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- 23 év szakmai tapasztalat
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17th European Congress of Herpetology

Veszprém, Hungary



17th European Congress of Herpetology
Veszprém, Hungary

PROGRAMME & ABSTRACTS



University of Pannonia
22–27 August 2013



PROGRAMME & ABSTRACTS



University of Pannonia
22–27 August 2013

Welcome

Chief Patron:

Tibor NAVRACSIKS, Deputy Prime Minister, Minister of Public Administration and Justice

Organising Institutions:

Societas Europaea Herpetologica (www.seh-herpetology.org)

Hungarian Ornithological and Nature Conservation Society, MME/Birdlife Hungary (www.mme.hu)

University of Pannonia, Department of Limnology, Veszprém (ornithology.limnologia.hu)

Hungarian Natural History Museum, Budapest (www.nhms.hu/en)

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Gábor SERESS (Hungary)

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17th European Congress of Herpetology, Veszprém, Hungary, 22–27 August 2013. *Programme & Abstracts*.

Congress logo: Balázs FARKAS

Herp photos: Bálint HALPERN

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Dear Colleagues,

Welcome to Veszprém, Hungary!

The 17th SEH European Congress of Herpetology is hosted by the University of Pannonia, and co-organised by the Hungarian Ornithological and Nature Conservation Society (MME) and the Hungarian Natural History Museum.

Participants from six continents (39 countries) registered for the event, giving the meeting a global perspective on the science of herpetology.

The scientific programme includes four invited talks on topics of broad interest (evolution of reptile venom, invasive species, biogeography and systematics) and 113 talks in 11 different parallel sessions. On the symposia day, four symposia will be presented on relevant topics such as invasive alien species, chytridiomycosis in Europe, monitoring of Natura 2000 species and herpetofauna and transport systems. There will also be 120 poster presentations divided between two poster sessions.

Wine will be served during the poster sessions and a morning raffle will be held with valuable prizes to be won. There will be a contest for the best student talk and poster, and for the first time in the history of SEH European Congress of Herpetology, a silent auction will take place.

The welcome party, the wine tasting in Balatonfüred-Csopak Wine Region and the gala dinner all provide further opportunities to meet the other delegates.

Although August is not the best time for field herping, locations have been chosen for congress excursions where sightings of amphibians and reptiles are guaranteed. These locations are the Kis-Balaton and the Hungarian Meadow Viper Conservation Center in Kiskunság.

On behalf of the Local Organising Committee I wish you an exciting and interesting meeting.

Kind regards,
Judit VÖRÖS

Our Sponsors



BRILL



Edition Chimaira



General Information

Venue

University of Pannonia
Egyetem út 10, 8200 Veszprém

The plenary sessions (conference room) will take place in the Aula (building B), this is the place where the posters will be on display. The sessions will take place in building A, in rooms 1 and 2.

Congress bureau before and after the congress

ALTAGRA Business Services and Travel Agency Ltd.

Örösi Pál Zoltán sétány 0172/19. hrsz.

2100 Gödöllő

Phone: +36 28 432985

Fax: +36 28 419647

E-mail: biszkup@altagra.hu

Homepage: www.altagra.hu

Congress bureau during the congress

University of Pannonia

Egyetem út 10, 8200 Veszprém

Phone: +36 30 3400013

Opening hours

22 August, Thursday	14:00–20:00
23 August, Friday	08:00–18:30
24 August, Saturday	08:00–17:00
25 August, Sunday	08:00–18:30
26 August, Monday	08:00–16:00

Internet access

Free Wi-Fi is available in the University halls.

Message board

You will find a message board in the Aula of the University.

Coffee

Coffee, tea, soft drinks, mineral water and small cakes will be served during the coffee breaks in the dining room adjacent to the Aula.

Please note that it is prohibited to consume meals or drinks in the Aula.

Lunches

Please note that lunches are not included in the registration fee. However, we offer you lunches between 23 and 26 August at the venue of the Congress (price per lunch 12 EUR). Limited number of lunch tickets will be available to purchase on site. Lunch will be served at the Menza of the University. The buffet lunch includes: warm dishes (soups and main courses), salads, desserts, mineral water, soft drinks and coffee.

Social Events

Opening Ceremony and Welcome Party

Date: 22 August (Thursday)

Time: 19:00 hrs

Place:

Opening Ceremony: Aula of the University of Pannonia

Welcome Party: Dining room of the University of Pannonia, adjacent to the Aula

Please note, that it is prohibited to consume meals or drinks in the Aula.

Admission is free for congress participants and for their registered accompanying persons.

Wine tasting with dinner in Balatonfüred-Csopak Wine Region

(23 August [Friday] and 24 August [Saturday])

Date: 23 August (Friday) and 24 August (Saturday)

To be visited: Szent Donát Winery, Csopak

Transfer: Will be provided

Meeting point: Entrance of the Aula

Departure time: 18:30

Transfer back: Approx. at 21:30

Admission: Only with ticket, tickets are available in limited number at the registration desk

Price: 30 EUR

Morning raffle

Every morning, five minutes before the plenary talk we will hold a morning raffle with valuable prizes. Registration numbers on the congress badge will serve as raffle ticket. In order to win, one has to be present. If owner of number is absent, another ticket will be selected.

Congress photo

A picture of participants will be taken and later uploaded to the congress website.

Place: stairs of the Aula building

Time: 24 August, 12:30

Gala dinner

Date: 25 August (Sunday), between 19:00 and 23:00, in *Betekints Étterem* (Restaurant) (Veszprémvölgyi u. 4, 8200 Veszprém). Transfer will be provided.

Meeting point: Entrance of the Aula

Departure time: 18:30

Transfer back: Between 21:30 and 23:00 continuously to all official congress hotels

Admission: Only with ticket, tickets are available in limited number at the registration desk

Price: 20 EUR

Field Excursions

1. Visiting the Hungarian Meadow Viper (*Vipera ursinii rakosiensis*) Conservation Centre in Kiskunság

Date: 27 August (Tuesday)

Services provided: Transportation by bus, English speaking guide, lunch

Meeting point: Aula of the University

Departure time: 08:00

Transfer route after the tour:

Budapest Airport, arrival not later than 18:00

Budapest City Centre, Erzsébet tér, approx. at 18:30

Admission: Ticket, price 25 EUR

2. Kis-Balaton (Balaton Uplands National Park)

Date: 27 August (Tuesday)

To be visited: Kányavár Island and other sections of the protected area and the Buffalo Reserve

Services provided: Transportation by bus, English speaking guide, lunch

Meeting point: Aula of the University

Departure time: 08:00

Transfer route after the tour:

Veszprém University, approx. at 16:30

Budapest Airport, approx. at 19:00

Keleti Railway Station, approx. at 19:30

Budapest City Centre, Erzsébet tér, approx. at 19:45

Admission: Ticket, price 25 EUR

Special Invitations

Free entrance to the BUDAPEST ZOO AND BOTANICAL GARDEN

Budapest Zoo & Botanical Garden is the oldest zoo park in Hungary and one of the oldest in the world. It has 733 animal species and is located within Városliget Park. Thanks to the management of the Zoo, the participants of the congress can visit this interesting place for free between 21th and 30th August. Free check-in available between 9:00 and 18:30 hours at the cashier where your name has already been registered.

Address: Állatkerti körút 6–12, 1146 Budapest

The service is available for those participants and accompanying persons who have registered for the Congress not later than 15 August.

Free entrance to the TROPICARIUM

Tropicarium Budapest is a particular indoor zoo, where you can find Central Europe's biggest shark aquarium. Thanks to the management of *Tropicarium*, the participants of the conference can visit this interesting zoo for free between 21 and 28 August. Free check-in available between 10:00 and 19:00 hours at the cashier where your name has already been registered.

Address: Nagytétényi út 37–43, 1222 Budapest

The service is available for those participants and accompanying persons who have registered for the Congress not later than 15 August.

Free entrance to the HUNGARIAN NATURAL HISTORY MUSEUM's exhibitions

Thanks to the management of the Museum, participants of the conference can visit the Museum for free between 20th August and 1st September. Free check-in available between 10:00 and 17:00 hours.

Please contact the information desk to pick up your visitor's card. You only have to tell that you are a SEH 2013 participant, the clerk at the desk will have the list of registered participants.

Address: Ludovika tér 2–6, 1083 Budapest

The service is available for those participants and accompanying persons who have registered for the Congress not later than 15 August.

Programme for Accompanying Persons

Accompanying persons are kindly invited to join the delegates at the *Opening Ceremony and the Welcome Party*. Accompanying persons are also welcome to the *Budapest Zoo and Botanical Garden*, the *Tropicarium* and the *Hungarian Natural History Museum*.

Presentation Guidelines

Poster display

Posters will be on display during the whole Congress. Authors are responsible for setting up their poster at the beginning of the congress and removing it after the end of the congress.

Venue: Aula of the University of Pannonia, ground floor and gallery

Poster boards: White wall elements in aluminium frame construction. Each poster will be attached to the boards with BLU-TACK® which will be provided free of charge. Push pins are not allowed.

Poster size: The maximum size allowed for each poster is 80 cm wide and 120 cm high.

Poster position: Vertical. Posters that do not adhere to the dimensional limits cannot be displayed.

Set-up: 22 August (Thursday) 14:00–18:30

No poster should be set up during the Opening Ceremony!

Poster removal: 26 August (Monday) 14:00–16:00

No poster should be removed during the Closing Ceremony!

Poster session 1. 23 August (Friday) 17:00–18:30

Topics: Climate change, Ecology, Monitoring

Wine and snacks will be served in the dining room adjacent to the Aula.

Please note that it is prohibited to consume meals or drinks in the Aula.

Poster session 2. 24 August (Saturday) 17:00–18:30

Topics: Behaviour, Morphology, anatomy and development, Distribution, Diseases and parasites, Phylogeography, Phylogeny, Population genetics, Systematics, Physiology, Tropical herp biodiversity, ENPARTS Symposium

Wine and snacks will be served in the dining room adjacent to the Aula.

Please note that it is prohibited to consume meals or drinks in the Aula.

Oral presentations

The length of the oral presentations will be 12 minutes with 3 minutes discussion, 15 minutes altogether. Please contact the technical staff if you have additional requests.



In Memoriam Olivér György DELY

The SEH 17th European Congress of Herpetology is dedicated to the memory of Hungarian herpetologist Olivér György DELY, curator of the Herpetology Collection of the Hungarian Natural History Museum for over 50 years.

Olivér György DELY was born in Nagyszalonta (now Salonta, Romania) on April 27th, 1927. He studied in Nagyvárad, Nagyszalonta and Budapest. After graduating as a museologist from Péter Pázmány University in Budapest, he started to work in the Herpetology Collection of the National Natural History Museum in 1950.

He published 83 scientific papers, mainly on the members of the Hungarian herpetofauna, discussing them from taxonomic and systematic points of view.

During the 1956 political revolution the museum building was shelled, and nearly 40,000 herpetological specimens—including historic type material—burned to ash. In the next decades, through exchanges, donations, and collecting trips, O. Gy. DELY rebuilt the collection. Thanks to his devotion the Herpetology Collection now owns nearly 20,000 specimens. Besides replacing the collection with material representing the herpetofauna of the Carpathian Basin, he conducted several expeditions to Egypt, North Korea, and Algeria, where he gathered hundreds of specimens to enrich the Herpetology Collection of the Hungarian Natural History Museum.

In 1981 he organized the First Herpetological Conference of the Socialist Countries, and in 1991, as honorary president, he hosted the Sixth Ordinary General Meeting of SEH in Budapest.

Olivér György DELY passed away on November 19th, 2003. In 2013, on the 10th anniversary of his death, the 17th SEH European Congress of Herpetology is held in Veszprém in commemoration of his lifetime achievements in herpetology.

Judit VÖRÖS

CHIMAIRA: a company portrait

The history of CHIMAIRA Buchhandels GmbH began with the opening of an individualistic bookshop in downtown Frankfurt, located in close proximity to the Zoological Gardens. Right from the start, maintaining a combination of new publications and antiquarian stock was a main goal.

Next to entertainment books for both adults and children, Andreas S. BRAHM had a particular interest in subject-specific literature of certain fields. As an experiment, he had a small sales list of herpetological titles typed on a typewriter, copied and distributed (ca. 1992/1993). This first catalogue of natural history titles was met with an unexpectedly strong response. The following years then saw a systematic expansion of the range of both new and antiquarian titles in the fields “*Herpetology*” and “*Aquarium Keeping and Ichthyology*”. Starting in 1994, extensive catalogues were published regularly in August that are by now mailed to some 10,000 customers—this year (2013) thus sees the publication of the twentieth catalogue. New customers are most welcome to request a copy of the latest issue.

A first attempt at publishing was undertaken in 1995 with a treatise on African ethnoherpetology (Segwagwanyana) by Ronald AUERBACH. Originally chosen as a name for the publishing sector, “*Chimaira*” also became the logo of the bookshop in 1998. During the period leading up to the turn of the millennium, further titles followed at a rate of one to two per annum. With Dr. Gerold SCHIPPER joining the team in 2000, the publishing sector was continually expanded. The number of new publications or new editions has since increased to between five and fifteen per year.

The range of publications extends from guides to terrarium keeping, via monographs on reptiles and amphibians, to dissertations and field guides. The programme of Edition CHIMAIRA here feels obliged to continuing the specifically German tradition that started in the early 20th century and has always been trying to create possibilities for a fruitful co-operation between amateurs and scientists as to broaden horizons to the benefit of both.

Providing detailed guides to the captive care of reptiles and amphibians is what we regard as our contribution to a responsible interaction with animals in human care. That in doing so the protection of endangered species is to be respected and improved and the acquisition of captive-bred animals is to be given preference, is a self-imposed directive we always strive to adhere to.

A more recent branch of CHIMAIRA’s publishing sector is dedicated to the field of veterinary medicine. Here, the focus is once more on providing publications that can help optimise the husbandry conditions of reptiles and amphibians in captivity on the one, and convey the advances in a field that has seen rapid progress in the past decades on the other hand.

One of the most exciting book projects of the last few years was the publication of the first edition of BOURRET’s “*Les Lézards de l’Indochine*” that came into being through a cooperative effort with the Natural History Museum of Paris. After the manuscript had been slumbering in an archive for some fifty years following the author’s death in 1957, an admirable initiative by Roger BOUR eventually made it possible to publish this milestone treatise in 2009.

The range of subject-specific literature was broadened over the past years by adding the fields “*Invertebrates*”, “*Mammals*”, “*Botany*” and “*Ornithology*”.

As early as in the mid-1990s, Andreas S. BRAHM realised that keeping close contact with clients was a crucial factor for a specialised bookshop such as CHIMAIRA. It is for this reason that large parts of our book range can be viewed at reptile fairs (such as the Terraristika in Hamm), meetings of the DGHT, as well as scientific symposia of the SEH and other organisations every year. The countless discussions with bibliophilic terrarium keepers, herpetologists and veterinary medicine practitioners held on these occasions have not rarely culminated in new book projects.

Major aspects, like species conservation or the systematic advancement of our knowledge of biological processes, are also part and parcel of a more recent project: the series entitled *A Life for Reptiles and Amphibians* that was initiated by Fabrizio LI VIGNI, the first volume of which is to appear in autumn of 2013.

LI VIGNI’s collection of interviews portray a colourful and multifaceted mosaic of global herpetological work in that they provide intimate insights into the professional careers of several dozens of contemporary herpetologists of all ages and origins, with all five continents being represented. This idea cannot be over-appreciated, because it emphasises two points in particular:

(1) Every scientific discipline has to address its roots and history, if it is to justify its doings and goals. This is achieved here for the period from about 1950 to the present day in a convincing manner in that it is an extraordinary compilation of interviews with prominent herpetologists from the world over. The portrayal of the past history of herpetology we owe to the three volumes of *Contributions to Herpetology* edited by Kraig ADLER, while *A Life for Reptiles and Amphibians* creates a link between ADLER’s works and the present day.

(2) Over and above this, the interviews are also meant as a stimulus for all those who are young, enthusiastic and interested in modern-day aspects of biology and who harbour the wish to enter a career in science or take up an occupation in nature conservation or an affiliated professional field.



