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**DEPARTMENTAL SEMINAR  
INTEGRATIVE ZOOLOGY  
Summer Term 2018**

**Programme and Abstracts**

Tuesdays, 10-11:30 hrs

SR 3, UZA1, Althanstraße 14, 1090 Wien





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## **Field identification key for Austrian Caelifera species**

**Markus Sehnal**

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*Advisors: Harald Krenn, Barbara-Amina Gereben-Krenn*

The Austrian grasshopper fauna includes 134 taxa (Ensifera: 63 species, Caeliera: 71 taxa). In comparison to the neighbouring countries Austria takes the third places in terms of species richness behind Italy (349 species) and Slovenia (157 species). Although the literature on this rather small group of insects has increased in the last two decades, there is still no identification key that contains all native grasshopper species. This diploma thesis is the first step to fill this gap in the Austrian grasshopper literature and is dedicated to the development of a field identification key for the native Caelifera species. The key is kept mostly dichotom and specially created for beginners. Introductory to the identification key are chapters which cover the system of the Caelifera, an overview about their Biology as well as tips and tricks for finding, catching and handling grasshoppers in the field. Scaled drawings of the relevant characteristics were made for this purpose as well as QR-Codes which lead to characteristic songs of the males of species which are difficult to identify only by morphological characters..

## **Hazards in the Urban Jungle: Managing Human-wildlife Conflicts of Crowned Eagles**

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Wildlife management is primarily a human response to reduce or eliminate causes of economic or social harm. However, these must be balanced against conservation goals regarding threatened species. Crowned eagles *Stephanoaetus coronatus* occupy urban landscapes of southern KwaZulu-Natal, South Africa. We identified negative incidents to human livelihoods, particularly predation on pets and livestock, and negative incidents to eagle livelihoods due to injuries, death, and nest disturbance. Citizen science involvement was developed with public awareness outreach, and this resulted in useful mortality and incident reports. Anthropogenic causes of harm are opportunities for active mitigation. Electrocutation and gunshot wounds were identified as primary threats. Collision with structures, glass panes, vehicles and fence wires also impact crowned eagle survival.

Time-lapse camera studies at urban nest sites demonstrated low rates of predation on livestock (6%) and pets (1%). Reported pet attacks were primarily by juveniles and sub-adults, and most occurred during winter months. Collaboration of wildlife authorities with NGO's and public stakeholder input creates an environment for successful crowned eagle conservation and management of human-wildlife conflicts. Active management and falconry-based rehabilitation processes can achieve a high standard of public support and conservation outcomes for human wildlife conflict concerning crowned eagles.

**Dr Shane McPherson** completed a Post Graduate Diploma in 2005 at Massey University, New Zealand. He developed field work experience working on New Zealand Falcons, the Mongolia Artificial Raptor Nest Project, and conservation management of Mauritius Parakeets. Volunteering for The Peregrine Fund East Africa project introduced seemingly endless needs for African raptor conservation – this experience included falconry-based fitness and hunting preparation of a captive bred Crowned Eagle who was successfully released. This is where he was inspired for the PhD project “Urban Ecology of the Crowned Eagle” that he completed in 2015 at the University of KwaZulu-Natal, South Africa.

## **Avoidance of inbreeding through increased migratory activity: A comparative study of two populations of *Salamandra salamandra* in the Vienna Woods**

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Inbreeding can have numerous negative effects on animal populations from elevated rates of developmental malformations to higher susceptibility to pathogens, the latter of which is of immediate interest considering the threat of the spreading fungus *Batrachochytrium salamandrivorans*. Spatial dispersal is one strategy to avoid incestuous mating and the most prevalent one in amphibians.

The larvae of the fire salamander (*Salamandra salamandra*) are usually dropped off into slow running water bodies, which often drift off and are consequently dispersed. In one of the two studied populations however, the larvae are dropped in small temporary still water bodies, thus eliminating this dispersal mechanism. Therefore, it is hypothesized that the lack of passive dispersal is compensated by a higher migratory activity after metamorphosis.

