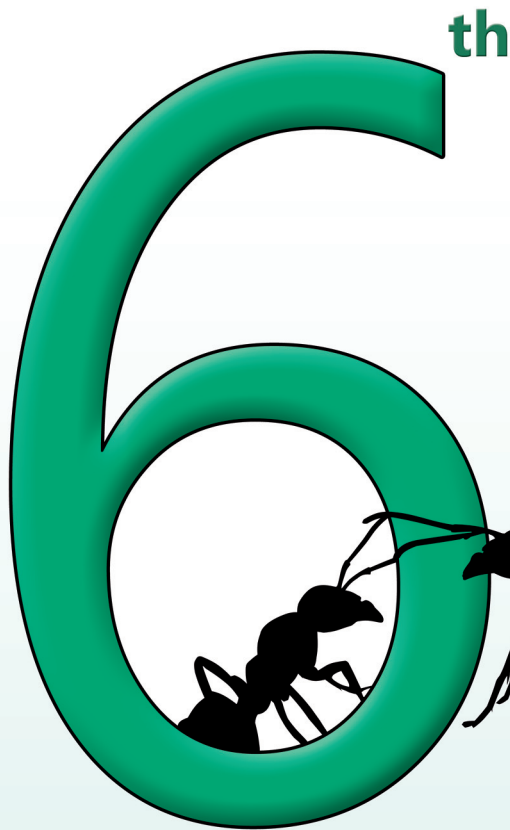




Organized by SERL (Société Ecologique à Responsabilité Limitée)  
serl2010.univ-tours.fr



# ECOLOGY & BEHAVIOR Meeting

Tours  
12 - 16 april 2010

## ABSTRACT BOOK



ECOLE DOCTORALE  
"SANTÉ, SCIENCES,  
TECHNOLOGIES"





**6<sup>th</sup>**  
**“Ecology and Behavior” Meeting**

Tours, 12<sup>th</sup> to 16<sup>th</sup> April 2010

<http://serl2010.univ-tours.fr>



Organized by the  
“Société Ecologique à Responsabilité Limitée”



# Welcome

Dear guests,

We are pleased to welcome you for the 6<sup>th</sup> meeting Ecology and Behavior that takes place in Tours, capital city of Touraine, a region that is well-known for its castles, the Loire valley and some excellent wines.

Like previous years, this meeting is organized by and for doctoral students and postdoctoral researchers. The aim of this meeting is the exchange between young and recognized scientists on various topics related behavioral ecology (biology, conservation biology, evolutionary biology, neurobiology, physiology and population ecology). These exchanges will be possible through interesting talks and posters by our invited speakers and by you!

Furthermore, there will be plenty of time for discussion and socializing with your fellow-participants by visiting the Chenonceaux castle, and the old town of Tours in your spare time.

We thank the University of Tours, that welcomes us, the IRBI, the CNRS, the UFR Sciences et Techniques, the Ecole Doctorale SST, the UFR Sciences et Techniques, the City of Tours and the Région Centre whose support has enabled these meeting to take place.

The organizing committee

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## The organizing committee



**Clément VINAUGER**, 2nd year PhD student.

PhD project: "Learning and memory in insects that are vector of human diseases".  
Supervisor: Claudio Lazzari.



**Denis LIMOUSIN**, 3rd year PhD student.

PhD project: "Evolutionary genetics of acoustic communication in *Achroia grisella*: study of genetic correlation between male signals traits and female preferences". Supervisor: Michael D. Greenfield.



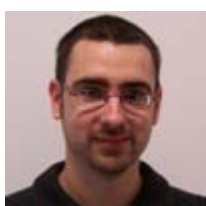
**Faustine LOUIS**, 2nd year PhD student.

PhD project: "Study about mechanism of bracovirus replication". Supervisor: Catherine Dupuy.



**Gaëlle BIMBARD**, 2nd year PhD student.

PhD project: "Kinematics in free-flying butterfly". Supervisor: Jérôme Casas.



**Jonathan VOISE**, 3rd year PhD student.

PhD project: "Wave propagation and echolocation in semi-aquatic insects". Supervisor: Jérôme Casas.



**Julien THEZE**, 1st year PhD Student

PhD project: "Genomic diversification and adaptation of pathogenic insect viruses".  
Supervisor: Elisabeth Herniou.



**Odette BRUNEL**, 2nd year PhD student.

PhD project: "Comparative study of acoustic communication traits between different populations of Tettigoniidae: *Ephippiger ephippiger* sp.". Supervisor: Michael D. Greenfield.



**Séverine LIGOUT**, post-doctoral researcher.

Research subject: "Acoustic communication and female preference in *Achroia grisella*: behavioural aspects and evolutionary genetics".



**Sylvain ALEM**, 2nd year PhD student.

PhD project: "Genetics and evolution of acoustic communication in a moth: *Achroia grisella* (Lepidoptera : Pyralidae)". Supervisor: Michael D. Greenfield.



**Sylvie MORICE**, 4th year PhD Student

PhD project: "Geometrical structure of the forest litter and its impact on the spider-cricket interactions". Supervisor: Jérôme Casas.

The organizing committee would like to thank Mélanie Body, Marie Decuigniere and Jérémy Defrize for their help.

## PROGRAMME

**Monday, 12<sup>th</sup> April 2010**

15:50 – 20:00 *Snack / Arrival*

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20:30 – 22:00

Public Evening: Documentary Film

Jaglavack, Prince des Insectes

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**Tuesday, 13<sup>th</sup> April 2010**

8:00 – 8:30 **Welcome/Introduction** **Faustine Louis**

Sexual Selection

8:30 – 9:20 **Mechanisms and evolution of communal sexual displays** **Michael Greenfield**

9:20 – 9:40 Partial local mate competition in a parasitic wasp **Véronique Martel**

9:40 – 10:00 Protandry in the leafhopper *Scaphoideus titanus*: sexual or natural selection? **Julien Chuche**

10:00 – 10:20 Environmental temperature alters the costs and benefits of polyandry in female red flour beetles **Vera Gräzer**

10:20 – 10:40 *Coffee Break*

10:40 – 11:30 **Sexual selection in females? The case of blue tit coloration** **Claire Doutrelant**

11:30 – 11:50 Does immunisation of the male affect song production and female choice in the zebra finch? **Justyna Kubacka**

11:50 – 12:10 Individual and sex odour signatures in kittiwakes **Sarah Leclaire**

12:10 – 12:30 Influence of environmental factors on the reproductive decision in female edible dormice (*Glis glis*) **Karin Lebl**

12:45 – 13:30 *Lunch*

Foraging Strategies / Parasitism

14:00 – 14:50 **Leafminer insects trigger the host plant physiology through an unexpected association with endosymbiotic bacteria** **David Giron**



14:50 – 15:10	Parasitoids assess prior patch quality from local cues and habitat	Philippe Louapre
15:10 – 15:30	Oviposition strategies of <i>Anisopteromalus calandrae</i> female's under intraspecific competition	Ouarda Benkhellat
15:30 – 15:50	<i>Coffee Break</i>	
15:50 – 16:40	<b>Foraging and parasitism in fig wasps: new insights on interactions between individuals and species</b>	<b>James Cook</b>
16:40 – 17:00	A pitcher full of secrets: a symbiotic ant helps its carnivorous plant to catch its prey	Vincent Bonhomme
17:00 – 17:20	Resource polymorphism revisited in Zenaida Doves from Barbados	Karine Monceau
17:20 – 17:40	Robbers suffer from disease more often	Karolina Kuszewska
17:45 – 18:45	<b>Poster Session</b>	
19:00 – 20:00	<i>Dinner</i>	

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20:30 – 22:00

Public Evening: Conference and debate  
Biodiversité - Jacques Weber

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### Wednesday, 14th April 2010

#### Habitat Selection / Dispersion

8:30 – 9:20	<b>Ecophysiological data: links that bond organisms to their habitat</b>	<b>Xavier Bonnet</b>
9:20 – 9:40	Ecology of Grass snakes ( <i>Natrix natrix</i> ): Ongoing study in a ruralwoodland landscape in Lincoln, UK	Ramakrishnan Vasudev
9:40 – 10:00	Interspecific interaction between Red Fox ( <i>Vulpes vulpes</i> ) and Common Buzzard ( <i>Buteo buteo</i> ): food, niche breath and niche overlapping	Łukasz Jankowiak
10:00 – 10:20	Explorers are more mobile and more flexible: first evidence of a highlyconservative personality trait related with dispersal performances in an insect	Simon Ducatez

10:20 – 10:40 *Coffee Break*

10:40 – 11:30 **The ecology and evolution of individual variation  
in dispersal strategies**

Jean-François Le Galliard

11:30 – 11:50 No silver spoon effect on natal dispersal behaviour  
in a small rodent

Alice Rémy

11:50 – 12:10 How do resource characteristics shape home range size?

Frederic Barraquand

12:10 – 12:30 Demographic mechanisms for vole population change  
and stability in response to grazing

Nacho Villar

12:45 – 13:30 *Lunch*

Group Behavior / Individual Interactions

14:00 – 14:50 **Interaction between individuals: from cooperation to cheating**

Alain Lenoir

14:50 – 15:10 Social parasitism in formica ants

Anton Chernenko

15:10 – 15:30 Raid organisation and division of labour in slave-making ants

Sebastian Pohl

15:30 – 15:50 *Coffee Break*

15:50 – 16:40 **Inclusive heritability: Behaviour as a major vector  
of information inheritance**

Etienne Danchin

16:40 – 17:00 Group size effect in nutmeg mannikin: between-individuals  
behavioral differences but same plasticity

Guillaume Rieucou

17:00 – 17:20 Effects of personality traits on territorial signalling:  
A playback experiment with radio-tagged great tits

Mathieu Amy

17:20 – 17:40 Adding Ecological Realism to the Maintenance of Cooperation  
in a Public Goods Dilemma

Christopher Trisos

17:45 – 18:45 **Poster Session**

19:00 – 20:00 *Dinner*

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20:30 – 22:00

Public Evening : Conference and Debate

L'apport de la physiologie en Ecologie Comportementale - Jérôme Casas

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**Thursday, 15th April 2010**

Neuroethology / Ecophysiology

- 8:30 – 9:20 **In the heat of the night: how to feed on blood without perish in the attempt** Claudio Lazzari
- 9:20 – 9:40 Foraging efficiency of honeybees (*Apis mellifera*) and bumblebees (*Bombus terrestris*) in visually complex environments Linde Morawetz
- 9:40 – 10:00 Color polymorphism in the dice snake, *Natrix tessellate* Aurélie Aïdam
- 10:00 – 10:20 Behavior of the gerbil adrenal zona glomerulosa cell to the chronic hydration Leïla Saadi
- 10:20 – 10:40 *Coffee Break*
- 10:40 – 11:30 **What can the canary tell us about the brain represents communication sounds ?** Catherine Del Negro
- 11:30 – 11:50 Stress hormone level increases in the absence of refuge: an experimental study in the aspik viper Catherine Michel
- 11:50 – 12:10 No evidence for a trade-off between carotenoid-based plumage colouration and immune response in blue tit nestlings Dariusz Wiejaczka
- 12:10 – 12:30 Plasticity in metabolic rates and life history traits affects foraging behaviour in a parasitic wasp Cécile Le Lann
- 12:45 – 13:30 *Lunch*

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13:30 – 18:00

Excursion : Chenonceau Castle Visit

20:30

Closing Evening : *Fiesta Latina* Restaurant

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**Friday, 16th April 2010**

Evolutionary Biology / Conservation / Applied Research

- 8:30 – 9:20 **Evolutionary Dynamics of Symbiotic Systems of Insects** Franck Dedeine
- 9:20 – 9:40 Population genetics and phylogeography of a flagship species emblematic of wetland conservation: the Greater flamingo (*Phoenicopterus roseus*) Julia Geraci

9:40 – 10:00	Genetic structure of populations of the barn swallow ( <i>Hirundo rustica</i> )	Sophie Dardenne
10:00 – 10:20	Can railway increase bird diversity in agricultural landscape?	Joanna Kajzer
10:20 – 10:40	<i>Coffee Break</i>	
10:40 – 11:30	<b>Distribution of biological diversity</b>	<b>David Orme</b>
11:30 – 11:50	Demographic changes in amphibian populations in south-central Poland	Maciej Bonk
11:50 – 12:10	Using wavelet analysis to disentangle the different movement regimes of foraging animals	Arnold Fertin
12:10 – 12:30	Biophonies in a bird community of Central Italy: temporal overlap and spectral segregation of bird songs	Rachele Malavasi
12:45 – 13:30	<i>Drinks / Departure</i>	

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14:00

Optionnal: Visit at IRBI

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# Invited speakers

## SEXUAL SELECTION

### Mechanisms and evolution of communal sexual displays

#### Michael D. GREENFIELD

Institut de Recherche sur la Biologie de l’Insecte (IRBI), University François Rabelais of Tours, France



Communal sexual displays of acoustically signaling insects, and their counterparts among bioluminescent species, are acknowledged to include some of the ‘great spectacles of the living world’ (Wilson 1975; *Sociobiology*). These group phenomena are noteworthy for the sheer numbers of participating individuals, the volume of sound or brilliance of light produced, and a precise choreography in space and time, which often gives rise to striking alternation or synchrony between neighbors. Here, potential mechanisms that may generate such temporally-structured phenomena are reviewed and then the evolution of these communal displays of sexually-selected signals is discussed. Under certain conditions alternation or synchrony may be adaptive per se, and the mechanisms that generate chorusing interactions are directly favored by selection. However, in other cases alternation and synchrony are merely epiphenomena, group effects that emerge as byproducts of simple, pairwise interactions between signaling neighbors. Here, such interactions between (male) signalers can represent the outcome of selection

imposed by psychophysical effects operating in the perception of (female) receivers. Simulation models inspired by various acoustic insects, and anurans, demonstrate how complex communal displays, i.e. choruses, may represent emergent properties that originate from these simple effects and interactions. But, the models also show how feedback loops may arise by which these emergent properties can yet influence the simple interaction responses from which they originated.

## Sexual selection in females? The case of blue tit coloration

**Claire DOUTRELANT**, Afiwa Midamegbe , Philippe Perret , Arnaud Grégoire  
CEFE-CNRS, Centre d'Ecologie Fonctionnelle et Evolutive, Montpellier, France



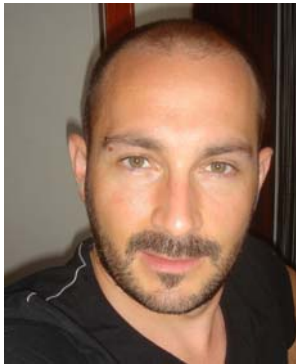
Sexual selection is a major selective force deeply affecting population dynamic and potentially affecting the long-term adaptive potential of populations. It increases the variance in individual reproductive success through intrasexual competition and mate choice. Given the initial asymmetry between male and female gametes size, sexual selection is commonly predicted to lead to the evolution of exaggerated secondary traits in males and mate choice in females. Yet, although male displays and female choosiness are indeed frequent in nature, they are by no means universal and in many biological situations (e.g. biparental care, variance in female reproductive capacity, cost of sperm production), sexual selection can also be predicted to operate in females.

I will present here the results of experiments investigating the mechanisms maintaining honesty of potential female signals, female feather coloration, and testing the links between these signals and maternal quality. Our results obtained in blue tits, *Cyanistes caeruleus*, show that past reproductive investment affects UV-blue cap coloration and that both yellow carotenoid based breast coloration and UV-blue cap coloration are linked to female reproductive characteristics (fecundity and maternal effects). Combined together, these results suggest that plumage coloration has the potential to evolve under sexual selection in female blue tits.

## FORAGING STRATEGIES / PARASITISM

### Leafminer insects trigger the host plant physiology through an unexpected association with endosymbiotic bacteria

David GIRON, Wilfried KAISER, Elisabeth HUGUET, Arnaud LANOUE, Jérôme CASAS  
Institut de Recherche sur la Biologie de l'Insecte (IRBI), University François Rabelais of Tours, France



Gall-inducer arthropods are usually distinguished from other insect-generated shelters by the fact that they involve active differentiation of highly nutritive tissues. However, plant manipulation appears not to be restricted to gall-inducers only, as shown by the autumnal formation of 'green-islands' around mining caterpillars. This study aims at understanding the underlying mechanisms of the host-plant physiological manipulation and their fitness consequences for the insect. Our results on the *Malus domestica/Phyllonorycter blancardella* plant-leaf mining system show: (i) The ability of this leaf-miner caterpillar to manipulate its host plant in order to generate a microenvironment with all the nutrient supply (overall sugars and proteins) needed for its survival. (ii) A decrease in plant defence compounds within the mined area (flavonoids in particular). (iii) A large accumulation of cytokinins in the mined tissues which is responsible for the preservation of functional nutrient-rich green tissues at a time when leaves are otherwise turning yellow. (iv) The primary role played by endosymbiotic bacteria (*Wolbachia*) in the synthesis of these cytokinins and in the induction of nutrient-rich tissues. Indeed, our most recent results revealed that leafminer insects trigger green-island induction through an unexpected association with endosymbiotic bacteria. All individuals analyzed so far are closely associated with *Wolbachia* and a key enzyme of the cytokinin biosynthetic pathway (ipt: isopentenyl transferase) has been isolated, cloned and sequenced from the *Wolbachia* genome (tRNA-ipt Wo). This key enzyme is clearly expressed in *Wolbachia*-infected insects. A recent manipulative study allowed us to show that insects cured of endosymbionts are not able to influence, to their own advantage, the host plant physiology (green-islands are no longer induced) showing the pivotal role played by endosymbionts in the host plant manipulation. All together, these results clearly show the ability of leaf-miner insects to manipulate their host plant physiology and to create an "optimal" nutritional micro-environment through cytokinin production by their endosymbiotic partners. *Wolbachia* is suspected to play an essential role which, if this is the case, will be the first evidence of a *Wolbachia*-mediated effect on plant physiology.