Visit our shop at www.chimaira.de

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(Publishing Manager)
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Programme

22 August Thursday	23 August Friday	24 August Saturday	25 August Sunday	26 August Monday	27 August Tuesday
	Plenary: Zoltan TAKACS	Plenary: Pim ARNTZEN	Plenary: Rick SHINE	Plenary: Wolfgang BÖHME	Departure for excursions
8:30	Behaviour of reptiles	Phylogeography and phylogeny	Symposium: IAS	Systematics	Practical conservation
9:30	Ecology of amphibians	Ecology of amphibians	Symposium: Symposium: Monitoring Bd	Systematics	Practical conservation
11:00	Coffee break	Coffee break	Coffee break	Coffee break	Coffee break
11:30	Behaviour of reptiles	Phylogeography and phylogeny	Symposium: IAS	Systematics	Practical conservation
12:30	Lunch break	Lunch break	Lunch break	Lunch break	Lunch
14:00	Behaviour of amphibians	Ecology of reptiles	Symposium: ENPARTS	Morphology, anatomy, physiology and development	Diseases and parasites
15:30	Coffee break	Coffee break	Coffee break	Coffee break	Coffee break
Registration					
16:00	Behaviour of amphibians	Monitoring	Symposium: ENPARTS	SEH Council Meeting	
17:00	Poster session 1	SEH Ordinary General Meeting	Writing and publishing scientific papers	Closing ceremony	
19:00	Wine tasting 1	Wine tasting 2	Gala dinner		Arrival to Budapest
20:00	Welcome party				

8:30–9:45		Room 1		Room 2	
Plenary Lecture: Z. Takács: The deadliest lifesavers: reptile venoms at the forefront of medicine Chair: R. Shine		Session 1a: Behaviour of reptiles Chair: W. Hödl		Session 2a: Ecology of amphibians Chair: T. Harrel	
9:30–9:45	A. Ibañez, P. López, J. Martín: Antipredatory behaviour of Spanish terrapins depends on reproductive state and individual conspicuousness	9:30–9:45	M. Barquero, M. Whiting, R. Peters: Geographic variation in the signalling behaviour of the Jacky dragon, <i>Amphibolurus muricatus</i>	9:30–9:45	G. F. Ficetola, C. Rondinini, A. Bonardi, V. Katarinya, E. Padoa-Schioppa, A. Angulo: An evaluation of the robustness of global amphibian range maps
9:45–10:00	A. Golubović, M. Andjelković, D. Atsovski, S. Djordjević, V. Iković, A. Vujović, X. Bonnet, L. Tomović: Tortoise's shell—a blessing and a curse: How tortoises cope with various obstacles	9:45–10:00	P. López, J. Ortega, J. Martín: Effects of climatic factors on the evolution of sexual chemical signals of the Iberian wall lizard, <i>Podarcis hispanica</i>	9:45–10:00	M. Denoël, G. F. Ficetola: Environmental correlates of paedomorphosis and metamorphosis in palmate newts
10:00–10:15	Ch. Broeckhoven: Influence of remittophagy on prehension mode in cordylid lizards: a morphological and kinematic analysis	10:00–10:15	M. A. Carretero, E. Aigüera, R. Duarte: Investigating the degree of behavioural plasticity in lacertids by comparing two populations of <i>Podarcis carbonelli</i> under different disturbance regimes	10:00–10:15	S. Salvidio, F. Oneto, D. Otronello, M. V. Pastorino: Long-term dynamics of a Speleomantes srinatii population living underground
10:15–10:30	O. Molnár, K. Bajer, J. Török, G. Herczeg: Experimental evidence for environmental factors affecting colouration in the European green lizard (<i>Lacerta viridis</i>)	10:15–10:30	K. Bajer, O. Molnár, J. Török, G. Herczeg: Male throat UV colouration affects maternal investment in European green lizard	10:15–10:30	N. Üztim, Ç. Güntaş: Age and some growth parameters in two insular populations of <i>Lyciasalamandra faizlae</i> (Caudata: Salamandridae) from Southwestern Turkey
10:30–10:45	K. Bajer, G. Horváth, O. Molnár, J. Török, G. Herczeg: Green lizard (<i>Lacerta viridis</i>) personalities: behaviour and individual quality at different ontogenetic stages	10:30–10:45	A. Cortada, E. García-Muñoz, M. A. Carretero: Predation pressure versus anipredator behaviour: a comparative study using a lacertid model	10:30–10:45	T. Reinhardt, S. Steinhardt, M. Wäster: New home, new life: linking the evolution of salamander larval habitat choice to ecosystem processes
10:45–11:00	Lunch break	10:45–11:00	Lunch break	10:45–11:00	Ph. Werner: Determinants of parapatric range limits in contact zones of European salamanders
11:00–11:30	Session 1b: Behaviour of reptiles Chair: W. Hödl	11:00–11:30	Session 2b: Ecology of amphibians Chair: T. Harrel	11:00–11:30	Session 2c: Ecology of amphibians Chair: T. Harrel
11:30–12:30	O. Molnár, K. Bajer, J. Török, G. Herczeg: Experimental evidence for environmental factors affecting colouration in the European green lizard (<i>Lacerta viridis</i>)	11:30–12:30	K. Bajer, O. Molnár, J. Török, G. Herczeg: Male throat UV colouration affects maternal investment in European green lizard	11:30–12:30	R. Rannap, M. Markus, T. Kaart: Habitat use of the common spadefoot toad (<i>Pelobates fuscus</i>) in Estonia—is forest essential?
11:30–11:45	K. Bajer, O. Molnár, J. Török, G. Herczeg: Green lizard (<i>Lacerta viridis</i>) personalities: behaviour and individual quality at different ontogenetic stages	11:45–12:00	A. Cortada, E. García-Muñoz, M. A. Carretero: Predation pressure versus anipredator behaviour: a comparative study using a lacertid model	11:45–12:00	G. Ludwig, U. Sinsch, B. Reiser: Fall migration behaviour and hibernation site selection in alpine common frogs (<i>Rana temporaria</i>)
12:00–12:15	Lunch break	12:00–12:15	Lunch break	12:00–12:15	B. Vági, T. Kovács, P. Katona, J. Újzegi, Á. Csillag, M. Szedekényi, M. Griggió, H. Hoi, A. Hertyey: Reproductive interference between <i>Rana dalmatina</i> and <i>R. temporaria</i> affects reproductive success in natural populations
12:15–12:30	Lunch break	12:15–12:30	Lunch break	12:15–12:30	Zs. Mikó, J. Újzegi, Z. Gal, A. Hertyey: The impacts of glyphosate and predation threat on tadpoles of the agile frog (<i>Rana dalmatina</i>) in different experimental venues
12:30–14:00	Lunch break	12:30–14:00	Lunch break	12:30–14:00	Lunch break

	Room 1	Room 2
14:00–15:30	Session 1c: Behaviour of amphibians Chair: C. Gabor	Session 2c: Ecology of reptiles Chair: D. Cogălniceau
14:00–14:15	W. Hödl: From simple field observations to a model species—confessions of a taxon-oriented field biologist	A. Zagac, K. Bitenc, M. A. Carretero, A. Vrezes: Differential antipredator responses in two sympatric lacertids
14:15–14:30	M. Mayer, S. Lötters: Phonotaxis field experiments on Peruvian poison frogs—do male frogs respond to modified calls of syntopic congeners?	J. Ortega, J. Marín, P. López: Divergent altitudinal phenotypes in Iberian wall lizards are not driven by different life-histories
14:30–14:45	L. M. Schulte: The smell of a killer: what specific cues avoid poison frogs to protect their offspring from cannibalistic conspecifics?	F. Ahmadzadeh, M. Flecks, M. A. Carretero, W. Böhme, C. Igúz, J. O. Engler, D. J. Harris, N. Uzum, D. Rödder: Rapid lizard radiation lacking niche conservatism: ecological diversification within a complex landscape
14:45–15:00	A. Paskonis, W. Hödl: The homing frog: orientation and homing behavior in a territorial dendrobatid frog <i>Allobates femoralis</i>	S. Scali, M. Sannolo, Ch. A. Giannoccarri, R. Sacchi, M. Mangiacotti: Back to black: the role of melanin in thermoregulation of polymorphic lizards
15:00–15:15	E. Ringler, A. Paskonis, M. Erich, W. Hödl, M. Ringler: Tadpole transport logistix in the Neotropical frog <i>Allobates femoralis</i>	C. Rato, D. J. Harris, A. Perera, S. B. Carvalho, M. A. Carretero, D. Rödder: A combination of divergence and conservatism in the niche evolution of <i>Tarentola mauritanica</i> (Gekkonae: Phyllodactylidae)
15:15–15:30	I. Stambberger, D. Poth, S. Schulz, M. Vences, J. Knudsen, M. F. Barej, M. O. Rödel, M. Walz, W. Hödl: Take time to smell the frogs—vocal sac glands of reed frogs contain chemical cues on species identity	D. Lisčić, S. Drakulić, E. Milčić, A. Herel, Z. Mihačević, D. Dikić, V. Benković, Z. Tadić: The effects of competition in two temperate gecko species
15:30–16:00	Coffee break	
16:00–17:00	Session 1d: Behaviour of amphibians Chair: A. Hertyvy	Session 2d: Ecology of reptiles Chair: M. A. Carretero
16:00–16:15	S. Bogaerts, M. Sparreboom, W. Benkeema, F. Pasmans: Observations of reproductive behaviour in <i>Salamandra atra</i>	C. Corti, L. Bassu, M. Biaggini, A. R. di Cerbo, N. di Francesco, I. di Tizio, C. Fresi, F. Mastropasqua, V. Nulchis, A. Romano, M. G. Satta, G. Scillitani, M. Zuffi: Size variation in Italian <i>Testudo hermanni</i> : does it follow Bergmann's rule?
16:15–16:30	R. Manenti, M. Denold, G. F. Ficetola: Does foraging plasticity favour adaptation to new habitats in fire salamanders? Preliminary data	M. Zuffi, G. D. Masucci: Rounded or elongated body shape? Emys orbicularis hatchlings-juveniles display phenotypic plasticity when under different ecological conditions
16:30–16:45	A. Rausch, M. Sztracny, E. Ringler, R. Jehle, W. Hödl: Sometimes bigger is better: the role of body size, nuptial colouration and parental relatedness for paternity success in moor frogs (<i>Rana arvalis</i>)	D. Sylwain: Impact of colour polymorphism in interaction with thermal conditions on reproductive success in asp viper (<i>Vipera aspis</i>)
16:45–17:00	C. R. Gabor, J. Bosch, M. C. Fisher: A non-invasive water-borne hormone assay shows that tadpole populations of <i>Alytes obstetricans</i> infected with <i>Batrachomyxium dendrobatidis</i> have elevated corticosterone levels	A. Weipert, T. Gaebels, I. Porvó, G. Gutti, M. Puly, Prey and microhabitat preferences of <i>Natrix tessellata</i> in a diverse floodplain along the Hungarian Danube section at Göd (1669–1671 rkm)
17:00–18:30	Poster session 1	17:30–20:00 SEH Council meeting

	Room 1	Room 2
8:30–9:15	Plenary Lecture: J. W. Arntzen: From historical biogeography and shifting range borders to phylogeography and dispersal Chair: W. Böhme	
9:30–11:00	Session 3a: Phylogeography and phylogeny Chair: S. Steinfurtz	Session 2e: Ecology of amphibians Chair: C. Corti
9:30–9:45	U. Joger, O. Zienko: The <i>Vipera</i> genus group: phylogeny, reticulate evolution and species borders	M. Ferreira, P. Beja: Multi-species occupancy modeling of natural and anthropogenic habitats by Mediterranean amphibians: grim prospects for conservation in irrigated farmland
9:45–10:00	O. Zienko, N. Stümpel, I. Mazanaeva, K. Shiryaev, G. Nilson, N. Orlov, B. Tunyev, N. Ananjeva, R. Murphy, U. Joger: The puzzling phylogeny of the <i>Vipera kazarakovi</i> complex	Z. Tóth, J. Van Buskirk, W. Babiak: Age limit on plastic responses? Modelling plasticity in a species with complex life history
10:00–10:15	F. Martínez-Freiria, G. Velo-Antón, J. C. Brito: Trapped in the Iberian Peninsula: reconstructing the evolutionary history and predicting suitable refugia under climate change for the endemic <i>Vipera seoanei</i>	A. Kurali, K. Pásztor, Z. Tóth: Assessing the costs of plasticity in chemical defences in common toad (<i>Bufo bufo</i>) tadpoles
10:15–10:30	S. A. Roussos, L. D. Denamora III: Molecular phylogeography of the long-nosed viper (<i>Vipera ammodytes</i>) in the Cyclades, Greece	B. Úveges, M. Szedekeányi, K. Máhr, H. Hoi, A. Hertyvy: The adaptive value of predator-induced defences in <i>Bufo bufo</i> tadpoles
10:30–10:45	C. Kindler, W. Böhme, C. Corti, V. Cvoždík, D. Jablonski, D. Jandžik, M. Metallinou, P. Siroký, U. Fritz: Mitochondrial phylogeography of grass snakes (<i>Natrix natrix</i> , <i>N. megaloccephala</i>) conflicts with taxonomy and reveals an additional unexpected contact zone in Central Europe	B. Mester, Sz. Lengyel, M. Puly: Occurrence of amphibian deformities in the Egység-Pusztaokos marsh and grassland system (Hortobágy)
10:45–11:00	N. Psonis, O. V. Kukushin, B. Petrov, J. Crobarnja-Isailović, I. Gherghel, P. Lymberakis, N. Poulakakis: Phylogeny and phylogeography of <i>Podarcis tauricus</i> group—insights from mitochondrial and nuclear data	O. Jovanović, Z. Lončarić, B. Kuntuzović Hackenberger: Influence of pesticides on the development of eggs of agile frog, <i>Rana dalmatina</i>
11:00–11:30	Coffee break	
11:30–12:45	Session 3b: Phylogeography and phylogeny Chair: G. Gollmann	Session 2f: Ecology of amphibians and reptiles Chair: J. Crobarnja-Isailović
11:30–11:45	G. Driedencks, S. R. Daniels: Aint no mountain high enough, aint no valley low enough? Attaining biogeographical barriers using <i>Corydalis cordylus</i> as template taxon	E. A. Galoyan, A. B. Vassilleva, N. A. Poyarkov: Annual activity dynamics of terrestrial amphibians in the monsoon lowland forest in southern Vietnam
11:45–12:00	S. Kieren, A. Crotti, Ph. de Pous, M. Veith: Phylogeny and phylogeography of the Syrian spadefoot toad (<i>Pelobates syriacus</i>)	S. Wolf, Ph. Böning, P. J. Venegas, S. Lötters: Anuran diversity of floating meadows in Amazonia
12:00–12:15	J. M. Szymura, M. Sander, U. Bühl, N. Alpagut-Kerskin, L. Choleva, A. Wandycz, S. Hofman: Drang nach Süden: missing codons reveal unorthodox routes of post-glacial expansion and secondary contacts in the fire-bellied toad, <i>Bombina orientalis</i>	M. Bellakhal, M. F. Bellakhal: Population dynamics of the North African green water frog <i>Pelophylax saharicus</i> in four lakes from northern Tunisia
12:15–12:30	A. Malezky, Ch. Duffresnes, N. Novarini, L. Bonato, M. Stöck: Phylogeographic relationships of green toads (<i>Bufo v. viridis</i>) from isolated Alpine populations	D. Virkki, G. Casley, C. Tran, T. Lewis: The role of fire in structuring reptile communities in dry sclerophyll forests of eastern Australia
12:30–12:45	S. Hauswaldt, D. Eikelmann, S. Steinfurtz, M. Vences: Phylogeny of the genus <i>Salamandra</i>	H. Nawal, M. Znaeni, M. Naimi, S. Naimous: Effects of prolonged summer drought and simulated water and food deprivation on body condition and osmotic responses in Souss Valley tortoises (<i>Testudo graeca soussensis</i>) from an arid area of West-Central Morocco
12:45–14:00	Lunch break	

	Room 1	Room 2
14:00–15:30	Session 4: Population genetics Chair: P. Mikulíček	Session 5: Climate change Chair: P. LyMBERAKIS
14:00–14:15	G. Degani: Various DNA sequence analyses of amphibian larvae in the semi-arid zone	J.-M. Hero, E. Narayan: Amphibian disease triangle: investigating interactions between disease, physiology and climate change
14:15–14:30	S. Yodthong, A. Aowphol: Distribution and genetic relationships among populations of the foam-nest treefrog <i>Chironomantis hansenae</i> (Cochran, 1927) in Thailand	M. Familiar Lopez, G. Lollback, D. Newell, J.-M. Hero: Occupancy modelling for predicting the distribution of <i>Philoria loveridgei</i> in the face of climate change
14:30–14:45	M. Vamberger, H. Stueckes, U. Fritz: Speciation under gene flow? The case of <i>Mauremys caspica</i> and <i>M. rivulata</i>	F. Ihlow, J. Dambach, J. O. Engler, M. Flecks, T. Hartmann, S. Nékum, H. Rajaei, D. Rödder: On the brink of extinction? How climate change may affect global chelonian species richness and distribution
14:45–15:00	C. Spitzweg, M. Vamberger, U. Fritz: Phylogeography and population genetics of a Mediterranean tortoise <i>Testudo hermanni</i> (Gmülin, 1789)	D. Rödder, A.M. Lawing, M. Flecks, F. Ahmadzadeh, J. Dambach, J. O. Engler, J. Ch. Habel, T. Hartmann, D. Hörnés, F. Ihlow, K. Schidelko, D. Stieles, P. D. Polly: Learning from the past to predict the future: linking palaeophylogeographic models with future climate change risk assessments in Nearctic chelonians
15:00–15:15	C. Geiser, N. Ray, A. Lehmann, S. Ursenbacher: Is expert knowledge adapted to build friction maps? A landscape genetic study of the slow worm (<i>Anguis fragilis</i>)	
15:15–15:30	V. Rovelli, E. Randi, F. Davoli, D. Macale, M.A. Bologna, L. Vignoli: Conservation genetics tools for the spectacled salamander, <i>Salamandrina perspicillata</i>	
15:30–16:00	Coffee break	
16:00–17:00	Session 6: Monitoring Chair: J. Wilkinson	Session 7: Distribution modelling Chair: S. Bogaerts
16:00–16:15	M. Ringler, W. Hödl, E. Ringler: Individual genetic tracking to assess amphibian dispersal: an island experiment in the Neotropical frog <i>Allobates femoralis</i>	N. Sillero, J. Campos, M.A. Oliveira, L. Gonçalves-Seco, A. Bonardi, C. Corti, R. Creemers, P.A. Crochet, J. Cmošnjica-Islović, M. Denoël, G.F. Ficetola, J. Gonçalves, S. Kuzmin, P. LyMBERAKIS, P. de Pous, A. Rodríguez, R. Sindaco, J. Spreyboeck, P. Sousa, F. Sousa, B. Toxopeus, D. R. Viçites, M. Veness: Na2re project — the new atlas of amphibians and reptiles: new compilation and online system
16:15–16:30	J. Herder, W. Bosman, T. Dejean, A. Valentini: The use of environmental DNA (eDNA) to monitor amphibians	E. Mizsei, B. Úvöges, J.P.Tóth: Use of distribution modelling for exploring new localities of an endangered European viperid, <i>Vipera ursinii graeca</i>
16:30–16:45	Ch. Leeb, E. Ringler, G. Gollmann, M. Ringler: A camera trap study of mass-hibernation in <i>Salamandrina salamandra</i> in the Vienna Woods, Austria	E. Mizsei, M. Szabolcs, P. Katona, Sz. Lengyel: Evidence for niche conservatism in the <i>Vipera ursinii</i> complex
16:45–17:00	M.X. Gonzalez Manilla, A. G. Toxopeus, T. Groen, A.K. Skidmore, P. LyMBERAKIS: Difference in the geographic overlap of the potential distribution of the green and ocellated lizards at continental and regional extents in the Mediterranean Basin	E. Romanazzi, L. Bonato: Updating the distribution range of the narrow endemites <i>Salamandrina atra auroreae</i> and <i>S. atra pasubiensis</i>
17:00–18:30	SEH Ordinary General Meeting	