To test this claim, data of animal captures from the years 2010 to 2015 will be analysed and compared. This includes GPS coordinates of locations individuals were found at and photos of their dorsal patterns by which they can be – with computer software support (WILD-ID) – identified individually. From this data home range sizes will be approximated and the number of individuals leaving the research area estimated.

Depending on the results, this study can suggest existing adaptations for inbreeding avoidance or highlight a possible risk of heightened inbreeding occurrences within the population using temporary still water bodies. Therefore, this study is not only of interest in terms of exploring population regulatory mechanisms but can also add to the conservation efforts of this threatened species.

# **The Antennal Circulatory Organ of the Blow-Fly *Calliphora vomitoria* L. 1758 (Diptera, Calliphoridae)**

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*Advisor: Günther Pass*

Accessory circulatory organs supplying the antennae are widespread among pterygote insects and exhibit an unusual disparity in their functional morphology. In Diptera, so far only the antennal pulsatile organs of nematoceran species were studied in detail. In this study, these organs in the brachycheran *Calliphora vomitoria* are investigated using light and electron microscopy together with the 3D reconstruction software Amira. The organ of the blowfly is located in the head medially beneath the basal segments of the antennae, and consists of an unpaired ampulla, to which lateral vessels are connected supplying the antennae. Two strands of dilator muscles are attached to the anterior ampulla wall which extend horizontally to the back of the head. In front of the brain the muscle strands merge and a single strand extends below the brain to the second attachment site at the anterior end of the dorsal vessel. The thin ampulla wall is built up of flat overlapping epithelial cells interconnected by hemidesmosomes and septate junctions. The ampulla exhibits an extraordinary thick and filamentous external lamina giving the wall probably a certain elasticity. Within the ampulla lumen numerous of tiny strands of connective tissue extend from the anterior wall to the posterior wall. This meshwork accumulates in the posterior area of the ampulla forming a tendon-like structure to which the ampulla dilator muscles are attached. The contraction of these muscles widen the ampulla and hemolymph is sucked into the lumen via two lateral valve-like ostia. During systole, the ampulla is compressed, probably due to the elasticity of the external lamina, and hemolymph forced into the antennal vessels. In the posterior region of the head the dorsal vessel terminates slightly above the neck opening with a large excurrent opening. In the area where the dorsal vessel bends dorsally, two lateral openings are found. Accessory circulatory organs with dilator

muscles attached to the dorsal vessel are already known from other dipteran species like *Culex pipines* and *Aedes aegyptii*. This functional model was also reported from other hexapod families like Orthoptera, Blattodea and Megaloptera.

## **Circulatory organs in the cerci of polyneopteran insects**

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The cerci are paired abdominal appendages at the rear end of many insects. They are true extremities which form in most cases long segmented structures which are densely covered with various sensilla. They function as backward directed antennae which serve important functions like triggering flight reaction. The sensory cells as well as the other living tissue hosted in the cerci require a continuous supply of haemolymph. In ancestral hexapods the cerci are supplied by cercal arteries which originate from the rear end of the dorsal vessel. This connection was probably lost during evolution and various other haemolymph guiding structures evolved like channels, diaphragms, or complex auxiliary pumping organs. The present study focuses on the functional morphology of cercal circulatory organs in the cockroach *Periplaneta americana* using semithin serial sections, microCT and the computer software AMIRA for 3D-reconstruction. Observation of the haemolymph flow pattern at the base of the cercus will be analysed in addition to try to elucidate the mechanism behind the flow in the cercus. The results will be used together with preliminary data from other major taxa to reconstruct the evolution of the circulatory organs within the polyneopteran clade.

