Behavioural Ecology Excursion to

Bulgaria 2004

3^{rd} – 24^{th} September 2004

Participants and project proposals

Zoological Institute, University of Tübingen, Germany

&

National Museum of Natural History, Bulgarian Academy of Sciences, Bulgaria

NATURA ET SCIENTIA

1889

EBERHARD KARLS UNIVERSITÄT TÜBINGEN

Participants (with email addresses)

Students from Tübingen University:

1. Saskia Keppler (saskep@web.de)
2. Volker Schmid (volkimail@freenet.de)
3. Katharina Steinlein (cajou81@hotmail.com)
4. Vivian Gabor (viviangabor@gmx.de)
5. Stephanie Siegl (stephaniesiegl@tiscali.de)
6. Grit Schauermann (grit.schauermann@student.uni-tuebingen.de)
7. Helen Haas (Helen.haas@gmx.de)
8. Barbara Kolar (bkolar@gmx.de)
9. Florian Aldehoff (aldehoff@web.de)
10. Rebecca Nerz (snif@nerzclan.de)
11. Marcelo Martinez (mll_bio@uol.com.br)
12. Franziska Hausmann (franziska@philosophie.uni-tuebingen.de)

Students from Sofia University:

13. Alexander Georgiev (onebluemammal@yahoo.co.uk)
14. Guergana Stoicheva (stoytcheva@yahoo.com)
15. Ivailo Borissov (ivailo_borissov@yahoo.com)

Teachers:

16. Dr. Teodora Ivanova, Sofia (tea@nmnh.bas.bg)
17. Dr. Björn Siemers, Tübingen (bjoern.siemers@uni-tuebingen.de)
18. PD Dr. Markus Fendt, Tübingen (markus.fendt@uni-tuebingen.de)

Guests:

19. Anna Wiesemeier
20. Maja Kilian-Siemers
21. Sarah Siemers (baby)

Project groups members and project proposals

Behavioural ecology of ants

Volker Schmid

Introduction:

Ants are frequent – almost abundant – in most of the habitats we can find in our environment. Individuals live together in highly organized societies, thus building a *super organism* where each ant plays a similar role as a single cell of our body. But unlike the mobile individuals it consists of, the super organism is a stationary being and as such a so called *central place forager*: food is collected within a certain radius around the nest, then it's transported back and fed to the brood and the queen(s).

Considering these conditions one might expect of an ant colony to optimise its foraging behaviour in regard to certain crucial parameters. Such factors could be: the threat of losing a profitable food source to other animals, especially direct competitors like conspecific neighbouring colonies; the energy consumption for transporting and handling the food in relation to the food intake rate; the threat of exposition to predators; …

The project:

As there are many ant species that can differ greatly in their behaviour and because I don't know which species will be present at the project site, a definite plan for this project can't be elaborated in advance. In the following paragraphs I will try to explain some general issues and preparations as well an example for a possible experiment with a certain ant genus.

The first thing to do after our arrival is going to be the search for ants in the available habitats by baiting (with various food types as baits) and the attempt to determine the species or at least the genera of the collected ants. Depending on the ants that can be found the goal of this project should be the qualitative and quantitative examination of some certain aspects of ant behaviour as well as the attempt to correlate them with manipulated environmental variables.

Those behavioural aspects may be:

- recruiting behaviour: sharing information about the food source with nest mates and thus summoning them to the food source for a faster or more efficient exploitation
- foraging 'efficiency', i.e. the food intake rate or the speed of exploiting food sources

- food choice: preference of one food source over (or at the expense of) an other one, based on
  quality (e.g. nourishment components) or quantity or other characteristics
- territorial behaviour (especially of ant species with small, transportable nests and low nest population numbers; e.g. species of the genus *Lepothorax*)

Some variables that might be easily controllable:

- the amount of food presented
- the distance of the food source from the nest/pathways
- availability/accessibility of food
- the quality of food
- the size/mass of food units
- artificial (and pheromonally marked) pathways (built by moving parts of established pathways)

The following quantities might serve as measures for drawing up correlations between ecological factors and ant behaviour:

- body size ("broadness" of the head, (mean) body mass)
- recruitment speed (rising number of ants at food source)
- running speed
- natural food size or mass and ant body mass
- measure for the load of a single ant worker: (ant mass + food mass) / ant mass
- fights (number of fights, number of ants, duration of aggressive conflicts)
- pathway systems (total length, number of branches)

Materials:

