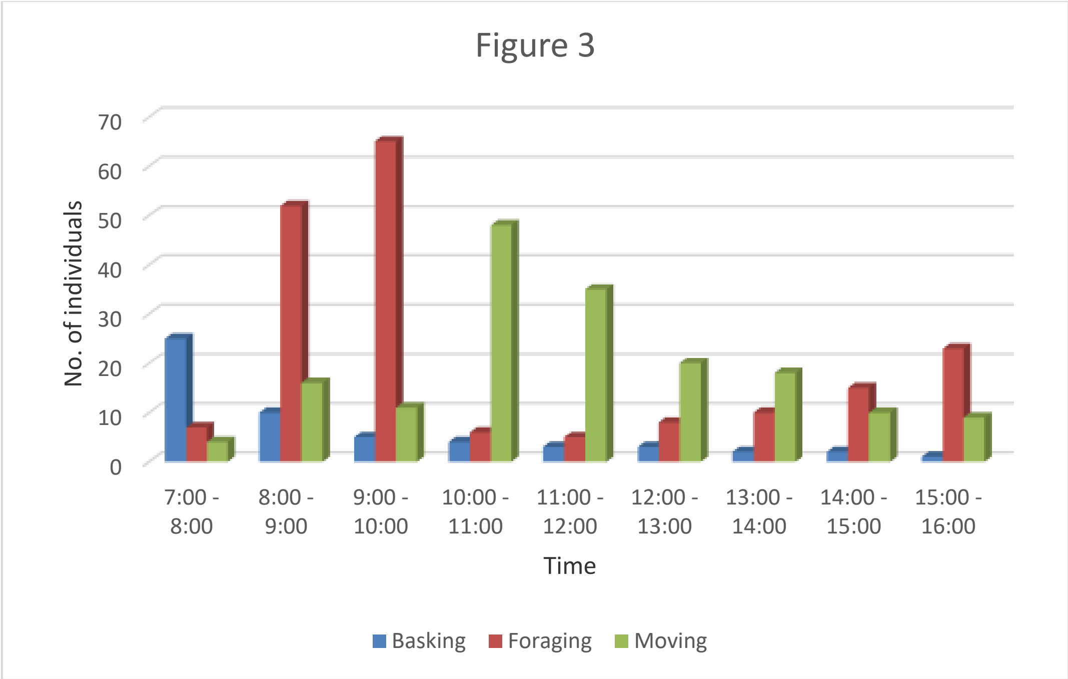

Fig 4 Showing the number of male and female Lizards in different activity pattern from 7:00 am to 16:00 pm