

are generally noticed in the areas that are structurally controlled. Keeping this aspect in mind, this line was finally selected to study the presence of VAMPs, if present. A bright spot is also clearly observed at ~ 3200 ms, which has the same polarity as that of the seafloor and may be marking the base of the free gas zone. On inspection of the stack section, we noticed only a few features resembling the velocity pull-ups (like at 'A' and 'B'; Figure 2 b), but they are not associated with any pull-downs.

Preliminary studies over the WCMI indicate the absence of VAMP anomalies in the multichannel seismic data, which implies that the acoustic impedance across the hydrate bearing and the free-gas zone is not quite significant.

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Demography of fan-throated lizard, *Sitana ponticeriana* (Cuvier) in a cotton field in Dharwad District of Karnataka State, India

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The demographic studies on *Sitana ponticeriana* show that the species is abundant in Gabbur village. The lizards exhibited a diurnal variation in their activity pattern (basking, foraging, seeking refuge, etc.). They were active in the morning hours when air temperature was $\leq 33^{\circ}\text{C}$ and census yielded maximum numbers (45 ± 2.19 in 18,748 sq m or ~ 1.9 ha area). The study provides a pilot index as well as a reliable and accurate methodology for population survey of the lizard. The pilot index is essential for any large scale monitoring project and population trend analysis in future.

THE general distribution of Indian reptiles is well known¹. It is believed that they are sparsely distributed and some species are endangered though in reality they are still abundant in a given area of their distribution. Hence, it is necessary to monitor populations of Indian reptiles in the wild by surveying a large number of sites periodically during specific periods of time, based on their activity pattern and breeding season. This will help in assessing changes in the species abundance. Such data represented as indices, using the first/pilot year as a base year, are essential for assessing the present status and also for long-term monitoring of the population dynamics^{2,3}. The findings of such studies will help in evolving conservation and policy-making strategies.

Sitana ponticeriana is a medium-sized (adult snout vent length, 5–8 cm), ground-dwelling agamid lizard (Figure 1) distributed throughout India, preferably in dry and more or less open country⁴. They are diurnal and insectivorous. The body of these lizards is brown above with a series of dark brown, black-margined, rhomboidal, vertebral spots on the back. The throat fan in males is brilliantly coloured with red, blue and dark shades during the breeding months. These lizards run with a considerable speed and on the approach of danger dash away with tail tip erect, until they find refuge in some bushes or crevices in the ground. When running quickly they often adopt bi-pedal mode of locomotion. These lizards are oviparous, polyautochronic, multi-clutched and breed from May to August in Southern India^{5–7}.

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To the best of our knowledge, no baseline data on the population size in a given area are available for any Indian lizard species including *S. ponticeriana*. During our routine field work, we encountered *S. ponticeriana* at many places in Karnataka (Figure 2) that include the surrounding areas of Bijapur, Gadag, Hospet, Gabbur village (near Hubli, Dharwad district), Chitradurga and Hassan. In Hospet and Chitradurga areas the lizards were spotted in the hilly and rocky areas beset with large boulders while in the other places they were found in open fields. In Gadag and Gabbur area they were found in the cotton fields, sites convenient for survey work. The present study was undertaken to (i) make a status survey of the population of *S. ponticeriana* in the cotton fields at Gabbur, (ii) to develop a standardized protocol for monitoring these



Figure 1. *S. ponticeriana* in the cotton field at Gabbur village. *a*, Male displaying its secondary sexual features; *b*, A gravid female basking in the open.



Figure 2. Map of Karnataka and places where *S. ponticeriana* was spotted.

lizards, and (iii) to provide a base index for future monitoring studies.

The present field survey was confined to a cotton field near Gabbur village 25 km away from Dharwad (15°17'N, 75°3'E). The habitat in the study area is characterized by its black soil with several crevices, burrows and wide cracks that serve as abode for the lizards. Harvested cotton plants, scanty grass and some bushes around the edges of cotton field dominated the vegetation.

The study area was arbitrarily divided into two parts and 28 transects using naturally available topographical marks. The first half of the study area had 14 transects, each measuring 6.09 m in width and 97.54 m in length. The second half of the study area also had 14 transects, each measuring 6.09 m W × 121.92 m L. The combined total area was thus 18,748 sq m (~ 1.9 ha). The transect boundaries were marked using coloured cloth flags numbered serially.

The surveys were conducted on three different days (27 April, 10 May and 20 May 2003). We walked in a given transect from one end to the other and recorded the sex and number of *S. ponticeriana*. Both visual spotting and combing methods were used. The surveying was done thrice in a day, i.e. between 0800 and 1030 h, 1400 and 1530 h and 1630 and 1800 h. Each transect was surveyed back and forth on all occasions. Thus, each transect was surveyed 18 times. To avoid overestimation of the lizard population due to back and forth transect sampling, the population size was derived by multiplying the observed counts (μ_i) with 0.5, the common weight (W_i) factor for each time point⁸.

Variation in the number of male and female lizards sighted, and total number of lizards recorded at different times of the day were analysed separately by χ^2 -test (*G* test and *R* × *C* model).