- scale
- arena (consisting of a plastic tarpaulin or a wooden/plastic board as ground and wooden/plastic boards as walls; another possibility might be a big plastic tub)
- food: casein pellets, mealworms, honey and sugar solutions, plant seeds (maybe bird food)
- slide gauge for measuring head broadness and other sizes of the ant body, as well as food

sizes

- wooden bridges (maybe some broader ones with railing); the wood should be roughened so that the ants can walk properly on the bridge’s surface
- video camera, e.g. for counting ants and measuring walking speeds
- tape measure
- stop watch
- thin wooden pieces of different sizes (to rearrange pathways and bridges)
- binocular: for determining the genus (and maybe even the species) of the observed ants

In the following, I will describe the course of an experiment with the ant genus *Formica*:

This ant genus usually uses various food sources: they collect and hunt arthropods and other protein-rich prey, and they collect honeydew, that is the sugar-rich excretions of aphids and other phloem sucking lice. Some species build high domes above their nest that can easily be found. The peoples can consist of up to several 10000 or even 100000 workers which often establish intensively used pathways to productive food sources.

After locating a suitable nest site and testing the acceptance of different food types (e.g. mealworms, casein pellets or sugar/honey solutions) two ‘forms’ of a certain food type can be presented. For example, let the food type be ‘mealworms’, then it can be presented as ‘half mealworms’ or ‘quarter mealworms’, each at the same distance from the nest or the nearest established pathways and with the same total food amount (measured as weight). Then the number of ants present at each food source and at the same time can be observed several times. The rise in the ant number in dependence of the time can be interpreted as the speed or effectiveness which new workers are recruited with. Based on a hypothesis elaborated in advance, one can try to predict which form of food presentation should attract more workers within the same time (e.g. “half mealworms will attract more workers because ‘big food parts = good food source’”; or “quarter mealworms will attract more workers because small food particles can be carried faster”) and compare this prediction with the actual results of the experiment.

This example shows only a small part of the research possibilities that ant behaviour opens up. I expect the actual experimental course to evolve with its own dynamic and I’m looking forward to the results of my efforts.

References:

SEIFERT, BERNHARD: *Ameisen - beobachten, bestimmen*; Augsburg: Naturbuch-Verlag, 1996

DUMPERT, KLAUS: *Das Sozialleben der Ameisen*; Berlin; Hamburg : Parey, 1994

The following literature wasn't actually used for elaborating the project, but might help to provide an insight in ants in general and foraging behaviour of ants in particular.

EDWARD O. WILSON, BERT HÖLLDOBLER: The ants; Cambridge, Mass. : Belknap Press, 1990

The prey catching behaviour of the toad and its releasing mechanisms

Katharina Steinlein and Vivian Gabor

Abstract

Toads have a specific scheme of their prey, which naturally are insects and worms. If they perceive a key stimulus, a releasing mechanism is activated. In our experiment the releaser will be a prey dummy and the reaction will be the handling of prey. We want to do a model-experiment in which we will present worm-like and anti-worm like figures. Thereby we want to examine the specific releasing mechanisms of the toads` prey catching behaviour.

Introduction

All organisms are susceptible to specific stimuli and are able to respond to them. This irritability is the base of orientation and communication. The environment of an organism is perceived by adequate sensory cells, the information is processed in the CNS and leads to a behavioural answer. A specific surrounding furthers talents, for example the good visually system of predatory birds or the good olfactory system of dogs.

In this connection releasing mechanisms (RM) are recognition systems which evolved as selective advantage. In the case of an innate releasing mechanism (IRM) a key stimulus activates a reaction that is not learned.

An innate recognition system of the toad is the prey detection. In their prey scheme are moving objects about half as big as their mouth. If oblong objects are presentet those are preferred, which move along in contrast to those which move across (Ewert and Traud, 1979). By experience RM can get selective, for example when toads are fed by hand, which previously caused fear, the toad enlarge its scheme of prey and detect the human hand as prey.

RM also depends on the individual motivation. An increased motivation can lead to an unsuitable reaction. For example, male toads clasp branches in the mating season when they cannot get a female toad.

The prey catching behaviour of the toad is composed of different sections

1. turn to the prey
2. approach

3. binocular fixation
4. prey catching with the tongue (small prey) or snapping up (large prey)

The sequence of the prey catching behaviour depends on the localisation of the prey. If the prey moves at one position in the field of view of the toad the sequence would be 1., 2., 3., 4.. Whereas in case the prey appears directly in front of the toad it would be 3. and 4. or just 4..

If you want to examine which characteristics are necessary for the toad to recognize a prey, you have to change the parameters of appearance and movement. In changing the length of worm-like objects in long direction and cross direction the value of the stimulus can be modified. Past studies showed that the value of the stimulus increased by lengthening the long direction and decreased by shortening. It was found that objects of a specific size induce fear which leads to an avoiding reaction (Ewert, 1987) and that an oblong object is preferred as prey if it is moving in long axis direction in contrast to objects moving in cross axis direction. Generally, objects that have an extended position in the toad`s field of view, rather lead to fear.

