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ECOLOGICAL CHALLENGES OF ROOSTING IN THE LEAF NOSED BAT, *HIPPOSIDEROS SPEORIS*

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Abstract:

The ecological success of microchiropteran bat *Hipposideros speoris* roosting inside the irrigation canal was studied. The canal was completely devoid of water during dry season (April–September) and bats occupied the dried canal. During rainy season (October-January), the water level reached to a height of 65 cm. Under such circumstances, all the individuals of *H. speoris* shifted themselves to the nearby motor-pump house. The colony that is temporarily distributed to the pump houses returned to the same irrigation canal at the beginning of dry season. The distances moved by bats were 350 m from the irrigation canal that appeared to be the main roost. To know the exact dispersal place and pattern, adult bats were captured during bat emergence hour (18.30-19.00 hours) and marked with coloured plastic split ring (left forearm for female and right for male) for individual identification.

Key Words: Roost, Irrigation Canal, *Hipposideros speoris* & Pump Houses

Introduction:

The place where the bat living is called 'Roost'. Roosts play an important role in the lives of bat and provide resting, protection from predators, weather conditions, site for energy conservation, digestion, information transfer and social interactions (Kunz, 1982). Bat populations are presently in decline because of habitat destruction, pesticide use and direct human disturbance (Hutson *et al*., 2001; Racey and Entwistle, 2003). Bats use many different type roosts depending on their physiological requirements, social behaviours and geographic distribution (Kunz and Lumsden, 2003).

The leaf-nosed *Hipposideros speoris* is confined to India and Sri Lanka (Bates and Harrison, 1997). *H. speoris* usually occupies natural caves and old temples and constructions (Gaikwad *et al*., 2012). As per the available literature the colony consists of 100 to 1100 individuals roosting alone or share with other species. Irrigation canals were exclusively used by *H. speoris* only for a short period of time. When the water overflows through the canal, the occupant bat colony is forced to move over to another place. The entire colony dispersed and divided into different colonies in different places. Hence the study was conducted with the following objectives;

- ✓ To identify the irrigation canals, which are used by bats for roosting in dry season
- ✓ To investigate the distance they move and dispersal pattern during rainy season
- ✓ Analyze the impact of water logging on *Hipposideros speoris*
- ✓ Whether the bats move to the same roost or not by the following season?

Materials and Methods:

Identification of Irrigation Canals: Irrigation canals were surveyed during day time with a low powered flash light to check the presence/absence of bats. The survey was conducted between January and September, 2015 at various places around Rajapalayam to find out the occupancy of bats inside the canal.

- ✓ **Roost Characters:** Structural variables of canals such as length, width and height were measured by a measuring tape. To record roost microclimates, a digital thermohygrometer was placed inside the canal for a week.

Investigation of Distance Moved by Bats:

- ✓ **Bat Capture and Marking:** Sivagiri – Periyathalaththu koil Pond irrigation canal was occupied by more than 300 *Hipposideros speoris*. The canal length is 14m, width is 60cm and the height is 95cm. The lengthy canal was constructed by stone with lime and the reason for harbouring more number of bats. In this site, the 10 male 10 female bats were captured for marking on 12 & 13.09.2015 between 18.45 and 20.00hour.

Impacts of Water Logging on Bats: We estimated the loss of individuals after water level increased inside the canal by colony counting and observation of marked bats in a dispersed population located nearby places.

Colony Dispersal Year by Year: The dislocated colony form irrigation canal to nearby places during water flow inside the canal, marked bats were identified as whether they returned or not to the canal after it was empty.

Results:

Identification of Irrigation Canals: Out of which 50 canals surveyed, three structural variables found in the canal. 18 canals were inverted U shaped (∩) structure, 5 canals were round shape and the remaining 27 canals were square shaped. Fourteen canals were unsuitable for bats to live because soils logged inside (Plate 1). The square shaped irrigation canal and inverted U shaped irrigation canal (Plate 2) was used by bats when the canal without water. Only 11 canals were occupied by bats with varied numbers. An average length, width and microclimate of canals are analyzed (Table 1).

Bat Counts:

Bats occupied in 11 canals were counted by visually during bat emerge out from the canal between 18.40 and 19.00hr at each canal. We counted for every 15 minutes the number of bats flying out from the canal. At 20.00 hour, by assuming that all bats have left, we entered inside the canal to check the presence of bats. If bats still stayed back when we entered the canal, we counted the number.

Table 1: Physiographic and microclimatic features of the roosts (n=50).

