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Lunar eclipse to the fore again

Solar and lunar eclipses have a deep fascination for people in general and biologists in particular. After one of these events, as one who had worked with bats, I am invariably asked if I had seen anything bizarre in the behaviour of my animals. Fortunately I was inside a true cave watching a colony of bats in Samanar Hills, 8 km from the Madurai Kamaraj University campus (9°58′N; 78°10′E) when a solar eclipse plunged Africa and parts of Asia into a twilight state of darkness for 4 min 8 s on 16 February 1980. Then onwards I could truthfully say 'Nothing happened to my bats during the solar eclipse. They all still roosted inside the cave upside down'. But something does indeed happen to most bats during a lunar eclipse. Four of my students and one of G. Neuweiler, were making 'bat counts' at two different sites in Madurai 8 km apart on the full moon night of 13 March 1979 when a lunar eclipse occurred from 01.10 to 04.30 h. The bats they counted were *Pipistrellus* sp., *Hipposideros speoris* or *H. bicolor* and *Rhinopoma hardwickei*. The bats were hunting insects (mostly Lepidoptera, Diptera, Coleoptera and Orthoptera) that swarmed to the cone of light of a petromax lamp we set up 2 m above the ground. Neither of the parties had known of the occurrence of the lunar eclipse and the data they obtained were not biased by any expectations or even hypotheses. This experiment was literally carried out for us, as it were, by nature. During maximal eclipse at 02.55 h, about 75% of the moon was covered and invisible. Activity of the bats (bat passes) increased steeply during the eclipse and was significantly higher than activity during full moonlight, which was measured a month later (control). The authors concluded that suppression of bat activity by moonlight is triggered by the overall brightness of light. Activity is then relegated to areas under canopy cover to avoid detection by predators such as owls and night hawks (Usman *et al.*, *Behav. Ecol. Sociobiol.*, 1980, **7**, 79–81). A similar suppression of the activity of the fruit eating bat *Atribeus jamaicensis* by moonlight was attributed to an endogenously governed *lunar phobia* by Morrison (Morrison, D. W., *Anim. Behav.*, 1978, **26**, 852–855). Our laboratory was in favour of discarding the misleading term *lunar phobia* and assigning the reduced overt activity of bats to the direct effect of bright light. Genuine lunar (and semi-lunar) rhythms have been reported only for the breeding cycles in marine invertebrates and the grunion fish.

There are other nocturnal animals such as kangaroo rats, and other rodents that restrict their activities on nights of bright moonlight to hours when the moon is down. N. Singaravelan and G. Marimuthu (**page 1020**) report the effect of the lunar eclipse on the night of 9 January 2001 on the foraging activity of the fruit bat *Cynopterus sphinx* in a vineyard, 95 km west of the Madurai Kamaraj University campus, in the Cumbum Valley. The number of bat visits was counted every hour between 1800 and 0600 h during three consecutive pre-lunar eclipse nights, on the lunar eclipse night and three consecutive post-lunar eclipse nights. The total number of bat visits during the night of the eclipse was significantly higher compared to both the pre- and post-lunar eclipse nights. What I find really interesting is that this bat, which depends entirely on vision for detection of food, forages in such high numbers during an eclipse when the light intensity falls close to starlight intensity (0.004 lux), a hundred-fold dimmer than full moonlight. Further, rather oddly, this fruit bat that avoids the *brightness* of moonlight may be seen foraging on the flowers of avenue trees in the glare of bright electrical lights around Safina Plaza, in Bangalore! They do not alight on the flowers, but feed on the nectar with swift and moth-like wing beats and the same bat may be seen circling and hovering around the same bunch of flowers for over 30 min at a time.

M. K. Chandrashekaran

Strategic planning for conserving the Asian elephant: A GIS-based approach

The Asian elephant is probably the most popular of the wild animals; certainly in India, and arguably in most other countries as well. It is therefore a matter of great concern that it has become an endangered species – less than 45,000 individuals are left in the wild in Asia, and less than 28,000 in India. The situation is further worsened by the fact that these animals are distributed across the country in rather small-sized (and hence more vulnerable) local populations. Though many of the conservation initiatives (such as creation of biosphere reserves) have helped to some extent in at least arresting the decline of local populations, a lot remains to be done. The resources needed to do so will, however, always fall well below what is needed. It is therefore of utmost importance to make the best use of available resources. A major step taken towards this objective has been described by Arun Venkataraman *et al.* (**page 1022**), wherein they have presented the results of their extensive surveys and comprehensive analysis.

Having identified 39 divisions in the four elephant reserves in Southern India as the appropriate administrative units for implementing conservation action programmes, Arun Venkataraman *et al.* have gathered extensive data (using field studies, census records, literature surveys, satellite imageries, etc.) on the various attributes of these localities. They thus have quantitative information on elephant densities, vegetation types, vegetation cover, fragmentation status, biodiversity of other taxa, etc. for these 39 divisions. Naturally, not all the information is readily or reliably available for all the divisions. The authors have made effective and ingenious use of geographical information system (GIS) for estimating the 'missing' values by interpolation and extrapolation. They have next developed a composite 'conservation value', a single number which summarizes this entire information (attributes which are good for elephants as well as bad for elephants). Divisions having a high conservation value can thus be objectively and rationally identified.

The authors have in fact gone further and have identified 'threat values' for the divisions as well, based on the extent of poaching, crop-raiding, etc. seen in the division. They have next performed a cluster analysis and used the results to prioritize the divisions. They thus have a rank order of the 39 divisions that can now be used to develop a strategic plan for elephant conservation.

Those interested in elephant conservation will find the article by Arun Venkataraman and colleagues full of interesting details. More importantly, the procedure developed by them would be a model for developing such strategic plans for other flagship species as well. As an example of making optimal and innovative use of mathematical techniques (e.g. cluster analysis, multicriteria evaluation, eigenanalysis), high technology (e.g. satellite imagery, geographical information system) combined with natural history (e.g. floristic surveys) and participatory approach (e.g. involvement of forest departments, local communities) for conservation, the readers of *Current Science* will find the article enjoyable and instructive.

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