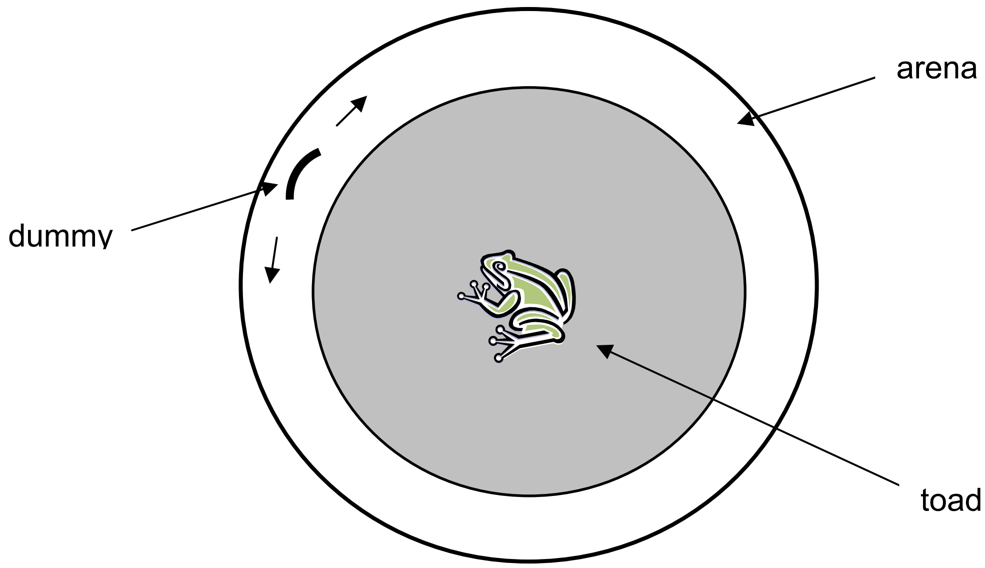
In Bulgaria, we want to study the prey catching behaviour of toads. Different dummies will be presented and the reaction will be observed. By presenting different stimuli we want to calculate the values of these stimuli. Parameters that can be varied are size, form, colour, moving speed and contrast of presented object. Further it would be interesting to examine the transition stage between prey scheme and predator scheme. We also know that toads are able to learn; therefore we want to analyse if the recognition features can be enlarged or modified. This could be done by classic conditioning or maybe by habituation to a stimulus, that previously caused fear.

Possible experimental animals:

- Bombina variegata – Gelbbauchunke
- Bombina bombina - Rotbauchunke
- Alytes obstetricans – Geburtshelferkröte
- Pelebates fuscus - Knoblauchkröte
- Hyla arborea – Laubfrosch
- Bufo bufo – Erdkröte
- Bufo calamita – Kreuzkröte
- Bufo viridis – Wechselkröte
- Rana esculenta – Wasserfrosch

- Rana lassonae – Tümpelfrosch
- Rana ridibunda – Seefrosch
- Rana temporaria – Grasfrosch
- Rana dalmatina – Springfrosch
- Rana alvalis – Moorfrosch

Experimental method:



References:

- Ewert J.-P. and Traud R. (1979) Releasing stimuli for antipredator behaviour in the common toad *Bufo bufo* (L.). Behaviour 68, 170 – 180.
- Ewert J.-P. (1987) Neuroethology of releasing mechanisms: prey – catching in toads. Behav. Brain Sci. 10, 337 – 405.

Predator induced fear behaviour in small mammals

Grit Schauermann and Stephanie Siegl

Fear and anxiety are two of the most potential emotional experiences which are critical to the survival of higher vertebrates. For example the presence of predators or stimuli predicting potential injury activate different autonomic, hormonal and behavioural changes in regard to fast and effective defense to increase the chance of survival (1). When confronted by a predator rats show flight, avoidance, freezing, and risk assessment and reduce locomotion and nondefensive behaviour such as eating, drinking, exploratation and sexual activity (2).

Measuring anxiety-like behaviour has been mostly taken place in laboratory designs using the classical animal models of anxiety such as the elevated plus maze, the light/dark coice or open-field tests.The main aspect of this study is to investigate behavioural changes in an open field in the presence of potential predators in small mammals using optical, olfactory and acoustic predatory stimuli. Usually these kinds of studys have been made with laboratory gnawer. We try to asses differences in the reactions of wild and laboratory species and among one and another specie.

An important role in predator defensive behaviour plays the choice of the habitat. Different mouse spicies living in different habitats show differences in the reaction when confronted with the same predator. We will try to correlate different behavioural reactions between species living in different habitats (with different predators).