Irrigation canals structural variables		
Number of Entrances	Dry season	2
	Wet season	1
Entrance (cm)	Height	71.5±0.1
	Width	62.2±1.5
Roost (m)	Length	18.5±1.1
	Width	0.62±0.5
	Height	0.72±0.1
Roost microclimate	Temperature (°C)	28.08±0.4
	Humidity (%)	82±1.3
Population range size		8 – 300
Species inhabited inside the canal		*H. speoris* only
Hanging surface		Cement/ stone/ lime
Entrance shape inverted U shape (∩) round shape square shape		 18 5 27

Investigation of Distance Moved by Bats:

Bat Capture and Marking: To find out the dispersal distance of bats from irrigation canal to unknown place bats were captured and marked with coloured bands from Sivagiri Periyathalaththu koil Pond to study the dispersal distance (Plate 3). On the second day of marking, more than 70 % of banded bats were found inside the canal. This suggested that *H. speoris* may be able to adjust with human disturbances. The details of bat marking done at Sivagiri Periyathalaththu koil Pond was listed in Table 2.

Table 2: Biometric ata and band code for bats caught and banded at Sivagiri.

Male		**Female**		**Breeding condition (♀)**	**Band code**	
Fore arm (mm)	**Body weight (g)**	**Fore arm (mm)**	**Body weight (g)**		♂	♀
50.0	12	49.9	14	Pregnant	B2	O1
49.8	11	50.4	11	Lactating	D6	P4
50.1	10	49.2	09	Post-lactating	F4	G1
49.0	11	49.8	11	Null	B3	Y5
51.1	13	49.1	12	Post-lactating	B1	Z1
50.3	12	50.4	11	Lactating	A4	D1
48.7	13	49.2	09	Null	Y7	B5
49.8	09	49.0	10	Null	C6	A1
52.7	11	48.4	11	Null/non-lactating	F8	O2
49.7	12	50.7	10	Post-lactating	H2	W3

Impacts of Water Logging on Bats: The pond was full of water and the shutter of the canal was opened for paddy irrigation in the end of October 2015. Water out let level in canal was about 65cm height and no bats were sighted inside the canal. We searched the marked bats around the pond irrigation canal between November 2015 and February 2016 for locating secondary roosts used by bats. They occupied nearby pump house located 350 m away from the canal in the midst of agricultural field. In the midst of the colony, banded nine males and seven banded females bats were found. Hence, we presume that the same colony of *H. speoris* had shifted by itself soon after the canal was full of water. The recorded mean values of temperature and humidity prevailing inside the pump house were 27.9±1.3° C and 76.7±7.3%. The canal was filled with rain water, bats moved a distance of 350 m from the irrigation canal (main roost) to pump house (secondary roost). Bat banding was

useful to locate roosting sites of *H. speoris* in this canal. Visual inspections proved to be an effective means of finding the presence of banded male and female bats in the roosting sites. Male and female banded bats were found roosting together.

Impact of Water Logged Roosts on Bats: About 300 bats occupied inside the canal during dry season. The entire colony was dislocated due to water logged inside the canal on October 2015. We searched the marked bats around the agricultural field and traced on 14.02.2016 inside the pump house. Nearly 50 bats were missed from the site. One male and three female banded bats were not found among the colony.