	Conference Room	Room 1	Room 2
8:30–9:15	Plenary Lecture: R. Shine: Invasive cane toads in Australia: the impacts of a giant frog in a strange land Chair: Z. Takacs		
9:30–11:00	Symposium 1: Invasive Alien Species Chair: B. Halpern	Symposium 2: Monitoring of amphibians and reptiles in the frame of the Habitats Directive Chair: K. Pöbölšaj	Symposium 3: Amphibian chytridiomycosis Chair: V. Baláz
9:30–9:45	G. Takács, R. Dankovics, A. Pelling: Populations and habitats of the Hungarian meadow viper (<i>Vipera ursinii rakostensis</i>) in the Hanság area	E. Govere, J. van Delft, R. Zollinger: Assessment of favourable conservation status for herpetofauna in the Netherlands	C. Mäud: Chytrid fungus in Western Europe
9:45–10:00	G. Babocsay, B. Vági: Civil efforts to conserve the Caspian whip snake (<i>Dolichophis caspius</i>) in the shadow of Budapest	B. Bakó: Dozen years of herpetological monitoring in Hungarian Biodiversity Monitoring System	M. Blooi, D. S. Schmeller, et al.: Environmental predation of <i>Batrachochytrium dendrobatidis</i> determines infection dynamics
10:00–10:15	R. Rozinek, D. Fischer, V. Baláz: Impact of invasive species on the herpetofauna of the Czech Republic	D. Cogălniceanu, L. Rozyłowicz, T. Harrel: Monitoring amphibians and reptiles of community interest in Romania	W. Bosman, A. Spitzen-van der Sluijs, et al.: Dramatic decline in the fire salamander (<i>Salamandrina salamandra</i>) in the Netherlands—a species on the edge of extinction
10:15–10:30	P. Mikulíček: Native or alien water frog species in Bratislava (Slovakia)?	K. Pöbölšaj, M. Cipor, A. Lešnik, M. Govedič: First attempt to set up the national monitoring scheme for four target amphibian species in Slovenia	A. Marrel, A. Spitzen-van der Sluijs, et al.: A novel pathogen from fire salamanders (<i>Salamandrina salamandra</i>)
10:30–10:45	W. Solarz, K. Kurek: Alien herpetofauna in Poland—problems and solutions	W. de Vries, A. Marco E. Govers: Educative and participative monitoring for a wider and more effective amphibian conservation, applicable on a wider European scale?	G.M. Rosa, S. Fernández-Beaquer, et al.: Exposure vs. infection: can <i>Batrachochytrium dendrobatidis</i> pathogenicity be an issue to salamanders?
10:45–11:00	Discussion	Discussion	Discussion
11:00–11:30	Coffee break		
11:30–12:30	Symposium 1: Invasive Alien Species Chair: B. Halpern	Symposium 2: Monitoring of amphibians and reptiles in the frame of the Habitats Directive Chair: K. Pöbölšaj	Symposium 3: Amphibian chytridiomycosis Chair: V. Baláz
11:30–11:45	C. Ayres: IAS and its impacts on the Iberian herpetofauna: a review of conservation projects	J. W. Wilkinson, A.P. Arnell, J. Foster, A. H. Gentr: Conservation status mapping of great crested newts in the UK	F. Pasmans, P. van Rooij, et al.: European plethodonid salamanders (genus <i>Spelotomates</i>): Resistant to chytridiomycosis?
11:45–12:00	J.R. Silva-Rocha, D. Salvi, M. A. Carretero: Invasion patterns of ancient and recent alien herpetofauna in the Balearic Islands	J. Kildgær, L.L. Iversen et al.: Conventional field methods vs. eDNA based species monitoring: A comparative assessment for three aquatic species under the EU Habitats Directive	A. Spitzen-van der Sluijs, M. Kik, et al.: Monitoring ranavirus-associated mortality in a Dutch heathland in the aftermath of an outbreak
12:00–12:15	J. van Delft, R. Zollinger, J. W. Lammers: Monitoring invasive alien species in the Netherlands, a multi-taxa approach	S. Ursenbacher, B. R. Schmidt: Assessing the occurrence of the great crested newt (<i>T. cristatus</i>) using water samples: is the method more efficient than the direct observation?	V. Baláz, P. Cvikš, et al.: Summary of <i>Batrachochytrium dendrobatidis</i> research in the Czech Republic in wild and captive amphibians during the last five years
12:15–12:30	J. Foster, J. Wilkinson, A. Arnell, T. Gentr: Challenges in responding to invasive herpetofauna threats in the United Kingdom	Discussion	Discussion
12:45–14:00	Lunch break		

	Conference Room	Room 1	Room 2
14:00–17:00	Symposium 1: Invasive Alien Species Chair: B. Halpern	Symposium 4: Herpetofauna and transport systems — towards the better understanding and impact reduction Chair: N. Sillero	
14:00–14:15	G. F. Ficicola, T. Dejean, F. Pompanon, P. Taberlet, C. Miaud: Environmental DNA for the detection of alien (and native) species in freshwaters	Introduction to the symposium and to ENPARTS initiative	
14:15–14:30	J. Secondi, C. Miaud, G. Koch, B. Auddebaud, N. Correl, S. Desgranges, T. Dejean: Tracking the expansion of an invasive species <i>Xenopus laevis</i> using environmental DNA techniques	T. Mechura, D. Gémesi, B. Mester, M. Puky: Amphibian migration characteristics and tunnel use during spring migration in 2009–2012 along the Hort–Parassapuszta section of the No. 2. road, Hungary	
14:30–14:45	W. Mellick, P. Arntzen, J. van Delft, B. Wielsra: Genetic contamination of the indigenous northern crested newt (<i>Triturus cristatus</i>) by the invasive Italian crested newt (<i>Triturus carnifex</i>) on the Veluwe (Netherlands)	M. Puky: Temporary and permanent mitigation measures on Hungarian roads: failures and successes	
14:45–15:00	E. Pujol-Buxó, O. San Sebastián, N. Garriga, C. Pereira Almeida, G. A. Llorente: Plastic invaders: reactions of tadpoles of the invasive anuran <i>Discoglossus pictus</i> in front of native and introduced predators	C. Matos, S. Petrovan: Road mitigation using tunnel and fence systems for a protected species, the great crested newt in the UK. Is it working?	
15:00–15:15	S. Böhm: Unwanted spring breakers at the Riviera Maya: the red-eared slider <i>Trachemys scripta elegans</i> (Wied-Neuwied, 1839) invades the cenotes of the Yucatan Peninsula, Mexico	Discussion	
15:15–15:30	Discussion		
15:30–16:00	Coffee break		S. Steinfortz, J. Marshall, S. Usenbacher: Writing and publishing scientific papers
16:00–16:15			
16:15–16:30		A. Hamer, R. van der Ree, M. J. Mahony, T. Langron: Low usage rates of an under-road tunnel by three Australian anurans in an experimental setting	
16:30–16:45		A. van Diepenbeek, R. Creemers: Gully pots: death-traps for amphibians	
16:45–17:00		Discussion	
17:00–18:30	Poster session 2		

	Room 1	Room 2
8:30–9:15	Plenary Lecture: W. Böhme: Functional and phylogenetic insights into squamate genital structures, with a focus on chameleons and monitor lizards Chair: J. W. Arntzen	
9:30–11:00	Session 8a: Systematics Chair: Z. T. Nagy	Session 9a: Practical conservation Chair: C. Ayres
9:30–9:45	J. W. Arntzen, J. McAteer, E. Recuero, J. M. Ziermann, A. Ohler, J. van Alphen, I. Martínez-Solano: How complex is the <i>Bufo bufo</i> species group?	G. Gollmann, H. Schedl, D. Philippi, W. Reckendorfer, A. Waringer-Laschenkohl: News in the city: research and conservation of amphibians in Lobau (Vienna, Donau-Auen National Park)
9:45–10:00	B. Wielsra, J. W. Arntzen: Taxonomical developments in <i>Triturus</i> newts, driven by genetic data	B. Unglaub, A. Drechsler, B. Schmidt, S. Steinfortz: Linking habitat suitability to demography in great crested newts (<i>Triturus cristatus</i>)
10:00–10:15	E. Najafi-Majid, U. Kaya: The study of correlation between age, body size and pattern (number and size of spots) in some <i>Neuregus derjugini</i> (Nesterov, 1916) populations from North-West of Iran	J. T. Gal, D. Jelić, J. Vörös: Detection of olm (<i>Proteus anguinus</i>) using environmental DNA in Croatia
10:15–10:30	A. Rujirawan, A. Aowphok: Morphology and advertisement call variation in the common tree frog <i>Bufo punctatus</i> complex in Thailand	R. Creemers, J. van Delft, R. Zollinger: Grazing effects on population densities of viviparous lizard (<i>Zootoca vivipara</i>) in heathlands
10:30–10:45	A. Aowphol, A. Rujirawan, D. S. McLeod: A re-evaluation of the taxonomic status of the foam-nest treefrogs, <i>Chironomantis</i> in Thailand based on morphological, molecular and bioacoustic evidence	K. Kurek, W. Król, K. Najberek, S. Bury, B. Najbar, R. Babiasz, G. Bas, M. Potoczek, A. Zięcik, A. M. Cmiel, P. Wierzbanowski: Distribution, habitat requirements and conservation of the Aesculapian snake <i>Zamenis longissimus</i> in south-eastern Poland
10:45–11:00	T. Harrmann, P. Geisler, F. Ihlow, N. A. Poyarkov, D. Rödder, A. Schmitz, W. Böhme: Cryptic diversity in <i>Calotes mystaceus</i> : an integrative approach to unravel a putative species complex	F. Martínez-Freiria, M. Lorenzo, P. García-Díaz, Miguel Lizana: An integrative approach for inferring spatial and temporal patterns for snakes fatalities on electricity distribution networks: the case of <i>Rhincheilus scalaris</i> in Spain.
11:00–11:15	A. MacLeod, V. Koch, C. García-Parra, F. Trillmich, S. Steinfortz: A putative cryptic species of Galápagos marine iguana on the brink of extinction	A. Stumpel, R. Zollinger: Identifying conservation priorities for herpetofauna in Europe
11:15–11:30	Coffee break	
11:30–12:30	Session 8b: Systematics Chair: S. Hauswaldt	Session 9b: Practical conservation Chair: T. Gent
11:30–11:45	Ph. Wagner: Big blues & small browns—systematics of African <i>Agamiae</i>	B. Halpern, E. Sós, Ch. Walzer, T. Réchy: Tracking Hungarian meadow vipers (<i>Vipera ursinii rakosensis</i>) following reintroduction
11:45–12:00	F. Ahmadzadeh, M. Flecks, M. A. Carretero, O. Mozaftari, W. Böhme, D. J. Harris, S. Freitas, D. Rödder: Cryptic speciation patterns in Iranian rock lizards uncovered by integrative taxonomy	S. Zamfirescu, A. Strugariu, I. Gherghel, T. C. Sahlean, O. Zamfirescu: Threats to the Moldavian meadow viper (<i>Vipera ursinii moldavica</i>) in eastern Romania
12:00–12:15	J. C. Marshall: A history of species delimitation methods applied in the <i>Sceloporus grammicus</i> species complex and what it tells us about the future	S. Mohd Salleh, S. A. Mohd Sah, M. Yobe: Relationship of <i>Scaevola taccada</i> tree with the nest site selection of <i>Chelonia mydas</i> at Penang Island, Peninsular Malaysia
12:15–12:30	L. D. Penev, T. A. Georgiev, P. E. Stoev, D. M. Roberts, V. S. Smith: Resolving the publishing bottleneck and increasing data interoperability in biodiversity science	A. H. Abd Mutaib, N. F. N. Rosely, N. Nasir: Understanding nesting ecology and behaviour of green sea turtles: intensive monitoring and ground survey as a method of conservation
12:30–14:00	Lunch break	

Room 1		Room 2
14:00–15:30	Session 10: Morphology, anatomy, physiology and development Chair: W. Böhme	Session 11: Diseases and parasites Chair: G. Rosa
14:00–14:15	J. Črnobrnja-Išajlović, D. Štojadinović, D. Milošević: Relation between righting time and carapace shape in adult Hermann's tortoises	G.W. Heard, M.P. Scroggie, N. Clermann, D.S.L. Ramsay: Wetland characteristics influence disease risk for a threatened amphibian
14:15–14:30	M. Lambertz, S. E. Perry: Morphological insights into pulmonary evolution in reptiles	D. Herczeg, J. Vörös: Species composition and chytridiomycosis infection of the <i>Pelophylax esculentus</i> complex (Anura: Ranidae) in the Hortobágy National Park, Hungary
14:30–14:45	G. Baboessay, H. Seligmann: Variation of sexual dimorphism in snakes: the case of the <i>Echis coloratus</i> complex (Ophidia: Viperidae)	P. Siroký, N. Dvořáková, J. Kvíčerová: How evident are the co-evolutionary patterns between haemogregarines and their turtle hosts?
14:45–15:00	R. Kopena, P. López, J. Martín: Relative contribution of dietary carotenoids and vitamin E to visual and chemical sexual signals of male Schreibler's green lizards (<i>Lacerta schreibleri</i>): an experimental test	I. Damas-Moreira, J.P.M.C. Maia, B. Tomé, D. Salvi, V. Gomes, A. Kaliontzopoulou, M.A. Carretero, D.J. Harris, A. Perera: Analyzing the impact of blood parasites in selected lizard species from Portugal and Morocco
15:00–15:15	Ch. Kindermann, E.J. Nanyan, C. H. Wild, J.-M. Hero: Sex colour and stress: investigating the role of stress and reproductive hormones in amphibian colour	S. Sant'Anna, K.F. Grego, C. Lorigados, A.C. Fonseca-Pinto, M. Carvalho, W. Fernandes, L.C. Sá-Rocha, J.L. Caião-Dias: Malformations in Neotropical viperids: qualitative and quantitative analysis
15:15–15:30		S. Canessa, A. Martel, F. Pasmans: Designing screening protocols for amphibian disease that account for imperfect and variable capture rates of individuals
15:30–16:00		
16:00–16:15		
16:15–16:30		
16:30–16:45		
16:45–17:00		
17:00–18:30	Closing ceremony	SEH Council Meeting