First of all we are going to set traps in different habitats like e.g. forest, rocky areas or grassland. We want to find out if there are different species prefer living in certain habitats and which kind of species those are and the ratio between them.

In this context we´d like to find out differences and special characteristics in the habitats of different species. Eilam et al. (3) showed that calls of owls induce a marked effect in the social vole whereas in the common spiny mouse no behavioural changes were detected. One explanation is, that these animals live in different habitats and therefore react in a different way to different predators. The spiny mice are rock-dwelling rodents preferentially foraging between boulders and in rock crevices where they are relatively protected from aerial predation whereas the vole lives in more open, unprotected habitat. Kotler et al (4) showed that gerbils respond to snakes and owls in qualitatively different manner although both are predators. Gerbils avoided the open microhabitat in response to owls and avoided the bush microhabitat in response to snakes. In our studies we will attempt to find such correlations to underline the fact that different species adopted completely different strategies to avoid predators. We like to assess differences in reactions of different species while presenting the same predatory stimuli in behavioural tests and to find correlations between habitat and a certain kind of reaction.

The main part of our experiments is to examine behavioural changes while presenting predatory stimuli. For these tests we will use an open field where native small mammals will be confronted with acoustic, visual and olfactory predator stimuli. For visual predatory stimuli we are going to use a self-made owl-like dummy moving over the open field. For olfactory stimuli we will use 2,4,5-trimethylthialine (TMT), which is a component of fox feces. The acoustic stimulus is going to be presented by playback vocalizations of native owls and other birds of prey.

After a short time of accustoming (5 min) we will present the stimulus (10 min). The whole time while the rodents and shrews are in the open field we will assess their behaviour. We will distinguish between rearing, contact with stimulus (olfactory stimuli), general exploration, grooming, sleeping, immobility (freezing) and eating. If possible we will distinguish in regard to the "flee or freeze – pattern". Our issue is to find correlations between reaction and environment the small mammals are living in.

(1) **Fendt M, Fanselow MS** (1999): The neuroanatomical and neurochemical basis of conditioned fear; *Neuroscience and biobehavioral reviews*, **23**: 743-760

(2) **D.C. Blanchard, Guy Griebel, R.J.Blanchard** (2003): Conditioning and residual emotionality effects of predator stimuli:some reflections on stress and emotion; *Progress in Neuro-Psychopharmacology & Biological Psychiatry,* **27**: 1177-1185

(3) **Eilam D, Dayan T, Ben-Eliyahu S, Schulman I I, Shefer G, Hendrie CA** (1999): Differential behavioural and hormonal response of voles and spiny mice to owl calls; *Animal Behaviour*, **58 (5)**: 1085-1093

(4) **B.P. Kotler, L. Blaustein & J.S. Brown** (1992): Predator facilitation: Combined effects of snakes and owls on the foraging behavior of gerbils; *Ann.Zool.Fennici,***29**: 199-206

small mammals, occuring in experimental environment:

-Spermophilus citellus (Ziesel)

-Eliomys quercinus (Gartenschläfer)

-Dryomys nitedula (Baumschläfer)

-Glis glis (Siebenschäfer)

-Rattus rattus (Hausratte)

-R. norvegicus (Wanderratte)

-Cricetus cricetus (Feldhamster)

-Mosocricetus newtoni (Rumänischer Goldhamster)

-Muscardinus avellanarius (Haselmaus)

-Micomys minutus (Zwergmaus)

-Apodemus agrarius (Brandmaus)

-A. sylvaticus (Waldmaus)

-A. flavicollis (Gelbhalsmaus)

-Mus musculus musculus (Hausmaus)

-M. spicilegus (Ährenmaus)

-Microtus arvalis (Feldmaus)

-Arvicola terrestris (Schermaus)

-Neomys anomalus (Sumpfspitzmaus)

-Crocidura leucodon (Feldspitzmaus)

-C. suavolens (Gartenspitzmaus)

Things needed:

-Lebendfallen, Watte

-Haltungskäfige

-Futter: Pellets, Nüsse, Sonnenblumenkerne

-Einstreu?

-Bastelkram

-Open field

-TMT

-Kamera

-Rekorder

-Vogelstimmen CD

-Bestimmungsbücher (Botanik – Säuger)

Are the alarm calls of the European souslik *(Spermophilus citellus)* modulated in their acoustic spectrum according to the type of predator detected?

Alexander Georgiev, Saskia Keppler, Helen Haas

General Information about *Spermophilus citellus*

Habitat: European sousliks inhabit open landscapes. They prefer to live in prairies and steppes, rocky country, open woodlands, abandoned farms, and desert mountain ranges (Nowak, 1991).