## **The influence of group dynamics on the hunting behaviour of individual archer fish (*Toxotes chatareus*): a laboratory analysis**

**Michael Pollirer**

*Associate Researcher*

*Workgroup: Helmut Kratochvil*

The archer fish (*Toxotes chatareus*) represents an excellent model for visual research because this fish has to compensate for the different optical features of water and air when hunting air-borne prey by shooting (i.e., ejecting water-streams). This foraging strategy relies strongly on visual capacities such as perception of environmental changes, motion perception and object recognition. Individual shooting behaviour has already been described in the literature, but little information is available on group dynamics and its influence on the hunting behaviour of individual fish. From our point of view, there are four important aspects in successful hunting by archer fish: prey detection, shooting accuracy, hunting endurance and catching the dislodged prey. To this end, archer fish (*Toxotes chatareus*, both individually and in groups of 5 individuals) will be presented with immobile (presented in an artificial structure for detection, experiment 1) and living flies (experiment 2). We will record hitting rates, different prey-catching strategies along with shooting performance and its changes within fish when hunting in groups or individually. The experiments will be carried out during the first two years of my dissertation (from June 2018 to June 2020). The results of this study will reveal important new aspects of the hunting behaviour of archer fish with regard to future collaborations with the Departments of Behavioural Research and Cognitive Research as well as teaching at the university.

## **The Eastern Mosquitofish, (*Gambusia holbrooki*) – a prime example of allopatric speciation**

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In the twenties of the 20th century the eastern mosquitofish *Gambusia holbrooki* was exposed in many European countries to malaria control. In aid of chemical pest control the project was forgotten shortly after. In many waters *Gambusia holbrooki* survived to date under different ecological conditions. This makes an excellent opportunity to study allopatric selection respiratory speciation in fishes. This was reason enough to carry out a series of researches on this species over several decades.

Hanno Fűrwein compared fishes from 5 different biotopes (Turkey Yugoslavia, Hungary) using morphometric methods. He clearly showed significant differences.

Individuals of two different habitats (a cold pond in Krk – Croatia and a thermal lake in Heviz – Hungary) were bred under identical conditions and tested for their respiratory rates and their reaction to cold temperatures. It was found that the fishes from the thermal lake lost their tolerance to low temperatures and developed a distinctive stenothermia.

Günther Hulla raised the offspring of fish from 2 different biotopes (thermal lake, cold lake) under identical conditions. It was found that the population from the thermal waters is characterized by faster growth and a significantly faster generation sequence.

## **The invertebrate *Phallusia mammillata* as a marine model for toxicity screening**

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Ascidians (sea squirts) are members of the sister clade to vertebrates and make a vertebrate-like tadpole larva composed of less than 3000 cells in 18 hours. The neural complex of ascidian larvae is made of only 350 cells (of which 100 are neurons) and functional genomic studies have now uncovered numerous gene regulatory networks underpinning neural specification and differentiation. Several studies also show that brain formation in ascidians is sensitive to toxic insults especially from endocrine disruptors (EDCs), making them a suitable model to study neurodevelopmental toxicity. To better characterize the phenotypes induced by EDCs, we have developed protocols for high-throughput analysis of multiple endpoints in the ascidian larva. Our approach allows us to characterize more specific phenotypes induced by different classes of compounds. This study is a first attempt to establish the ascidian *Phallusia mammillata* as a model system for developmental toxicity screening.

# **E-Learning und partizipative Lehr- und Lernkonzepte für die Lehrveranstaltung „Morphologie und Funktion der Tiere“. Ein hochschuldidaktisches Konzept**

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The inverted classroom or flipped classroom model is a pedagogical method that reverses the traditional learning environment by providing them with videos and other content input to prepare outside of the classroom.

Hence, time resources are mobilized for the students in order to practice and apply the acquired knowledge and skills. The theoretical part of the lecture is shifted from the classroom to home and the exercises which in traditional teaching methods would be given as homework are done in class. Therefore, students can profit from the teacher's presence during the period of transfer from theory-to-practice which causes most of the issues and questions.

The purpose of this diploma thesis is to give deeper insights into the students' perceptions of the inverted-classroom-model and the gained benefits of the method.

The inverted classroom model was applied to the first two dissection sessions in winter term of 2016 and then to the whole course of the winter semester 2017 during which the concept was also extended by a learning journal the students were asked to write during the term.