## Foraging and parasitism in fig wasps: new insights on interactions between individuals and species

**James M. COOK**

School of Biological Sciences, University of Reading, UK.



Foraging for resources is a common and important aspect of animal behaviour. It has been studied particularly in the context of birds foraging for food and parasitic insects foraging for hosts. I will present the results of two recent projects involving fig wasps that extend classic foraging studies in different ways. The first is a novel approach to understanding the symbiosis between fig trees and their pollinating wasps by viewing this as an optimal foraging problem. The second involves the use of molecular markers to study patterns of reproduction in fig wasp parasitoids under field conditions.

Figs and fig-pollinating wasps form an obligate coevolved mutualism. However, this involves evolutionary conflict, because each flower can give rise to either a pollinator offspring or a seed, but not both. Since pollinators are selected to maximise their own reproductive success, figs must find ways to prevent wasps from eating all their seeds. Existing theories do not provide a general explanation for this problem, so we developed a new approach, considering egg-laying as a foraging problem for wasps. Flowers are arranged in layers inside syconia and foraging theory predicts that entering female wasps should specialise on the “best” flowers if flower heterogeneity has major consequences for the fitness of their offspring. We found that selection to avoid parasitoid attack creates such heterogeneity. Parasitism risk decreases dramatically towards the centre of the syconium, because parasitoids lay eggs through the fig wall and cannot reach the inner flowers, which provide enemy-free space for pollinator offspring. This can explain the widely documented segregation of pollinator galls in inner, and seeds in outer, flowers and can contribute to mutualism stability.

The parasitoids mentioned above provide interesting study opportunities themselves. In particular, we can compare their foraging and reproductive patterns with those of fig-pollinating wasps inhabiting the same patchy environment. We studied *Sycoscapter* parasitoids and detected cryptic genetic species that we have not been able to distinguish morphologically. Subsequently, we found that all three species show similar patterns of reproduction to each other, but differ dramatically from fig-pollinating wasps in some respects. The number of *Sycoscapter* females contributing eggs to a patch is low (1-4) and mating is local within the patch, which should select for strongly female biased sex ratios (as observed in pollinators). However, each wasp lays only 1-3 eggs per patch and this limits the ability to adjust sex ratios in response to foundress number. These parasitoids appear to spread their foraging efforts across many patches and different factors may contribute to this. First, they face high risk of predation by ants while laying eggs. Second, the male wasps engage in fatal fights for access to mates and mothers may be selected to only lay one male per patch to keep brothers apart!

## HABITAT SELECTION / DISPERSION

### Ecophysiological data: links that bond organisms to their habitat

**Xavier BONNET**

CEBC, centre d'étude biologique de Chizé, France



I'm going to focus my talk on very practical aspects.

As far as habitat selection is concerned, I will present the interest of ecophysiological data, especially in the understanding of the narrow links that bond organisms to their habitat. From there, I will describe the interest of intensive population follow-up, in order to extract dispersion data.

Marine snakes will be the thread of my lecture, but I may add data from other species.

My works focus on the interface between physiology, ecology and evolution. The study of acquisition strategies and resources allocation for reproduction represents a major part of my work, as well as the study of phenotypic plasticity. I found in reptiles some specificities and advantages for the study of particular evolutionary processes. For instance, these organisms present extended variation ranges of life history traits (variable adult body size, oviparity-viviparity). Since 2006 my researches have strongly evolved towards conservation problematic. These research programs are developing over three distinct axes. First of all, in New Caledonia, where I use the researches that I have set up on marine reptiles to improve the protection of islands and species, as well as biodiversity follow-up techniques. The second one is education to environment and, finally, the improvement of forestry management techniques.

My researches are strongly based on an in-depth field work. I spend two to three months per year to do fieldwork. For practical purposes, work is split between population follow-up on the long run and laboratory experimentations. We have at our disposal large capture-mark-recapture field databases, essential to understand how natural selection acts on individuals. From field studies, it is possible to conceive in-lab experiments. That is the reason why our studies also rely on our experimental devices. For example, we acquired eight climatic chambers that allow us to simulate environmental changes effects on organisms. Broadly speaking, it is quite easy to manipulate environmental conditions (climate, food?) in the lab, and then observe the consequences on growth, reproduction and survival: information that are essential in the study biological evolution processes and in order to interpret the effects of global changes.

## The ecology and evolution of individual variation in dispersal strategies

**Jean-François LE GALLIARD**<sup>1</sup>, Julien Cote<sup>2</sup> & Jean Clobert<sup>3</sup>

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<sup>1</sup>CNRS/ENS UMS 3194, CEREEP – Ecotron IleDeFrance, École Normale Supérieure, 78 rue du Château, 77140 St-Pierre-lès-Nemours

<sup>2</sup> Department of Environmental Science and Policy, University of California, Davis, CA 95616, USA

<sup>3</sup> Station d'Ecologie Expérimentale du CNRS à Moulis, USR 2936, Moulis, 09200 Saint-Girons, France



During the last decade, our knowledge of animal dispersal has been greatly advanced by studies that investigated the behavioral and ontogenic processes underlying dispersal patterns. In this talk, I will discuss three major conclusions of these recent findings: (1) behavioral flexibility in dispersal tactics enables to cope with a various selective pressures resulting from spatial and temporal heterogeneity at small spatial scales; (2) dispersal status often covaries with a suite of behavioral and morphological attributes, resulting in dispersal syndromes; and (3) condition-dependent dispersal is quite ubiquitous and can result in complex relationships between environmental variability, individual quality and habitat fragmentation. I will mainly review evidences for condition-dependence in natal dispersal behaviour from Arvicolinae rodents (voles, lemmings, muskrats) and from our own experiments with common lizards (*Lacerta vivipara*).

## GROUP BEHAVIOR / INDIVIDUAL INTERACTIONS

### Interaction between individuals: from cooperation to cheating

**Alain LENOIR**

Institut de Recherche sur la Biologie de l'Insecte (IRBI), University François Rabelais of Tours, France



Evolution has favoured many interactions between individuals of the same species and between species. The degree of interaction varies from simple parasitism to cooperation (mutualism). The persistence of cooperation is an evolutionary paradox as selection should favour those individuals that exploit their partners (cheating) obtaining benefits without providing a reward in return, resulting in the breakdown of cooperation. To prevent this, mechanisms avoid or retaliate against exploitation by cheaters, maintaining the stability of mutualisms. I will present some examples mainly in ants and micro-organisms.

Interspecific cooperation is well-known in vertebrates, for examples in cleaner reef fishes. Some cleaner will try to feed directly on the client mucus instead of parasites but various strategies will limit the spread of cheating behaviour.

Cleaning behaviour has been discovered in ants where a small species licks the bigger harvester ant in Arizona desert. The harvester ant adopts a cleaning

posture. We suppose that the benefit of the client is prophylactic. We studied myrmecophile beetles, which enter the nest of the host ants using chemical mimicry. They are tolerated as they have the host colony odour. Are they simple guests? We observed that they spend considerable time licking the ants and the larvae. This may be also an example of cleaning behaviour.

Fungus-growing ants are also a good model for studies in mutualism. 45 million years ago, they have domesticated a fungus used to feed their larvae. There is a parasite fungus which can destroy very efficiently the garden and kill the colony. The ants defend as they have bacteria on their cuticle providing an efficiency antifungal. The symbiosis is much more complicated as yeasts and many other bacteria have been recently discovered; their role being unknown at present.

Micro-organisms are a superb model for evolutionary studies due to their rapid reproduction (in bacteria one generation every 30 minutes). The social amoebae *Dictyostelium discoideum* have been studied using the kin selection theory of social insects. They are clonal organisms that aggregate in multicellular slimes when environmental conditions are not good. They form a fruiting body where cells from the stalk (25% of the cells) die by apoptosis (programmed cell death) while the other ones become a spore. When two strains are mixed to form the fruiting body, some behave as selfish cheaters: they prefer to take the good place to become spores. These cheaters cannot invade the population as they need the presence of altruists (demonstrated by game theory).

Our last example will be on bacteria. The pyocyanic bacillus *Pseudomonas aeruginosa* is a dangerous pathogen for mammals (nosocomial infections in humans). When injected to mice they kill them in a few days. They produce and excrete siderophores (molecules fixing iron, here a pyoverdine), available for the secretory cell but also for neighbours. It represents a cost for the producer which is altruistic. Cheater mutants do not produce siderophores, but profit of those produced by neighbours. Here again mutants cannot invade the population. A great discover was that mice mortality is lower when a mixture of secretors and cheaters was injected. May be in a few years we will treat infections by injection of cheating strains?

## **Inclusive heritability: Behaviour as a major vector of information inheritance**

**Etienne DANCHIN,**

Evolution & Diversité Biologique (EDB), University Paul Sabatier of Toulouse, France.



Evolutionary ecologists acknowledge that many behaviors are adaptations produced by selection. However, most of us do not yet perceive behavior as a major vector of inheritance, and thus of evolution. For instance, behavioral biologists often seek genetic causes of behavioral variance, while overlooking the potential role of environmental inheritance. Genetic information rather, should be viewed as producing the plastic template on which behavior can develop and thus vary according to the multiple forms of information obtained during development. In particular, once the genetic template leading to social learning has evolved, inherited social information that we define as culture may become susceptible to evolution. Behavior, and social learning in particular, is thus at the origin of another, non-genetic, system of inheritance.

More generally, recent developments in various branches of biology, from epigenetics to behavioural ecology, are causing such a major rethinking of the underlying principles of biological change that biology may be viewed as undergoing something akin to a revolution. In particular, these changes lead to the development of an inclusive conception of inheritance that incorporates all the dimensions of heritability, be genetic or non-genetic. I will discuss the notion of heritability in relation to natural selection and show how non-genetic inheritance constitutes one of the major challenges of current evolutionary biology. I will focus on one domain of non-genetic inheritance, namely social (or cultural) inheritance of behaviour. Cultural inheritance is the direct product of social learning and constitutes one of the most fascinating consequences of group living.

## NEURO-ETHOLOGY / ECOPHYSIOLOGY

### **In the heat of the night: how to feed on blood without perish in the attempt**

**Claudio LAZZARI**

Institut de Recherche sur la Biologie de l’Insecte (IRBI), University François Rabelais of Tours, France



The blood of vertebrates constitutes a highly nutritive element which is, except for the eventual presence of parasites, otherwise sterile. Thus, many arthropod species have developed the ability to adopt it as main or even exclusive food. Feeding on blood, however, requires solving major problems such as how to obtain it from inside vessels hidden under the skin of mobile hosts, avoiding at the same time to be killed. Blood-sucking insects should be able to locate their hosts in space, to approach them at the right moment, to locate a blood vessel to bite, to feed on their blood without being detected, to handle a massive food and to avoid the contact with a host when it is not strictly necessary. We will discuss the particular sensory, behavioural, morphological and physiological adaptations, necessary for feeding on the blood of warm-blooded vertebrates, as well as how the comprehension of the constraints

associated to haematophagy could help us for developing novel tools for the control of disease vectors.

## What can the canary tell us about the brain represents communication sounds?

**Catherine DEL NEGRO**

Centre de neurosciences de Paris-Sud, UMR CNRS 8195, Université Paris-Sud, Orsay.



Songbirds are a particularly attractive model for studying how the brain represents communication sounds. They use song and other vocalizations for numerous communication tasks. They can discriminate the songs of neighbours from those of strangers, songs of relative from those of non-relatives and mates from non-mates. Also, like speech, song is a learned behaviour that depends on auditory experience. Auditory-vocal interactions are likely to be important to vocal learning.

Song behaviour is controlled by a network of interconnected brain areas, the song nuclei. Among them, the telencephalic nucleus HVC (used as a proper name) is essential for producing learned song. Beyond their role in singing, many HVC neurons show highly selective auditory responses, firing more to playback of the bird's own song (BOS) than to reverse BOS or conspecific songs. Moreover, this selective tuning to the BOS develops in parallel with the bird's own motor production. However, this song-selectivity has been mostly studied in one songbird species, the zebra finch.

In songbirds, there is extensive diversity among songbird species in different aspects of song behaviour including the seasonality of song behaviour. In species that breeds seasonally, such as the canary, dramatic seasonal morphological changes occur within the HVC in parallel with changes in song structure. We reported that seasonal factors also modified the functional properties of HVC neurons (Del Negro et al, 2005). Outside the breeding season, when songs are less stereotyped, the degree of selectivity for the BOS was reduced indicating that, in canary, the song selectivity is not a fixed property. This also suggests that the tuning of HVC neurons is not continuously adapted to the current BOS, as observed during song development.

In breeding canaries, the selectivity of HVC neurons for the BOS over conspecific songs led us to suppose that songs convey information about the individual identity of the bird. Extensive analyses of the complex canary song structure thus revealed that only 16% of a repertoire of 20-30 song components (called phrases) of a given bird consisted in strictly individual specific phrases (Lehongre et al, 2008; 2009). In contrast, most sequences of, at least, two phrases within any song were sung by only one individual suggesting that delivery order of phrases provide potential cues for individual identity encoding (Lehongre et al, 2008). At the light of these results, we examined whether manipulating the delivery order of phrases of the BOS affected auditory responsiveness of HVC neurons. All neurons in the canary HVC were found to be sensitive to the temporal order of phrases within the song stimulus. Therefore, the neural strategy by which the autogenous song is represented in the canary HVC may require something other than a discrete representation of the repertoire of song components as in species that sing a single song, such as the zebra finch (Lehongre and Del Negro, 2009).

Our studies present evidence for interspecies differences in functional properties of HVC neurons. Exploiting the diversity in song behaviour between songbird species may therefore provide insights into the neural strategies used to code communication sounds.

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# EVOLUTIONARY BIOLOGY / CONSERVATION / APPLIED RESEARCH

## Symbiotic associations in insects: from parasitism to mutualism

**Franck DEDEINE**

Institut de Recherche sur la Biologie de l'Insecte (IRBI), University François Rabelais of Tours, France



Symbiotic associations are of major importance as drivers of ecological function and evolutionary processes. However, how do symbioses stabilize and persist in the course of evolution remains a challenging question. Symbiotic associations form a continuum ranging from parasitism to mutualism with respect to the outcome of the association (i.e., the cost or benefit for the host), and can be either facultative or obligate for the host. It is usually assumed that parasitic or mutualistic symbionts interact in fundamentally different ways with their host. However, many bacterial symbionts can exist either as a mutualist or as a parasite, depending on their host. In addition, recent studies revealed that the same molecular mechanisms are used by both parasitic and mutualistic symbionts to interact with their host.

During my talk, I will present aspects concerning the evolution of symbiotic associations in insects. I will then review several studies on a particular case study in the wasp *Asobara tabida*, in which an intracellular parasitic bacterium (genus *Wolbachia*) has become obligatory for host reproduction.



## Distribution of biological diversity

### David ORME

RCUK Research Fellow, Division of Biology, Imperial College London



My research aims are to understand some of the general features that underlie the distribution of biological diversity. This has included using phylogenetic methods to look at explanations of unequal distributions of species richness among clades and using spatial data to look at the global distribution of species. This macroecological work has looked at both the distribution of diversity, and the ways in which that distribution differs between major groups, and the spatial distribution of species characteristics, such as range size and body mass.

## Abstracts



[www.phdcomics.com](http://www.phdcomics.com)

## Talks

## Session 1

# SEXUAL SELECTION



## Partial local mate competition in a parasitic wasp

Parasitoids are organisms which develop inside or outside their host, and eventually kills it. As hosts (i.e. insects larvae or eggs) are often aggregated in patches, populations are usually structured. Parasitic wasps with structured populations are generally assumed to follow the local mate competition (LMC) model: females lay only the minimal number of sons necessary to inseminate all daughters in the emergence patch. After emergence, daughters mate with local males before dispersing for host location and oviposition. The main predictions from the model have been verified for many species. However, conflicting evidences exist on the status of the egg parasitoids *Trichogramma* regarding their on-patch versus off-patch mating. Although the life history traits of several species indicate that mating must occur on the emergence patch, recent data suggest that mating could occur outside the natal patch. In this study, we measured the level of off-patch mating in the egg parasitoid *Trichogramma euproctidis* using two isofemale lines in a greenhouse experiment. The impact of the sex ratio on the level of off-patch mating was also tested. The overall off-patch mating proportion was 40.5% with a range between 0 to 85.7%, and was influenced by the sex ratio on the emergence patch: the more males available at emergence, the less off-patch mating occurring. The mating structure of this species can be described as partial local mate competition.

Keywords: Dispersal, local mate competition, sex allocation, greenhouse, insects, parasitoid, *Trichogramma euproctidis*



*Trichogramma euproctidis*



**Véronique MARTEL**<sup>1</sup>, Josée DOYON<sup>2</sup> and Guy BOIVIN<sup>2</sup>

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## Protandry in the leafhopper *Scaphoideus titanus*: sexual or natural selection?