Physical Description: The European souslik has a slender but strong body. The legs are relatively short; the forelegs and hind legs are about the same length (Parker, 1990). The back is yellow-gray and densily covered by whitish-yellow speckles or dots. The dots disappear on the sides of the body, and the belly is yellow. The chin and the throat are white. The European souslik has short and smooth body hair which becomes straighter and stiffer in winter (Parker, 1990). The external ears of the European souslik are flat. The forehead is broad and flat, causing the large eyes to be far apart. The cheek pouches are rather small. The tail is short, measuring about 3.8-7.4cm, and is coated with hair (Parker, 1990).

Reproduction: The gestation period of the European souslik is 25-26 days. European sousliks mate only once a year, producing 2-9 youngs per birth. The offspring are born naked; the eyes and the ears are still closed. The weaning period is about 30 days, and the males hardly participate in the weaning of a litter. European sousliks reach sexual maturity in 1 year (Parker, 1990).

Behaviour: European sousliks are active during the day. They dig and live in lodges of two types. One is the permanent den, in which they spend nights or the entire winter. The other is a temporary, protective hole which serves as a refuge or for a short rest (Parker, 1990). European sousliks hibernate. The old males start to hibernate in the first half of August while the adult females continue to remain outside until the first half of September. European souslik are rarely seen outdoors as late as November (Parker, 1990). Therefore we hope to find enough active individuals during our or experiments in September. European sousliks bring food into the lodge for consumption, and they provide food for the young. However, they never store any supplies for the winter (Parker, 1990). European sousliks are solitary in their burrows; however, they are colonial in the sense that they build their burrows close together. This helps in protecting them from predators (Caspers, 1997).The european sousliks are known to vocalize when predators are present. We want to investigate in this alarm vocalization.

Food Habits: The European souslik feeds primarily on vegetation, nuts, seeds, and grains; however, individuals may also consume small invertebrates, small vertebrates, and birds'eggs (Emanoil, 1994; Nowak, 1991).

Conservation Status: The European souslik has been declining rapidly in Europe because of the destruction of habitat through intensification of agriculture and large-scale reallotment of land. Although European sousliks are disappearing in Europe, they are still common in other countries (Parker, 1990).

Aim of our Investigations

The variation of alarm calls depending on the predator type was shown in red squirrels (*Tamiasciurus hudsonicus*): 'Red squirrels, can produce alarm calls when they detect a potential predator. Observations of natural interactions between red squirrels and large birds, and predator presentation experiments in the field, showed that red squirrels produce acoustically different alarm calls in response to aerial danger (live birds and a model hawk flown towards them) versus danger approaching from the ground (dogs and humans)' (Greene 1998). The referential use of alarm calls has also been reported for Belding´s ground squirrels and marmots (Mateo 1996; Blumstein 1999).

The alarm calling behaviour of the European souslik - a closley related species to Belding´s ground squirrels – however, is less well understood. To us no publication is known dealing with the topic whether the european souslik is using alarm call modulation to communicate informations about different approaching predator types (aerial versus pedestrian). It was shown that to aerian predators many individuals of a colony give alarm calls whereas to approaching pedestrian predators far less individuals answer with alarm calls (I.E.Hoffmann 1995).

In this study we hope to collect some preliminary data about the possibilities for referential communication in the european souslik. We will attempt to record alarm calls of the European souslik that result from different types of predators (aerial versus pedestrian). In this study we will try to establish if there is a consistent difference in the acoustic modulation of alarm calls used in different predator situations. In this way we may demonstrate whether the European sousliks´ vocal repertoir can convey referential information to conspecifics.

Methods

We are planning to estabilsh a hiding point within a maximum distance of 15m. From there we hope to be able to watch the souliks without disturbing them. Since we will be using a acoustical recording system, we will have to position the microphone between the burrows and have an extension cord leading to our hiding place. We plan to monitor the activity of the sousliks when undisturbed daily for half an hour. For the easier recognition of the monitored individuals we plan to mark them with different colours or patterns. If it is not possible to mark the animals we´ll only be able to do some rouhg behavioural observations (e.g. how many individuals are present and how many are foraging within sight). We will also try to note reactions of the sousliks when apossible predator is approaching. These informations will be used as background informations.

The main research will be the alarm calls. We plan to present different visible dummies and / or acoustical stimuli to the sousliks. According to our informations the main predators for ‘our’ souslik colony are definetly cats as well as possibly foxes, jackals and stray dog. Aerial predators are reported to be the long-legged buzzard and possibly the common buzzard, the peregrine falcon, the imperial eagle as well as the egyptian vulutures. We will concentrate on playback and dummy experiments with cats (*Felis silvestris f. catus)* and the long-legged buzzard (*Buteo rufinus*) since they are supposed to be the main predators and are present in the area.