For the learning journal students were asked to write about their learning process and its success as well as perceived benefits of the method. Most student mentioned 'being prepared' as a positive impact on their motivation and their process of learning whereas the increased time effort was considered as negative. Writing a learning journal and reflecting on the content and the learning process was considered as positive by most students.

## **Common Swift (*Apus apus*) in Vienna: distribution and population estimate**

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The Common Swift (*Apus apus*) is a synanthropic bird which breeds at buildings mainly in larger cities. Currently, renovation and thermal insulation of buildings is happening at a high rate in Vienna as well as in many other European cities. This leads to a loss of suitable cavities for house-nesting birds. In 2017 the MA 22 (Municipal Department for Environment Protection of the City of Vienna) conducted a study about nest-sites of the Common Swift (*Apus apus*) in the City of Vienna, Austria. The focus of the study was to identify as many buildings as possible with nest-sites in order to enable target-oriented protection in the future. Therefore, not flying individuals were counted, but buildings with nest-sites that were reported by citizens or already known by the department. In order to map as many buildings as possible, the citizen science approach was chosen. More than 40 volunteers helped to map the number of nest-sites at the reported buildings. The standardized mapping was performed based on the proposed method of nest-site identification by SÜDBECK et al. (2005). The mapping took place in the evening hours, the observation of each building took at least 30 minutes and a nest-site was only counted, when a Common Swift was observed when entering or exiting. Altogether, more than 830 nest-sites have been mapped at about 240 buildings across the city. In the next years the study will be continued to hopefully become an on-going project.

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**Biologie und Ökologie der beiden nahverwandten  
Orthopteren-Arten *Barbitistes constrictus*  
(BRUNNER VON WATTENWYL 1887) und  
*Barbitistes serricauda* (FABRICIUS 1798)**

**im Kamptal**

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*Barbitistes serricauda* and *Barbitistes constrictus* are two closely related Ensifera-species within the family of Phaneropteridae.

Both species are highly associated with woodland habitats, which is rare among orthopterans. Until the use of bat detectors as a method of mapping orthopterans was introduced, they were only rarely observed systematically, because the imagines dwell in treetops and evidence of their presence was in most cases a discovery by chance. With this device, the species can easily be detected through their species-specific song at 18-30 (37) kHz. Since then, more in-depth information about their biology and ecology has been collected.

In 2017, „Die Heuschrecken Österreichs“ (Zuna-Kratky et. al.) was published, merging information about the distribution of all native orthopteran species. In Austria, *B. constrictus* is only found on the Bohemian Massif, while *B. serricauda* inhabits all Austrian provinces and is only missing in areas where *B. constrictus* is found. Within the scope of the two diploma theses, habitats in the Thayatal (Lisa Reiss) south of the czech border, which is the only region in Austria where the two species seem to occur syntopic, and the Kamptal (Lisa Liska), where the species seem to be spatially separated, have been analyzed. Randomized woodland areas (47 areas in the Thayatal and 51 areas in the Kamptal) of 225 m<sup>2</sup> each were examined in terms of the presence or absence of one of the *Barbitistes*-species, the sealevel and the

composition of the vegetation using Braun-Blanquet analysis. Indicator values of the occurring plant species provide information about climate parameters, since climate and vegetation seem to be key factors in the distribution of orthopteran species. The main aim of the two diploma theses is to find clues to the distribution pattern of *B. constrictus* and *B. serricauda* in the examined areas.

## **Phylogeny, morphology and pollen preferences of five Austrian species in the *Colletes succinctus* group (Hymenoptera: Apidae)**

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*Colletes* Latreille, 1802 is a solitary bee genus with almost worldwide distribution (except Australia). The common name “polyester bees” derives from a characteristic cellophane nest lining produced by the Dufour gland and applied with the tongue (Westrich 1990). Noskiewicz divided the genus into 26 species groups. Especially the *Colletes succinctus* group, which consists of 14 species, demands some questions to be answered regarding taxonomy and phylogeny (Noskiewicz, 1936). In Austria five species of this group fly from late summer to autumn, with one generation per year. Regarding their pollen preferences, they are classified as either polylectic, pseudo-oligolectic, or oligolectic (Müller & Kuhlmann 2008, Teppner & Brosch 2015). The oligolectic behaviour and habitat preferences were sometimes used for identification of females, which are difficult to separate by morphology. Specimens collected in September and October 2017 in Vienna, Lower Austria and Burgenland as well as those from the collection of the Natural History Museum Vienna will be sorted to species level based on morphology and DNA-barcoding.