Climate change	Monitoring
K. Filz, S. Löters: The invasion potential of pet herps under climate change in Europe	D. Kovács, I. Kiss: Photographic method for the European snake-eyed skink (<i>Ablepharus kitaibeeii frizingerii</i>) individual identification
R. Iosif, C. Samolla, M. Papes, D. Cogălniceanu: What limits range overlap of common and Syrian spadefoot toads: climate or competition?	D. Stančič, M. Čiprot: Distribution and status of <i>Rana arvalis</i> in the Central Slovenia
S. Drakulić, H. Feldhaar, T. Spatz, M. Seiler, C. Dittrich, M.-O. Rödel: Adaptive potential and phenotypic plasticity of two anuran species, <i>Rana temporaria</i> and <i>Bombina variegata</i> , from northern Steigerwald (Bavaria, Germany) in a response to thermal heterogeneity	M. Lorenzo, F. Martínez-Freiría, M. Lizana: Spatial and temporal patterns of the ladder snake (<i>Rhinechis scallans</i>) in a human modified landscape: preliminary results from a radio-telemetry monitoring program in eastern coastal Spain
Ecology	M. Lutznik, B. Kryštufek: Three years of population monitoring of newts (<i>Lissamphibia</i> , Salamandridae) in isolated karstic ponds
R. Băncilă, A. Ivanović, J.W. Arntzen: Symmetry of the cranium in island populations of Podarcis lizards analyzed with a high resolution 3D geometric morphometric approach	M. Szabolcs, Sz. Lengyel, T. Zsélyomi: Amphibians and reptiles in drinking water manholes: a supplementary method for herpetofaunal data collection
A. Rocha, L. Vianna, X. Santos, F. Martínez-Freiría: A spatial approach for testing the cryptic role of dorsal pattern design in <i>Vipera seoanei</i>	T. Kovács, C. Samolli: Mapping Budapest herpetofauna using GIS techniques
A. Eckerlein, S. Löters, M. Veith, B. Vierteil: What is the 'ideal' stream-adapted anuran larva?	A.M. Castilla, A. Valdeón, D. Cogălniceanu, A. Gosá, P. Mas, A. Alkuwary, E. O. Saifelnasr, N. Al-Jaidah, R. Richer: A preliminary checklist of lizards of Qatar
A. Hettyey, Z. Tóth, K. Thonhauser, D. Penn, J. Van Buskirk: The importance of direct chemical cues for predator detection in tadpoles	Practical conservation
A. Lansari, S. Tahar, E. M. El Hassan, P. Alain: Phenotypic variability in the complex of <i>Pelophylax saharicus</i> along an altitudinal gradient in the region of Marrakech and its surroundings (Morocco). Discriminant analysis and implications in terms of conservation	E. Turniak, A. Kolanek: The Active Protection Program of the common toad (<i>Bufo bufo</i> L., 1758) with the population's condition analysis on the migratory routes in Wrocław, Poland
B. Heltai, P. Sály, I. Kiss: Habitat use and daily activity of <i>Lacerta viridis</i> and <i>Lacerta agilis</i> in a cemetery	I. Garin-Barrio, C. Martínez-Saura, C. Cabido: Sublethal concentrations of glyphosate affect to life history and antipredatory behaviour of Iberian amphibians, which could reduce their probability of survival
C. M. Biancardi, A. R. Di Cerbo, E. Razzetti: Call differences among brown frog species of the Atlantic forest of southeastern Brazil	J. Črnobrnja-Išajlović, D. Milošević, M. Ilić, B. Macura: Status of amphibian breeding sites in Djerdap National Park, Serbia
C. Orriz, K. M. P. Micchi de Barros Ferraz, J. Bertoluci: Edge effect on leaf-litter anurans of the Atlantic forest of southeastern Brazil	M. Mešič, E. Romanazzi, J. R. Fernández Cardenete, A. G. Represas, J. B. Sánchez de Molina, S. Doglio, A. Pitr, U.-G. Berninger: Educational work and protection of salamanders in three European countries within a Sparkling Science project
D. Rosioru, R. Plaiasu, R. Băncilă, C. Măruț, D. Cogălniceanu: Population structure dynamics of a common frog population at the northern limit of its range	B. Mester, M. Szalai, M. Puky, Sz. Lengyel: Effects of conservation management on anurans in Hortobágy: burning of reed and cattle grazing create suitable habitats
E. Simon, E. Mizsei, J. T. Kunderá, J. Gyulai, M. Braun, B. Tóthmérész: Effects of thermal spring on elemental concentration of frog toe bones	M. Iglesias-Carrasco, C. Cabido: Are alien tree plantations ecological traps for amphibians? Effects on immune response and secondary sex characteristics of palmate newts
S. O. Ogoanah, E. Uchedike: Niche partitioning in seven syntopic anuran species in a pond in Benin City, Nigeria	M. Bellakhal, M. F. Bellakhal: Retiring conditions of tadpoles from the North African green water frog <i>Pelophylax saharicus</i>
F. Ithlow, H. Ghaffari, M. V. Plummer, B. S. Mahroo, D. Rödder: Home range and habitat selection of the endangered Euphrates softshell turtle <i>Rafetus euphraticus</i> (Daudin, 1812) in a fragmented habitat in southwestern Iran	M. Sopornik, T. Jagar, N. Kirbis, A. Ležnik, E. Osanek, I. Petrović, K. Pobjoljšaj, A. Rozman, L. Rozman, D. Stančič, M. Vambergner, Daniela Vlačić, A. Zagar: Societas Herpetologica Slovenica's activities for helping amphibians at road crossings

Ecology (continued)	Practical conservation (continued)
G. Dzeák, P. Sály, I. Kiss: Population dynamic and habitat use of two sympatric newt species <i>Triturus dobrogicus</i> and <i>Lissoisotriton vulgare</i> at the breeding site	N. Wagner, S. Löiters: Effects of water contamination on site selection by amphibians: experiences from an arena approach with European frogs and newts
G. Dobay, I. Kiss, D. Kazák: Habitat preference of fire salamanders (<i>Salamandra atra</i>) in the Stávnické Vrchy Mountains	P. Katona, B. Vági, T. Kovács: Creating open water surfaces substantially increases amphibian biomass in eutrophic wetlands
I. Kiss, J. Vörös, S. B. Balogh, E. Jäger: Ecological survey of a rediscovered urban fire salamander (<i>Salamandra atra</i>) population in Budapest	A. Kéri, M. Tóth, B. Meszner, T. Mechura, M. Puky: Herpetological education projects in Hungary: effective tools for protection and a meaningful support for research projects
C. Mermoud: Ant predation by the wall lizard (<i>Podarcis muralis</i>)	P. Kaufmann, A. Malečnický, P. Mikulčíček: On the status of water frogs <i>Polophylax</i> sp. (Fitzinger, 1843) in the Austrian state of Salzburg: morphological and preliminary molecular data
J. Reniers, L. Brendonck, B. Vanschoenwinkel: Adaptive variation in development time in response to habitat type in <i>Rana temporaria</i> : a joint assessment of inter- and intrapopulation variation and variation within clutches	A. Krasa: Czech action plan activities for <i>Zamenis longicaudatus</i>
J. Ujszegi, Z. Gál, Zs. Mikló, A. Hertyey: The effect of the pesticide Glyphogan Classic® on two common aquatic predators	Ecology (continued)
K. Pásztor, A. Kunali, Z. Tóth: Testing new methods to extract skin toxins from common toad (<i>Bufo bufo</i>) tadpoles	N. Garriga, E. Pujol-Buxó, G. A. Llorente: Differences in metabolic needs may relax competition and enable coexistence of the several species of tadpoles within a Mediterranean anuran community
K. Bircenc, A. Zagar, M. A. Carretero, A. Vrežec: A preliminary study on predation pressure using plasticine models and automatic video camera traps in allopatric and sympatric populations of two lizards	P. Székely, R. Băncilă, D. Székely, D. Cogălniceanu: Variation in body size and sexual size dimorphism in two <i>Pelobates fuscus</i> populations
M. Hölting, R. Ernst: Reduced impact logging and climate extremes: mutual determinants of homogenisation in tropical amphibian communities?	M. S. Sarhaizad, S. A. Mohd Sah, M. Yobe: Eleven years observation on the breeding season of the green turtle, <i>Chelonia mydas</i> at Penang Island, Peninsular Malaysia and future recommendations to upgrade the conservation
N. D. Tzankov, G. S. Popgeorgiev, A. P. Grozdanov: Spatial niche segregation among three lacertid taxa living in close proximity in Bulgaria	S. Fardli, L. R. Adriano, F. P. A. Pereira, F. L. Souza, B. Gruber, A. Georges, J. Bertolucci: Home range and movement patterns of the Neotropical freshwater turtle <i>Hydrochelys maximiliani</i> (Testudines: Chelidae) in southeastern Brazil
N. Bulakhova, E. N. Meshcheryakova, D. I. Berman: Reproduction and cold hardiness of the eggs of Siberian wood frog, <i>Rana amurensis</i> in the North-East habitat	Z. Mačák, L. Jeřábková, A. Reiter, M. Rulík: Habitat features and syntopic species of crested newt ponds in South Moravia, Czech Republic
N. Popović: Population size, survival and viability of the fire salamander (<i>Salamandra atra</i>) in central Croatia	Z. Gál, J. Ujszegi, Zs. Mikló, A. Hertyey: The effect of a common herbicide on survival of agile frog (<i>Rana dalmatina</i>) tadpoles in the presence of lethal predators
I. Martín, O. Rodríguez de Rivera, I. Angulo, Y. Véllez: Spatial distribution and population density of <i>Pelophylax perezi</i> (Ranidae: Anura) in Tablas de Daimiel National Park (Central Spain)	Zs. Lovász, T. Kovács, P. Sály, I. Kiss: Activity patterns and habitat preference of European pond turtle (<i>Emys orbicularis</i> L.) in Lake Naplås
I. Martín, O. Rodríguez de Rivera, I. Angulo, Y. Véllez: Spatial distribution and population density of <i>Hyla arborea</i> (Hylidae: Anura) in Tablas de Daimiel National Park (Central Spain)	G. Güntürkün, N. Üzümlü: Age structure and body size in two populations of the northern banded newt <i>Ommatotriton ophryticus</i> (Berrhold, 1846) from Turkey
	H. Nawal, M. Znaeni, M. Naimi, S. Namous: Clutch size and egg characteristics in the Sous Valley tortoise, <i>Testudo graeca soussensis</i> Pich, 2001 (Testudines: Testudinidae) from a coastal and an arid inland area in West-Central Morocco

Behaviour	Morphology, anatomy, and development
G. Fera, K. Pásztor, A. Hertyey: Release and function of alarm pheromones in agile frog (<i>Rana dalmatina</i>) tadpoles	H. Sheverdjukova: Complex origin of some bones in the grass snake <i>Natrix natrix</i> skull embryogenesis
B. Vági, T. Kovács, J. Cservenka, T. Telbisz: Common lizard: microhabitat choice in a subarctic habitat	B. Borczyk, M. Gorynia: Comparison of skull form in the snake genus <i>Natrix</i> (Squamata: Serpentes: Natricinae)
M. Lorenzo, P. García-Díaz, F. Martínez-Freiria, M. Lizaso: An experimental approach for testing the role of olfactory and visual stimuli in snakes climbing towers behaviour	E. Yildirim, E. Nejjafi-Majid, U. Kayı: Geometric morphometric analysis of cranial variation in peadomorph and metamorphic forms of the northern banded newt, <i>Ommatotriton ophryticus</i>
D. Székely, M. Denoël, P. Székely, D. Cogălniceanu: Differences in locomotor activity in two syntopic spadefoot toad species (genus <i>Pelobates</i>)	S. Sant'Anna, D. R. Vasconcellos, A. P. Croce, C. Y. Fuguiwara, J. L. F. Silva, R. Molerani, M. S. Hidalgo, B. M. Costa, R. V. Fernandes, W. Fernandes: Ovarian cycle of <i>Boobrops atrox</i> , a neotropical viperid
T. J. Urszán, J. Török, A. Hertyey, G. Herczeg: Behavioural consistency and life history in <i>Rana dalmatina</i> tadpoles	M. Djurakic, A. Herrel, A.-C. Fabre, R. Cornette: How accurate do 2D geometric morphometrics quantify shell shape in chelonians?
E. García-Muñoz, C. Rato, B. Mesquita, M. A. Carretero: Diversity of lateralization patterns in <i>Tarentola</i> geckos	Distribution
F. Stanescu, P. Székely, R. Márquez, Dan Cogălniceanu: Acoustic communication in two syntopic spadefoot toads	T. Sos, I. Ghira, Zs. Hegyeli: New distribution data and conservation status of <i>Vipera ursinii rakosensis</i> (Méhely, 1893) in Transylvania, Romania
L. Winandy, M. Denoël: Fish introduction affects amphibians by increasing avoidance behaviour and inhibiting sexual activity	Diseases and parasites
M. Erich, M. Ringler, W. Hödl, E. Ringler: Bet-hedging in tadpole deposition in the Neotropical frog <i>Allobates femoralis</i>	A. Ibáñez, J. Martín, P. Lopez, A. Marzal: Occurrence of blood parasites on Spanish terrapins (<i>Mauremys leprosa</i>) from the southwestern Iberian Peninsula
M. Gregorovičová: Reactions of green lizards (<i>Lacerta viridis</i>) to defensive secretion of <i>Graphosoma lineatum</i> (Heteroptera: Pentatomidae)	B. Mészáros, K. Bayer, J. Török, O. R. Molnár, G. Herczeg: Blood parasite load and individual quality in male European green lizards (<i>Lacerta viridis</i>)
R. Koppena, G. Herczeg, J. Martín: Escape strategy of Schreiber's green lizards (<i>Lacerta schreiberi</i>) is determined by simple environmental factors but not ecological context or sex	D. Herczeg, J. Vörös, Z. Bara, Zs. Végvári, D. R. Brooks: Amphibian parasites in the Hortobágy National Park: preliminary findings
C. Cabido, J. Martín: Different effect of thermal and humidity conditions on duration of chemical signals of two sympatric and sister lizard species	E. Grasselli, G. Vecchione, S. Di Piazza, M. Zotti, S. Salvidio: <i>Batrachochytrium dendrobatidis</i> detection in amphibian samples using real-time PCR with SYBR GREEN chemistry
	R. Krzysciak-Kosińska, M. Orłowska: Amphibian eggs' mortality in the Białowieża Forest, Poland
	A. Valdeón, V. Rada, C. Ayres, R. Iglesias, L. A. Longares, R. Lázaro, V. Sancho: Distribution of <i>Polystomoides ocellatum</i> (Monogenea: Polystomatidae) in Spain parasitizing the European pond turtle (<i>Emys orbicularis</i>)

Phylogeography	Phylogeny
A. Perezold, W. R. Branch, L. du Preez, L. Meyer, A. Schleicher, M. D. Hofmeyr, U. Fritz: Disentangling the <i>Pelomedusa subrufa</i> complex	J. Rautenberg, S. Löters: Phylogenetic signal in vocalizations of Neotropical harlequin frogs (<i>Aelopus</i>)?
B. Veleki, F. Lakatos, P. Bró, É. Acs, M. Puky: Higher than expected genetic diversity in a small area: <i>Zootoca vivipara</i> in the eastern part of Hungary	K. Sagonas, N. Poulakakis, P. Lymberakis, A. Parnakellis, P. Pafilis, E. D. Valakos: Phylogenetic relationships and phylogeography of the genus <i>Lacerta</i> in Greece
D. Jablonski, G. Džukić, D. Jandžić, D. Jelić, K. Ljubišević, P. Mikulićek, J. Moravec, N. Tzankov, V. Gvozdik: Mitochondrial phylogeography of three species of slow worms (<i>Anguis</i>) in the Balkans	M. Lambertz, T. Hartmann, S. Walsh, P. Geissler, D. S. McLeod: Systematics of the 'flap-headed' frogs of the dicroglossid genus <i>Limnonectes</i> Fitzinger, 1843
D. Rössler, J. Kiedgast, R. Bell, E. Greenbaum, M. Dehling, V. Gvozdik, Z. T. Nagy, W. Conradie, P. J. McLaughlin, S. Müller, M. Burger, S. Löters: Frog biogeography and evolution in the Congo Basin: some preliminary insight	A. Vasilopoulos, A. Antoniou, A. Magoulas, P. Lymberakis, E. Valakos, N. Poulakakis: Evaluation of the evolutionary history of <i>Podarcis cretensis</i> (Sauria: Lacertidae)
F. Ahmadzadeh, M. Flecks, D. Rödder, W. Böhme, Ç. Ilgöz, D. J. Harris, J. O. Engler, N. Üzümlü, M. A. Carrerero: Multiple dispersal out of Anatolia: biogeography and evolution of oriental green lizards	R. García-Roa, Diego Llusia, D. Buckley, R. Márquez: Phylogenetic signal of the advertisement call in tropical hylids (<i>Smilisca</i> and <i>Triprion</i>)
E. Karameta, N. Poulakakis, S. Sfenthourakis, P. Lymberakis, H. Grillitsch, Ç. Ilgöz, P. Pafilis: Phylogeography of <i>Stellagama stellio</i> : resolving the relationships within its subspecies	Population genetics
J. Vörös, K. Szabó: Mitochondrial DNA diversity of the Alpine newt, <i>Mesotriton alpestris</i> in the Carpathian Basin	A. Mangold, K. Trenkwalder, W. Hödl, M. Ringler, E. Ringler: The genetic mating system of <i>Hyalinobatrachium valerioi</i>
D. Djurić, K. Bogićević: Late Pleistocene herpetofauna from the Baranica Cave (Serbia)	I. Groß: Genetic characterisation of isolated populations of Aesculapian snakes (<i>Zamenis longissimus</i>)
F. Ahmadzadeh, M. A. Carrerero, D. Rödder, D. J. Harris, S. Nunes Freitas, A. Perera, W. Böhme: Inferring the effects of past climate fluctuations on the distribution pattern of <i>Iranolacerta</i> (Reptilia, Lacertidae): evidence from mitochondrial DNA and species distribution models	K. Trenkwalder, A. Mangold, W. Hödl, M. Ringler, E. Ringler: Genetic connectivity of (meta-)populations in <i>Hyalinobatrachium valerioi</i>
Symposium: ENPARTS	K. Knorr, H. Pröhl: Isolation by time in the yellow-bellied toad <i>Bombina variegata</i>
C. Matos, N. Sillero, E. Argaña: Amphibian road mortality: comparing spatial statistical methods to detect hotspots	P. Lagler, P. Amutzen, G. Gollmann, B. Wiedstra: Species composition of <i>Triturus</i> populations in a three way contact in the Waldviertel (Lower Austria)

