

Do European sousliks produce ultrasonic calls?

Research outline for the European Souslik Study Group @ Tabachka 2004

This outline is also available online at: <http://www.geocities.com/thesousliks/>

Introduction

Alarm calls have been widely documented for the European Souslik, *Spermophilus citellus* as well as other sciurid rodents (Betts 1976, Blumstein et al. 1997, Hoffman 1995, Leger et al. 1984, Owings 1977, Popov & Sedefchev 2003). All of these calls, however, are within the hearing range of humans, i.e. they are audible.

Wilson & Hare (2004) reported the first evidence for an ultrasonic call in a North American rodent – Richardson's ground squirrel, *Spermophilus richardsonii*. According to their work these 'whisper calls' serve the function of highly directional warning signals to conspecifics. While the presence of such calls has not been recorded in other similar species, it is believed that this phenomenon is more widespread than previously thought (James Hare, Vladimir Stefanov, personal communications).

From an evolutionary perspective it would be interesting to examine whether the European species of ground squirrel, which on the whole has a less refined alarm-calling system than that some of its North American relations possess (Macedonia & Evans 1993), also uses ultrasounds in its anti-predator behaviour.

In this study we will examine this phenomenon by answering the following questions:

- Do European sousliks produce ultrasonic calls?
- What is the context of such vocalizations (if present)?
- How these calls affect the behaviour of conspecifics?

Additionally, depending on logistical limitations, an attempt will be made to test experimentally the effect of the possible ultrasonic calls on the European sousliks.

Methods

Detection/Recording of 'whisper calls'

Initially, basic tests will be made to try to establish whether ultrasonic calls are included among the signals broadcast by the European souslik. For this, bat detectors will be used. These are devices intended for sensing signals used by bats for echolocation and thus constitute the perfect tool for a preliminary trial that aims to confirm the occurrence of ultrasounds.

The research of Wilson & Hare (2004) found that the calls broadcast by Richardson's ground squirrels attenuate very rapidly over distance. This, together with the fact they are highly directional, depending on the abiotic factors of the field site, makes it difficult to record/detect the 'whisper calls' from a distance of more than 5 m from the signaler (James Hare, personal communication). It is therefore recommended that we try to place the bat detectors as close to the caller as possible. In the cited research on Richardson's ground squirrels this has been achieved by walking towards the subject until it retreats to its burrow, after which the bat detector is placed close to the burrow, facing the entrance at 0.49 +/-0.02 m away (*Supplementary Methods* for Wilson & Hare 2004 at www.nature.com/bca). This method has the added advantage that the approach of the experimenter acts as a simulated predator stimulus, since testing the presence of such alarm calls in naturally occurring predation episodes would be impractical (Barash 1975 in Sherman 1977, Hoogland 1983). On re-emergence from the burrow some of the animals may 'whisper-call' and their vocalization is to be detected/recorded, depending on the equipment available.

During the initial trials an ultrasonic microphone may also be used for recording purposes. Under the methods used to detect/record these calls, they would be classified as related to a potential predator context, thus it can be inferred that they could serve alarm-signaling functions. To further examine this hypothesis, though, playback experiments will be needed. Given logistical limitation of the current study these may or may not be arranged.

Provisional playback protocol

Playback would be possible if successful recording of ‘whisper calls’ is achieved. Once more the high directionality and the quick attenuation of these calls will be a limiting factor (Wilson & Hare 2004). The methodology of Wilson & Hare (2004) (*Supplementary Methods* at www.nature.com/bca) will be followed to ensure that results obtained from this study can be compared as reliably as possible to those from the playback experiments with Richardson’s ground squirrels.

Observational criteria

Focal animal sampling (Altmann 1974) will be used to record the behaviour of the European sousliks before, during and after the sound broadcast. Their activities will be coded as vigilant/non-vigilant behaviour according to Hare & Atkins 2001.

Vigilant behaviour under those definitions constitutes any of the following:

- *Low vigilance* (standing on four feet, head above horizontal plane)
- *Slouch* (hind feet on ground, head above a curved back)
- *Alert* (standing up on hind feet with head raised above back, stance is perpendicular to the ground)

Non-vigilant behaviour is exhibited when the animal is on all fours on the ground and its head is NOT raised above the horizontal plane (e.g. it is foraging).