It has been reported that the sousliks are most active in the moring hours. They start to forage around 7.30am and stay active until about midday. There is a second activity period in the late afternoon. We plan to collect our data in the morning, using the afternoon hours for evaluation. During the time spend in the field, we hope to be able to do about four playback or dummy experiments.

We want to keep at least a one hour time distance between the recordings. This will hopefully give us enough time to prepare for the next experiment and for the sousliks to calm down after the ‘excitement’.

Project schedule

Step	**1.**	**2.**	**3.**	**5.**	**6.**	**7.**
what we do	say hello & have a look	observation point (trapping and marking of some individuals?)	approach of human	display of predator calls and/or predator dummy	display of predator calls and/or predator dummy	put it on paper
what we get			monitoring data recording data	monitoring data recording data	monitoring data recording data	protocol
quest-ions to answer	where are the sousliks? when are they active?	do they accept our presence?	recording quality all right? do we have to modify our ethogram?	do they respond?	do they respond different to different alarm or predator calls?	anything significant ?
things to bring		hiding place	recording system ethogram binoculars	display system different preadator calls dummies (cat´n´kite)		PC incl. Selena evaluation programme all papers we gathered

Please note: this table is dealing with “steps” not “days”.

Materials

Hiding place: dyed linnen or trap, strings, sticks (available)

Dummies: buzzard shaped kite, dummy cat (needed)

Construction to move dummies: (needed)

Playback sounds: cat sounds (available) and buzzard cries (needed)

Sound system: microphone, tape player, extension cord, speakers, PC with Selena, wind protection for the microphone, tapes (Björn) spare batteries, Diskman (available)

[Color for marking: (needed)]

[Traps for sousliks: (needed)]

Observation chart: (available)

Car for transportation: (Björn/Markus)

Binoculars: (available)

Watch: (available)

References

-Erick Greene, Tom Meagher. 1998. *Red squirrels, Tamiasciurus hudsonicus, produce predator-class specific alarm calls*. Animal Behaviour 55**,** 511–518

-Ilse E. Hoffmann. 1995. *Raubdruck, Warnrufe und Wachsamkeit bei europäischen Zieseln*. University of Vienna.

-Daniel T. Blumstein. 1999. *Alarm calling in three species of marmots*. Behaviour 136, 731-757.

-Jill M. Mateo. 1996. The development of alarm-call response behaviour in free-living juvenile Belding's ground squirrels. Animal Behaviour 52, 489–505.

-Parker, S. 1990. Grzimek's Encyclopedia of Mammals. McGraw-Hill Publishing Company, New York.

-Nowak, R. 1991. Walker's Mammals of the World. Fifth Edition. Johns Hopkins University Press, Baltimore & London.

-Emanoil, M. 1994. Encyclopedia of Endangered Species. Gale Research Inc., Detroit.

-Caspers, T. 1997. http://www.hermes.de/westernimprints/data/wildlife/facts/groundsquirrelfacts.html.

Echolocation behaviour in bats

Ivailo Borissov, Florian Aldehoff, Marcelo Martinez, Franziska Hausmann

Project idea

We attempt to record and compare calls of Bulgarian bats (*Noctylus spp., Pipistrellus spp.*, species depending on occurrence.)

1. in dependence of vegetation/walls and open space. In this case we expect to find CFs (constant frequency) in open space situations and FMs (frequency modulation) in edge and gap situations (background cluttered space or edge space). (as shown in *Myotis nattereri* by Siemers and Schnitzler, 2000)

2. during approach of prey and shortly afterwards to compare calls of successful attempts with those of failures. It has been shown before by Britton and Jones (1999) that in case of success the duration of buzz II and post-buzz pause as well as the post-buzz interpulse interval and the minimum frequency of first search call after buzz II change significantly in laboratory experiments.

Methods

Observation and rough identification of (target) bat species

- night time observations of flight behaviour with head torches, bat detectors and determination of call frequencies and modulation using live spectrograms
- rough identification of conspicuous species by typical call parameters, appearance and flight behaviour (height, speed), with special focus on *Nyctalus sp.* and *Pipistrellus sp*.