Systematics	Tropical herp biodiversity
D. Rödder, F. Ahmadzadeh, T. Hartmann, M. Flecks, F. Ihlow, T. Schörtler, J. Fleck, J. Astrin, W. Böhme: Systematics, niche evolution and biogeography of the Middle Eastern newt (<i>Neurergus</i>)	S. Wangkulangkul, P. Bates, Ch. Sarasook, Tsh. Nidup, J. Vörös: Amphibian diversity in Tarutao National Park and capacity-building in amphibian research and conservation in Peninsular Thailand
N. Baptista, R. Rebelo, A. Channing: <i>Amietia angolensis</i> and <i>A. fuscigula</i> (Anura: Pyxicephalidae) in southern Africa: hidden clades revealed	T. Hartmann, P. Geissler, M. Handschuh, F. Ihlow, D. Rödder, R. Seng, W. Böhme: Herpetofauna of northern Cambodia: biodiversity, ecology and zoogeography
Ph. Wagner: An extraordinary tail—integrative review of the agamid genus <i>Xenagama</i> Boulenger, 1895	V. Gvozdik, J. Mariaux, M. Menegon, S. Loader: Phylogeography of <i>Leptopelis</i> frogs across the sky islands of the Eastern Arc Mountains in East Africa
Ph. Wagner: Island zoogeography on a continental scale	Z. T. Nagy, Ch. Kusamba, V. Gvozdik: Notes on the herpetofauna of western Bas-Congo, Democratic Republic of the Congo
Ph. Wagner: Resolving sky island speciation of East African <i>Adolfus alleni</i> (Sauria, Lacertidae)	
Physiology	
N. Dertus, M. Czamoleksi: Cellular bases of body size variance in the fence lizard <i>Sceloporus undulatus</i> (Phrynosomatidae) from different latitudes	
V. Lisi-Mizan, E. Karameta, K. Sagonas, E. D. Valakos, S. Sfenthourakis, P. Pafilis: Habitat effect on the digestive efficiency of a Mediterranean lizard	
B. Grillitsch, L. C. Schiesari, H. Grillitsch: Ecotoxicological risk of cadmium, lead, and mercury to early life stages and the reproductive function of reptiles	
T. Molnár, J. Gál, I. Benedek, I. Pálmács, M. Molnár, M. Marosán: Evaluation of metal accumulation and its effect on shell deformations in the European pond turtle (<i>Emys orbicularis</i>)	



Plenary Lectures

From historical biogeography and shifting range borders to phylogeography and dispersal

Jan W. ARNTZEN

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Parallel species distributions often reflect similar ecological requirements and are frequently interpreted as evidence for shared evolutionary histories. However, over what time period may this hold true and how deep in time can we look back, really? Early on in my career I adopted the comparative approach to deal with this type of questions and I worked with pairs of amphibian species, such as in the genera *Bombina* and *Bufo*, *Lissotriton* and *Triturus*. A keystone for fixing the history of species in time and space has been ‘enclaves’—pockets of a species range geographically isolated from the stock by the other species in the pair. In my talk I hope to show how my work, from historical biogeography and shifting range borders to phylogeography and dispersal, has been inspired by enclaves and other remarkable biogeographical patterns.

Functional and phylogenetic insights into squamate genital structures, with a focus on chameleons and monitor lizards

Wolfgang BÖHME

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The final conquest of land by amniote tetrapods was not only successful due to their keratinized integument and the calcified egg with an additional embryonic envelope, but also to the possession of an intromittent organ allowing sperm transfer outside of water. This organ called penis is plesiomorphically unpaired and is retained by all chelonians, crocodylians and by primitive birds, and—of course—by mammals. It has got lost in modern birds and in lepidosaurs where it is still missing in sphenodontids while squamates developed a new, paired structure which is called hemipenis. Hemipenes show a great variety in shape and structure of both macroscopic and microscopic details. Some of these structural peculiarities have phylogenetic signals and are thus of taxonomic value while others are closely connected with function, including behaviour. Lizard families with a complex social system and evident epigamic attributes tend to have uniformly structured hemipenes across species and even genera while others which lack a marked sexual dimorphism have much more diverse genital structures making them diagnosable on species level. Iguanian families are examples for the first group with the chameleons as a more complicated case. The second group is best represented by monitor lizards which can often be diagnosed only by means of their genital structure. It was discovered that, as in the penis-bearing groups, also females have a homologous, paired and miniaturized structure which is called hemiclitoris.

The talk gives an overview of squamate genital organs and discusses the problem of sexual selection and structural stability, also in view of respective organs in other animal groups such as molluscs and arthropods. Moreover, it correlates genital-based phylogenetic hypotheses with those derived from gene sequencing as compared with traditional ones based on external morphology.

Invasive cane toads in Australia: the impacts of a giant frog in a strange land

Rick SHINE

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Almost 80 years ago, agricultural scientists brought American cane toads (*Rhinella marina*) to the sugar cane fields of tropical Queensland, in a futile attempt to control insect pests. The descendants of those toads became pests themselves, spreading across the Australian tropics, and even setting up satellite populations in cities as far south as Sydney. The toad's invasion has had devastating impacts on native wildlife, but also has enabled scientists to explore the evolutionary and ecological consequences of toad invasion, to learn how a tropical ecosystem has dealt with the novel challenges posed by this toxic frog, and to develop new ways to combat the invader.

The deadliest lifesavers: reptile venoms at the forefront of medicine

Zoltan TAKACS

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Reptile and other animal venom toxins have evolved over millions of years to harm, immobilize, or kill prey and predator in seconds to minutes. Accordingly, toxins aim at vital physiological functions such as nerve-to-muscle signaling, blood coagulation, and blood circulation. At the molecular level, the toxin-target interaction is characterized by high affinity, potency, and target specificity. Consequently and from the medical point of view, the animal kingdom's toxin arsenal causes up to an estimated 100,000 human fatalities a year, yet also poses an enormous potential for clinical therapy. Today, about 15 pharmaceuticals are derived from toxins, including first-in-class, top-selling, and major life-saving agents. They are used to treat a diverse range of diseases such as heart attack, heart failure, hypertension, diabetes, and chronic pain, and are taken by tens of millions of patients globally. Most of these pharmaceuticals were derived from snakes, in part due to the large venom sample requirement for existing analytical methods. Recent technological advances however, in many although not in all respects, enable the utilization of tissues instead of crude venom, have reduced the quantity of venom/tissue sample requirement, and allows for high-throughput processing. Along this strategy, we have developed Designer Toxins technology that permits the creation and screening of target-specific combinatorial animal toxin libraries based on either, the toxins' amino acid, mRNA or genomic DNA sequences. As a result, we have identified a novel toxin selective for a subtype of human voltage-gated K⁺ channel implicated in autoimmune disorders. It is estimated that over 20 million toxins remain unexplored in more than 100,000 venomous animal species found in nature. This highlights the molecular biodiversity of venom toxins as an unparalleled and a valuable source for the development of novel therapeutics and presents yet another critical dimension for nature conservation.



Symposium on Alien Invasive Species

and their impact on Natura 2000
amphibian and reptile species in Europe,
with special emphasis on
the V4 countries

IAS and its impacts on the Iberian herpetofauna: a review of conservation projects

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The Iberian Peninsula has a huge record of human-mediated introduction of non-indigenous species (NIS). Since the arrival of the Phoenicians or the Romans, and later the occupation by the Muslims, several species were introduced. Some of them make part now of the fauna of the Iberian Peninsula, even as protected species, like the spur-thighed tortoise (*Testudo graeca*).

But in the second half of the 20th century the number of NIS that became invasive alien species (IAS) has increased exponentially. Some of the cases are known globally, such as the zebra mussel (*Dreissena polymorpha*), American mink (*Neovison vison*), North-American sliders (*Trachemys scripta*), or the red swamp crayfish (*Procambarus clarkii*). A huge numbers of fishes have been introduced by anglers, like the Danube catfish (*Silurus glanis*) or the black bass (*Micropterus salmoides*). Recently, the Iberian herpetofauna faces a new threat due to the arrival of new IAS, like the raccoon (*Procyon lotor*).

An increasing number of conservation projects have aimed to control or eradicate invasive species in the Iberian Peninsula. This presentation is a review of the different projects, from large scale (LIFE *Trachemys*, LIFE⁺ *Lampropeltis*) to smaller more specific projects (Eradication of the northern banded newt [*Ommatotriton ophryticus*]).

Civil efforts to conserve the Caspian whip snake (*Dolichophis caspius*) in the shadow of Budapest

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The Caspian whip snake (*Dolichophis caspius*) is close to extinction in Hungary. Very few isolated populations have survived, and only sporadic observations of individuals have been recorded in the last two decades. The populations are under heavy pressure from invasive plants and human activities. In 2011, the Amphibian and Reptile Conservation Group (ARCG) of MME BirdLife, Hungary launched a conservation programme to assess the status of the species and its habitats in the vicinity of Budapest, and to build up a habitat management plan. During 2011 and 2012 with volunteers, we made a total of 32 visits to seven habitats, of which one at Pesthidegkút was discovered only in 2012, and observed *D. caspius* in two (including the new one; on the urban Sas-hegy we made no surveys, but *D. caspius* is regularly seen there). *Dolichophis caspius* was observed 11 times at Farkas-hegy and 22 times at Pesthidegkút, but only 11 (five on Farkas-hegy and six at Pesthidegkút) could be positively identified as different. Two different hatchlings were observed on Farkas-hegy. Other historic habitats have yielded no snakes during our surveys. All suitable habitats are highly isolated, small in their extent (< 5 ha), and burdened with an increasing number of invasive plants and recreational activities. Most profoundly *Ailanthus altissima*, *Pinus nigra* and *Populus tremula* alter the habitats. We partially removed the black pines from two fragments (altogether ca. 0.5 ha) on Farkas-hegy where snakes were most often observed. Further tree fellings are scheduled to the end of 2013. The effects of the removal of invasive plants on the benefitted population cannot be evaluated at this point, but only a large scale habitat restoration and connection of suitable habitat patches can prevent the short term extinction of *D. caspius* from the northernmost parts of its European range. Our *Dolichophis* programme together with other programmes of ARCG triggered an increased citizen involvement.

Unwanted spring breakers at the Riviera Maya: the red-eared slider *Trachemys scripta elegans* (WIED-NEUWIED, 1839) invades the cenotes of the Yucatan Peninsula, Mexico

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Known to be the turtle species with the most extensive geographic distribution, the red-eared slider (*Trachemys scripta elegans*) has been recorded from dozens of countries all over the world. Because of its longevity, fecundity and opportunistic omnivory it may locally threaten autochthonous turtles and other aquatic wildlife and plants, and is listed among the top 100 worst invasive species by the IUCN Invasive Species Specialist Group (ISSG).

During a field trip to the Yucatan Peninsula from February 13–20, 2012, five cenotes (sinkholes filled with freshwater) in the area around Tulum and the Laguna Bacalar (a lake at the border to Belize) were surveyed for turtles. Temperature, pH, carbonic hardness (KH), total hardness (GH) and conductivity were recorded. Turtles were spotted by snorkelling in the waterbodies and photo-documented.

At all surveyed localities, Meso-American sliders (*Trachemys venusta*) were found, but at two sites red-eared sliders were also present. An adult melanistic male was found in Cenote Cristal (20°11'24"N, 87°29'56.4"W) and an adult female in Cenote Carwash (20°16'26.4"N, 87°29'9.6"W). According to the Global Invasive Species Database, these records are the first ones for the Yucatan Peninsula.

Besides these findings, research in hobbyist web forums also showed that *Trachemys* species readily hybridize in captivity. Would this also occur in nature, the currently unstable situation of Meso-American sliders could be even more complicated than thought before.

Monitoring invasive alien species in the Netherlands, a multi-taxa approach

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Collecting of distribution and population data by volunteers, has a long and successful history in the Netherlands. This also concerns (invasive) alien species. Next to data of herpetofauna, Reptile, Amphibian and Fish Conservation Netherlands (RAVON) stimulates and facilitates volunteers to collect and pass on data on other taxonomic groups, since the introduction of online data entry portals. RAVON collaborates with eleven other non-governmental organisations and the governmental Invasive Alien Species Team. They set up a multi-taxa (invasive) alien species project, to stimulate the collection of data. The importance of collecting data on (invasive) alien species of all taxonomic groups is stressed by various activities (e. g. the development of an App, identification keys, a popular newsletter, magazine, websites etc.). In this way 25,000 volunteers are reached. This resulted in an increase of records of many taxa, as well as a broader range of taxa being reported by individual volunteers.

An important herpetological result of this project, which can be considered an Early Warning System (EWS), was the detection of the first reproducing population of American bullfrog (*Lithobates catesbeianus*) in the Netherlands in 20 years. This population was subsequently successfully eradicated. Other relevant (invasive) alien herpetofauna species to this programme are *Triturus carnifex*, *Rana dalmatina*, *Elaphe schrenkii* and several aquatic turtle species. Another striking result is a strong increase of RAVON volunteers entering data on other exotic taxa such as crayfish.

This national project might serve as an example for the development of a European EWS for invasive alien herpetofauna species. A European EWS for invasive alien herpetofauna species, could also pay attention to invasive alien species from other taxonomic groups, affecting herps and their habitats. Therefore, we propose to scale-up this project to a European level.

Environmental DNA for the detection of alien (and native) species in freshwaters

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Early detection of alien invasive species is extremely important for management, as eradication efforts are most likely to be successful if performed when alien species have limited abundance and range. However, early detection may be challenging, due to the limited density of individuals. Aquatic and semi-aquatic species release DNA into the environment through mucus, faeces, urine and remains. It is thus possible using the DNA present in the environment (eDNA) to detect the presence of alien (and native) species in freshwater. Analyses performed on invasive populations of American bullfrogs (*Lithobates catesbeianus*) showed that primers amplifying short mitochondrial DNA sequences allow to successfully track the presence of frogs in natural wetlands. Using eDNA allows a more accurate detection of bullfrogs at very low densities and at any life stage compared to traditional visual and audio-surveys. eDNA therefore allows early detection of invasive populations, or to confirm the success of eradication projects. Furthermore, multiple studies showed that eDNA allows a reliable detection of a growing number of species, including several species of both invasive and native amphibians and fish. Furthermore, recent advances of DNA meta-barcoding promise the simultaneous detection of multiple species. Nevertheless, major technical challenges remain, such as contamination and identification of universal markers with high resolution.

Challenges in responding to invasive herpetofauna threats in the United Kingdom

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At least 10 IAS amphibians and 3 reptiles are thought to be present in breeding populations, ranging from a single site to areas extending across tens of km². Reports of further introductions are common though most do not result in population establishment. There has been excellent progress in some of the main IAS policy areas. For example, there are now standardised risk assessments for many IAS. Specific control operations have been very successful, for example on North American bullfrog *Lithobates catesbeianus*. Broad IAS policy has been substantially strengthened in recent years, and legal mechanisms are being improved. There have been valuable research projects on, for example, the link between introduced alpine newts *Ichthyosaura alpestris* and the amphibian chytrid fungus. Despite these successes, overall implementation of IAS policy is patchy and poorly co-ordinated for herpetofauna. For instance, despite the acknowledgement of the primacy of prevention, there is minimal action to address the likely key introduction pathways. IAS detection and surveillance systems are passive, largely relying on chance to detect invasions. Research into prevention, impacts, control and mitigation is negligible. Links between government and specialists need further development, with a more engaged and transparent process for acting on risk assessments. There is concern about whether the current allocation of resources is targeted toward the highest priority actions. Uncertainty about risks too often results in no action, even when rapid response would involve minimal cost. Underlying these issues, there is a worrying complacency among many herpetologists about the risks of IAS. This has contributed to hesitation over action and has even prompted deliberate introductions. We believe that substantial action to address all these issues is needed soon, especially in light of proposed European Commission IAS legislation.

Genetic contamination of the indigenous northern crested newt (*Triturus cristatus*) by the invasive Italian crested newt (*Triturus carnifex*) on the Veluwe (The Netherlands)

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Two crested newt species, the Italian crested newt (*Triturus carnifex*) and the northern crested newt (*Triturus cristatus*), have a parapatric distribution. Hybridization is known to occur between both species in the laboratory, at localities where one of the species has been introduced in the range of the other, and at the natural contact zone. The Italian crested newt has been introduced to the Veluwe, the Netherlands, where *T. cristatus* is a native species. At other localities where *T. carnifex* has been introduced, populations appear to be stable and long-lived. Furthermore, displacement of *T. cristatus* by introduced *T. carnifex* has been observed in Switzerland. A study on the distribution of *T. carnifex* in the Netherlands revealed a recent range expansion. Furthermore, individuals with intermediate phenotypes were found which suggests that hybridization between the two species has occurred. Hence, not only direct competition, but also genetic pollution by the introduced *T. carnifex* could pose a threat to the native *T. cristatus*. A detailed knowledge of the distribution of *T. carnifex* and genetically admixed individuals is indispensable for management considerations. However, morphological identification in itself is unreliable. Therefore, a detailed map needs to be created on the basis of genetic data.

Widespread sampling was performed on the Veluwe and individuals were provisionally classified based on morphological characters. An equal number of individuals were chosen per population for DNA extraction. One mitochondrial DNA marker was used for Sanger sequencing and showed that the distribution of *T. carnifex* haplotypes is more widespread than expected based on morphological data. An additional 52 markers were amplified by multiplex PCR and sequenced by the Ion PGM Next Generation Sequencing platform. The nuclear DNA data were analysed using New Hybrids to determine the extent of introgression of *T. carnifex* alleles into *T. cristatus* populations on the Veluwe.

Native or alien frog species in Bratislava (Slovakia)?