Back and forth survey of a given transect took ~ 45 min. The maximum number of adult *S. ponticeriana* recorded on three different days was consistent, i.e. 41, 47 and 48 respectively, in 18,748 sq m or 1.9 ha area. There was no significant difference in the number of males and females

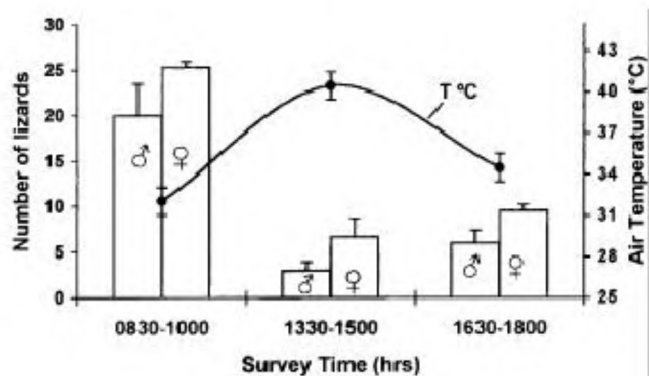


Figure 3. Number of male and female *S. ponticeriana* recorded on three different days (mean ± SD) and plotted in relation to air temperature and time of survey. Survey area = 1.9 ha.

(G test $\chi^2_{df1} = 0.004$, $P > 0.05$, Figure 3). The average number of lizards recorded during the morning sessions was 45 and hence amounted to one lizard/416 sq m area.

On all occasions the total number of lizards sighted varied greatly with respect to the time of the day ($\chi^2_{df2} = 5.99$, $P < 0.05$). Maximum number of lizards was sighted during morning hours when the average air temperature was low ($32.08^\circ\text{C} \pm 1^\circ\text{C}$, Figure 3). As the day progressed, by afternoon a few lizards could be sighted in each transect (Figure 3). In the afternoon the lizards were found either in shady areas or inside the burrows where the air temperature was 34°C – 35.5°C while in the open field it was $40.5^\circ\text{C} \pm 1^\circ\text{C}$ (Figure 3). In the evening hours the total number of lizards sighted was greater compared to that of the afternoon survey. Yet, the number of lizards sighted during evening was less than that recorded in the morning hours (Figure 3).

During morning hours *S. ponticeriana* were very active and generally engaged in basking or feeding. With the rise in air temperature by noon they confined themselves to shady areas or natural burrows and became less active. During evening once again they appeared in the open field but exhibited only a moderate activity. The females were invariably gravid and showed bulged abdomen beset with oviductal eggs. The males exhibited gorgeous fan throats. Thus, the specimens were adults and in breeding condition. No juveniles were encountered.

Despite its wide distribution in India, demographic studies on the fan-throated lizards are lacking. The present demographic work though restricted to a cotton field reveals many interesting aspects of the lizard biology. It shows that survey of any lizard species is best carried out during appropriate weather conditions and time of the day/month based on the knowledge of its seasonal/daily activity patterns. Since reproduction-related events in *S. ponticeriana* occur between April and May when they come out of their shelters in large numbers in search of mates and suitable sites for egg-laying and so on, the present status survey was undertaken in these months. Indeed, the study shows that during the favourable part of the day (morning hours) the lizards engage themselves in various breeding-related activities like mate searching, sexual display, territory guarding, etc.

Different methods are employed for the estimation of population size in reptiles^{9,10}. Of these, we find that visual spotting combined with combing is a good method for demographic studies on *S. ponticeriana*, a fossorial lizard. The census data based on 18 surveys done on three different days, with 10 to 12-day interval in the same field gave consistent results, thereby suggesting the accuracy and reliability of the transect sampling method. Likewise, the census data were remarkably consistent with respect to the time of the day. The number of lizards recorded in the morning hours was always the greatest. Apparently to arrive at a realistic population size of the *S. ponticeriana* the survey should be undertaken before noon hours. Dur-

ing this time, the lizards are found foraging or basking in the open and males displaying their secondary sexual characteristics. Since the maximum number recorded was close to the mean value, the latter serves as a good indicator of population size of *S. ponticeriana* in a given area, as also reported recently for the Netherlands lizards³.

The activity pattern in reptiles may vary with the species or ecological conditions^{11,12}. Reptiles being ectothermic, generally exhibit intense activity pattern when the thermal microclimate is favourable. In addition, prey availability also governs their activity pattern. The present findings clearly show that activities of *S. ponticeriana* mainly depend upon the air temperature. The number of lizards that could be sighted was more with rise in the morning air temperature. Mean number of lizards observed before noon was distinctly higher than that of afternoon/evening sightings. During afternoon due to a rise in the air temperature the lizards sought shelter under crevices and bushes and were difficult to sight. Although evening temperature was comparable to that in the morning, the lower number of lizards sighted in the evening suggests the possible influence of other unknown factors or diurnal activity pattern, if any. A variation in the number of lizards that could be spotted at different times of the day indicates that knowledge of the activity pattern of a given species is crucial for demographic studies. Evidently, the best time to conduct population survey of *S. ponticeriana* is early morning hours when they emerge out of their abodes and are highly active. Based on the pilot study (first year data) no major conclusions can be drawn with regard to the population trend. However, the pilot study provides a base index and allows future population trend analysis over a period of time.

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