In many animal species, a time-lag occurs between the two reproductive genders occurrence in breeding sites, called protandry. Since Darwin, protandry in insects is often explained as a trait sexually selected that favors mating of early emerging males. But, some authors have however defended that the maintenance of protandry could be due to natural selection.

*Scaphoideus titanus* (Homoptera: Cicadellidae) is an invasive species native to the Great Lakes region and was reported for the first time in Europe in South Western France in 1958. Now, *S. titanus* is spreading in Europe from ca. 35 to 50 ° N and thermal conditions are supposed to explain this distribution. We hypothesized that the lack of cold temperatures during winter incubation could explain to the South limit of the distribution area by disturbing the embryonic development that produce lower fitness offspring and affect the degree of protandry.

To examine this, we tested how cold exposure during egg incubation makes male and female eggs hatching dynamics varying by exposing a wild population of eggs either to a warm or a cold 3 months simulated winter.

The sex-ratio dynamic of hatchings was affected by the incubation temperature and the difference observed between the two treatments is only due to the hatching pattern of females. Thus, eggs incubation temperatures and its effect on protandry could be an explanation to the weak colonization of Southern vineyards in Europe but the question by which mechanism this external factor affect only one sex has still to be solved.

Keywords: leafhopper, diapause, protandry, sexual selection, natural selection



The leafhopper *Scaphoideus titanus*

**Julien CHUCHE** and Denis Thiéry

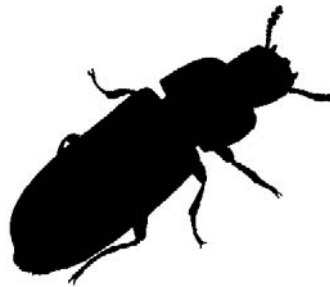
INRA, UMR 1065, Villenave d'Ornon, France



## Environmental temperature alters the costs and benefits of polyandry in female red flour beetles

The evolutionary interests of males and females are rarely identical potentially causing conflict. Sexual conflict may occur over various components of reproduction from mating rates to parental care. Multiple mating may be beneficial but also costly, and these costs are not incurred equally by the sexes. It is likely that males profit more from mating multiply, whereas females bear more severe costs. Such costs may stem from various sources and include damage leading to reduced longevity. Flour beetles are highly promiscuous and used extensively to study sexual selection. Using *Tribolium castaneum* as our model system we are investigating fitness costs of polyandry to females in detail. Here we assess fitness (longevity and reproductive success) of single females, which have had the opportunity to mate with no, one, six or twelve males. It is becoming increasingly clear that environmental factors may profoundly shape the cost-benefit balance of mating. It is thus critical to investigate consequences of mating rates across a range of environments. We therefore performed our study at different temperatures, allowing us to assess the nature of costs and benefits when females additionally suffer from temperature stress. We show that under standard temperature conditions females gain no fecundity benefits from polyandry, but that under stressful conditions females have more offspring when mated with multiple males. In addition, polyandry is costly for females via reducing longevity. These findings suggest that females bear fitness costs due to sexual conflict, but that associated benefits may change depending on the environment.

Keywords: sexual conflict stress polyandry *Tribolium castaneum*



*Tribolium castaneum*



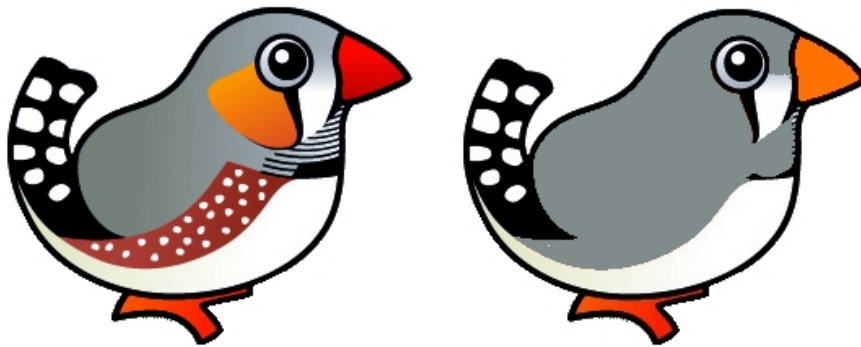
**Vera M. GRÄZER<sup>1</sup>** and Oliver Y. Martin<sup>1</sup>

<sup>1</sup>*ETH Zurich/Experimental Ecology*

## Does immunisation of the male affect song production and female choice in the zebra finch?

As stated by the immunocompetence handicap hypothesis, secondary sexual traits are traded-off with the immune function and hence elaborate sexual displays should be produced only by high-quality individuals. In birds, it can therefore be expected that immune capacity is traded-off with song. We tested this hypothesis on male zebra finches, predicting that challenging the immune system of a male will cause its song to deteriorate. The birds were immunised with a non-pathogenic antigen, sheep red blood cells. Their songs were recorded before and 8 days after immunisation, at the expected peak of antibody response. We found that latency to sing was longer in the immune-challenged birds, revealing decreased motivation to sing. However, song rate, phrase duration, song duration and total singing time were unaffected by the treatment. This indicates that in the zebra finch there is only weak support for the trade-off between immunity and the song output parameters which we studied. We also found that phrase duration predicted the strength of immune response, and hence this trait can be an index of male quality. In a follow-up experiment, in order to check whether immunisation of males might affect their fitness through altered female choice, we investigated whether females preferred songs of non-immunised males over songs of immunised males.

Keywords: zebra finch, song, immunocompetence handicap, SRBC, mate choice



Male and female zebra finches (from [www.birdorable.com](http://www.birdorable.com))

**Justyna KUBACKA**, Joanna Rutkowska and Mariusz Cichoń

*Institute of Environmental Sciences, Jagiellonian University*



## Individual and sex odour signatures in kittiwakes

Black-legged kittiwakes *Rissa tridactyla* preferentially mate with genetically dissimilar individuals but the cues used to assess genetic characteristics remains unknown. In other vertebrates, olfactory cues have been identified as implicated in the advertisement of genetic compatibility. We thus hypothesized that kittiwake body odours may carry individual and sexual signatures thus reliably signalling individuals' genetic makeup. Here, we test whether odours in preen secretion and feathers of kittiwakes may provide an individual signature, by the use of gas chromatography-flame ionization detector and mass spectrometry. We first found that male and female odours differ quantitatively, suggesting that scent may be one of the multiple cues used by birds to discriminate between sexes. We further detected an individual signature in the volatile and non-volatile fractions of preen secretion and feathers. These results suggest that kittiwake body odours may broadcast the genetic makeup of individuals and might be used to assess the genetic compatibility between potential mates in mate choice.

Keywords: individual signature, kittiwake, mate choice, odour, preen gland, uropygial secretion



Black-legged kittiwakes *Rissa tridactyla*



**Sarah LECLAIRE<sup>1</sup>**, Thomas MERKLING<sup>1</sup>, Christine RAYNAUD<sup>2</sup>, Scott A. HATCH<sup>3</sup> and Etienne DANCHIN<sup>1</sup>

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## Influence of environmental factors on the reproductive decision in female edible dormice (*Glis glis*)

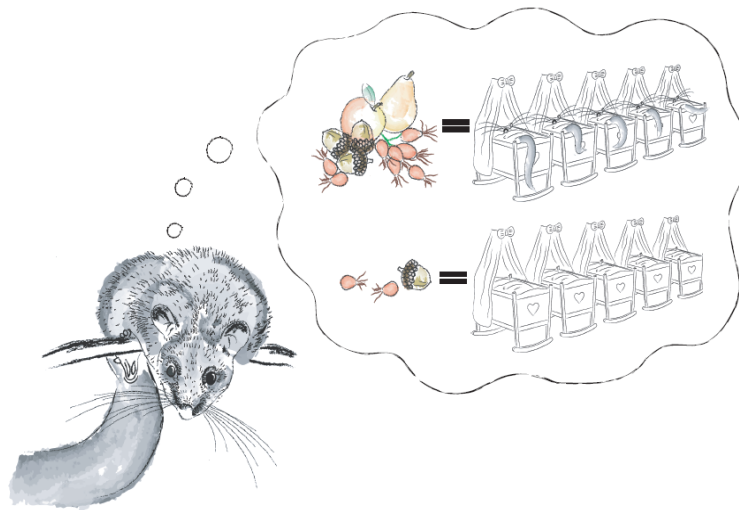
The edible dormouse is a specialized seed forager which is highly adapted to pulsed resource availability caused by the mast seeding of trees. Most dormice reproduce in full masting years, only parts of the population reproduce in intermediate years, and whole populations skip reproduction in years without seed production. The decision to reproduce in any particular year is made long before the ripe seeds are available. It therefore seems that dormice can anticipate the upcoming mast situation.

We conducted a field study to identify the factors affecting the individual reproductive decision in any particular year. Further, we used a supplemental feeding experiment to test the hypothesis that dormice use high energy rich food resources in spring as a cue for the autumnal mast situation.

Our study revealed that in intermediate masting years more adult than yearling females reproduced. Further, the age of the forest in their home range positively influenced the reproductive decision as older trees can produce more seeds. In a low masting year, reproduction was also influenced by the proportion of beech trees. Litter size was affected by different masting situations and increased with forest age.

The supplemental feeding in spring increased the proportion of reproductively active individuals. This implies that dormice use the presence of an energy rich food resource to predict the autumnal mast situation. Importantly, their decision to reproduce is not the result of an increased body mass due to this high energetic food, they rather use the availability of energy rich seeds as a cue.

Keywords: Environmental signals · Food availability · *Glis glis* · Reproduction · Pulsed resources · Supplemental feeding



The decision of the female edible dormice (*Glis glis*)

**Karin LEBL**, Klaus KÜRBISCH, Birgit ROTTER, Claudia BIEBER and  
Thomas RUF

University of Veterinary Medicine Vienna / Research Institute of Wildlife  
Ecology





## Session 2

# FORAGING STRATEGIES / PARASITISM



## Parasitoids assess prior patch quality from local cues and habitat

When hosts are patchily distributed in the environment, parasitoids have to optimize their residence time in each patch they visit, to maximize their fitness: The more eggs female parasitoids lay in hosts, the more offspring they will obtain. The Marginal Value Theorem of Charnov (1979) identifies the optimal residence time according to the patch quality and to the overall quality of the habitat. The optimal rule proposed by Charnov implies that parasitoids are able to assess the current patch quality relatively to patches previously visited. In the literature, conflicting evidences exist about the ability of parasitoids to assess the relative quality of a patch depending on the previous experience. We performed an experiment that clearly demonstrates that the braconid *Asobara tabida*, a parasitoid of *Drosophila* larvae, use cues both from the current patch and from the habitat in its prior patch quality estimate. This prior estimate strongly modulates the incremental effect of an oviposition, thus influencing the patch leaving decision. Our findings are consistent with optimal prediction of the MVT. This ability to estimate patch quality could be linked to the ecological features *Asobara tabida* experienced under natural conditions.

Keywords: Optimal foraging, assessment, relative patch quality, decision-making, parasitoid.



The parasitoid wasp *Asobara tabida* stinging a *Drosophila* larva.



**Philippe LOUAPRE**, Jacques Van ALPHEN, Joan Van BAAREN and Jean-Sébastien PIERRE

*University of Rennes 1 – UMR CNRS 6553 “Ecology, Biodiversity, Evolution”*

## Oviposition strategies of *Anisopteromalus calandrae* female's under intraspecific competition

In solitary parasitoids, only one individual can emerge per host, supernumerary individuals are eliminated during the larval competition. In these species, superparasitism is generally disadvantageous. We have studied the oviposition strategies of solitary ectoparasitoid, *Anisopteromalus calandrae*, under intraspecific competition. We examined the response of females to *Callosobruchus maculatus* hosts parasitized either by the female herself or by conspecific in presence or in lack of unparasitized hosts on the area and varying time intervals between successive egg-laying phases. We first analyzed the movement of females as soon as they begin exploiting a patch of hosts of different quality. We then studied the female's egg laying under the same conditions. The results showed that the females of *A. calandrae* are able to discriminate between healthy hosts and parasitized hosts by themselves at different interval of time ( $P < 0,05$ ) or by conspecific ( $P < 0,05$ ). In spite of the host parasitized since 24H by a conspecific ( $P > 0,05$ ). Female of *A. calandrae* placed in a complex environment (host parasitized and healthy hosts) will first move and parasitize healthy hosts and then parasitized hosts. Our study also showed that females of *A. Calandrae* lay much egg on hosts parasitized by conspecifics than those parasitized by them.

Key-words: intraspecific competition, discrimination, superparasitism. *Anisopteromalus calandrae*, *Callosobruchus maculatus*

**Ouarda BENKHELLAT**<sup>1</sup> Aissa Moali<sup>1</sup> & Jean Paul Monge<sup>2</sup>

<sup>1</sup>Laboratoire d'Ecologie et Environnement, Université de Béjaia, Bejaia, Algérie.  
<sup>2</sup>IRBI, institut de la recherche de la biologie des insectes, Université de Tours, France.



## A pitcher full of secrets: a symbiotic ant helps its carnivorous plant to catch its prey

*Camponotus schmitzi* is the sole plant-ant to be associated with a carnivorous plant. It lives specifically in the tendrils of *Nepenthes bicalcarata*, a climbing plant from Borneo bearing pitcher traps that capture and digest arthropod prey. The nature of this intriguing ant-plant association was not clearly elucidated. The ant has first been described as unaggressive and suggested to benefit its host plant by preventing pitcher putrefaction through the selective removal of large dead prey items. It was then shown to provide anti-herbivory protection against a specific weevil. We thus tested whether *C. schmitzi* also displays aggressiveness inside mature pitchers and if it hampers or rather favours prey capture in *N. bicalcarata*. We revealed that *C. schmitzi* exhibits a hunting behaviour that had remained cryptic so far. Unlike most specific plant-ants which conspicuously and dissuasively patrol their host-plant, these ants spend most of their time concealed, letting numerous visitors, access the nectar produced by the external parts of the pitcher. They lie in ambush under the pitcher rim until visitors fall into the pitcher. *C. schmitzi* then systematically attack these prey items attempting to escape from the pitcher. We demonstrated that pitchers occupied by *C. schmitzi* retained more experimentally-dropped ants than *C. schmitzi*-deprived pitchers. We also showed that *C. schmitzi* regularly feeds on prey items inside the pitchers. Therefore the ant helps the plant to catch and maybe also digest its prey. These results suggests that this interaction is a nutritional mutualism, implying the unusual association of carnivory and myrmecotrophy.

Keywords: Ant-plant mutualism, *Camponotus schmitzi*, myrmecophyte, *Nepenthes bicalcarata*, pitcher plant, predation strategy.



*Nepenthes bicalcarata* and *Camponotus schmitzi*



**Vincent BONHOMME**<sup>1</sup>, Isabelle GOUNAND<sup>1</sup>, Emmanuelle JOUSSELIN<sup>2</sup>, Daniel BARTHÉLÉMY<sup>1</sup> and Laurence GAUME<sup>1</sup>

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## Resource polymorphism revisited in Zenaida Doves from Barbados

Resource polymorphism, defined as the occurrence in the same population of different morphs specialised in the exploitation of distinct resources, has mainly been studied in fish but remains scarce in birds. Recently, a study by Sol et al. (2005, *Ecology* 86: 2397-2407) report a case of resource polymorphism in Zenaida Doves (*Zenaida aurita*, Columbidae) in Barbados, primarily driven by competition for territories. There, doves exhibit two foraging tactics, with some birds defending aggressively year-round territories, while others feed in groups at grain-storage sites. We repeated and expanded this study through adding replications in space and time for each foraging tactic, but also molecular tools for sexing birds (sex markers) and analysing genetic differentiation (microsatellite markers). Our results confirm that, irrespective of sex, territorial adults are larger than adults feeding in flocks, whereas the reverse was observed in juveniles. Contrary to previous evidence, we found a significant excess of females among flock-feeding adults, whereas the sex ratio was balanced in territorial adults and in both territorial and flock-feeding juveniles. In addition, body condition did not differ between birds feeding in flocks and birds feeding on territories. Finally, we found no evidence for genetic differentiation between flock-feeders and territorial birds. Overall, we found only weak evidence for resource polymorphism. We suggest alternative, more parsimonious explanations to account for the existence of alternative foraging tactics in Zenaida Doves in Barbados, based on age- and sex-related differences in the benefit of holding a territory.

Keywords: alternative resource use, competition, genetic differentiation, metareplication, morphometrics



Zenaid Doves *Zenaida aurita*

**Karine MONCEAU**, Rémi WATTIER, François-Xavier DECHAUME-MONCHARMONT, Sébastien MOTREUIL and Frank CEZILLY

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## Robbers suffer from disease more often

Non reproductive division of labor is thought to be the key to success of eusocial insects such as wasps, bees, ants and termites. In these insect societies there is a strong relationship between the tasks workers perform and their age or what we suggest, their life expectancy. According to division of labor by division of risk hypothesis the workers with shorter life expectancy (older and/or infected) undertake more risky tasks like foraging than workers with longer life expectancy, which are working inside the nest. In our experiment we wanted to test this hypothesis comparing health of the robbing honeybee (*Apis mellifera*) workers with those collecting pollen or nectar. To measure the workers health we checked the presence and level of infection with *Nosema apis*, a very common microsporidia parasite of bees,. We assumed that the infected workers have a shorter life expectancy and that bee-robbers risk more than foragers collecting pollen or nectar. Therefore, we predicted that infected workers would be willing to risk more in comparison to healthy bees. The results confirmed our expectations. The ratio of diseased robber workers was significantly higher than other foraging workers (G-test;  $p = 0.012$ ). Our results also showed that robber bees have higher level of infection (median  $40.80 \times 10^4$  spores per bee) than other foraging bees (median  $1.69 \times 10^4$  spores per bee; Test U-Mann  $p < 0.0001$ ).