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Non-native species of the western Palearctic water frogs (*Pelophylax esculentus* complex) were established in many western European countries. They have a potential to readily invade new sites, where they compete with indigenous species and predate on the congeneric specimens. Hybridization between alien and indigenous individuals leads to introgression and genetic pollution of native water frog populations. In this study we investigate genetic structure of water frogs in Bratislava (Slovakia) to find out the origin of local populations and dispersal abilities of water frogs for colonization of new sites. We apply two types of molecular markers with a different mode of inheritance and evolutionary history: sequences of mitochondrial ND2 and ND3 genes and nuclear microsatellites. All examined frogs possess either “*lessonae*” or “*ridibundus*”-specific mtDNA haplotypes known from central Europe, corroborating their native origin. While natural ponds in a studied area are inhabited predominately by *Pelophylax esculentus* and *Pelophylax lessonae*, man-made gravel pits, established in the course of the last century, are occupied almost exclusively by *Pelophylax ridibundus*. This finding highlights a colonization potential of *P. ridibundus* and its ability to occupy new established artificial habitats. Our results also suggest that rivers, river branches and artificial canals facilitate dispersal of *P. ridibundus* to new environment. In contrast, a highly fragmented urban landscape lacking water corridors limits dispersal and gene flow between the ponds.

Plastic invaders: reactions of tadpoles of the invasive anuran *Discoglossus pictus* in front of native and introduced predators

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A growing number of studies consider phenotypic plasticity one of the major forces driving survival and rapid adaptation of species in front of new threats like invasive predators, thus being biological invasions an optimal system to study the evolution of anti-predator phenotypic plasticity. In order to deeper understand the role of inducible responses in the population dynamics related with current biological invasions in our area, we first studied the plastic responses of both native (*Pelodytes punctatus*) and invasive (*Discoglossus pictus*) anuran tadpoles, all facing native (dragonfly *Anax* sp.) and two invasive (fish *Gambusia holbrooki* and crayfish *Procambarus clarkii*) predators. Native *P. punctatus* displayed the predictable set of reactions against native dragonflies, but milder (morphological or behavioral) reactions to invasive predators. Invasive *D. pictus* reacted behaviorally to all predators, unexpectedly reacting also morphologically to native *Anax* sp. Our results support prey-predator specificity in these reactions and dissociation between behavioral and morphological plasticity in tadpoles, although some reactions in *D. pictus* could suggest unspecific plastic reactions against predation in this species. To have a deeper understanding of the anti-predator plastic reactions of this invasive species, in a second experience we confronted this invasive anuran with the most usual predators in our study area: common backswimmers (*Notonecta* sp.) and common darters (*Sympetrum striolatum*). Results of this second experience further support the ability of *D. pictus* to react specifically to native predators and reinforce conclusions of the first work, pointing to an important role of phenotypic plasticity in this system. On the other side, each species suffered from a particular set of trade-offs between inducible responses and their costs, and interestingly we usually detected milder and unexpected patterns in combinations using introduced species.

Impact of invasive species on the herpetofauna of the Czech Republic

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Every herpetologist is aware of the danger that alien species pose to amphibian and reptilian populations. However most of the support for deleterious effects of non-native and invasive organisms is based on anecdotal reports. Scientifically processed and analysed data about the non-native species impact on reptilian and amphibian fauna is completely absent from the area of Czech Republic. Only individual observation data are available at the moment e.g. a dissection of invasive fish, brown bullhead (*Ameiurus nebulosus*), that showed the digestive tract to be completely filled by ingested smooth newts (*Lissotriton vulgaris*). Most of the “evidence” is in form of mere observations about some surveyed species going lost from locality after alien species was detected there. An example of such case is the absence of dice snake (*Natrix tessellata*) in the watershed of the Berounka River after invasion of mink (*Mustela vison*). The most important introduced species with direct effect on amphibians and reptiles (and other fauna as well) include the fish species *Ameiurus melas* (black bullhead), *A. nebulosus* (brown bullhead), *Carassius gibelio* (Prussian carp), *Pseudorasbora parva* (topmouth gudgeon) and of mammals *Mustela vison* (mink), *Procyon lotor* (raccoon) and *Nyctereutes procyonoides* (raccoon dog). The area of Czech Republic harbours at least two species of alien (American) crayfish species that are known to propagate the crayfish plague, which extirpates native crayfish species. Additionally these invasive crayfish are potential vectors of the amphibian pathogen causing chytridiomycosis. The habitat changes triggered by expanding non-native plant species cause serious problems to both amphibians and reptiles. Examples of such plants include Canadian waterweed *Elodea canadensis* with ability to overgrow the ponds, thus making them unsuitable for survival of amphibians and their larvae. Terrestrial plants especially *Helianthus tuberosus* and *Impatiens glandulifera* cause intense shading of river banks, thus limiting the options for basking for dice snake (*Natrix tessellata*) and lowering the temperature of egg-laying sites.

We have to admit that our knowledge of the invasive species impact on our amphibians and reptiles is still limited, although first studies are on the way we will have to wait until the results are available.

Tracking the expansion of an invasive species *Xenopus laevis* using environmental DNA techniques

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The African clawed frog *Xenopus laevis* has been introduced in several parts of the world where it is considered as an invasive taxon now threatening local herpetofaunas. It has been released about 30 years ago in western France where populations survived in the wild and rapidly expanded. The introduction point lies on the Loire River basin which covers 20% of the French territory and includes two wetlands of international value (Brenne, Sologne). Our ability to track and predict the movement of individuals is a key issue for the control of invasive species. To this regard, tracking the colonization front is crucial to better apprehend the dispersal behaviour of *X. laevis* in the local context. However, the task becomes more and more challenging as the size of the colonized area increases. Classical trapping methods may fail to ascertain species presence on the outer margins because of unbearable logistic constraints. For these reasons, alternative methods are required to improve detectability and coverage of expanding invasive species. Environmental DNA (eDNA) techniques may provide suitable solutions. We provide an update of the colonized area by *X. laevis* in western France and outline the conservation issues related to that invasion. We then present results from detection tests using several eDNA methods in sites of low and high density, and compare the pros and cons of classical capture and eDNA methods for *X. laevis*.

Invasion patterns of ancient and recent alien herpetofauna in the Balearic Islands

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Species introductions are becoming a major threat to biodiversity and economy but its effects are unevenly distributed in time and space. The Mediterranean Basin is the biodiversity hotspot where introductions shape the vertebrate communities in greater extent, being the insular species the most affected. Due to their life history, amphibians and reptiles are among the groups most widely introduced but also most threatened by species introduction. Mediterranean islands harbour a combination of herpetofaunal elements: endemics long time evolving under insular conditions; natural colonisers from the adjacent continents in recent geological times; and ancient or recent invaders transported, voluntarily or not, by humans. Distinguishing between them, as determining the sources and invasion pathways, is not only of biogeographical interest but also crucial for conservation management. Here we analyse the paradigmatic case of the Balearic herpetofauna by using a combination of literature and original molecular data. The Balearic Islands currently harbour much more alien than native amphibians (4/1) and reptiles (21/2). Although archaeology dates some introductions back to the Neolithic, the Balearic Archipelago has increasingly importing alien species until present. Source regions and invasion routes have shifted throughout time, from the Eastern Mediterranean and North Africa to the Iberian Peninsula and extra-European areas and from passive cargo transport or food/religion related to pet shops, nursery trade and tourism. Overall, one native amphibian (*Alytes muletensis*) and two native reptiles (*Podarcis lilfordi* and *P. pityusensis*) are restricted to Ibiza and the less disturbed Formentera and small islets. Even there, menaces have increased during the last decade, particularly due to predatory snakes and competitive lacertids. While the Balearic herpetofauna forecasts what could be an ominous fate, it also provides an opportunity to extract lessons for developing effective conservation strategies.

Alien herpetofauna in Poland—problems and solutions

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Although there are no established alien amphibians or reptiles in Poland to date, the problem of alien herpetofauna should not be ignored. Availability of exotic pets and number of amateur keepers is increasing. However, the level of awareness about causes and consequences of biological invasions remains low. As a result, the number of releases of unwanted pets, including herptiles, is alarming. In addition, there were cases of illegal introductions of reptiles for “fauna improvement” by professional herpetologists and dedicated nature lovers. At least 10 reptile species have been recorded in the wild. There are only anecdotal records for most of them but the number of confirmed records for red-eared slider (*Trachemys scripta elegans*) and Cumberland slider (*T. s. troostii*) reached a few hundreds. Single cases of egg-laying of red-eared sliders were detected but hatching was not confirmed so far. Even though the species may not breed successfully in Poland, its life span combined with the number of released individuals constitute serious threat for native biodiversity, particularly for European pond turtle (*Emys orbicularis*).

One of the major attempts to mitigate the invasive alien species problem in Poland is a new decree of the Minister of Environment that came into force in 2012. It imposes restrictions on 52 invasive alien species of plants and animals. Import, keeping, breeding and selling of these species requires a permission from the General Director for Environmental Protection. Breaking the law is subject to a fine or jail. Negligence leading to escape of animals listed in the decree may result in similar consequences. Restricted species include American bullfrog (*Lithobates catesbeianus*): its import and breeding is forbidden altogether, including by zoos. However, to reduce the risk of release of unwanted individuals, it is possible to obtain a permit for keeping and selling bullfrogs that are already possessed, on the condition that they are microchipped the risk of escape is kept to a minimum. Restricted reptile species are snapping turtle (*Chelydra serpentina*), painted turtle (*Chrysemys picta*), false map turtle (*Graptemys pseudogeographica*) and all subspecies of *Trachemys scripta*. Import and breeding of these species will only be allowed for zoos, while individual owners and pet shops can only obtain permits to keep and sell turtles that they currently possess, provided that they are microchipped and the risk of escape is minimized.

The major challenge to make the new law effective is awareness raising among pet keepers. A few campaigns were organised and new are planned in close future.

Populations and habitats of the Hungarian meadow viper (*Vipera ursinii rakosiensis*) in the Hanság area

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The Hungarian meadow viper is one of the most endangered snakes within the European fauna. The West-Hungarian population of the subspecies survived in the Hanság area on two pitches with dry grasslands (loess grasslands, secondary grasslands) void of floods and inland inundations that make up less than 25 ha altogether and are surrounded by lower lying marsh meadows, willow marshes and marsh forests.

Within the frame of the “Conservation of Hungarian meadow viper (*Vipera ursinii rakosiensis*) in the Carpathian-basin” LIFE+ project intervention is done on 392 ha within the 1609 ha “Viper Reserve”. The aim of project is the suppression of invasive species, conservation of and help to spread grassland communities favourable for the Hungarian meadow viper. In the place of higher situated hybrid poplar plantations and ploughlands 32 ha of new dry grassland are created that doubles the extension of wintering grounds. The surrounding former marsh meadows and swamp meadows are being restored on 360 ha primarily due to the removal of *Salix cinerea* and *Solidago gigantea*. Further conservation management of the habitats is done by mowing and grazing of sheep, and it is protected by an electric fence to eliminate damages by wild boar.

Within the frame of botanical monitoring the spread and general state of habitats was examined with vegetation mapping. We try to show the changes in the state of the single habitat types due to management with coenological snapshots taken on constant sampling spots.

The monitoring survey of the Hungarian meadow viper and its potential food animals—Orthoptera, Amphibia, Reptilia—is done since 2001. Changes in the number of species and individuals of the assigned taxa as well as the relative frequency of the viper sightings in a unit time were tracked on the two habitats with nearly the same times of sampling. The presence of predator species and the effect of habitat management were also subject of the survey.



Amphibian chytridiomycosis
Symposium

Summary of *Batrachochytrium dendrobatidis* research in the Czech Republic in wild and captive amphibians during the last five years

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The Czech Republic is inhabited by 13 anuran and 8 caudate species, thus having the richest batrachofauna in Central and Eastern Europe. All native species are protected by law and many receive conservation attention. The exotic amphibians are common in both public and zoo collections. This context gives many opportunities, yet challenging environment for the *Batrachochytrium dendrobatidis* research.

The first effort to study *B. dendrobatidis* in the area was triggered by cooperation with the RACE (Risk Assessment of Chytridiomycosis to European Amphibian Biodiversity) in 2008. At the moment two Czech universities work in close collaboration on the topic and several nature conservation and research bodies are involved in field sampling.

Altogether 1562 samples from wild amphibians were collected between 2008 and 2012, allowing analyses of host specificity and bioclimatic modelling. The distribution of the pathogen in the Czech Republic appears to be almost general, but lowlands and warmer areas seem to be more suitable. The most commonly infected amphibians are from the genera *Pelophylax* and *Bombina* with subadult post-metamorphic individuals being in the greatest risk of acquiring the fungus. Individual cases of mortalities linked with high infection burdens detected by qPCR were observed in *Bombina variegata* and *Bufo viridis*, but several species showed the ability to lose the infection (*Bufo calamita*, *B. viridis*, *Bombina variegata*).

The preliminary results from exotic amphibians showed that over 100 species are found in Czech collections. Dataset of approximately 500 samples proved that cases of infection by *B. dendrobatidis* and fatal chytridiomycosis occur in small private collections as well as in zoos. Obtaining data from “pet trade” proved to be a challenging task, bringing very little data.

The Czech Republic is a great area for chytridiomycosis research and it allows unique comparisons between the present taxa, analysis of bio-geographic, bioclimatic and social context.

Environmental predation of *Batrachochytrium dendrobatidis* determines infection dynamics

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The occurrence pattern of *Batrachochytrium dendrobatidis* (*Bd*) is not homogeneous at local and regional scales. Sites which seem appropriate and in vicinity to long-term infected sites, are not always colonized by *Bd*. We hypothesized that the presence of resident microorganisms that prey on *Bd* contributes to explain the observed pattern of *Bd* colonization. The aim of this study was to better understand the interactions of *Bd* with resident microbial communities, with a focus on the impact of microorganisms on *Bd* viability, infection probability and infection intensity in amphibian hosts.

Sites in the Pyrenean mountain range with known history of absence or presence of *Bd* were sampled. The decrease in *Bd* zoospore viability after exposure to the water samples was assessed using a method combining ethidium monoazide with real-time PCR₃. This method was also used to assess the effect of cultures of several freshwater microorganisms on *Bd* viability. Based on the results of these first experiments several microorganisms were selected for *Bd* zoospore ingestion experiments and for a *Bd* infection experiment with *Discoglossus scovazzi* tadpoles in the absence and presence of microorganisms.

We were able to show a significant correlation between the abundance of microorganisms and *Bd* zoospore persistence in the Pyrenean water samples. In pure culture, some but not all microorganisms were highly efficient in killing *Bd*. These highly effective species ingested *Bd* zoospores and prevented *Bd* colonization of tadpoles. In conclusion, environmental microorganisms dictate chytrid infection dynamics.

Dramatic decline in the fire salamander (*Salamandra salamandra*) in the Netherlands—a species on the edge of extinction

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In the Netherlands, the fire salamander (*Salamandra salamandra*) occurs at the edge of its distribution range and is restricted to three small populations in the extreme south of the country. The largest of these populations, the Bunderbos population, has been very well monitored since the seventies. For many years, the population was stable until the population completely collapsed in 2010. In 2011 four specimens were seen, in 2012 only two. A trend analysis based on the populations from 1997–2011 showed a highly significant drop of 96%. We aimed at determining the reason for the decline, by examining the population's genetic diversity, presence of known amphibian pathogens, and environmental concentrations of pesticides and nitrate concentrations. We failed to attribute the observed extinction event to any known cause of amphibian decline, rendering the collapse of the fire salamander populations in the Netherlands enigmatic.

A novel pathogen from fire salamanders (*Salamandra salamandra*)

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In the Netherlands, the fire salamander (*Salamandra salamandra*) is restricted to three small populations in the extreme south of the country. Since 2010 the species has shown a rapid and significant decrease of 96% of the total population. Here we isolated and characterized the novel agent that drove this *Salamandra* population to extirpation. Molecular and phenotypic characterization, including infection experiments, show this agent to be highly pathogenic to fire salamanders. The emergence of a novel lethal pathogen in European amphibian communities is worrying. We developed a diagnostic PCR that allows inclusion of the detection of this novel agent in any amphibian health assessment protocol.

Chytrid fungus in Western Europe

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It has been over three decades since scientists first studied the massive declines of amphibian populations observed across the globe. Among several causes, *Batrachochytrium dendrobatidis* (*Bd*) was identified as the causative agent in many cases, and the World Organization for Animal Health (OIE) now includes *Bd* as a notifiable disease. The aim of this presentation is to focus on the ongoing studies mostly in Western Europe e.g. the observed *Bd* occurrence and prevalence in amphibian populations and species, the identification of lineages and factors contributing to the spread of virulent lineage, their impact on native amphibians, and effort to mitigate the threat of chytridiomycosis. Despite many gaps in the understanding of the disease, we are beginning to unravel important elements of *Bd* biology and make progress toward amphibian conservation.

European plethodontid salamanders (genus *Speleomantes*): resistant to chytridiomycosis?

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Plethodontid salamanders are represented in Europe by 8 species of the genus *Speleomantes*, which are confined to small geographic ranges. Despite the established presence of *Batrachochytrium dendrobatidis* (*Bd*) in their geographic range, mortality attributed to chytridiomycosis has not been reported for this genus. The aim of this study was to determine the prevalence of *Bd* in *Speleomantes* populations across their distribution range, and to determine the susceptibility of *Speleomantes* salamanders to chytridiomycosis. We show that *Bd* was undetectable in 921 skin swabs of all eight species of European *Speleomantes*. After inoculation of *Speleomantes strinatii* with a highly virulent isolate of *Bd* (BdGPL), none of five exposed *S. strinatii* were colonized by *Bd* beyond 2 weeks post inoculation. For comparison, experimentally inoculated *Alytes muletensis* developed increasing *Bd*-loads over a 4-week period. A partial explanation for the observed resistance to chytridiomycosis was provided by the antifungal activity of the skin secretions of seven *Speleomantes* species, showing pronounced killing activity against *Bd* over 24 hours. In conclusion, the absence of *Bd* in *Speleomantes* combined with resistance to experimental chytridiomycosis and highly efficient skin defenses indicate that the genus *Speleomantes* is a taxon unlikely to decline due to *Bd*.