The time spent in vigilant vs. non-vigilant behaviour prior to the stimulus broadcast will be then compared to the time spent in such behaviour during/up to 30 seconds after the broadcast to see if there is correlation between the perception of the ultrasonic call and a possible increase in vigilant behaviour.

Discussion

Alarm-calling in social rodents has been proven to be nepotistic behaviour – one that favours kin (Sherman 1977, Hoogland 1983, 1996). This behaviour is potentially risky to the caller in that it can draw the attention of a predator. Therefore it would pay the signalers if they can employ an effective strategy of alarm signaling that is less costly to themselves. The use of ultrasonic alarms, it is hypothesized by Wilson & Hare (2004), can serve precisely these purposes since most of the ground squirrel predators are not capable of hearing the ‘whisper calls’. Furthermore, even those predators that *could* potentially perceive these high-frequency sounds, would not be able to do so in reality, since the ‘whisper calls’ documented for Richardson’s ground squirrels fade down quickly with increased distance from the caller and also show high directionality. Because of this directionality of the ‘whisper calls’, according to Wislon & Hare (2004), the ground squirrels would be able to target precisely the recipients of their warnings (philopatric kin) and avoid detection at the same time.

The results of the current study will, hopefully give us some preliminary information on the question of how widespread these ‘whisper calls’ are among diurnal social rodents. Their presence in a European species of ground squirrel will show that this phenomenon is not an oddity of the vocal repertoire of one particular species but a more broadly expressed adaptation in a wide array of species experiencing ecological pressures similar to those, which predators impose on Richardson's ground squirrels.

Acknowledgements

Dr. James Hare from University of Manitoba reviewed this outline and made useful comments and suggestions on the draft. His help is much appreciated.

References

- Altmann (1974).** Observational study of behavior: sampling methods. *Behaviour*, 49: 227-67
- Betts, B. J. (1976).** Behaviour in a population Columbian ground squirrels, *Spermophilus columbianus columbianus*. *Anim. Behav.*, 24: 652-680
- Blumstein, D. T. & Armitage, K. B. (1997).** Alarm calling in yellow-bellied marmots: I. The meaning of situationally variable alarm calls. *Anim. Behav.*, 53: 143-171.
- Hare, J.F. & Atkins, B.A. (2001).** The squirrel that cried wolf: reliability detection by juvenile Richardson's ground squirrels (*Spermophilus richardsonii*). *Behav. Ecol. Sociobiol.* 51: 108-112.
- Hoffmann, I. E (1995).** Raubdruck, Warnrufe und Wachsamkeit bei europäischen Ziesel. University of Vienna.
- Hoogland, J. L. (1983).** Nepotism and alarm calling in the black-tailed prairie dog (*Cynomys ludovicianus*). *Anim. Behav.*, 31: 472-479.
- Hoogland, J. L., (1996).** Why do Gunnison's prairie dogs give anti-predator calls? *Anim. Behav.*, 51: 871-880
- Leger, D. W., Berney-Key, S. D. & Sherman, P. W. (1984).** Vocalizations of Belding's ground squirrels, *Spermophilus beldingi*. *Anim. Behav.*, 32: 753-764
- Macedonia, J. M. & Evans, C. S. (1993).** Variation among mammalian alarm call systems and the problem of meaning in animal signals. *Ethology*, 93: 177-197.
- Owings, D. H, Kiriazis, J., Fischer, C. & Creef, E. (1977).** The behaviour of California ground squirrels. *Anim. Behav.*, 25: 221-230
- Popov, V. & Sedefchev, A. (2003).** Field Guide to the Mammals in Bulgaria. Geosoft, Sofia.
- Sherman, P. W. (1977).** Nepotism and the evolution of alarm calls. *Science*, 197: 1246-1253.
- Wilson, D. R. & Hare, J. F. (2004).** Ground squirrel uses ultrasonic alarms. *Nature*, 430: 523