Morphological studies (morphometry, analyses of genitalia and microstructures by scanning electron microscopy) will be performed to find so far unrecognized characteristics. In addition, the bee-collected pollen will be analysed to determine how plant-specific the species are within a small geographic range. The aim of this study is to develop a better understanding of phylogeny, morphology and pollen preferences of eastern-Austrian members of the *Colletes succinctus* group.

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## **Embryonic development of phylactolaemate bryozoans**

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Phylactomaemate bryozoans are the only group of bryozoans restricted to fresh water of merely 70-80 species. Therein the family Plumatellidae constitutes the most speciose one. These bryozoans reproduce asexually via budding and as adaptation to freshwater habitats also by dormant buds or statoblasts, which serve overwintering and dispersal. Besides asexual reproduction, they also reproduce sexually and brood their embryos in specific chambers, so-called embryo sacs. The embryo sac form from an invagination of the cystid wall, close to the ovary. Only two species of this family, *Plumatella fungosa* and *Plumatella casmiana*, have been subject to few studies that deal with the embryology and sexual development of phylactolaemate bryozoans. According to those studies a presumably unfertilized egg is transferred from the ovary to the embryo sac, where it gets fertilized and further nourished by a placenta-like structure. Sexual development results in a phylactolaemate-specific mantle larva, that consists of a ciliated mantle surrounding two functional zooids. It settles as a small colony after a short free-swimming period. Ever since the pioneering studies of Braem from the 19th and beginning of the 20th century, no detailed has been carried out on the embryology of this group of bryozoans. Still, several gaps remain in our understanding of the developmental processes in Phylactolaemata. Consequently, the aim of this study is to analyse and reconstruct the embryology of *Plumatella casmiana* by means of serial semithin sections and 3D-reconstruction, but also ultrastructural studies for the first time. Preliminary results will be presented.

## **Mesoderm and muscle formation in the zebra mussel *Dreissena polymorpha***

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Myogenesis involves modification, reduction and de novo formation of muscular tissue and is particularly dynamic in mollusks. In Aculifera, studies into muscular development has contributed to a better understanding of the evolutionary history of the taxon and reconstruction of its last common ancestor. Herein, I describe the dynamics of myogenesis and larval myoanatomy in the zebra mussel *Dreissena polymorpha*. It is a small, mytiliform freshwater mussel and belongs to the Neoheterodonta. The zebra mussel is an invasive species in Europe and the USA that originated in the Caspian and Black Sea. They may occur in masses and are important biofouling organisms. Native species are affected too, because *Dreissena polymorpha* is an active filter feeder that may efficiently remove nutrients from the water column.

Only two studies on bivalve myogenesis using state-of-the-art methods are currently available, namely on the scallop *Nodipecten nodosus* and the shipworm *Lyrodus pedicellatus*. Typical larval muscular components identified are a larval velum ring, velum retractors and a ventral larval retractor. These structures are thought to belong to the ground pattern of the bivalve larval musculature. This hypothesis will be tested with confocal microscopy and 3D reconstruction using *Dreissena polymoprha* as a model. Comparing my data to that of other bivalves and conchiferans will contribute to the reconstruction of the larval muscular ground pattern in Bivalvia and Conchifera.

In mollusks, the mesoderm (i.e., the germ layer from which the musculature forms) emerges from two sources, an ectodermal and an endodermal one, but little is known about the genes that control mesoderm formation in mollusks. Time permitting, I want to test whether well-known marker genes such as *hes*, *twist*, or *snail* are expressed during *Dreissena* mesoderm formation or whether mollusks have co-opted other genes into the development of this crucial bilaterian germ layer.





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