Exposure vs. infection: can *Batrachochytrium dendrobatidis* pathogenicity be an issue to salamanders?

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In recent years, pathogenic fungus *Batrachochytrium dendrobatidis* (*Bd*) has becoming widely recognized as posing major threats to amphibians. However, while some species seem to have disappeared completely following *Bd* outbreak, other species (and even populations) persist without being (apparently) affected. Although correlation of *Bd* with loss of anuran populations has been well documented, the pathogenicity of the fungus to urodeles is still poorly understood particularly in Europe.

Recently has been documented a massive decline in common midwife toads (*Alytes obstetricans*) in Serra da Estrela, Portugal, where the species have disappeared from several ponds. Both *A. obstetricans* and fire salamander (*Salamandra salamandra*) populations have been monitored since 2010 for presence, counts and assessment of *Bd* prevalence. Our study aimed to understand the susceptibility of *S. salamandra* to amphibian chytrid. Experimentally we tested the affects of *Bd* on growth and developmental rates in larvae, exposing individuals to different doses of *Bd* zoospores (low, medium, high and two controls: sham exposure and extremely high dose).

Our field surveys showed no significant fluctuation in the numbers of larvae found over the four years, contrasting with the abundances of *Alytes* tadpoles that dropped dramatically. Both species share the same chytrid contaminated water habitats, however, no mortality or *Bd* positive salamanders have been recorded in any of the monitored sites. Additionally, lab experiments provided robust data to support that *S. salamandra* larvae are very resistant to the disease chytridiomycosis. Exposing larvae to a highly virulent *Bd* strain and in a manner that resulted in potentially lethal infection resulted in infection of only a reduced number of salamanders in the positive control treatment. After four weeks of exposures, no infection was detected in any of the other treatments. Sublethal costs exist in exposed individuals, indicating that successful immune responses to *Bd* exposures come at a considerable cost. Costs are accrued in a dose dependent manner during the larval stage and can be also expressed accordingly.

Monitoring ranavirus-associated mortality in a Dutch heathland in the aftermath of an outbreak

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When ranavirus epizootics lead to mass mortalities of adult life stages, this is relatively easy to spot in the wild. However, in the aftermath of such an outbreak, mortality associated with ranavirus infection may be more difficult to detect. We provide an overview on the spatial distribution and temporal dynamics of ranavirus infections in a Dutch National Park in the year following a mass mortality event caused by ranavirus infection in 2010.

We monitored five ponds intensively between May–October 2011. The visits to the site were biweekly in May, June and October, and weekly in the other months. We noted the number of encountered amphibians and their condition, and we additionally monitored the chemical water quality. Ranavirus was detected in 4/5 ponds, causing mortality in water frogs (*Pelophylax* spp.) and great crested newts (*Triturus cristatus*). Of all sighted amphibians 2% showed ranavirus-related disease symptoms, and additionally a ten-spined stickleback (*Pungitius pungitius*) tested positive for CMTV, but it is unclear if this animal died due to this infection.

Amphibian mass mortalities were not encountered, but throughout the season dead individuals were observed. These continuing mortalities are unrelated to water quality and water temperature.



Herpetofauna and transport systems

— towards a better understanding
and impact reduction

Gully pots: death-traps for amphibians

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Gully pots are essential for ridding the roads of rainwater but can be a death-trap for amphibians. Each year, large numbers of amphibians, both adults and juveniles, fall into gully pots and die through starvation or by being washed away into the sewer system by surges of rainwater. This happens year around, but especially during spring migration.

The vastness of the problem is illustrated by the numbers of amphibians retrieved from gully pots in the Netherlands in 2012. In 36 locations, in three random counts we collected a total of 782 vertebrates from 526 gully pots of which 683 were amphibians. A rough calculation of the numbers that fall victim to the drainage system came up to an estimate of between several hundred thousand to more than half a million adult amphibians, and many times this number of immature ones, each year alone in the Netherlands (the Netherlands has 7 million gully pots).

A test with live amphibians showed that amphibians will find and use climb-out constructions. Our innovative research suggests to implement these constructions at European level to prevent this additional amphibian mortality.

Low usage rates of an under-road tunnel by three Australian anurans in an experimental setting

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Many amphibians in Europe and North America regularly use under-road tunnels during dispersal. However, these structures have not been shown to mitigate the impacts of road mortality on frog populations in Australia. We tested the behavioural response of three Australian frog species to a 12-metre amphibian under-road tunnel (ACO Polycrete Pty. Ltd.). We used infra-red camera units at night to view frog behaviour upon release from an acclimation chamber near the tunnel entrance. In April and October 2012 we tested 34 striped marsh frogs (*Limnodynastes peronii*), 54 green and golden bell frogs (*Litoria aurea*) and 15 broad-palmed rocket frogs (*Litoria latopalmata*). During an experimental run, one individual was placed under the acclimation chamber for 5 minutes, then released and its behaviour was monitored. A “balk” was recorded and the run was terminated after 25 minutes if (1) an individual had not entered the tunnel, (2) an individual entered the tunnel but remained inside, or (3) an individual entered the tunnel but turned back. The overall proportion of tunnel usage (i. e. frogs entering the tunnel) among the three species was 0.13 out of 103 frogs tested. The proportion of usage for *Lim. peronii*, *Lit. aurea* and *Lit. latopalmata* was 0.21, 0.07 and 0.13, respectively. The mean time taken for an individual to enter the tunnel was 14 minutes 24 seconds. The results of this study showed that there was low usage of the ACO under-road tunnel compared to the relatively high usage rates of the tunnels by amphibians in the Northern Hemisphere. However, Australian frogs exhibit no seasonal movements in migratory behaviour. Therefore, the lack of use of the tunnels probably reflects the behaviour of Australian frogs and our experimental setting, rather than the apparent unsuitability of the ACO tunnels. The next step in this study is to test frog usage of ACO tunnels installed under several roads near wetlands so that the behaviour of wild individuals can be assessed.

Prioritizing amphibian road mitigation measures at regional scale: predicting *Bufo bufo* mortality hotspots using habitat-resistance models

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Among all effects produced by roads, mortality by collision with vehicles can be the most important. Amphibians are the most affected group and road fatalities have a significant impact on population dynamics and viability, especially in protected areas. Considered the most threatened by roads in Europe because of their movement patterns and need for a complex matrix of habitats, *Bufo bufo* is a target species for mitigation measures. However, due to the extensive road network, precise locations (hotspots) identification is needed to apply these measures successfully. The aim of the study was to develop and test habitat-resistance models using GIS for identifying possible *B. bufo* mortality hotspots on roads located at 12 different Nature Improvement Areas (NIA) in UK. Also, it aims to inform the different stakeholders (local planning authorities, regional nature partnerships, NIA staff, conservation bodies and toad patrollers) about the potential critical road sites for this priority species in different regions. Twelve habitat suitability models and least-cost models were built using expert-literature knowledge on *B. bufo* road mortality. Models were validated with *B. bufo* presence data collected from different sources. Model's fit was good, predicting 80% of species occurrence, despite information on ponds location being not used uniformly across the NIA network. Models predicted high-quality habitat and possible corridors for *B. bufo* presence in all NIA's. From the network considered for analysis, 3% of 500 m cells showed 90% of possibility for being *B. bufo* road-kill hotspots. All NIA cells presented sections with 45% probability for being a hotspot, representing nearly 20% of the road network. TOR sites buffers match 30% of the possible hotspots cells. These models were designed to provide regional-scale data information on potential road mortality hotspots to different management parts for future study and implementation of possible mitigation measures.

Road mitigation using tunnel and fence systems for a protected species, the great crested newt in the UK. Is it working?

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FROGLIFE manages Hampton Nature Reserve, probably the largest population of great crested newt (*Triturus cristatus*) in Europe with an estimated 35,000 adult individuals in around 400 ponds. Since 2007 we have conducted intensive monitoring of a tunnel and fence system connecting two parts of the reserve which have been separated by a new road. Both areas contained terrestrial and aquatic habitats which makes this system different than most other amphibian road mitigation sites. The system comprises two large ARCO tunnels (2.5 m high × 5.5–6 m wide) as well as a 50 × 50 cm ACO tunnel. Here we present 5 year annual monitoring results demonstrating that while the system successfully connects the newt metapopulations separated by the road there is very important variability in annual tunnel crossings, probably influenced by weather conditions. Between 10 and 113 newts were annually trapped in the tunnels in different years with newts successfully crossing from both sides of the road but with substantial sex bias. We suggest that such monitoring studies need to be carried out over a long period of time (5–10 years) and should include data from before the tunnel system has been emplaced in order to accurately verify their success.

Amphibian migration characteristics and tunnel use during spring migration in 2009–2012 along the Hont–Parassapuszta section of the No. 2. road, Hungary

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Amphibian mitigation measures have been built on roads worldwide since 1969. In 2006 a tunnel-barrier system was constructed between Hont and Parassapuszta, which is the site of the longest-running amphibian rescue operation in Hungary organized by Varangy Akciócsoport Egyesület. Tunnels of different sizes were constructed, the diameter of new tunnels were either 40 or 60 cm, already existing culverts included into the system were over 100 cm. However, the new system built by the local national park hardly reduced amphibian road kills in the 2007 and 2008 migration period, its use was below 0.5%. Initiated by Varangy Akciócsoport Egyesület, maintenance was made by the local road authority in spring 2009 and by the Danube–Ipoly National Park Directorate in 2010 and 2011. As a result, at least 8.8–14.6% of the migrating amphibians crossed the road in the tunnels in 2009–2011. Still, more than ten thousand amphibians died on that road section during every spring migration between 2009 and 2011 even though toad rescue was also carried out by volunteers. In 2012 migration was much less intensive than in the other years due to severe drought. We observed the corpses of seven anuran and two newt species along the road, nearly 90% of them were common toads (*Bufo bufo*). In the first half of the migration period *Pelobates fuscus*, *Rana dalmatina* and *Lissotriton vulgaris*, in the middle and the final stages of the migration *B. bufo* and *Bombina bombina* migration peaks were observed. Depending on the weather, the start and the peak of the migration varied among the studied years by 20 and 10 days, respectively. Unfortunately, no maintenance was made in 2012 that led to the gradual disintegration of the plastic fences. Marked differences were found among the tunnels, common toads (*Bufo bufo*) significantly more frequently crossed the road in large culverts than in smaller tunnels.

Temporary and permanent mitigation measures on Hungarian roads: failures and successes

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Fragmentation is a main conservation problem, especially in Europe, where providing access to habitats of different quality for wildlife is of increasing importance. A typical example of this process is the creation and maintenance of temporary and permanent mitigation measures to help herpetofauna species under or over roads. Legally, it is dealt with in many European Union countries, the practice, however is not so successful. Here an overview is given on Hungary with a focus on characteristic problems and possible solutions. Temporary mitigation measures are made by several organisations. They often focus on the breeding migration towards the breeding sites only, which may lead to situations when the erected fences become barriers for amphibians leaving the breeding sites. Besides positioning, the set of fences is often without following basic rules, e. g. how to make the edge of fences to avoid animals to get onto the roads in large numbers. However, these actions save well over an annual 100,000 amphibians and reptiles (mainly grass snakes), on average. The priorities of such activities should also be enlarged, besides focussing on common species dying on roads in large numbers, rare species and small populations should also be given priority when decisions are made in what areas to intervene. Permanent mitigation measures can be even more effective, the most successful, modern design in the Danube Tisza Interfluvium created in 2011 saves more amphibians than temporary mitigation measures as it functions during the whole year including the juvenile dispersal period, which is completely overlooked at temporarily protected road sections. However, most of these constructions do not work properly due to improper design and realisation or the lack of maintenance, which means a conservation failure as well as waste of money.



Monitoring of amphibians and reptiles

in the frame of the Habitats Directive

Dozen years of herpetological monitoring in Hungarian Biodiversity Monitoring System

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Altogether 18 amphibian and 15 reptile species are known from Hungary, of which all are included in the annexes of the Habitats Directive, meaning that they are protected or strictly protected. The standardised, long-term study of Hungary's amphibian and reptile fauna began in 2001. Monitoring under the Hungarian Biodiversity Monitoring System (HBMS) initially covered various habitats in seven regions of Hungary. These surveys were carried out under guidance of specialised experts, and following HBMS protocols for amphibians and reptiles, using numerous methods.

Sampling methods for monitoring amphibians

Night search by torch light, bottle-trapping: methods suitable for sampling Caudata.
Egg counts: a method suitable for the assessment of the number of reproducing females of toads, agile frogs and common frogs.
Count of adult animals along shorelines (fire salamander assessment can be done on land as well).
Bottle trapping for *Triturus* species.

Sampling methods for monitoring reptiles

One of the possible methods is transect sampling, during which the numbers of individuals of the observed species are recorded. It is recommended to invest the same time effort during each sampling. Another method is quadrat sampling, which is used when features of the sample site do not allow transect sampling to be performed.

A new monitoring method

The collected monitoring data were not always reliable (different weather, different observability, changing habitat or microhabitat, etc.).
In 2011 for the better observability and gaining more information we designed a not habitat-based but a new species-based monitoring methodology for Caudata species, and some Anura and three reptile species, too.

Monitoring amphibians and reptiles of community interest in Romania

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Romania has a high diversity of habitats and landscapes and covers five biogeographical regions. Half of the 41 protected amphibians and reptiles occurring in Romania reach the limits of their geographical range here, being more prone to range shifts (contractions or expansion).

Romania joined the European Union (EU) in 2007 but started the process of implementing the environmental legislation and designating Natura 2000 sites in 2005. Despite the progresses made in developing the Natura 2000 network, which now numbers 383 SCIs and 148 SPAs and covers 22.66% of the land surface, little has been done in promoting a scientifically sound and coherent monitoring system, as required by article 17 of the Habitats Directive. We identified several major issues needed for complying with this requirement and for supporting the development of a comprehensive network of protected areas:

- (1) Monitoring should be carried out at a biogeographical region scale, keeping in mind that the goal of monitoring is to detect range/population trends, and not just provide raw data for each Natura 2000 site. The average size (\pm SD) of 108.41 (\pm 314.98) km² of a SCI, does not allow identification of trends in range changes;
- (2) Agreeing upon regional scale favorable conditions for each species of Community interest in terms of acceptable limits for a minimum set of attributes is needed before the start of a monitoring program;
- (3) Agreeing upon a common working methodology, including data collecting, management and analysis;
- (4) Undertaking a baseline survey that will provide a starting reference condition;
- (5) Cooperating with neighboring countries for a regional scale assessment;
- (6) Identifying the nature of threats and if/how these can be mitigated, by involving local communities and other stakeholders.

Assessment of favourable conservation status for herpetofauna in the Netherlands

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According to the EC Habitats Directive, article 17, Member States have to report in a regular six-yearly progress on the conservation status of Europe's most vulnerable habitat types and species. As part of this assessment, Favourable Reference Values (FRVs) are crucial. In 2008, in the first Dutch report on this topic, the assessment of the conservation status of the species was based on expert judgements and a description of the species. In the next report, which will be published summer 2013, the Dutch government changed the methodology in describing the Conservation status. Favourable Reference Population Size (FRPs) and Favourable Reference Range (FRRs) are now the most important figures to assess the Conservation status of a species. The year 1994 is used as year of reference. Details of the methodology are presented as well as the outcome for Annex II and IV species such as the great crested newt, based on the large database collected largely by volunteers.

Conventional field methods vs. eDNA-based species monitoring. A comparative assessment for three aquatic species under the EU Habitats Directive

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Reliable species monitoring is a crucial foundation for the implementation of most conservation projects. However, for many species it remains a challenge owing to field methods that are hard to standardize and depend heavily on taxonomic expertise in decline. In recent years a new DNA-based approach has been proposed to address this problem in aquatic animals. It has been demonstrated for several rare species that even minute volumes of water from their habitat contain environmental DNA (eDNA) that can be used to confirm their contemporary presence. However, little is known about the comparative performance of this new monitoring strategy compared to conventional field surveys. We tested the eDNA detection approach in the context of the current Danish national monitoring regime for three aquatic species on the Habitats Directive Annex II and IV. Our results support previous studies on amphibians and validate a high level of sensitivity. The great crested newt was detected by eDNA at 39% of the investigated localities corresponding with 97% of the those obtained by conventional monitoring. The common spadefoot toad was detected at 22% of the monitored localities by eDNA including eight where conventional monitoring failed to find the species. On the contrary, the large white-faced darter was only detected by eDNA at half of the localities (26%) compared to results of conventional monitoring and exhibited indications of specificity issues. These findings clearly illustrate that there are vast differences in the efficiency of eDNA monitoring across taxa and underline the importance of thorough comparative documentation. The use of eDNA in monitoring is clearly in its infancy and there are many avenues of research that can be expected to improve the utility of this general principle. Nonetheless, these first comparative results do indicate that eDNA detection may have a promising future in species monitoring under the EU habitats directive.

