The Sakaerat Tortoise Telemetry Project, Sakaerat Biosphere Reserve, Nakhon Ratchasima, Thailand

Matt Ward

Sakaerat Environmental Research Station, Udom Sup, Wang Nam Khiao, Nakhon Ratchasima, Thailand 30370
Email: ward.behaviour.research@gmail.com

The Sakaerat Tortoise Telemetry Project was initiated in March 2016 as a research project to investigate the home ranges, behaviours and habitat uses of the endangered elongated tortoise (*Indotestudo elongata*). This species is found widely across south-east Asia from India to China and throughout the Malayan peninsula. However, despite its wide geographic range, global and local population numbers are unknown, with a latest census carried out in 2000. At this census the species gained its Endangered status, going up from Vulnerable, because of increased traffic in trade with the species in the pet, medicinal and food markets across Asia. For a species at risk of extinction from direct human causes and indirect habitat loss across much of its range, there was very little information about ecological and habitat requirements. This was the rationale for the start of the Sakaerat Tortoise Telemetry Project, led by principal investigator Matt Ward, who is a behaviourist and conservation researcher from the UK, with the running title 'An investigation into the spatial and behavioural ecology of the endangered elongated tortoise *Indotestudo elongata* in the mixed forests of Sakaerat Biosphere Reserve (SBR)'. SBR is located 300km northeast of Bangkok in the Nakhon Ratchasima province of Thailand, with the project based primarily around the core area of SBR in the Sakaerat Environmental Research Station (SERS).

The project started on March 1st 2016 with the aim of conducting a radio-telemetry programme to determine movements and habitat use by the tortoises. The initial phase of the project involved the location and capture of adult tortoises for attachment of radio transmitters. As animals were caught their habitat type, GPS location and behaviours at point of capture were recorded and they were brought back to the main research base at SERS for processing. This included taking biometric details of sex, age range (adult, juvenile, hatchling), body mass, length & width, recording any parasites found and any noticeable features or scars. Each animal was photographed from all sides to get an image map of its specific carapacial and plastron patterning, to use as an identity marker. All animals across the entire study

period were processed in this manner to build a database of tortoises within the reserve. Surveys were conducted within both of the predominant habitats in the reserve, dry dipterocarp (grassland) and dry evergreen forest, although at that time in the year, the hot dry season, the grasses of the dipterocarp forest had started to burn away. Ten adult tortoises had been found after 31 days, five males and five females. All were processed and fitted with radio transmitters. Radio tracking started two days after release of each animal and they were tracked once per two days either in the morning (06:00-10:00) or late afternoon (15:30-18:30). The radio telemetry enabled each individual to be located, at which point their behaviour, GPS location, habitat, microhabitat features and shelter type were recorded on a digital data-sheet app on an iPad by either the author or his volunteer assistant.

The tracking revealed many interesting and novel behaviours for this species including identifying that individuals were repeatedly using specific shelter types; certain animals had apparent favourite caves and termite mounds which they would return to every few weeks. The team also recorded occasions of multiple animals sheltering together within one cave or under a fallen tree, occasions of mass breeding gatherings within the grasses of the dipterocarp forest and many occasions of animals appearing to 'shelter' or rest/sleep in the open with no cover except a thin layer of leaf-litter over the head. It was observed that breeding took place from March through to November, with no apparent seasonality. However there did seem to be a correlation between the breeding observations and the occurrence of rain on the day or immediately beforehand. Rain also seemed to be a trigger for activity in general with the species, as immediately preceding rain the animals would largely be moving, feeding and active outside of shelters no matter the time of day. The feeding behaviours observed with the species suggest a largely generalist and opportunistic diet. Few occasions were observed in the initial dry season of animals feeding at all, but of those that did occur the animals seemed to feed on dry leaf-litter and grasses. Later in the year with the onset of the rainy season animals were observed eating a variety of other items including young shrubs, new shoots, vine leaves, broad leafy shrubs, fallen flowers and fruits, and fungi. Along with this expected foliage foraging were occasions of feeding on faeces, bones, live invertebrates (worms, woodlice and snails) and carcasses. The carcasses ranged from small deceased birds and mammals to roadkill of other elongated tortoises and on one occasion a large dead Burmese python (*Python vivittanus*). The python had been attacked by local villagers after eating some chickens and was brought to the reserve to be treated but died of its wounds. As no drugs were used on the animal its carcass was released into the forest and remote trail cameras were put alongside to record what would come to eat it over the coming days. In a reserve which also holds dhole (*Cuon alpinus*), Asian jackal (*Canis aureus*), Asiatic black bear (*Ursus thibetanus*), wild