Keywords: *Apis mellifera*, age polyethism, division of labor, division of risk, *Nosema apis*



**Karolina KUSZEWSKA<sup>1</sup>**, Michal WOYCIECHOWSKI<sup>1</sup>

<sup>1</sup> *Institute of Environmental Sciences, Jagiellonian University, Krakow, Poland*



## Session 3

# HABITAT SELECTION / DISPERSION



## Ecology of Grass snakes (*Natrix natrix*): Ongoing study in a rural woodland landscape in Lincoln, UK.

Snakes are successful hitherto on both terrestrial and aquatic habitats. By nature they are highly secretive. In some species, especially Natricines (subfamily of Colubrids to which grass snakes belong) it is a profound behaviour to congregate on wood/leaf piles for basking as they are poikilotherms. Grass snakes are common throughout the UK, rarer in the North and absent in Ireland. This species is currently highly protected due to decline in numbers. It is well known from their biology that they adapt to marshy areas with plenty of outgrowth. In spring 2008 we initiated a survey to keep develop awareness of their presence on the site and since we have observed, captured over 300 individuals of different ages. The landscape we carry out the survey on is rural and well managed woodland for farming, teaching and agriculture. Despite anthropogenic interference grass snakes have adapted exceptionally feeding on amphibians and insects. We aim to deduce how they allocate their time at key sites at different times of the day within a given home-range. Our observations started in March and ended in September as the snakes disperse to hibernate. Dorsal and Ventral head patterns have been photographed, as these scale patterns are unique for a particular individual which will aid in future surveys as we can then ascertain the population size from recapture data.

Key words: Grass snake, Habitat conservation, Home range, Poikilotherms, Dorsal-Ventral scale pattern.

Year	Observed	Captured	Recapture	male	female	Total
2008	116	40	2	10	30	42
2009	186	100	17	39	61	117



Grass snake (*Natrix natrix*)



**Ramakrishnan VASUDEV**, R. Farrow, C. Deeming, S. Ligout, H. Pickard, W. Hayes, I. Bradley, S. Roche, J. Britt and P. Eady

*Department of Biological Sciences, Riseholme Park, University of Lincoln, UK*

## **Interspecific interaction between Red Fox (*Vulpes vulpes*) and Common Buzzard (*Buteo buteo*): food, niche breath and niche overlapping**

Red Fox (*Vulpes vulpes*) and Common Buzzard (*Buteo buteo*) feeding ecology and their interspecific trophic relationship were investigated in west Poland. The aims of this study were: (1) to evaluate the importance of different prey categories in diets of predators, compare the food composition, niche breadth and food niche overlap, (2) to answer the question whether Red Fox is relevant to Common Buzzard presence (another way too). We obtained for four years the data of predators diet composition, trophic niche breadths and niche overlap. Spatial distribution of Red Fox dens and Common Buzzard nests were also measured. Common Vole abundance in and outside predators territories were counted. The data for food-composition of Common buzzard were obtained from 544 pellet and remains of prey. The diet of foxes was examined by analyzing 1022 scats and remains of prey. Results revealed that buzzards consumed more small mammals (frequency of consumed biomass by Common Buzzard 79.5 %, by Red Fox 26.1%). In Red Fox diet also great participation had birds (24.8%) and carcass (26%). The trophic niche breadth of Common Buzzard was narrower (2.733) than Red Fox (3.875) and was significant different in four years. The overlap of diet between predators was quite high (62.1%). Spatial analysis showed that Red Fox dens were founded significant often near common buzzard nests (95.4%) than other raptors nests (30.9%). Distances between Common Buzzard nests and Red Fox dens were significant shorter than distances between random created nests and random created dens. In sites where Common Buzzard and Red Fox were present the abundance of voles was higher than in sites where this two predators were not recorded. This finding provide information on the interspecific relationship between this two predators and habitat selection.

Keywords: predator, prey, niche breath, niche overlapping, *Vulpes vulpes*, *Buteo buteo*

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## Explorers are more mobile and more flexible: first evidence of a highly conservative personality trait related with dispersal performances in an insect

Dispersal behaviors are highly variable among individuals of a same species. Such variations can be explained by environmental differences (condition-dependent dispersal), individual-state differences (phenotype-dependent dispersal) or interactions between environment and phenotype. Phenotypic-dependent dispersal has only recently been acknowledged, highlighting the fact that dispersers are not a random sample of populations. Indeed, phenotype constrains both the ability of an individual to disperse, but also the ability to adapt its behavior to new environmental conditions. In this context, behavioral traits implying dispersal related behaviors are still poorly studied. Using measurements in semi-natural and laboratory conditions of exploratory behavior and flight performance of the butterfly *Pieris brassicae*, which are both known to highly influence dispersal, we aimed at (1) testing for the first time the existence of behavioral types related to dispersal in a butterfly, the most studied group for dispersal, in which no personality trait has yet been shown, (2) investigating differences in behavioral flexibility between residents and dispersers, which is expected to be a major determinant of colonization and dispersal success in animals. We found exploratory behavior to be highly variable among individuals and highly consistent across time and situations within individuals. We thus highlighted the existence of a dispersal related personality trait within this species. We also found that residents were less flexible than dispersers in their behavior. Our study testifies of the importance of taking phenotype dependence into account into population dynamic models.

Keywords: dispersal, *Pieris brassicae*, behavior repeatability, temperament, behavioral syndrome, phenotype dependence, phenotypic accommodation



The butterfly *Pieris brassicae*



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## No silver spoon effect on natal dispersal behaviour in a small rodent

In heterogeneous and patchy landscapes, all individuals benefit from settling in high quality habitats. However, individuals born under favourable conditions may have higher condition traits (“silver spoon” effect), which make them more successful in their dispersal attempts than those born under poor conditions. To test this hypothesis, we studied root voles (*Microtus oeconomus*) in experimental model systems. We manipulated (i) postnatal conditions by enlarging and reducing litter sizes during lactation and (ii) the quality of their habitats by manipulating the vegetation cover in different patches (0%, 25% and 75% degraded). We analysed the effects of these two factors on morphological and life-history traits, and tested whether individual condition influenced dispersal behaviour. Our results indicated that silver spoon effects did not influence dispersal and habitat selection. We found, however, that our condition treatment had a long-lasting effect on several traits, particularly on body size. Moreover, individuals prospected their environment to a great extent, with females moving in accordance with habitat quality. Competition for establishment in high quality habitats was strong, and it appeared that adult size influenced settlement success, leading to an ideal despotic distribution. The results emphasized the need of other experimental approaches to understand mechanisms involved in natal dispersal and habitat selection.

Keywords: natal dispersal, habitat quality, habitat choice, delayed life-history effects, life-history trade-off.



Root voles *Microtus oeconomus*

**Alice RÉMY**<sup>1</sup>, Jean-François LE GALLIARD<sup>2</sup>, Gry GUNDERSEN<sup>3</sup>, Harald STEEN<sup>4</sup> and Harry P. ANDREASSEN<sup>1</sup>

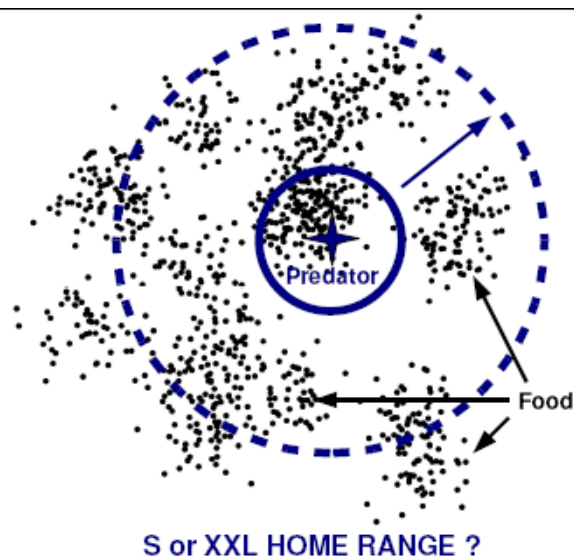
<sup>1</sup> Faculty of Forestry and Wildlife Management, Hedmark University College, Norway; <sup>2</sup> CNRS – UMR 7625, Laboratoire Ecologie-Evolution, Université Pierre et Marie Curie, Paris, France; <sup>3</sup> Centre for Ecological and Evolutionary Synthesis, University of Oslo, Norway; <sup>4</sup> Norsk Polarinstitutt, Seabird ecology and management, Norway.



## How do resources characteristics shape home range size?

Populations of the same consumer species can exhibit large differences in home range size (Herfindal et al., 2005), because of differences in resource traits such as productivity or mobility. However, the theory relating consumer home range size to resource behavioural traits is still under-developed (e.g., in contrast to optimal territory size theory, Schoener, 1983). Here, using a spatially explicit, individual-based predator-prey model (IBM), we vary non-spatial resource traits such as productivity, as well as spatial scales of competition and dispersal, generating various spatial patterns in the consumer and resource. To model the consumer-resource community dynamics, we transform these IBMs into convenient deterministic approximations, that efficiently describe the expected spatial structure. These models are then embedded into a game-theoretic framework to find evolutionarily stable home range sizes. We show that the evolutionary outcomes critically depend on the fine-scale spatial segregation between the consumer and its resource, and recover some of the results of optimal territory theory, such as the decrease of home range size with increasing resource density and productivity. However, we found no prey spatial aggregation effect, in striking contrast to earlier findings with models inspired by carnivorous mammals (e.g., Johnson et al., 2002). We then summarize our results, compared to that of other models, to provide some insight on the ecological drivers of home range size.

Keywords: home range, spatial ecology, foraging, adaptive dynamics



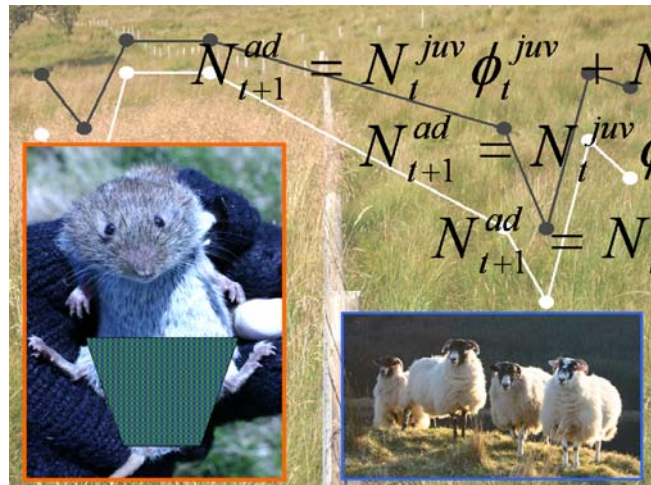
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<sup>1</sup> Centre d'Etudes Biologiques de Chizé, CNRS - <sup>2</sup> University College London

## Demographic mechanisms for vole population change and stability in response to grazing

Land use can lead to demographic changes with population level consequences, which might cascade across trophic levels. Using a randomised replicated grazing experiment in Glen Finglas (Scotland), we investigated the demographic mechanisms through which livestock grazing impacts on rodent populations in grassland systems, where they play an important role in ecosystem dynamics. Our results show that changes in the demographic rates of our model system, the field vole *Microtus agrestis*, are best understood in the light of a behavioural response to livestock grazing. In particular, results support the role of mobility and dispersal behind a cascading demographic syndrome leading to declines in rodent densities. Regardless, several rates of density dependent reproductive rates and population growth showed remarkable consistency across experimental grazing treatments. Thus, grazing limited vole population densities but did not change density dependent regulation. We discuss these results in the context of the paradigm of population regulation.

Keywords: grazing; voles; population declines; dispersal; density dependence



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## Session 4

# GROUP BEHAVIOR / INDIVIDUAL INTERACTIONS



## Social parasitism in formica ants

Nests of social insects are an attractive resource in terms of nutrition and shelter. Nests are always targeted by a number of parasites, which are sometimes enter the colony unharmed. Colonies of ants *Formica fusca* and *F. lemni* are often parasitized by other *Formica* species (for example *F. truncorum*). Our aim was to investigate how well workers of the hosts species discriminate between con-colonial (and thus con-specific) and parasite eggs. We first used a behavioral assay, allowing workers to choose between two types of eggs simultaneously. Given that ants may pick up eggs and carry it to their nests to destroy them later, we complemented the first experiment by allowing workers to rear eggs in two assays. In the first assay we gave workers eggs of both types mixed in one pile to test whether parasite eggs are preferentially removed during rearing; then we introduced parasite eggs only to test whether this response is conditional on the presence of a preferred alternative. The results show that workers of hosts are able to discriminate between con-colonial eggs and parasite eggs in favour of their own eggs. Nevertheless, some parasite eggs were reared in a considerable number of colonies. In the absence of con-colonial eggs more parasite eggs were reared, so the presence of con-colonial eggs seems to influence workers' behaviour in this respect. There also was significant difference between species; *F. lemni* was more lenient in egg acceptance than *F. fusca*.

Keywords: ant, social, sexual selection, female choice, inbreeding avoidance



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## Raid organisation and division of labour in slave-making ants

The North American slave-making ant *Protomognathus americanus* is an obligate slavemaker, meaning that its colonies completely rely on enslaved host workers for all colony tasks such as foraging and brood care. To satisfy the colony's demand of slaves, some slavemaker workers - the scouts - leave their nest in summer and search for host nests in the vicinity. Successful scouts recruit nestmates and subsequently raid these host nests for slave brood, but they can also attack the nest without assistance.

We performed laboratory experiments to gain insights into processes regulating this complex raiding behaviour. We observed more raids when the slave to slavemaker ratio inside the colony was low, indicating a higher need for slaves. Slavemaker workers could determine the colony's need for additional slaves by their nutritional status, as they are exclusively fed by slaves. An experiment with different feeding regimes revealed that in colonies with a lower food provisioning rate, an increased proportion of slavemaker workers search for host nests. This result supports the hypothesis that reduced food supply leads to increased host nest searching.

Behavioural observations of unmanipulated colonies during raids showed that some workers were invariably involved in raiding activities, whereas others stayed inside the nest. Cuticular hydrocarbon analyses demonstrated differences between active and inactive workers, and subsequent determination of morphology and fertility parameters added to our understanding of division of labour in *P. americanus*.

Keywords: foraging, division of labour, social parasite, slave raids, *Protomognathus americanus*



Slave-making ant *Protomognathus americanus*



**Sebastian POHL** and Susanne FOITZIK

University of Munich, Department of Biology II

## Group size effect in nutmeg mannikin: between-individuals behavioral differences but same plasticity

When group size increases, animals from a wide range of taxa reduce vigilance and increase feeding rate; the so-called group size effect. This effect requires that group members display plastic behavioural responses both in terms of vigilance and foraging to obtain the security benefit from grouping and/or to cope with feeding competition. Most studies on group size effects have reported mean group changes in behaviour. However, individuals' adjustment of behaviour and thus their individual contribution to the overall group-level plasticity remains unexplored. Using wild-caught nutmeg mannikins (*Lonchura punctulata*), small estrildid finches known to exhibit the group size effect, we investigated individual differences in baseline levels and in plasticity of vigilance and feeding behaviour. We experimentally manipulated the number of companions foraging with focal birds and noted how they individually adjusted their vigilance and foraging behaviour when group size varied. We found that individuals differed consistently in their vigilance level and foraging rate, but not in their ability to adjust to experimental variation in group size. Effect sizes for individual consistency in behaviour were as large as those for group-level plasticity. Our results reveal high, albeit not maximal, levels of plasticity in both vigilance and feeding behaviour for all individuals in this social foraging context.

Keywords: group size effect, social foraging, behavioural plasticity, behavioural consistency, nutmeg mannikins, *Lonchura punctulata*.



*Lonchura punctulata*



**Guillaume RIEUCAU**<sup>1,2</sup>, Julie MORAND-FERRON<sup>1</sup> and Luc-Alain GIRALDEAU<sup>1</sup>

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## Effects of personality traits on territorial signalling: A playback experiment with radio-tagged greats tits

In animals, individuals often differ consistently in behavior across time and contexts and such consistent behavioral differences are commonly described as behavioural syndrome or personality. So far, relationship between avian personality and territorial signalling are poorly understood. We investigated whether personality of territorial male great tits (*Parus major*) influences their own and their neighbors' territorial responses towards simulated intruders. As a proxy of personality, we tested the exploratory behaviour of males in a standard context several weeks before the experiment. Using interactive playback, we engaged birds in a vocal interaction with a simulated intruder in their territory. The playback intruder either overlapped or alternated the subjects' songs. Before, during and after the playback we radio-tracked the subject and a neighbour. We will discuss how the behaviour of subjects and their neighbours vary according to male personality.