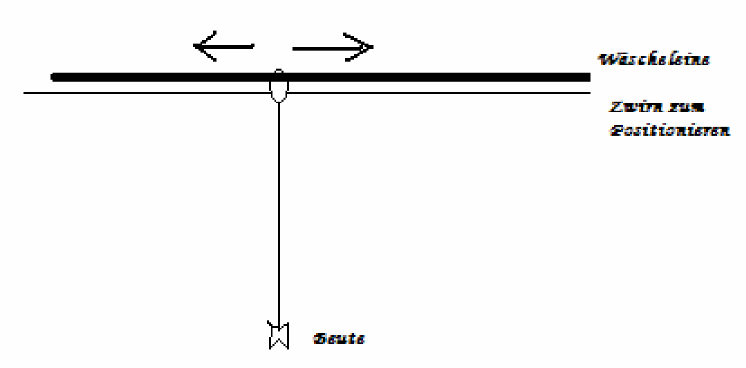
Analysis of changes in modulation of echolocation calls from *Nyctalus sp*. and *Pipistrellus sp*. during transition from open space to edge space

- recording of echolocation calls of hunting bats in open space and edge space situations (in case of two available microphones synchronous recording in different angles - vertical and pointed to tree vicinity - or in case of only one microphone recording in alternating angles in alternating nights)

- synchronous confirmation of bat position within defined open or edge space by monitoring with head torches and IR equipment (if possible)
- acoustical analysis of recorded sound signals concerning main frequency, signal intensity and frequency spectrum
- statistical analysis of data looking for significant differences between open space and edge space situations

Analysis of echolocation call parameters indicating prey capture success

- Prey consists of living moths (local species, captured using light trap) being threaded (still allowing minor fluttering) and suspended vertically from a clothesline in 3-4 meters height (between trees, buildings or light posts)
- Exchange of prey items facilitated by ladder and metal ring on end of thread used to slide prey along the clothesline



- recording of attempts of prey capture using ultrasound microphone and IR equipment or multiflash photography to distinguish between successful and unsuccessful attempts
- acoustical analysis concerning length of buzz II, post-buzz pause, post-buzz interpulse interval and minimum frequency of first search call after buzz
- statistical analysis of significant differences of those 4 parameters in case of prey capture failure or success

Equipment

- ultrasonic microphone with flat frequency response (as flat as possible) and sensitivity in between 15 and 200 kHz (two would be even better, recording in two situations at the same time!)
- IR stroboscope

- IR-sensitive camera with tripod
- digital recording device (probably laptop, with sufficient hard drive space, sound card and installed programs for acoustical and statistical signal analysis)
- additional bat detectors
- energy source(s) including cables / batteries for stroboscope, camera, laptop, bat detectors…
- head torches
- torches
- identification keys (frequency table, descriptions of flight behaviour, time patterns)
- tape measure
- rain covers for equipment

additional equipment for experiments including prey offering

- light trap to catch moths
- clothesline
- thread to attach moths
- plastic or metal ring ("Duschvorhangring")

Schedule

Day 1 and 2

- search for roosting sites
- search for suitable sites for experiments
- rough identification of target species
- assembly and test of equipment

Days 3 to 8

- prey success experiments
- use of recorded data for open space experiments possible
- acoustical analysis of gathered data during the morning

Day 9 to 13

- first analysis and evaluation of data gathered in prey success experiments; in case of high significance continuation of experiments, otherwise concentration on edge space experiments

- if possible, recording of echolocation calls at roosting sites (jamming avoidance, group specific calls)
- acoustical analysis of gathered data during the morning

Day 14

- overall (acoustical and statistical) analysis of gathered data
- elaboration of presentation

Day 15

- elaboration of presentation
- presentation and discussion of results

References

Britton, A. R. C. and Jones, G. (1999) Echolocation behaviour and prey capture success in foraging bats: laboratory and field experiments on *Myotis daubentonii*. *J. Exp. Biol.* 202:1793-1801.

Schnitzler HU, Moss CF, Denzinger A (2003) From spatial orientation to food acquisition in echolocating bats. Trends Ecol. Evol. 18:386-394

Siemers BM, Beedholm K, Dietz C, Schunger I, Ivanova T (2004) Intra- and interindividual variation in echolocation call frequency in the middle-sized European horseshoe bats (*Rhinolophus blasii*, *R. euryale*, *R. mehelyi*) assessed with high frequency resolution. (submittred)

Siemers BM, Schnitzler HU (2000) Natterer´s bat (*Myotis nattereri* Kuhl, 1818) hawks for prey close to vegetation using echolocation signals of very broad bandwidth. Behav. Ecol. Sociobiol. 47:400-412

Siemers BM, Kalko EKV, Schnitzler HU (2001b) Echolocation behaviour and signal plasticity in the Neotropical bat *Myotis nigricans* (Schinz, 1821) (Vespertilionidae): a convergent case with European species of Pipistrellus? Behav. Ecol. Sociobiol. 50:317-328

Surlykke, A., Vuttrup, V. and Tougard J. (2003). Prey-capture success revealed by echolocation signals in pipistrelle bats *(Pipistrellus pygmaeus). J. Exp. Biol.* 206:93-104.