boar (*Sus scrofa*) and monitor lizards (*Varanus* spp) it was a dozen tortoises which were recorded visiting and eating the carcass. These included both adults and young tortoises over a period of two days. At times more than one tortoise was present at the carcass.

The completion of the radio telemetry gave the team an indication of the habitat use, habitat overlap and home range sizes of this medium sized tortoise species. Initial analysis shows that this species has an average home range size of 33.68ha (SD = 21.7ha) for males (Fig. 1) and 22.80ha (SD = 16ha) for females (Fig. 2) with no real differences in movement patterns between the sexes. There was also no difference in habitat use with both sexes using the evergreen forest during the drier months and remaining in the wet grasses of the dipterocarp forest during the wet season. Even with unusual bouts of rain in the dry season the animals would move from the forest into the dipterocarp grass for those days, then back to the forest again. It was also noticed that there were some considerable differences between individuals in their habitat use and shelter types. Whilst it was expected that there would be spatial partitioning between adult tortoises, the individual differences in shelter selection, when the same shelter types were available across the range, were interesting to note. Some animals appeared to be more comfortable around the team and others quicker to flee; it seems as though there are definite separate characters and personalities within a population. Looking at the home range size and shapes it was clear to see that there were considerable individual differences with no apparent reasoning biologically or ecologically for this variation. Tortoises M1 (Fig. 1: white outline MCP) and M6 (Fig. 1: pink MCP) had home ranges of 10.9ha and 49.4ha respectively, with both individuals spending similar proportions of time between dipterocarp and evergreen forests.

Overall the project comprised one year of radio tracking and a little longer in surveys and biometric measurements and a great deal of information has been garnered. This endangered species is in need of study, especially in relation to population levels and reactions to habitat loss and climate change. The current study has added to the little data already available and suggests that there is a complicated multi-habitat requirement for the species. There seems to be a strong link between activity, and potentially breeding, and rainfall. There is further evidence that this species will eat pretty much anything but may also act within the ecosystem as an important seed disperser and potentially a scavenger. Within this particular reserve these animals were recorded breeding throughout March to November, again usually at the sight of rain, but no nests were ever found; so it cannot be confirmed how successful all year breeding is, whether eggs are viable across the year or whether animals are even nesting across the year or sperm holding until a nesting period is possible.