Keywords: Personality, Territorial signalling, Bird song, Communication networks, Radio-tracking.

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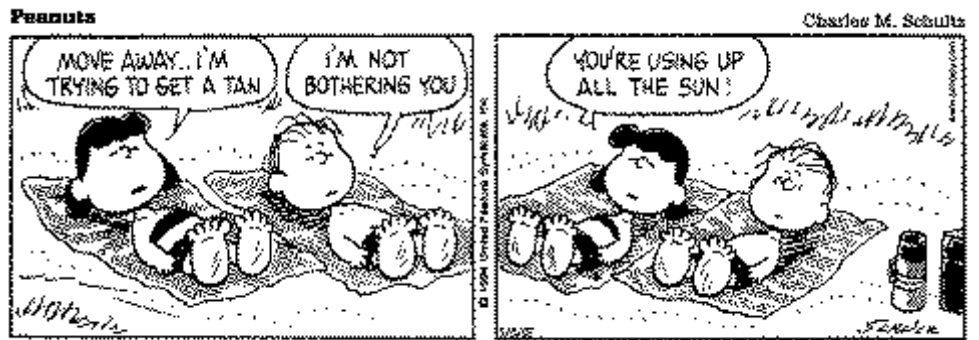
<sup>2</sup> *Laboratoire d'Ethologie et Cognition Comparées, Université Paris Ouest  
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## Adding Ecological Realism to the Maintenance of Cooperation in a Public Goods Dilemma

Explaining the cooperative behaviour required to produce the wide array of public goods found in nature - from extracellular enzymes to street lighting - is a challenge for evolutionary biology. A public good, by definition, is one from which individuals can not be excluded. This non-excludability creates a social dilemma by allowing defectors, individuals that do not contribute (or contribute less) to the production of the public good, to benefit from using it. Theoretical models of public goods dilemmas tend to be one dimensional, focussing solely on the frequency of cooperators by assuming that the amount of the public good, and, therefore, the benefit to individuals, is completely determined by the current frequency of cooperators in the population. Recent empirical and theoretical work, however, has emphasised the need to look beyond frequency dependence in public goods dilemmas and to include more ecology into the study of cooperation. Here, we present a more ecologically realistic model of a public goods dilemma. We consider explicitly the demography of cooperators and defectors and relax the frequency dependent assumption on the public good. Under negative frequency dependent selection, we find that the carrying capacity, per-capita growth rate, and the durability of the good affect oscillations in the density of cooperators, defectors and their public goods on the approach to coexistence equilibrium. Under positive frequency dependent selection, we predict periods of pseudo-coexistence between cooperators and defectors as well as density dependence in the initial frequency of cooperators required for cooperation to be maintained. An expanded view of public goods dilemmas, testing the effects of cooperator and defector demography and the durability of public goods on public goods production is required.

Key words: free-rider problem; tragedy of the commons; game theory; sociality.



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**Session 5**

**NEURO-ETHOLOGY / ECOPHYSIOLOGY**



## **Foraging efficiency of honeybees (*Apis mellifera*) and bumblebees (*Bombus terrestris*) in visually complex environments**

A bee searching for flowers on a meadow may encounter several flowers per second of flight that may differ in their reward and various floral features. To maximize foraging efficiency, she needs to memorize and discriminate high rewarding flower species from other co-flowering species using visual and olfactory cues. In doing so, bees must cope with a great amount of information from the sensory periphery. Since this amount of data usually exceeds the capacity which can be processed by the brain (Dukas, 2004), bees must focus selectively on different aspects of information collected by the sensory periphery, a process which is called attention (Chittka & Raine, 2006).

Here we present data on the extent to which limited attention influences object detection and discrimination in honeybees and bumblebees. In particular, we tested how distractor number and the complexity of the background affect the object detection. Both species had to search for a yellow target among a varying number of green distractors, either against a uniformly grey background or against a highly cluttered background of a black and white Julesz pattern. Error rate and decision time indicate the difficulty of the task. The data show that bumblebees perform significantly better than honeybees. Therefore they seem to be adapted to detect single flowers in highly structured environments.

Keywords: honeybee; bumblebee; foraging attention



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## Color polymorphism in the dice snake, *Natrix tessellata*

Trade-off between opposing selective pressures favor the existence of different morphs in the same species. These variations (or polymorphism) can be caused by genetic mechanisms as multiple allele combinations. One of the most notable examples in polymorphism is the variation of color between individuals in the same population. This phenomenon is largely studied in many ectotherm species such as insects, amphibians and reptiles. Variation of color patterns is commonly attributed to two major types of selection: sex-linked selection and ecological selection. In the present study, we used a wild population of dice snake (*Natrix tessellata*, N>1,500 marked individuals) as a model for studying color polymorphism. There are three color morphs: black (melanistic), grey and dice. In each morph, there is a potential trade-off between costs (predation) and benefits (thermoregulation). We also studied life-history traits of this species to examine if there are differences between morphs frequencies (size, sex, age, alimentary habits...). Interestingly, we observed an ontogenic establishment of melanism: neonates (N=144) were not black, whilst 21% of the adults were black (N=1,334), suggesting that genetic and epigenetic process were involved. As expected from thermoregulatory advantage hypothesis, the catchability of black individuals was greater under cool conditions: in spring versus summer, or during cool years versus hot years. Such ecological divergence between the morph did not translate into morphological difference, except a slight trend with larger black females.

Keywords: color polymorphism, selection, *Natrix tessellata*



Dice snake *Natrix tessellata*

**Aurélie AÏDAM<sup>1</sup>** and Xavier BONNET<sup>2</sup>

<sup>1</sup>Université François Rabelais/Tours – <sup>2</sup>CEBC CNRS/Chizé



## Behavior of the gerbil adrenal zona glomerulosa cells to the chronic hydration

The adrenal cortex activity is stimulated by several stress factors associated with an activation of hypothalamic-pituitary-adrenal axis. In this context, the present study was performed to examine the response of adrenal zona glomerulosa cells, at a histo-ultrastructural level, to the experimental hydration of gerbils (*Gerbillus tarabuli*), a nocturnal rodent living in desert conditions. Animals kept in the laboratory, were exposed to a diet rich in water during four months. Thin sections of the adrenal glands were observed in photonic and electron microscopy. Compared with controls, the outer portion of zona glomerulosa of hydrated gerbils showed a decrease in thickness. The glomerulosa cells present a regression of the lipid compartment, the development of chondriome as well as smooth endoplasmic reticulum, enlargement of the Golgi apparatus zone and appearance of endocytosis elements. These findings indicate that experimental hydration exerts a potent stimulatory effect on the adrenal zona glomerulosa cells activity through perturbation of gerbil hydromineral balance. It seems to be in favor of a possible physiological adaptation of adrenal zona glomerulosa to the hydric stress in order to maintain the hydromineral balance of desert rodent.

Keywords: *Gerbillus tarabuli*; Adrenal Zona Glomerulosa; Structure; Hydromineral balance; Experimental Hydration.



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<sup>1</sup>Biology Department, Faculty of Agro-Veterinary Sciences, BLIDA SAAD DAHLAB University, ALGERIA. - <sup>2</sup>Laboratory of Animal Physiology, Biology Department, Kouba High School, ALGERIA.

## **Stress hormone level increases in the absence of refuge: an experimental study in the aspic viper**

Although obviously essential, the role of shelter for snakes both in the field and in captivity has been largely neglected. We explored experimentally this issue in the aspic viper. We manipulated several key environmental factors - access to source of heat [thermoregulation], predation risk and shelter availability - and assessed the level of chronic stress via corticosterone assays. Our results show clearly that all these factors are important, but that the absence of refuge combined with cool ambient temperatures generated the most elevated levels of chronic plasma corticosterone. This suggests that the absence of suitable shelter can have far greater negative consequences than previously assumed. For instance when snakes cannot reach high body temperatures at night in temperate and cold climates or during bad weather conditions; similarly when snakes actively select low body temperatures, for example during drought to limit evaporation. These notions likely translate for animal welfare in captivity; indeed the level of stress easily detected via hormonal assays was otherwise invisible.

Key-words: stress, hormone levels, aspic viper.



The aspic viper (*Vipera aspic*)

**Catherine MICHEL** , Xavier BONNET, Alain FIZESAN, Khalid Ben KADDOUR, Jean Pierre DEGOIT

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## No evidence for a trade-off between carotenoid-based plumage colouration and immune response in blue tit nestlings

Carotenoid-based colouration is a widely used signal in animal communication. It is widely accepted, that honesty of carotenoid signalling might be maintained by the trade-off between immunocompetence and pigmentation. There is, however a growing number of studies confirming that this relationship is maintained by more complex mechanisms. We tested whether allocation of carotenoids into these two traits by blue tit nestlings depends on environmental conditions. By enlarging brood size, we created poor quality rearing environment for half of the broods and investigated nestling cell-mediated immune response, feather colouration (saturation, brightness, hue) and plasma carotenoid levels. Nestlings from enlarged broods had less saturated plumage colouration than nestlings from control broods. Among three parameters of plumage colouration only hue was related to the strength of immune response with more responsive nestlings having higher hue values. Importantly, this relationship did not differ between control and enlarged broods. Therefore, our results do not support the hypothesis of a trade-off between immunocompetence and pigmentation, however confirm that plumage colouration may be an honest indicator of bearer's quality.

Keywords: blue tit, carotenoids, evolutionary immunology, ornamentation, plumage colouration, cell-mediated immunity, immune response



**Dariusz WIEJACZKA**<sup>1</sup>, Natalia Pitala<sup>2</sup>, Anna Dubiec<sup>3</sup>, Szymon Drobnik<sup>1</sup>, Lars Gustafsson<sup>4</sup>, Mariusz Cichoń<sup>1</sup>

<sup>1</sup>*Institute of Environmental Sciences, Jagiellonian University* - <sup>2</sup>*Department of Biological and Environmental Science, University of Jyväskylä, Finland* - <sup>3</sup>*Museum and Institute of Zoology, Polish Academy of Science* - <sup>4</sup>*Department of Animal Ecology, University of Uppsala, Sweden*

## Plasticity in metabolic rates and life history traits affects foraging behaviour in a parasitic wasp

Temperature affects plasticity in ectotherms. Ectotherms developing at low temperatures usually achieve a larger size through a low growth rate (Temperature size rule, TSR) and have higher metabolic rates than those developing at higher temperatures, when compared in a common environment (thermal compensation). Increased metabolic rates may incur a cost between competing functions such as maintenance and reproduction: state-dependent foraging models predicted that animals should exploit patches of resources more intensely when the probability they will attain another patch later is low (e.g. by low life expectancy). This study investigates the effect of developmental temperatures and temperature experienced as adults on metabolic rate, life history traits and foraging behaviour. For this purpose, females of the parasitoid *Aphidius rhopalosiphi* were reared at 10, 15, 20 and 25°C. At emergence, we checked if their life history and morphological traits followed the TSR. Then, we placed all females in a common environment (20°C), we measured their metabolic rate and examined if it incurs a cost on longevities and/or egg loads. Finally, we examined the impact of temperature on these traits on their patch exploitation behaviour at 20°C. First, traits at emergence followed the TSR. Second, metabolic rates of individuals developing at low temperatures were higher, leading to a reduction in longevity but an increase in oviposition rate. Finally, patch exploitation behaviours were conform to the predictions of state-dependent foraging models. To our knowledge, this is the first study to demonstrate developmental plasticity in metabolic rates and relates this to foraging behaviour and life history traits in ectotherms.

Key-words: thermal compensation, metabolism, fecundity, longevity, patch exploitation, developmental plasticity.



The parasitoid wasp *Aphidius rhopalosiphi* sticking his host (*Sitobion avenae*)

**Cécile LE LANN**<sup>1</sup>, Thomas WARDZIAK<sup>1</sup>, Joan VAN BAAREN<sup>1</sup>,  
Jacques J.M. VAN ALPHEN<sup>1/2</sup>

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## Session 6

# EVOLUTIONARY BIOLOGY / CONSERVATION / APPLIED RESEARCH



## **Population genetics and phylogeography of a flagship species emblematic of wetland conservation: the Greater flamingo (*Phoenicopterus roseus*)**

The Greater flamingo (*Phoenicopterus roseus*) is a flagship species, emblematic of wetland conservation. This monogamous colonial species requires specific habitats (shallow saline waters) both for feeding, overwintering and breeding. Its distribution encompasses the entire Mediterranean basin, austral and eastern Africa, to southwestern Asia. However, about 90% of the reproduction occurs in ten major breeding sites largely spread across the geographical range of the species. Although the world population size of the Greater flamingo is estimated ca 500.000, the species remains highly sensitive to climatic and anthropogenic perturbations which might drastically put its future at risk. Resightings of ringed birds through capture-recapture methods have demonstrated exchanges between some European, Mauritanian and Turkish colonies, suggesting a metapopulation functioning in the Mediterranean. However, very little is known about population connection at a larger scale, highlighting the need for a new approach complementary of capture-recapture methods to understand its population dynamics and history. We therefore studied population genetics and phylogeography of the Greater flamingo and investigated actual genetic diversity, historical demography, gene flow and connectivity between breeding sites spread across the distribution range of the species. Sequencing of two mitochondrial markers showed very low haplotype number, no genetic differentiation between colonies of the Mediterranean and suggests recolonization of the Mediterranean from single glacial refugia.

Keywords: population genetics, phylogeography, conservation, metapopulation dynamics, dispersal



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## Genetic structure of populations of the barn swallow (*Hirundo rustica*)

Cooperative and dispersal behaviours can be observed within populations. Their evolutionary routes can be viewed as opposites: the evolution of dispersal is based on avoidance of kin-competition and kin selection is supposed to be the main force for the evolution of cooperative behaviours. This second theory assumes relatedness between cooperators. Without genetic population structuring, dispersal would act against the evolution of cooperative behaviours. Conversely, if cooperation provides benefit in terms of inclusive fitness, it will decrease kin-competition and can favour philopatry. We used three years of genetic data (microsatellite profiling) from the barn swallow *Hirundo rustica* populations in a rural area in Belgium. This species exhibits some cooperative behaviours (communal nest defence and cooperative feeding of nestlings) and a high rate of natal dispersal. Moreover, this species presents an important natural variability in colonial behaviour.

I used genetics to investigate the relationship between social structure and genetic similarity among barn swallows. I assessed the correlation between genetic relatedness and social grouping. I expected individuals nesting in colonies to be more related than predicted from random association between birds. However, the results show that individuals nesting in colonies are no more closely related than expected from random association between birds. This result invalidates the hypothesis that cooperation evolved through kin selection.

Keywords: cooperation, colony, barn swallow, kin selection



Barn swallow (*Hirundo rustica*)

**Sophie DARDENNE**<sup>1</sup>, Virginie STEVENS<sup>2</sup> et Pascal PONCIN<sup>3</sup>

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## Can railway increase bird diversity in agricultural landscape?

Habitat loss and fragmentation is one of the most important problems in applied ecology and conservation. Linear barriers such as roads and railways are concerned to be a major reason for habitat fragmentation for a variety of organisms. However, some modest disturbance in a homogenous (e.g. agricultural) landscape may contribute to the increase in biodiversity providing habitats unlike arable land. We hypothesise that railways' verges may harbour higher number of bird species than relatively undisturbed agricultural areas.

We collected data about number of species in 40 transects (each transect 1km length, half of them placed directly along railway (R) and others were control transects (C) located at least 2km away. We detected 68 bird species. The mean number of species per transect was  $17.8 \pm 5.84$  for R and  $13.4 \pm 4.59$  for C. The difference was significant (Paired Student's t-Test  $P=0.002$ ). General linear model analysis revealed that bush cover had significant, positive influence on birds diversity ( $P=0.025$ ). Bush cover was more abundant nearby railways rather than in fields.

Our results confirm the idea that some man-made habitats may have a positive effect on farmland biodiversity.

Keywords: agricultural landscape, linear barrier, railway, birds



**Joanna KAJZER**<sup>1</sup>, Maciej BONK<sup>2</sup>, Magdalena LENDA<sup>1</sup>, Dawid MORON<sup>3</sup>, Elzbieta ROZEJ<sup>1</sup>, Marta WANTUCH<sup>1</sup>, Piotr SKORKA<sup>4</sup>

<sup>1</sup> Jagiellonian University/Institute of Environmental Sciences, <sup>2</sup> – Jagiellonian University/Institute of Zoology <sup>3</sup> – Polish Academy of Sciences/Institute of Systematics and Evolution of Animals <sup>4</sup> - Poznan University of Life Sciences/Institute of Zoology, Poland.