Possible projects (List of ideas):

(Literature search and estimation of feasibility are still in progress)

Comparison of

1. Calls of two bats while they are flying/handheld alone (without any other bat present) vs. the same two bats together.

The aim is to find out if jamming avoidance can be found in bats if two or more bats fly in the same area.

One could as well artificially broadcast the main frequency a bat is using to see if it in this case changes over to another frequency.

A problem could be that bat do not need to change their frequency because they do not – as electric fish do – broadcast simply one frequency but rather a complex set of frequencies which might suffice to tell apart own and foreign echoes.

2. Calls of two populations of different species living in non-sympatry vs. the same two species living sympatric. This could for example be *Rhinolophus mehelyi*, *R. euryale* and *R. hipposideros*, which show quite similar call frequencies (Siemers, Beedholm, Dietz, Schunger and Ivanova) to find if they establish a (more) specific type of call if they live in sympatry.

Problems in this idea are specification of bat without catching them. Recording calls of handheld bat seems not to be possible for us.

Carnivore-Group: Golden Jackal (*Canis aureus*)

Barbara Kolar, Guergana Stoytcheva, Rebecca Nerz

About the Golden Jackal in Bulgaria

Golden Jackals usually live in pairs or (if food supply allows) small family groups consisting of a mated pair and their offspring, although larger groups have been described[3]. Last year's pups might help their parents e.g. by feeding their younger siblings.

Jackals are more or less omnivorous with a mixed diet of fruit, human waste, carrion and self-hunted animals ranging from insects and rodents to new born calves[2]. The diet seems to be highly variable, depending on local "supply".

They need dense cover for daytime refuge, but are not found in unbroken forests. In Bulgaria, jackal population increased considerably between ~1970 and ~1990 [1], [2]. This increase may be caused by various reasons, such as the clearing of forests and planting of coniferous stands which provided cover, the increase in food supply by means of carcasses of game and farm animals, the reduced use of poisoned baits or simply due to normal fluctuations in the population's density[2].

Although the exact meaning of jackal group-howling is not fully understood, howling, like marking with urine and faeces [3], [1], seems to play a role in marking of territories. In Bulgaria, howling can be heard especially between September and December[1]. According to G. Giannatos, Golden Jackals, like wolves, will answer to playback howling, especially during the night. By counting answering groups, an estimation of a population's size can be obtained. This method has been used in Greece as part of a countrywide survey.

What we intend to do

The project's aim is to collect information about the population and distribution of the Golden Jackal near Ruse, using the acoustic stimulation mentioned above.

In order to find regions with jackal population, we will try to gather "start off-information" by talking to local people. The next step will be to look for appropriate sites (providing good visibility and acoustics, good access) on maps. At several locations a night, we will try to localize and count answering individuals (or groups). On these occasions, sound-samplings will be made to compare answer-patterns on “original” howls with those on howls taken from the Animal Sound data base in Berlin.

Given a regularly /reliably answering group is found, we will test their reaction on foreign howls such as wolves’, coyotes’ or dogs’ howls. We would expect, that Jackals would answer to Jackal howls and maybe approach the playback- point, but differently, if at all, answer to foreign howls, especially to wolves and other potentially dangerous canidae.

Every sighting will be used for behavioural observations.

If motion detectors can be obtained and sites with frequent jackal presence are found, an optic track might be set up to take pictures of passing jackals and estimate the size of the local group(s).

Schedule

The first two days at least will be needed to get information about possible jackal areas and to plan the sites for the playbacks. During as many nights as possible, playbacks will be done.

Equipment -list

1. Speaker(s)
2. 2x Audio player (disk-man or cassette recorder, for playback and recording)
3. Microphone
4. empty cassettes
5. batteries
6. extension lead?
7. spotlights or such
8. car with reliable power supply (at least the light will be taken from the car’s battery)
9. detailed maps and road maps
10. binoculars
11. possibly meat for “baits”
12. optional: camera, motion detector

If everything goes wrong… what else can we do?

Maybe we can lay out food and compare the species approaching by day and night or different places (varying cover / proximity of human settlements, urban areas, etc.)

References

1. DEMETER, A., SPASSOV, N., „Canis aureus“ im Handbuch der Säugetiere Europas
2. GIANNATOS, G., 2004, Conservation Action Plan for the golden jackal *Canis aureus* L. in Greece, WWF Greece, pp 47.
3. MACDONALD, D:, 1979, The flexible social system of the Golden Jackal, Canis aureus, Behav. Ecol. Sociobiol. 5, 17-38, 1979