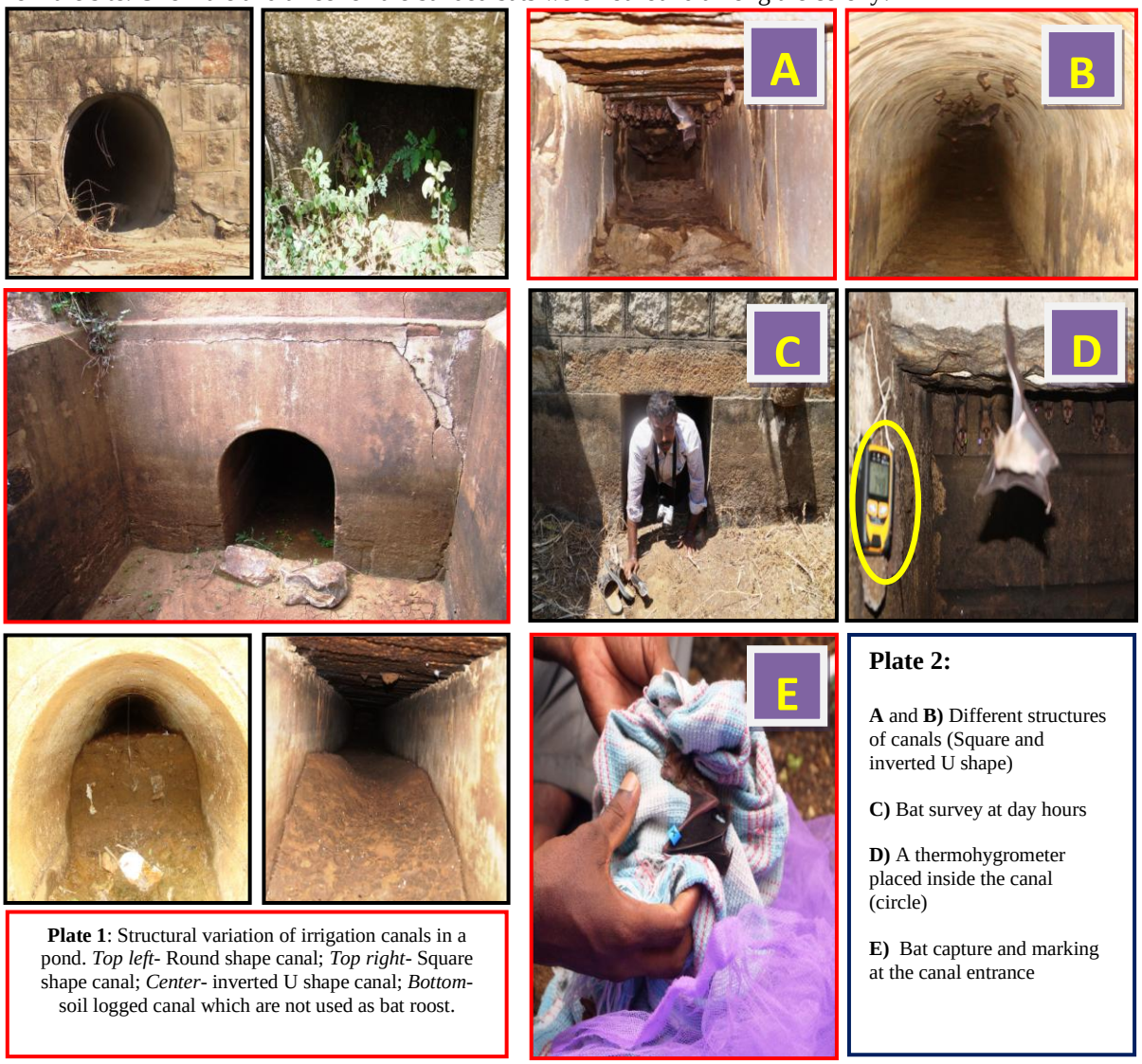

Plate 1: Structural variation of irrigation canals in a pond. *Top left*- Round shape canal; *Top right*- Square shape canal; *Center*- inverted U shape canal; *Bottom*- soil logged canal which are not used as bat roost.

Plate 2:

A and **B)** Different structures of canals (Square and inverted U shape)

C) Bat survey at day hours

D) A thermohygrometer placed inside the canal (circle)

E) Bat capture and marking at the canal entrance

Plate 3: Map of the study area (Periyathalaththu koil Pond - Sivagiri). Pin mark indicates the outlet of the pond irrigation canal used as bat roost.

Bat Colony Dispersal Year by Year:

All the bats returned from the pump houses to irrigation canal after the canal was dried. When the canal was emptied, bats were regularly uses the canal for roosting. Bats visited the canal during night hours between 18.25 h and 05.00 h at the time of water flowing season and act serve as night roost.

Discussion:

There is a need to monitor bats to achieve conservation and management goals. Surveying roosts provides valuable information concerning the status of bat species (Sherwin *et al*., 2003). Roost switching and dispersion reflects the differences in bat colony size between bats forming large colonies in caves and buildings and those roosting in smaller colonies in trees, perhaps due to thermal differences or to competition for space when the individuals increases and the cavity is too small (Whitaker, 1998; Lefebvre *et al*., 2003).

The specific type of roost selected by bat species determined by the morphology of the bat (Vaughan, 1970), temperature or humidity within the roost (Entwistle *et al*., 1997), roost to suitable foraging and drinking areas (Entwistle *et al*., 1997), or other features of the landscape surrounding the roost (Wunder and Carey, 1996). The thermo physical characteristics of roosts also affect bat physiology (Altringham, 1996; Kerth *et al*., 2001).

Underground sites such as caves and mines are crucial to the survival of many bat species worldwide. In temperate countries such sites may be used for breeding in summer and hibernation in winter. Whereas in tropical countries, bats do not hibernate, caves and mines may provide roosts for large colonies (Mickleburgh *et al*., 2002). The environmental stability and protection provided by this irrigation canal make them highly suitable for roosting.

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