## Demographic changes in amphibian populations in south-central Poland

Amphibians are a globally threatened group of animals. The phenomenon is well recognized in both temperate and tropical regions. Nevertheless, the scale of amphibian declines in central Europe is poorly understood. In Poland, several authors suggested that amphibian populations have declined. However, these contributions concern only small areas and do not provide rigorous statistical assessments. We describe the demographic trends in 15 amphibian taxa at a regional scale in south central Poland (ca. 5000km<sup>2</sup>). Using inventory data collected in 1979-1984 and 2006-2008, we compared the number of colonization (absence at a given locality in the 1980s and presence in 2006-2008) and extinction (presence in the 1980s and absence in 2006-2008) for each taxon, for a total of 71 localities. We detected a significant decline in four species: *Triturus cristatus*, *Lissotriton vulgaris*, *Rana temporaria* and *Pelophylax lessonae*. Applying a less conservative approach we found a decline for a further three species: *Bombina bombina*, *Bufo bufo*, *P. esculentus*. One species, *P. ridibundus*, has thrived in the region. In general, the mean number of species per site decreased by  $2.2 \pm 4.0$  ( $P < 0.0001$ ). The distribution of most species slightly overlaps with historical ranges but varies among taxa. The most stable distribution was noted in the commonest *R. temporaria* and *Bufo bufo* and the least stable in the rarest *Mesotriton alpestris*, *Epideleia calamita* and *P. ridibundus*. Possible factors affecting amphibians in the surveyed region are loss in breeding ponds due to irrigation, fish introduction and terrestrial habitat fragmentation due to increasing traffic volume.

Key words: amphibian decline, distribution, Poland



*Rana temporaria*

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## Using wavelet analysis to disentangle the different movement regimes of foraging animals

When foraging in their environment a lot of animals adopt an intermittent search strategy composed of various movement regimes. In order to highlight these regimes, a fine description and analysis of animal trajectories are required. While the use of computerized video tracking techniques has allowed to fully automatize the acquisition of these trajectories, the development of suitable software for their analysis is still lagging behind. In particular, animal movements that include at least two movement regimes are characterized by kinematics with transient and non-stationary properties that make their processing very difficult. We used a method based on Continuous Wavelet Transform (CWT) to analyze these movements. CWT is a mathematical tool which achieves a time-scale (or time-frequency) analysis of signals and which is especially appropriate to overcome non-stationarity problems. The CWT decomposes a one-dimensional time-series in the two-dimensional time-scale space, allowing a fast and easy identification of the different kinematic regimes corresponding to the various locomotory behaviors that can be observed during the movement of an animal. This tool was applied on acceleration data recorded on foraging individuals of the ant species *Odontomachus hastatus*. It turned out to be an excellent method for identifying different kinematic regimes, and therefore to properly quantify the ants' locomotory behavior.

Keywords : wavelet analysis, animal movement, intermittent search, foraging



The ant *Odontomachus hastatus* and its future meal...



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## **Biophonies in a bird community of Central Italy: temporal overlap and spectral segregation of bird songs**

Factors involved in the structuring of bird communities nowadays remain unclear. Traditional ecology considers variables such as vegetation structure, reproductive micro sites and food preferences as elements of the niche of hyper-volume, giving little or no attention to informative domains like the acoustic one. The few studies carried out on the acoustic niche, primarily analyze the temporal coordination of vocalizations *between partners*. Our research, which falls into the realm of ethological zoosemiotics, considers coordinated vocalizations *within a community*. The study was conducted on a bird community in a mixed Turkey oak forest in Central Italy. Recordings were analyzed at a short temporal scale (0.5 sec). Using co-occurrence pattern analyses and Monte Carlo simulations, we observed that species tend to vocalize at the same time, while segregate along spectral frequencies. We interpreted this emergent acoustic cue as a signal of strength of the mixed-species association against species from other habitats or communities; likewise, partners display coordinated behaviors when it deals to defense of shared resources. We could speak about multi-species territoriality. Indeed, when simultaneously uttered, birdsongs of the community fit one another like puzzle pieces, leaving no acoustic space for transient or temporary visiting individuals. We believe that the difficulties for these individuals to communicate could reduce their access to shared resources. This study underlies the importance of the acoustic cues inside the Niche Theory, and fills the gap of studies on mixed-species associations, whereas they could shed light on the adaptive significance of sociality.

Keywords: acoustic niche, mixed-species association, multi-species territoriality



One bird, two birds, three birds...

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## Abstracts



## Posters

## Session 1

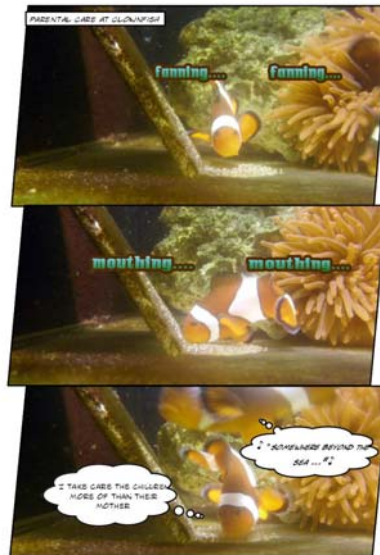
# SEXUAL SELECTION



## Parental behavior patterns in a territorial monogamous reef fish species with a size dimorphism

The studied fish, *Amphiprion ocellaris* (Pomacentridae), lives in an obligate symbiosis with some anemone species which protect the monogamous pairs. In this species, there is a significant size dimorphism: the larger female, which is the dominant sex, defends the territory, while the smaller males tend the eggs. Although it is a well-known fact that *Amphiprion* species take care of their offspring, the details of this behavior are hardly known. I conducted my studies on captive fishes in laboratory circumstances, and characterized the parental care pattern with two forms of behavior, i.e. mouthing and fanning activity, which I measured in the early, middle as well as late phases of the egg caring period. The results demonstrated that mouthing and fanning activity correlated with the age of the eggs: the more developed the embryos were, the more the parents invested in parental care. *Amphiprion* genus show a cooperate biparental care but I found that the males invested significantly more time tending embryos than females. Because larger females lay more eggs and defend their territory more successfully, it can be predicted that the parental investment of males may depend on female body size: due to the expected higher reproduction success, males that have a large pair- female invest more into egg tending than those males whose pairs are small. The preliminary analysis of the data suggests that this prediction has gained support, which can be a novel result in parental care in fish.

Key words: parental care, paternal care, egg tending, mouthing, fanning, fish



Male reef fish (*Amphiprion ocellaris*) mothering his offspring



**Anita RÁCZ**

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Budapest, HUNGARY



## Sexual selection, parental cooperation and avian personalities: mate choice and parental care in zebra finches in light of boldness

Cooperation between parents to raise the young is beneficial in species with biparental care in terms of increased chances of the offspring to survive, but is costly in the same time for the caring parents in many ways. Apart from time and energy, caring may involve a considerable risk as parents have to share their attention between their young and monitoring potential predators. In addition, frequent visits to the nest during incubation and chick feeding may draw attention and expose the caring parent(s) and their young. We investigated the possible link between parental cooperation, avian personalities in terms of shyness-boldness and sexual selection in aviary tests using a biparental species, the zebra finch *Taeniopygia guttata*. We began with a standard mate choice test followed by a novelty test to investigate whether mate preference might be influenced by boldness. Then, depending on the success of the mate choice test, breeding pairs were formed and data of the novelty test was correlated with parental cooperation during incubation. Using the same breeding pairs, we also investigated the flexibility of parental cooperation between different breeding contexts including incubation, feeding and nest defence. We predicted mate choice to be influenced by boldness, more cooperation by bold parents and consistent parental cooperation between breeding contexts, however, pilot analyses suggest that males did not cooperate differently according to their boldness. Taken together, our experiment suggests that biparental care is an excellent model system to investigate cooperation between two unrelated individuals.

Keywords: avian personality, boldness, parental cooperation, sexual selection, zebra finch, *Taeniopygia guttata*



The zebra finch (*Taeniopygia guttata*)

**Ernő VINCZE**, Róbert ENYEDI, Zita SZUROVE CZ and Ákos  
POGÁNY

*Department of Ethology, Eötvös University, Poland*



## **Social effects on parental cooperation in zebra finches: do females increase their share in care with preferred mate?**

Parental care is indispensable in several taxa including cichlid fishes, birds and primates. In avian species, biparental care is the most frequent type when the male and female parents cooperate in providing care for their young. Despite its widespread occurrence, the evolutionary processes and mechanisms influencing parental cooperation are not fully understood. We investigated the social context of parental cooperation in an aviary experiment using a biparental songbird, the zebra finch *Taeniopygia guttata* as model species. We hypothesized that parental cooperation is influenced by mate preference, and expected more relative effort by females mated with a preferred partner. Following a standard mate choice test, half of our experimental females were housed and allowed to breed with their preferred and half of them with their least-preferred male. Analyses of the relative workload of females versus males during biparental incubation and changes in care during male-removal showed no difference between our experimental groups. Our results suggest parental cooperation might be relatively fixed in relation to the closest and probably one of the most important elements of social environment, the partner.

Keywords: parental cooperation, social environment, mate preference, zebra finch, *Taeniopygia guttata*



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## Session 2

# FORAGING STRATEGIES / PARASITISM



## Food composition of the European otter (*Lutra lutra*) living in small artificial watercourses in the agricultural landscape of Western Poland

The aim of this researches was to investigate the food of otters (*Lutra lutra*) living in small artificial watercourses located in farmland area. The increasing abundance of this predator in Poland is associated with a decreasing habitat selectivity and the use of watercourses of a lower quality. As a result, otters are more frequently found even in small channels. Obviously, to enable these ecological adaptations the otter is flexible in its feeding habits and we want to find what the dietary habits in this specific habitat are. The study was conducted in two winters seasons 2006/2007 and 2007/2008 in an extensively used agricultural landscape of Western Poland. Diet was determined by the analysis of scats and food remains (2422 samples). Fish were by far the most important prey item, accounting for 97.8% of consumed biomass. Amphibians were present in more than 22.7% of samples and accounted for almost 15.5% of all prey items but their contribution to biomass was only about 1%. Mammals, birds, crabs, insects, molluscs and reptiles were also recorded but their biomass represented less than 1%. The diversity of diet changed depending on temperature during the winter. We also observed patterns in the fish component of the diet. The number of pike (Esocidae) in the diet each month was negatively correlated with the number of perch (Percidae). There was also a negative correlation between the quantities of pike and carp (Cyprinidae).

Our results provide new detailed information on winter food composition and diet changes of otters living in small watercourses in an extensive agricultural landscape in Poland.

Keywords: *Lutra lutra*, feeding habits, prey selection, agricultural landscape, Poland



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## Diet of the polecat *Mustela putorius* in an agricultural landscape

Polecat (*Mustela putorius*) biology and ecology, in comparison to other carnivorous mammals, is generally well known, however, feeding habits of the polecat are still unclear. Many authors regard the polecat as a generalist feeder, an amphibian specialist or even a lagomorph specialist. The aim of this study was to analyze diet of polecat in the agricultural landscape and its seasonal variability because extensive farmland with a mosaic character may provide a shelter and abundant food for polecats and hence it can be a crucial habitat for polecats in a man-modified environment. Feeding habits of the European polecat in extensive farmland area in Poland were studied by analyzing 1078 scats collected since 2006 to 2008. Diet of polecat was almost exclusively carnivorous and included a wide variety of prey species. Rodents represented the principal prey (51.7% of biomass), mainly *Microtus arvalis* (14.2% of all preys). Birds were the second important group of prey in the diet (14.5% of preys). Further elements of importance are anurans, reptiles and invertebrates. Seasonal variations reveal differences in the diet between seasons. Amphibians and reptiles were characteristic prey in spring diet, whereas in winter diet carrion and other mammals were the staple food. The results presented in this paper confirm that polecats are unspecialized predators with an almost totally carnivorous diet. A large diversity of food in the diet of the examined population provides that in a human-modified environment polecats are forced to use every available food source.

Key words: *Mustela putorius*, diet, seasonality, agricultural landscape, Poland

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<sup>2</sup>*Department of Behavioural Ecology, Institute of Environmental Biology,  
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## Oribatid mites feeding guilds. Comparison of enzymes activities and cafeteria tests

Oribatid mites (Acari: Oribatida) are crucial for forest ecosystem functioning. They contribute in nutrient cycling and support microorganisms development in forest soils. Although nutrition biology of these animals is still little known. The main source of information about feeding preferences of oribatid mites are cafeteria tests (food choice tests with different types of food offered). There is only few studies about digestive enzymes activities of oribatid mites. The aim of our study was the comparison of two methods used for determining feeding guild of 23 common oribatid species. The first method was the cafeteria tests with different type of food: fungal hyphen, litter, algae and homogenized *Tetradontophora bielensis* body). The second method was the determination of digestive enzymes activities (cellulase, chitinase and trehalase). It was surprising that oribatid mites have broader feeding preferences than it was supposed before. 9 species seemed to be omnivorous and capable to digest proteins. This results are not supported by previous research. An overview of the previous research methods based on cafeteria tests was also conducted. Most of former experiments are based on feeding behavior observation only and in most cases cafeteria tests offered only fungal/vegetal food. This could be the reason of the deduction discrepancy in previous investigations and classification of most of oribatid mites as fungivorous or herbivorous. The feeding preferences of mites could be used for bioindicator of soil health. They seem to be more appropriate indicator than species mites composition, because they show the reaction of community on the higher, functional level.



**Magdalena MAŚLAK<sup>1</sup>**, Katarzyna Michalczyk<sup>2</sup>, Paweł Maślak<sup>3</sup>

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## Session 3

# HABITAT SELECTION / DISPERSION



## Causes of habitat divergence in two species of agamid lizards in arid central Australia

The deserts of central Australia contain richer communities of lizards than any other arid regions, with the highest diversity occurring in sand dune habitats dominated by hummock-forming spinifex grasses. To investigate the mechanisms that permit coexistence, we studied two species of coexisting agamid lizards that exhibit striking divergence in their use of habitat in the Simpson Desert of central Australia. Here, the military dragon *Ctenophorus isolepis* is restricted primarily to sites providing >30% cover of hard spinifex *Triodia basedowii*, whereas the central netted dragon *C. nuchalis* occurs in areas with much sparser (<10%) cover. We constructed four mechanistic models to explain this pattern and then derived hypotheses to test them. One hypothesis, that competition restricts each species to its preferred habitat, was rejected after dyad encounters in field enclosures failed to elicit any habitat shift or any overt interactions between the species. Our next hypotheses were that each species exhibits preferences for different thermal environments or different prey types and that each selects the habitats that maximize access to them. Both were supported. *C. isolepis* preferred lower temperatures when active and specialized in eating ants <5 mm long and selected spinifex-dominated areas where these requirements were met. In contrast, *C. nuchalis* preferred higher temperatures and a diversity of prey, both of which were available mostly in open areas. Finally, we used plasticine models to test the hypothesis that each species faced lower risk of predation in its selected habitat. This was partly supported, as models of both species were attacked more often in the open than under spinifex cover. The results show that habitat divergence occurs along several, probably covarying, niche axes. We suggest that different levels of spinifex cover provide the template for a broad range of ecological interactions, allowing lizard species to partition biotic and abiotic resources and achieve the extraordinarily high levels of local diversity that are observed.

Key words: agamid; competition; diet; dragon; habitat selection; habitat separation; lizard; predation; spinifex; temperature.



**Benjamin G. DALY**<sup>1,2</sup>, CHRIS R. DICKMAN<sup>1</sup>, AND MATHEW S. CROWTHER<sup>1</sup>

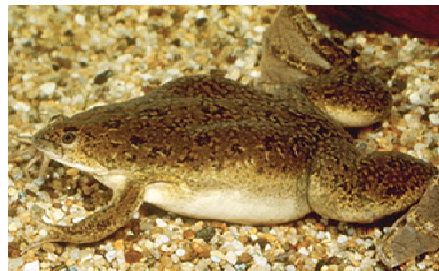
<sup>1</sup>*Institute of Wildlife Research, School of Biological Sciences, The University of Sydney, Australia* - <sup>2</sup>*Current affiliation: Benjamin Daly, D.Phil Student Edward Grey Institute, Department of Zoology, University of Oxford, U.K.*



## Habitat selection and trophic niches of anurans in ponds near lake Victoria's coast, Kenya

Farming and livestock holding practices have led to deforestation and drainage of the Victoria Lake coasts. Amphibians are strictly dependent on moist condition, and are sensitive to perturbations of these ecosystems. Our aim is to identify the ecological parameters that influence the presence of Anurans in a semi-natural wet area located near Lake Victoria (Kisumu district, Kenya). Just behind the coastal vegetation belt, consisting of papyrus and marsh grasses, cultivated fields extend over large areas and (served by several artificial ponds). Amphibians inhabiting 15 different ponds (10 artificial and 5 natural) were sampled during February and March 2004. In particular, we focused on habitat selection and trophic niche of 5 species inhabiting the ponds: *Xenopus victorianus*, *Phrynobatrachus natalensis*, *Hoplobatrachus occipitalis*, *Hemismus guineensis* and *Ptychadena mascareniensis*. Our results, based on species habitat selection, clustered these 5 species in three groups, two of which are monospecifics, depending on the hydro-morphological characteristics of the ponds: (i) *X. victorianus*; (ii) *P. natalensis*; (iii) *H. occipitalis*, *H. guineensis* and *P. mascareniensis* (mainly in natural ponds). The species grouped in latter cluster showed no trophic niche overlap, while trophic niches overlap was evidenced for *X. victorianus* and *P. natalensis* (mainly in different ponds). The impact of human activities on the very frail wetland ecosystems is widely recognized. In this context the implementation of conservation project aimed at reconciling human activities and wildlife are of overwhelming importance. Our preliminary work, which investigate the ecology of amphibian inhabiting artificial ponds, can consequently be useful for planning conservation and management initiatives

Keywords: amphibians, Kenya, trophic niche, habitat selection, ponds.