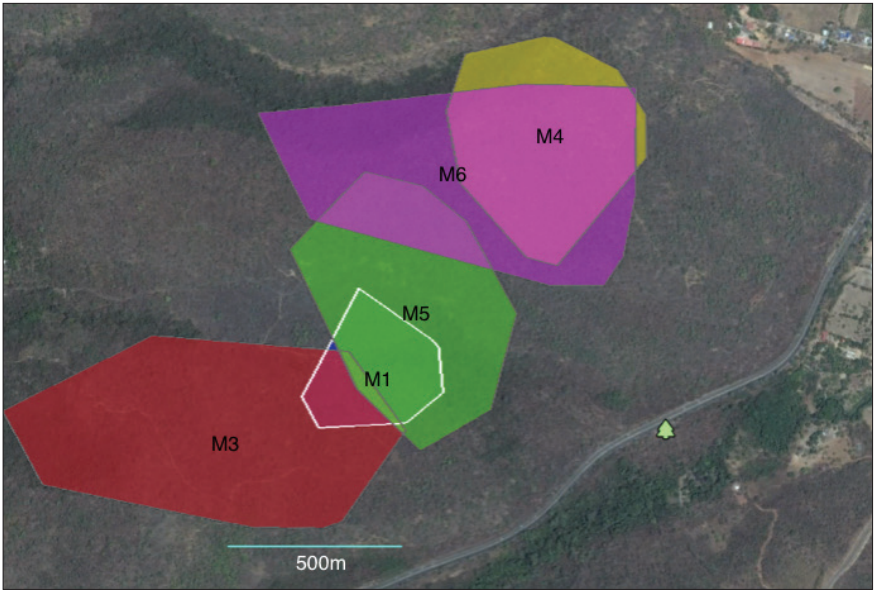

Fig. 1. MCP (minimum convex polygon) of the home ranges for male elongated tortoises.

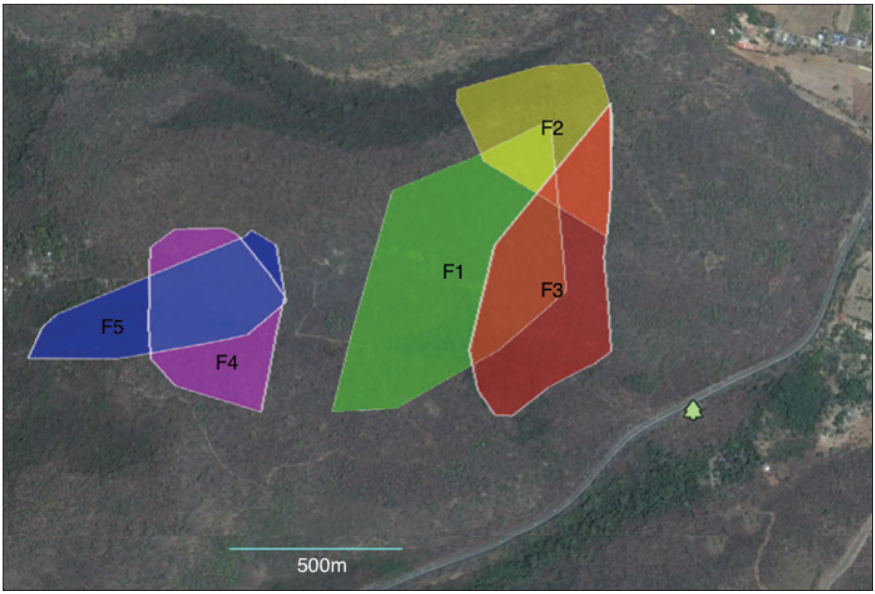

Fig. 2. MCP of the home ranges for female elongated tortoises.

Acknowledgements
The Sakaerat Tortoise Telemetry Project would like to thank its sponsors, Perdix Wildlife Supplies, Gurit Ltd, Craghoppers, National Geographic Conservation Fund and the British Chelonia Group, for supporting the project with supplies and funding. It would also like to thank the National Research Council of Thailand (NRCT), National Parks Department of Thailand (DNP) and Sakaerat Environmental Research Station, Suranaree University of Technology and Queens University Belfast for enabling permissions and access to conduct research on the species within the Sakaerat Biosphere Reserve. Finally the Project would like to acknowledge all of the help it received – financial, technical, human hours or advice – from the Sakaerat Conservation and Snake Education Team (SCSET), Sakaerat Najas Project, Director Dr Surachit Waengsothorn, former Director Dr Taksin Artchawakom (an endless inspiration for conservation), Dr Colin Strine, Dr Anchalee Aowphol, Dr Flora Ihlow, Jose Cairos, and all the individuals who made and make the Sakaerat Tortoise Telemetry Project: Jonathan Clegg, Rachel George, Dr Archana Nathani, Mark Read, Moji (MJ) Suriyamongkol, Indy Montano-Ward and Ysabella Montano.