Frogs! (From up - left to down – right) : *Hemismus guineensis*, *Hoplobatrachus occipitalis*, *Phrynobatrachus natalensis*, *Ptychadena mascareniensis* and *Xenopus victorianus*

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## The effect of forestry on small rodents abundance and habitat use in south-eastern Norway

This study aims at understanding the effects of forestry on the abundance and habitat use of microtine species. Intensified forestry has been linked to the decline of the most common vole species in Norway. However the effect on the individual vole species remains debated. We livetrapped voles between 2006 and 2009 in two harvested forests in south-eastern Norway. We tested the hypothesis that grass dweller and open-areas vole species (i.e. *Microtus* spp.) are associated with clearings at the expense of forest dwellers (i.e. bank vole, *Myodes glareolus*) and investigated the variation in vole abundance among patches of fragmented forests based on fine-scale descriptors of the vegetation. We could not find support for the hypothesis that *Microtus* spp. are favoured in clearings and their density was 25 times lower than the bank vole one during the whole study period. In forested patchy landscapes the presence of “source” patches (i.e. abandoned fields) for *Microtus* spp. may be too low to sustain large populations, compared to forest-farmland mosaic landscapes. The decline of open-area vole species in these landscapes may thus be enhanced both by increased predation risk associated with fragmentation and by low habitat productivity. On the other hand, bank vole may spread over all areas thanks to its “generalist” quality and reduced interspecific competition. However, mature forests are positively related to bank vole survival and may suggest an effect of forestry on the demography of the species which needs further investigation.

Keywords: forestry, *Myodes glareolus*, habitat use, patchiness



Bank vole *Myodes glareolus*



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## Adult demography, dispersion and behaviour of *Hipparchia statilinus* (Lepidoptera, Nymphalidae, Satyrinae)

Mate-locating behaviour in butterflies which is influenced by the distribution of nutritional resources, also affects population spatial structure. Two kinds of mate-locating behaviour predominate: patrolling and perching. Males of *Hipparchia* spp. display typical perching behaviour (i.e., males remain settled at particular locations waiting for flying females). In *Hipparchia statilinus* the main purpose is to detect the factors contributing to bring males and females together, in reproductive context. In particular, we analysed: a) the ability of dispersion of the individuals at different scales; b) the microhabitat use by individuals related to reproductive and foraging behaviour. Second purpose was to estimate population parameters as size, sex ratio and phenology. Investigations were conducted by mark release recapture during two consecutive years in eight areas in the Central Apennines, near Vallemare (Rieti, Italy). Results revealed a good level of philopatry of *H. statilinus*, since only few individual movements were observed across study areas. Individual mobility analysis on small scale provided indication on adult behaviour related to habitat characteristics. In fact, males and females inhabit mostly rocky grassland at the beginning of the flight period, since the stones are used as perching sites. At the end of the season, butterflies moved exclusively towards the sole area abounding in flowers. Here, most of individuals were represented by mated females requiring energy for the egg-laying.

Keywords: *Hipparchia statilinus*, dispersion, population size, sex ratio, phenology, mate-locating behaviour



*Hipparchia statilinus*

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## Session 4

# GROUP BEHAVIOR / INDIVIDUAL INTERACTIONS



## Behavioural reversion in social Hymenoptera: are honeybees and ants alike or different?

In social Hymenoptera workers usually engage first in intranidal tasks and act as nurses, and then switch to extranidal tasks and become foragers. However, that process may be reverted. Phenotype modifications accompanying the transition nurse-forager (behavioural maturation) and forager- reverted nurse (behavioural reversion) were most extensively studied in the honeybee (*Apis mellifera*). Numerous classical and recent data provide the evidence of genuine reversal of ontogenetic development and/or ageing processes in relation not only to specialization in intranidal/extranidal tasks, but also to such phenotype traits as morphology of some exocrine glands, hormonal state, whole-body protein profile and immunosenescence. As pointed out by several authors, honeybee and ant behavioural reversion may involve qualitatively different processes: in contrast to honeybees, ant behavioural reversion may be limited exclusively to rapid reappearance of brood care behaviour in foragers. The results of recent research of our team on behavioural reversion in workers of the red wood ant *Formica polyctena* support the view that honeybee and ant behavioural reversion show profound differences. In particular, we found no evidence of reversal of modifications of brain biogenic amine contents and amine ratios accompanying the transition nurse - forager. However, we also found evidence that ant behavioural reversion does not consist exclusively in rapid induction of brood care behaviour in foragers: reverted nurses of *F. polyctena* showed nurse-like dynamics of choice between dark and light environment, although their general illumination preferences remained forager-like. We will also discuss several open questions raised by recent research on honeybee and ant behavioural reversion.

Key words: ontogeny, Hymenoptera, *Apis mellifera*, Formicidae, behavioural reversion



The ant *Formica polyctena*



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## A new ethological test to study the effects of worker behavioural status on responses of ants to brood

As they age, social insect workers usually switch from intranidal tasks to extranidal ones. The transition nurse – forager, also known as the change of worker behavioural status, involves mainly anatomical, physiological and behavioural maturation. However, worker behavioural development may be accelerated, delayed, and even reversed by the manipulations of the social context. Responses of ants to brood are related to general worker specialization in intranidal versus extranidal tasks. Whereas nurses engaged in brood care behaviour displayed inside the nest, retrieval of brood to the nest is carried out preferentially by foragers. Reverted nurses show brood care behaviour similar to that of normal age nurses, but its quality may be very poor. We present a new test designed to study the effects of worker behavioural status on responses of ants to brood. Nurses and foragers of the red wood ant *Formica polyctena* were put together with homocolonial pupae in various containers exposed to strong white light illumination and containing a shadowed area. Single workers did not show brood hiding behaviour. Pupae started to be transferred to the shadowed area in groups consisting of 3 workers. Fully expressed brood hiding behaviour was observed in groups of 20 workers. Hence, such group size was chosen as the standard one for the future tests. The values of scores quantifying brood hiding behaviour were positively correlated with the worker group size. Our data provide thus new evidence that group size plays an important role in the mediation of the expression of behaviour in social Hymenoptera.

Keywords: ants, Formicidae, brood care, illumination responses, social context



The ant *Formica polyctena*

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## **Roosting of Tree Sparrow *Passer montanus* and House Sparrow *Passer domesticus* in White Stork *Ciconia ciconia* nest during winter period**

The aim of this research was to check how many sparrows (*Passer domesticus* and *Passer montanus*) use white stork nest as a roosting site and what are main factors effecting this phenomenon. The study was conducted in the winters 2005/2006 and 2006/2007, in the agricultural landscape of western Poland. A total of 33 and 36 nests, in 2005/2006 and 2006/2007 winters respectively, were controlled twice, to record sparrow flight into the nest before sunset. During the study period, between 36 and 51% of white stork nests were occupied by roosting sparrows; tree sparrow occurred in 7-10.5%, house sparrow in 32.5-44.5% of white stork nests. The maximum number of roosting sparrows in one nest was 40 individual from both species. Whereas maximal number of roosting tree sparrows was 27, house sparrows – 33 in one nest. I also recorded 7 cases when Sparrowhawk *Accipiter nisus* was attacking Sparrows flying into the nest for roosting. I did not find a relationship between weather conditions, date, age or size of white stork nest and the number of sparrows roosting in it. Currently we can only guess the reasons. These may be to do with population structure, age, social hierarchy or individual preference. So this phenomenon needs further and more intensive study.

Keywords: sparrows, *Passer*, white stork, *Ciconia ciconia*, wintering, roosting, Poland



**Marcin TOBOLKA**

Poznań University of Life Sciences, Institute of Zoology, Poland



## **Influence of social learning on oviposition site choice in *Drosophila melanogaster***

Much behaviour is transmitted through a population by social learning. Acquiring new information from others can be advantageous in certain situations and permits to confer fitness benefit to the learner. Many studies have shown its presence in vertebrates and in social insects but only recently, existence of social learning has been demonstrated in an asocial insect, *Drosophila melanogaster* which choose preferentially a partner that it has previously seen copulating. Importance of mate choice on eggs fitness is usually known but oviposition site choice is also a crucial factor. Using a transmission chain based on demonstration process, we wonder if social learning can also influence oviposition site choice behaviour. Demonstrator females were conditioned to lay eggs specifically on a medium with a certain odor when they have choice between two of them with different odor. Then demonstrators were gradually changed by naive females. Our results show that presence of others in a medium have an impact on oviposition site choice of a female. Social learning can inverse preference, even if this preference is naturally strong for a certain odor. This observation suggests that social learning may play a role in speciation.

Keywords : Social transmission, chain, demonstration process, oviposition, odor.

**Marine BATTESTI<sup>1</sup>** and Frédéric MERY<sup>2</sup>

<sup>1</sup>*University of Paris 13* - <sup>2</sup>*Laboratory of Evolution, Genomes and Speciation, CNRS, Gif sur Yvette*



## The applicability of Experimental Model Systems (EMS) for predicting behavioral patterns across taxa and trophic levels

Experimental model systems (EMS) in ecology are conducted at small spatial and temporal scales in controlled and enclosed environments. Their applicability depends on the critical premise that causal mechanisms behind patterns observed in experimental conditions are similar to those seen at larger spatiotemporal scales in natural environments. An argument for using EMS for making predictions across taxa and trophic levels is that certain behavioral features will be similar among species despite large ecological differences between them. We address this issue by comparing results from two Scandinavian projects; an experimental study on root voles and a long term study on brown bears. We show that similarities in intraspecific spatial interactions between the two species extend far beyond their basic social structure. Examples are patterns of dispersal and resettlement, kin-related spatial structure, and intersexual relationships. In view of the results, we discuss the role of small mammals as model species for studying how behavioral mechanisms transpose to population dynamics in larger and more space requiring species.

Keywords: *Microtus oeconomus*, *Ursus arctos*, sexually selected infanticide, natal dispersal, reproductive suppression, matrilinear assemblages



Mister Bear discussing with mister Vole of EMS !



**Morten ODDEN**<sup>1</sup>, HP. Andreassen<sup>1</sup>, OG. Støen<sup>2</sup>, JE. Swenson<sup>2</sup> & RA Ims<sup>3</sup>

<sup>1</sup> Faculty of Forestry and Wildlife Management, Hedmark University Collage, Norway . - <sup>2</sup> Department of Ecology and Natural Resource Management, Norwegian University of Life Sciences, Norway.- <sup>3</sup> Department of Biology, University of Tromsø, Norway.

## Do juvenile zebra finches recognize their siblings on the basis of their begging calls?

In birds, recognition between parents and offspring can be of crucial importance by avoiding misdirected parental care and limiting infanticide. After fledging, the nest does not function as a meeting place anymore and different recognition systems may help the parents to provision their own offspring as well as the young to solicit their own parents. For instance, the chicks may directly recognize their parents but may also use brood recognition to join their siblings in soliciting the parents for food. The zebra finch (*Taeniopygia guttata*) is a gregarious passerine, which shows extended parental care up to twenty days after fledging. During this period, fledglings may gather in crèches. Although it has been recently demonstrated that parents can recognize their own chicks using their begging calls, it is unknown whether the chicks can recognize their siblings. We used a two choice paradigm during which playbacks of the begging calls of a sibling vs. an unrelated familiar individual were broadcasted. Begging calls of 39 chicks (2 to 5 chicks per brood) were recorded approximately one week after fledging using a design that controlled for individuals' satiety level and thus motivation. Chicks called significantly more in response to their siblings than to familiar unrelated age-mates. They also tend to spend more time near the loudspeaker broadcasting their sibling's calls. Juveniles thus show evidence of discriminating their siblings using only acoustic cues. Further analyses are currently carried out to assess the existence of a vocal "brood-signature" which might account for such sibling discrimination.

Keywords: Zebra finches, *Taeniopygia guttata*, Siblings, Begging calls, Vocal discrimination, Brood signature



Sleeping and begging zebra finches (*Taeniopygia guttata*).

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**Session 5**

**NEURO-ETHOLOGY / ECOPHYSIOLOGY**



## The role of multi-modal sensory stimuli and their interaction in oviposition learning and memory in *Drosophila melanogaster*

Learning and memory studies in *Drosophila melanogaster* have provided valuable insight into the mechanisms and neuronal circuits involved in these processes, as well as the ecological and evolutionary conditions that underlie and shape them, many of which are conserved throughout animal phyla. Traditionally, these studies have consisted of classical and operant conditioning using olfactory or visual stimuli as the conditioned stimulus and mechanical/electrical shocks or aversive gustatory cues as the unconditioned stimuli. Oviposition has recently emerged as a stereotyped and tractable behaviour used in innate and in learning and memory studies. This ethologically relevant behaviour suggests itself as a multimodal associative process, amenable to studying the interactions of different sensory modalities in learning and memory. Using a two-choice oviposition assay with an aversive gustatory stimulus as the unconditioned stimulus we study the interactions between olfactory, gustatory and visual stimuli in this context. Our results show that olfactory, gustatory and visual stimuli are used in oviposition site learning and memory and suggest that these three types stimuli interact in learning and memory processes and mechanisms in the fly brain.

Keywords: *Drosophila melanogaster*; learning and memory; oviposition; multi-modal sensory cues



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## Effects of methylxanthines on development and locomotor activity of house cricket, *Acheta domesticus*

Effects of methylxanthines (i.e. caffeine, theobromine and theophylline) on insects, as well as mechanisms of their action are still poorly understood. It is known that their mode of action involves mainly nonspecific antagonism to adenosine receptors and inhibition of cAMP phosphodiesterase. Since adenosine is paracrine regulator of cellular metabolism, any disturbance in its signaling pathway may result in numerous negative effects on cellular and organismal level. It was stated that caffeine in flies prolonged periods of activity and reduced resting intervals. However, it is not known whether such stimulation elevates metabolic rate and food consumption.

We applied methylxanthines as food admixture (0,01, 0,1, 1,0 and 10 mg/g feed) to larvae of house cricket and observed their development and mortality for 20 days, then we recorded locomotor activity (stimulated activity) with digital camera. The obtained movie was analysed by SwisTrack software and the raw output data were transformed to quantified movement parameters with the elaborated set of formulas, using MS Excel .

The lowest concentration of theophylline and caffeine resulted in elevated food consumption in larvae and acceleration of their development, while the highest concentration decreased both developmental parameters and increased larval mortality.

Both compounds had different effects on crickets activity – we have observed enhancement of activity (total distance per minute, total time spent on resting and active movements), in comparison with control, in crickets supplemented with 1 mg/1 g theophylline, but not in those fed with caffeine or lower concentrations of theophylline.

Obtained results suggest that effect of methylxanthines may be species-specific or even stage-specific and further studies are necessary to clarify the biochemical and molecular differences in insects susceptibility to these most commonly use abusing substances.

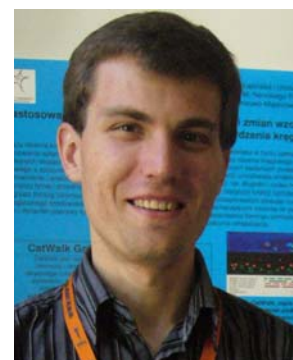
Keywords: methylxanthines, *Acheta domesticus*, development, locomotor activity



Larvae of the house cricket (*Acheta domesticus*)

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## **Influence of the adipokinetic hormone on insect locomotor activity and AKH immunocytochemical localization in the brain of the cricket *Acheta domesticus***

Adipokinetic hormone (AKH) is a member of adipokinetic hormone/red pigment-concentrating hormone (RPCH) family, an arthropod short peptides family with similar structure. AKH was first purified in 1976 and the chemical structure was determined to be a peptide hormone formed from 10 amino acids (locusta AKH I). Since 1976 many AKHs isoforms have been isolated and characterized.

AKH is a lipid mobilizing hormone and is responsible for regulating fuel transport in the insect haemolymph, it can cause increase of locomotor activity. In this study we investigated influence of the locusta AKH II on increase of locomotor activity of the house cricket *Acheta domesticus*. Locusta AKH II is formed from 8 amino acids and more similar to AKH isolated from *Acheta domesticus* than first purified locusta AKH I. Localization of the AKH peptide in the cricket central nervous system was also obtained. AKH was detected in corpora cardiaca, pars intercerebralis and dorso-lateral protocerebrum.

Keywords: adipokinetic hormone, locomotor activity, *Acheta domesticus*, immunocytochemistry



Immunocytochemistry



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**Session 6**

**EVOLUTIONARY BIOLOGY /  
CONSERVATION / APPLIED RESEARCH**



## Validation of Time-Depth Recorders in the American Mink (*Mustela vison*)

The impact of invasive species on native fauna and flora are a major conservation concern in many countries around the world. Science has provided significant insight in how to deal with this problem, which often requires extensive knowledge of the invasive species themselves. Data loggers, including time depth recorders (TDRs) have been providing scientists with information on the general biology of many deep diving and aquatic species for over 50 years. Recent technological advances could allow the extension of their use in understanding the activity and behavior of a wide range of free-living semi-aquatic species-which include a number of invasive species and species of conservation concern. The American mink (*Mustela vison*) is a detrimental invasive species for which this method could have important conservation implications. We aimed to validate the use of TDRs for inferring general activity patterns on the American mink. This was done by comparing the activity pattern durations extracted from the TDR with the durations recorded by direct observation in a captive scenario. Results showed TDRs to be a valid method of extracting broad activity patterns such as 'inactive', 'active in environment' or 'in water' as there was no significant difference between the TDR output and the direct observation output over any observation period. Some inconsistencies did exist however, and further work on minimizing data extraction errors is needed, as well as careful trials on free-living mink.

Key Words: time-depth recorders, bio-telemetry, activity budgets, behavior, American mink, *Mustela vison*.



American Mink (*Mustela vison*)



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## An attempt to better define the needs and expectations of visitors in zoological gardens

The aim of this research was to better define the principal needs and expectations of visitors in respect to animal exhibits presented in zoological gardens. We analysed the behaviour of visitors at 4 chosen exhibits in the Municipal Zoological Garden in Warsaw: three newly-built exhibits housing gorillas, jaguars and elephants, and a traditional one (goats exhibited together with a donkey). The visitors were classified into five categories: F (female), F+Ch (female+child), M (male), M+Ch (male+child) and Ch (child). The analysis of the obtained behavioural data (altogether, 234 observations) revealed that the frequency of behavioural category “watching animals” did not differ significantly between various exhibits and, hence, did not depend on attractiveness of exhibited species. In contrast, frequency of behavioural category “watching surroundings” showed highly significant differences between various exhibits (Chi-squared Test:  $P < 0.00001$ ) Post-hoc pairwise comparisons (Fisher Exact Probability Test with Bonferroni corrections) revealed highly significant differences between the frequency of that behavioural category in all compared pairs of exhibits with the exception of the comparison between jaguars and elephants. Visitors were “watching surroundings” most frequently in case of gorillas. No case of such behaviour was recorded at the exhibit of goats and a donkey. Visitors watching modern naturalistic exhibits were making photographs of them even if the animals were hidden from their view. Modern naturalistic settings of animal exhibits are thus clearly more attractive for visitors than traditional ones. The responses of visitors were also influenced by availability of other exhibits and by occurrence of interesting behaviour patterns.

Key words: zoological gardens, animal exhibits, human behaviour, animal-human interactions



People looking at the zoo map

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## Food niche overlap between American mink and Eurasian otter under different winter conditions in the Biebrza Wetlands (NE Poland) – is there an interspecific competition?

European otter (*Lutra lutra*) is native species in Poland. In recent years another semi-aquatic mustelid species, American mink (*Neovison vison*), has appeared in habitat inhabited by otter. Studies on interspecific competition between those two predators concentrate mostly on their food niche overlap and territory use. Some hypothesis suggests that the competition between American mink and European otter should be the strongest in the periods with limited food resources and weaker while the alternative prey groups (for American mink) are present in environment.

We predicted, that if the food competition between European otter and American mink exist in Biebrza Wetlands (NE Poland), it should be the strongest during winter season, which is a “starvation season” for most predators. The study was based on the analysis of prey remains in the faeces of the predators. Scats of mink (n=125) and otter spraints (n=171) were collected during two climatically different winter seasons along the Biebrza and Wissa rivers (21 km). The diet of American mink was highly varied between winter seasons and rivers, while the Eurasian otter fed almost exclusively on fish. Both mustelid species were found in sympatry and their density was stable in compared winter seasons. Food niche overlap between mink and otter was greater under harsh winter conditions, compared to mild one, but the niche overlap value was rather low. The results suggest that in studied area is very hard to find clear evidences which are able to support the hypothesis on interspecific food competition between those two mustelids.

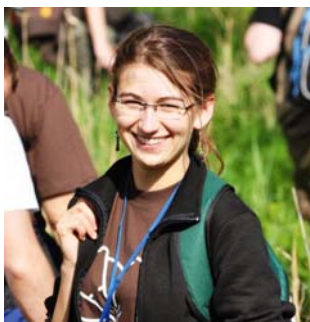
Key words: American mink; Eurasian otter; competition; niche shift; Biebrza Wetlands.



Eurasian otter *Lutra lutra*



American mink *Neovison vison*



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## Individual vocal signature as a tool for monitoring the ring-necked pheasant

Native to Asia, the Ring-necked Pheasant (*Phasianus colchicus*) has been widely introduced as a game bird across Eurasia. The male territorial vocalization is a loud call, penetrating kok-cack. It is frequently heard in agricultural areas where this territorial call is a good indicator of the pheasant's presence. Accurate estimates of pheasant population size over large landscape to calculate hunting plans are often difficult to obtain. We investigated whether the number of individuals on a site could be easily censused using individual acoustic characteristics.

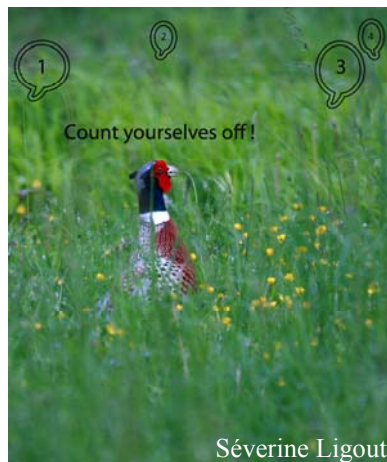
Our study aimed firstly to assess individual acoustic signature in the Ring-necked Pheasant and secondly to test the reliability of this information to determine the number of individuals present in an area. For this purpose, we used an experimental approach using known size population.

The analysis of songs of 21 different individuals reveals slight differences in the temporal and the frequency domains. Indeed the duration of two notes, the temporal gap between the note, and the fundamental, the mean and the peak frequencies, are stereotyped for each individual.

By divisive hierarchic methods, the individual discrimination in controlled area confirms the reliability of this information to take a census of the population. Indeed, our preliminary results on estimation of population density were in good agreement with the data known (mean individual correct classification rates: 83% of call in Ø300m area). We could show that the bioacoustic approach to bird census can be successfully applied to this bird species in open landscape. These work present new perspectives on monitoring/conservation by bioacoustic methodologies.

The study was supported by the ONCFS, the CNRS, the Fédération Départementale des Chasseurs de Loir-et-Cher and the Fédération Régionale du centre.

Keywords : vocal signature, monitoring, pheasant, censusing.



The Ring-necked Pheasant (*Phasianus colchicus*)

**Frédéric SÈBE**<sup>1,2</sup>, Céline ARZEL<sup>2</sup>, Thierry AUBIN<sup>1</sup>, Sylvain BAERT<sup>2</sup>, Alois GODARD<sup>3</sup>, Pierre MAYOT<sup>2</sup>, Guy PINDON<sup>3</sup>, François REITZ<sup>2</sup>, Elisabeth BRO<sup>2</sup>

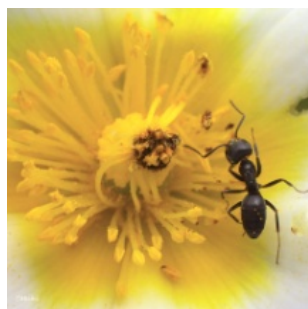
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## ***Tapinoma nigerrimum* (Hymenoptera: Formicidae): last shield against the spread of the Argentine ant?**

Conservation of biodiversity is one of the most important subjects for sustainable human development and resource use. With the expansion of international trade, invasive alien species have become a major cause of biodiversity loss on the global scale. Invasive ants are among the most harmful groups, causing serious problems to ecosystems, agriculture and human life. The Argentine ant *Linepithema humile* (Mayr) native to South America is one of the most important invasive species as it is currently found in many parts of the world; it attains high population densities and is able to out-compete many native ant species. Like other invasive species, its eradication or effective management with existing strategies has proved difficult. For example, containing these invasions with pesticide application and toxic baits can cause serious damage to the local biodiversity. In Corsica, native ant *Tapinoma nigerrimum* seemed to limit the spread of Argentine ant. Moreover, we chose *T. nigerrimum* as an interspecific competitor because its biology, behavior and colony attributes are remarkably similar to those of *L. humile*. Both species exist in Provence-Côte d'Azur Region. Bioassay between *L. humile* and *T. nigerrimum* testing competition for food and space has been made to test the hypothesis of a local resistance. In the laboratory *Tapinoma nigerrimum* showed ability to resist or even, in some case, to exterminate the Argentine ant. This occurred irrespective of the order of introductions and until a relative excess of *Linepithema humile*.

Keywords: invasive species, *Linepithema humile*, pest management, biotic resistance.



*Tapinoma nigerrimum*



*Linepithema humile*  
(Argentine Ant, invasive species).



**Laurence BERVILLE**<sup>1</sup>, Olivier BLIGHT<sup>1</sup>, Marielle RENUCCI<sup>2</sup>,  
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## Can feeding habits of native birds and changes in land use cause invasion of alien walnuts?

Invasive species are highly dispersive and competitive what make them winners during colonization of new habitats. Plants producing big seeds are rarely invasive due to problems with dispersal. Here we show that behavior of native animals and political-related changes in land use may be the factors responsible for invasion of species producing. We describe invasion of Asian plant Walnut (*Juglans regia*) in Europe and show that native corvids that transport seeds and cache them in arable fields, create a large seed bank of the aliens in soil. Vast land abandonment after collapse of Socialism in 90s of twentieth century caused that all hidden walnut seeds could grow.

Corvids carried seeds over 500 m from the natal tree and cached in arable fields. Distances with seeds were longer than flights during usual foraging. Due to synurbanization of corvids the interactions between them and walnuts (growing mostly in gardens) become more frequent nowadays. Presence of walnuts and their abundance in abandoned fields were higher near human settlements, where adult walnut trees grew. The density of young trees in abandoned fields reached even 1000 individuals per hectare and some individuals produced seeds as well. As birds preferentially cached walnut seeds in arable land and after measurements of the walnuts' age, we concluded that only land abandonment caused by political transformation could allow for the this exotic plant invasion. The oldest individuals were in age of about 20 years which coincides with the time of political changes.

Key words: invasion, alien species, corvids, walnut, changes in land use

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Keywords: INIST, Portal, Document delivery, Bibliographic database, Scientific watch, Ecology



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## Behaviour and reactions of visitors in zoological gardens, and attractiveness of exhibits

The aim of this research was to analyse behaviour and reactions of visitors in Warsaw Zoological Garden observed at 4 selected animal exhibits (3 newly-built ones and a traditional one): elephants, jaguars, gorillas, and goats exhibited together with a donkey. Visitors were classified into five groups: F (female), F+Ch (female+child), M (male), M+Ch (male+child), Ch (child). Their behaviour was quantified in terms of 25 categories (e.g. initiation of observation, indifference, photographing animals, photographing persons, observation of surroundings, comments on animals etc.). Pre-defined behaviours and reactions were noted on observation sheets using an ordinal scale 0-1. The total scores obtained for each behavioural category allowed us to identify the most frequent behaviours and reactions. The total time spent at the exhibit (recorded by a stop watch) and frequency of such behaviours as ‘awaiting’ indicated attractiveness level of a given exhibit. Our data revealed interdependence between some behaviours and reactions of visitors, time spent at the exhibit, and exhibit arrangement. Most frequent behaviours were ‘observation of animals’ and ‘comment on animals’, but very high scores have also been obtained for ‘observation of surroundings’, in particular in the case of newly-built exhibits. The behaviour ‘photographing animals’ was more frequent than ‘photographing persons’. However, surprisingly, the behaviour “read information board” was observed very seldom. The visitors rather paid attention to direct explanations provided by animal caretakers. Our data suggest thus that attractiveness level and, consequently, educational value of animal exhibits may be significantly enhanced by their arrangement and by service provided by the personnel.

Key words: zoological gardens, exhibit, education, transmission of information, human-animal interactions



Jaguars exhibit

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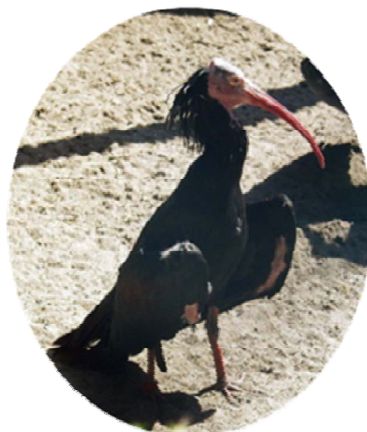


## Project of introduction of the bald ibis *Geronticus eremita* in the area of Laguermi Wilaya of El Bayadh Algeria

The Northern Bald Ibis (*Geronticus eremita*) was once widespread across the Middle East (Turkey), northern Africa (including Algeria) and southern Europe. It is now a species considered as critically endangered. A program to reintroduce captive-bred birds is under way in Austria. The species breeds quite well in captivity: there are more individuals in zoos and bird parks than in the wild. The species suffered a serious decline. The first results after information's collected, by Fellous Amina, is the observation in autumn of year 2005 of 02 individuals in flight, to the place called "Theniet Ouled Moumen" to some 2 km with bird flight of the last site of nesting announced meadows of the appendix of the CNDRB to Laguermi (W. of El Bayadh). In 1996, 3 individuals were observed in the area of Labiodh Sidi Chikh situated to a hundred kilometers in the South of the old colony

This site lies within the historic range of the species. The proposed project mainly involves: assessing the causes of extinction of the Northern Bald Ibis and studying the possibility of reintroduction. The expected benefits imply: improved survival, restoration of environmental conditions allowing natural recolonization and involvement in biological control of locusts, and finally its reintroduction will be a tourist attraction.

Keywords: Bald Ibis, Reintroduction, conservation, Laguermi, Algeria



Bald Ibis (*Geronticus eremita*)



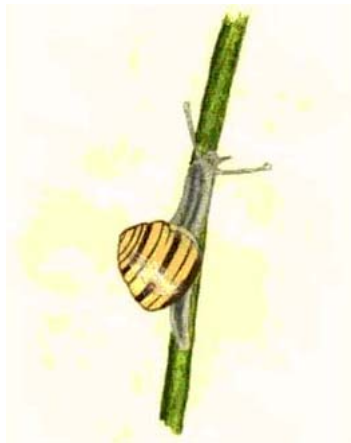
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## Birds and mammals differ in their predatory pressure on *Cepaea*

The evolution of shell polymorphism in the land snail *Cepaea nemoralis* (L.) is a textbook example of the effect of natural selection on gene frequency, where avian and mammalian predation is an important selective force. However, many questions about predation remain unclear, especially in the case of mammals. We collected 732 *C. nemoralis* and 90 *C. hortensis* (Müll.) shells to investigate predation pressure exerted by birds and mice on these species. We found evidence of avian and mammalian predation in 59.6% and 14.3% of *C. nemoralis* shells and in 18.9% and 34.4% of *C. hortensis* shells, respectively. Both birds and mammals were selective in respect of snail size and morphs. Mice avoided pink 1-banded *C. nemoralis* and preferred brown 1-banded morphs, which were totally neglected by birds. However, birds preferred brown unbanded *C. hortensis*. In contrast to mice, birds chose larger individuals. Significant differences in their predatory pressure can influence evolution and maintenance of shell size and polymorphism of shell colouration.

Keywords: polymorphism, natural selection, shell size, *Cepaea nemoralis*, *Turdus merula*, *Turdus philomelos*, *Apodemus sylvaticus*



*Cepaea nemoralis*

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	Mon 12 Apr	Tue 13 Apr	Wed 14 Apr	Thu 15 Apr	Fri 15 Apr
<u>Session</u>		<u>Sexual Selection</u>	<u>Habitat Selection / Dispersion</u>	<u>Neuroethology / Ecophysiology</u>	<u>Evolutionary Biology / Conservation / Applied Research</u>
8:30 - 9:20		<b>Michael Greenfield</b>	<b>Xavier Bonnet</b>	<b>Claudio Lazzari</b>	<b>Franck Dedeine</b>
9:20 - 9:40		Véronique M.	Ramakrishnan V.	Linde M.	Julia G.
9:40 - 10:00		Julien C.	Lukasz J.	Aurélie A.	Sophie D.
10:00 - 10:20		Vera G.	Simon D.	Leïla S.	Joanna K.
10:20 - 10:40		Coffee Break	Coffee Break	Coffee Break	Coffee Break
10:40 - 11:30		<b>Claire Doutrelant</b>	<b>Jean-François Le Galliard</b>	<b>Catherine Del Negro</b>	<b>David Orme</b>
11:30 - 11:50		Justyna K.	Alice R.	Catherine M.	Maceij B.
11:50 - 12:10		Sarah L.	Frédéric B.	Dariusz W.	Arnold F.
12:10 - 12:30		Karin L.	Nacho V.	Cécile L.L.	Rachele M.
12:45 - 13:30		Lunch	Lunch	Lunch	Drinks / Departure
<u>Session</u>		<u>Foraging Strategies / Parasitism</u>	<u>Group Behavior / Individual Interactions</u>		
14:00 - 14:50		<b>David Giron</b>	<b>Alain Lenoir</b>		
14:50 - 15:10		Philippe L.	Anton C.		
15:10 - 15:30		Ouarda B.	Sebastian P.		
15:30 - 15:50		Coffee Break	Coffee Break	Excursion	Optional: Visit at IRBI
15:50 - 16:40		<b>James Cook</b>	<b>Etienne Danchin</b>		
16:40 - 17:00		Vincent B.	Guillaume R.		
17:00 - 17:20		Karine M.	Mathieu A.		
17:20 - 17:40		Karolina K.	Christopher T.		
17:45 - 18:45		Poster Session	Poster Session		
19:00 - 20:00		Dinner	Dinner		
20:30 - 22:00		Jacques Weber	Jérôme Casas	Party!	
		Documentary Film			