First attempt to set up the national monitoring scheme for four target amphibian species in Slovenia

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The Centre for Cartography of Fauna and Flora carried out the project “Setting up the monitoring of target amphibian species in Slovenia” between 2010 and 2011. Target species were Italian crested newt (*Triturus carnifex*), Italian agile frog (*Rana latastei*), yellow-bellied toad (*Bombina variegata*) and fire-bellied toad (*Bombina bombina*). This was the first attempt to set up a monitoring scheme for Habitats Directive Annex II species of amphibians in Slovenia on the basis of the analysis of existing data and carrying out additional surveys.

As a result there is a proposal for monitoring scheme for each species in terms of both types of monitoring (species distribution and population size). Since there are significant differences in species distribution and ecology, we took an individual approach in designing monitoring schemes.

For *T. carnifex* there are still a lot of gaps in known distribution in Slovenia, therefore the distribution monitoring should primarily aim at surveying the areas with potential newt habitats. We also proposed population monitoring on 27 known sites and prepared the protocol that allow comparison over time within each site and between sites.

In 2009 there was also the first morphological evidence for the presence of Danube crested newt (*Triturus dobrogicus*) in the Prekmurje region, NE Slovenia. Therefore we need also additional research on the distribution of the species and potential hybrid zone with *T. carnifex*.

Assessing the occurrence of the great crested newt (*Triturus cristatus*) using water samples: is the method more efficient than the direct observation?

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During the last years, the development of environmental DNA (eDNA) allowed the detection of species in aquatic environment only based on a very few number of cells of the target species. Recent publications showed the possibility to assess the occurrence of an amphibian or fish species in a pond or river based only on a single water sample (15 ml). In some examples, the detection was even better based on the eDNA method compared to direct observation. However, the efficiency of both eDNA and direct observation approaches has never been properly tested.

In 2012, we sampled three times 29 ponds in the Basel region (Switzerland) and visually detected the occurrence of the great crested newt (*Triturus cristatus*). The water samples were later analyzed in an adequate laboratory with specific methodology used for ancient and low quantity DNA. Real time PCR with specific primers were conducted to evaluate the amount of eDNA belonging to the focus species and we compared this results with direct observation. Site occupancy models were used to evaluate the detection probability by both methods.

The direct observation (detection probability = 0.73 ± 0.06) was slightly better in our study area compared to the eDNA (0.61 ± 0.07). When conducting the analyses for both methods separately, the eDNA method overestimated the detection and underestimated the occupancy. The probability of detection using eDNA is also strongly associated with the number of crested newts observed in the pond.

In conclusion, eDNA is a good and simple method to detect organisms, even if not necessarily better than other ones. This method is not perfect (as other ones), should not replace direct observation, but can be used in complement, especially when the target species is difficult to detect.

Educative and participative monitoring for a wider and more effective amphibian conservation, applicable on a wider European scale?

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In 2011 a new monitoring design was developed by Association AMBOR and RAVON Foundation with the aim of obtaining comparable data on the status of amphibian populations and habitats in a Spanish natural park of 177,000 ha with low accessibility: Educative and Participative Monitoring for Amphibian Conservation (EPMAC). Since 2011 annual monitoring were executed twice in 110 preselected sites with involvement of professional and amateur herpetologists (national and international), local community, nature managers and biology students. An auto-financed educative system was set-up and the results are of high value to nature conservation as well as for understanding the natural dynamics and involving the local community by a constructive educational method. During the three years around 150 persons were involved and a large spin-off effect was observed. For 2013 we have applied for various small grants to set-up additional areas with this monitoring system in other regions in Europe among others to evaluate the applicability on a wider European scale. The direct involvement of locals together with professional participants make it possible to obtain a wider understanding of the natural dynamics and population dynamics, get in contact with local communities and create awareness. This stimulates more effective conservation activities, increase knowledge and experience of professionals or nature managers. We would like to suggest the applied approach of monitoring for other areas with high nature values, low local involvement and low accessibility. We will present the methods, results, limitations and difficulties of three year monitoring in southwestern Spain and the evaluation of the experiences for launching the method in other regions.

Conservation status mapping of great crested newts in the UK

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The great crested newt is the only Habitats Directive Annex II species of amphibian in the UK. Since the 1970s there have been various attempts to define status and to assess trends, with estimates given of 50% declines during the 1960s–1970s, and 2% changes every five years in the 1990s. National population estimates have produced widely ranging estimates based on numbers of ‘sites’ or ‘breeding populations’ and the focus for recent work has been to provide data for the reporting requirements of the Habitats Directive. The data collected are, however, not ideal for helping ‘on the ground conservation action’ or for providing information that helps with issues where the species is affected by development.

Amphibian and Reptile Conservation is developing fine-scale modelling tools to predict distribution of great crested newts, target surveys and conservation action (e. g. habitat linkages), and assess the effects of putative developments on local conservation status. These goals contribute to an integrated surveillance strategy for the species. We demonstrate these approaches with examples from the great crested newt ‘hotspot’ in North-east Wales. An understanding of the effects of development and changes in pondscape connectivity, and their impacts on conservation status, can inform sustainable development whilst delivering positive conservation benefits in the long term.



Oral Presentations

Understanding nesting ecology and behaviour of green sea turtles: intensive monitoring and ground survey as a method of conservation

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Monitoring and ground survey on the nesting beach provide sightings on the population status and conservation of green sea turtles, *Chelonia mydas* in Setiu, Terengganu, Malaysia. This method is carried out especially to overcome anthropogenic threats in the area such illegal poaching, excessive noise and light pollution, unplanned development near the coast and so on. We collected the distribution data from 2007 until 2012, and recorded that the highest number of nesting occurred in 2012 (mean = 28.714). Nesting attempts are recorded mostly in May (mean = 33.333 ± 4.539, $p < 0.001$). We also mapped 98 nesting areas in reserved Telaga Papan Beach, Setiu within six months period (March until August) in 2012 by using Global Positioning System (GPS). By plotting the areas into ten plots, we observed the nesting frequency in each plot and relate it to human activities and land-use. We recorded that Plot 4 has the most frequent nesting activities with least human disturbance and land-use. We recorded that most attempts occurred at dunes and emergence hour were most frequently at 12 am–1.59 am (23%). During this extensive survey in Telaga Papan, we measured the curved carapace length (mean = 98.369 cm) curved carapace width (mean = 85.595 cm) and clutch size (mean = 81.602 eggs) of the nesting marine turtles. In this study, no significant correlation recorded between both clutch size with curved carapace length ($r_s = 0.2339$, $p = 0.1359$, $p > 0.05$). Out of 151 nesting attempts, 35.1% false crawls are recorded and both variables (nesting attempts and false crawls) are strongly correlated ($r_s = 0.8827$, $p = 0.0198$). We suggest that strict monitoring by adequate number of rangers is to be done to reduce illegal poaching and other disturbances from human activities. As trainings are continuously provided to these rangers, these threats can be reduced and conservation status of green sea turtles can be improved from time to time.

Cryptic speciation patterns in Iranian rock lizards uncovered by integrative taxonomy

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While traditionally species recognition has been based solely on morphological differences either typological or quantitative, several newly developed methods can be used for a more objective and integrative approach on species delimitation. This may be especially relevant when dealing with cryptic species or species complexes, where high overall resemblance between species is coupled with comparatively high morphological variation within populations. Rock lizards, genus *Darevskia*, are such an example, as many of its members offer few diagnostic morphological features. Herein, we use a combination of genetic (two nuclear and two mitochondrial loci), morphological (15 morphometric, 16 meristic and four categorical characters) and ecological (11 newly calculated spatial environmental predictors) criteria to delimit cryptic species within two species complexes, *D. chlorogaster* and *D. defilippii*, both distributed in northern Iran. Phylogenetic analyses of the molecular data confirmed the monophyly of *D. chlorogaster*, while *D. defilippii* is paraphyletic in respect to *D. steineri*. However, each of the complexes comprises several highly divergent clades, especially when compared to other congeners. We identified seven candidate species within each complex, of which three and four species are supported by Bayesian species delimitation within *D. chlorogaster* and *D. defilippii* (including *D. steineri*), respectively. Although the species within one complex lack clear diagnostic features, they can be well separated based on morphological variables when sample size is appropriate. Ecological Niche Modeling provided additional support for the identified species and niche overlaps between them are generally low, especially in the *D. defilippii* complex.

Rapid lizard radiation lacking niche conservatism: ecological diversification within a complex landscape

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Diversification and rapid radiation are well documented in lacertid lizards. Niche conservation is frequently observed among related taxa, whereby niches will not change much during speciation events. Here, we investigate the relationship between environmental niche divergence and phylogenetic relatedness in a widespread group of green lizards, the *Lacerta trilineata* group. A dated phylogeny based on three mitochondrial genes was contextualized using species distribution models of all genetically identified lineages in the *Lacerta trilineata* group. Based on this analysis, ancestral climatic niche occupancy was reconstructed using niche occupancy profiles. Niche divergence among lineages was quantified by computing multivariate niche overlaps. All taxa are associated with humid areas, but there is extensive variation in their climatic niche breadths and positions, which accord with the main phylogenetic split in the group. Our results suggest divergent niche evolution within subclades and convergent evolution among clades, which implies only a limited degree of niche conservatism regarding annual variations in temperature and precipitation. In contrast, niche axes—mainly reflecting precipitation patterns of the coldest quarter—show a greater difference among clades than within clades, and therefore a higher degree of niche conservatism. Based on estimated divergence times between taxa and geological events in Anatolia, our results can be explained by fragmentation of the range of a hypothetical ancestral species, resulting in different adaptations of subclades either to humid continental climates or to more Mediterranean climates. Our study highlights deviations from classical niche conservatism theory due to significant niche shifts among sister taxa.

Analysis of distribution of Acrodonta lizards in Vietnam as a tool for designation of Important Herpetofaunal Areas

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Results of faunistic, taxonomic and phylogenetic study of agamid lizards in the fauna of Vietnam and data on their distribution are summarized and analyzed. Taxonomic diversity of agamids and representation of different evolutionary lineages in different regions of South-east Asia are considered. Composition of the fauna of agamids in Vietnam and ratio of endemic and wide distributed species is discussed in biogeographic aspect. Based on data on distribution of endemic agamids within Vietnam territory we offer to designate Important Herpetofaunal areas in mountain tropical forests in southern regions of Central Vietnam on the Tay Nguyen Plateau.

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A re-evaluation of the taxonomic status of the foam-nest treefrogs, *Chiromantis* in Thailand based on morphological, molecular and bioacoustic evidence

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With a wide distribution in two continents, some rhacophorid frogs of the genus *Chiromantis* exhibit phenotypic similarities. The Asian species *C. hansenae* has been considered a junior synonym of *C. vittatus*. We assessed the taxonomic status and phylogenetic relationships of congeneric species of *Chiromantis* frogs from Thailand based on three types of evidence. Analyses of morphological, molecular and bioacoustic data sets support four evolutionarily distinct and monophyletic clades: *C. doriae*, *C. nongkhorensis*, *C. vittatus* and *C. hansenae*. Genetic divergence between *C. vittatus* and *C. hansenae* is significantly greater than between *C. doriae* and *C. nongkhorensis*. These four *Chiromantis* species show distinct call characteristics. Multivariate analyses showed morphological differentiation within Thai *Chiromantis* species. Our results support the taxonomic validity of *C. hansenae* and suggest that there may be more diversity within *Chiromantis* in Thailand than is currently recognized.

How complex is the *Bufo bufo* species group?

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The common toad (*Bufo bufo*) has an enormous range, from Tunisia to deep into Russia. A range-wide recent study revealed a marked genetic differentiation, with one species in and adjacent to the Iberian Peninsula (*Bufo spinosus*), two species in the Caucasus and the—still very wide ranging—*Bufo bufo*. We expanded upon our work as follows. (1) With mitochondrial and nuclear gene sequences, we confirmed the deep split and that the mutual range border of *B. bufo* and *B. spinosus* is in France. (2) We searched for morphological characters that would discriminate the species in France and we tested some potentially informative characters on museum material (Leiden, Paris and Madrid) covering a North to South transect in western Europe, from the UK to southern Spain. (3) We identified the position of the contact zone in France, from the Atlantic coast to the upper Rhone valley near Lyon, which gave us some clues about the “why” of morphological species differentiation. Finally, (4) we scrutinized published nuclear data to investigate claims of hybridization and extensive introgression among species across the Mediterranean.

Variation of sexual dimorphism in snakes: the case of the *Echis coloratus* complex (Ophidia: Viperidae)

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Using museum specimens, we examined sexual differences in size, in 54 morphological characters and in allometric growth in three populations of the *Echis coloratus* complex: *E. c. coloratus* (n=50) from the southern Levant, *E. c. terraesantae* (n=70) and *E. omanensis* (n=32). Significance of differences in meristic characters was tested using two-tailed T-test and Chi-square test. Differences between sexes in the slope of allometric growth were tested by ANCOVA. In many characters conventionally regarded as sexually dimorphic, all populations showed sexual dimorphism. Differences were not tested for causation, but we propose possible functional explanations. The largest number of characters showing sexual dimorphism occurred in *E. omanensis* (20) followed by *E. c. coloratus* (16) and *E. c. terraesantae* (15). Males were larger than females, possibly due to their agonistic behaviour, had longer tails presumably as a result of need for more room for hemipenes. Females had more ventrals, more dorsals along the entire length of the body, and with a varying level of significance, tended to have more scales in head characters. All these female biased differences may be attributed to fecundity related increased bulk and swallowing capacity. Numbers of body somites (ventrals + subcaudals) did not differ between sexes, but the longer males had more dorsal blotches than females. We suggest that this helps to maintain a blotch frequency necessary to achieve a flicker fusion effect of the blotchy pattern to promote visual illusion. *Echis coloratus* females, unlike males, showed an ontogenetic change in relative tail length. Snakes of this population tend to be arboreal at adult age, that necessitates long tails which may be *a priori* available for males but not for females. To substantiate our proposed functional explanations testing with possible environmental correlates or in experimental sets is necessary.

Male throat UV colouration affects maternal investment in European green lizards

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According to life-history theory, individuals should increase their reproductive effort when fitness benefits of reproduction are high. Differential allocation hypothesis predicts that it can be advantageous for females to invest more heavily into offspring sired by males of high quality and decrease investment into future reproduction. However, there are species in which even opposing reproductive strategies are present, and females compensate for low offspring quality by increased maternal investment. Animals have developed various costly sexual signals to advertise their quality. Here, we investigated whether European green lizard females adjust their maternal investment according to males' nuptial UV colouration, a trait that plays an important role in mate choice. We experimentally manipulated the UV colour of the male pairs, where the members of the pair did not differ significantly in their morphological characters, or throat colouration measured prior to manipulation. After the mate choice experiments, half of the females mated with their preferred male, while the rest had only the option to mate with the male they rejected during the trials. Females showed preference toward males with higher relative UV intensity. Maternal investment was affected by the males' UV colouration, because males differed systematically only in this character, and clutches sired by preferred males included heavier eggs. Clutch size was affected by the male body size. Our result support the predictions of positive differential allocation, as females invested differently into clutches sired by different males of quality, with higher investment to those of sired by attractive males. Moreover, increased investment to these clutches was based on the direct preference showed for the male throat UV colouration manipulated within the natural range. Taken together, our results suggest that UV colour signals can be a cue of male quality and affect the patterns of maternal investment.

Green lizard (*Lacerta viridis*) personalities: behaviour and individual quality at different ontogenetic stages

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The importance of animal personality became well recognised in behavioural ecology during the past decade. Nevertheless, our knowledge about the mechanisms in the evolution and development of animal personality is still incomplete. For instance, the link between animal personality and individual quality has rarely been established. In male European green lizards (*Lacerta viridis*), components of nuptial throat colorization has been linked to individual quality and fitness. In this present study, we first measured exploration–boldness in adult male European green lizards during the reproductive season, and second, we measured the same behaviour in their 2–3 weeks old laboratory-reared offspring. Our aims were to see if (i) animal personality was present, (ii) there were correlations between behavioural type/behavioural consistency (the main components of individual personality) and individual quality, and (iii) behavioural type/behavioural consistency were heritable. Both adults and juveniles showed strong personality. Males with brighter throat colour were more explorative–bold, and larger males were more consistent. However, we did not find any correlation in juveniles. Behavioural type differed between the F1 families, but behavioural consistency did not. Neither behavioural type, nor behavioural consistency showed heritability in our father–offspring regressions, however, we note that the assumption of equal age of fathers and offspring was obviously violated. We conclude that European green lizards have strong ‘built in’ personalities, but its link to individual quality emerges only during ontogeny. Based on earlier studies, we suggest that better quality males are more explorative–bolder and more consistent than worse males.

Geographic variation in the signaling behaviour of the Jacky dragon, *Amphibolurus muricatus*

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Animal communication systems are extremely complex and diverse. Signal diversification has been shown to be the result of several mechanisms, including genetic differentiation, natural selection and sexual selection. However, the influence and interaction of these mechanisms are still far from being understood, especially in a within-species context. We use an agamid lizard endemic to Australia, the Jacky dragon (*Amphibolurus muricatus*), to examine relationships between genetic structure, morphology and signaling behavior. We also investigate the consequences of this variation on the ability to discriminate conspecifics. We used three populations separated by over 280 km, two of which belong to the same genetic clade. We found that individuals from the more closely-related populations exhibited more similarities both in morphology and signaling behaviour than lizards from the third, more distant population. In addition, animals from all populations showed different levels of aggression if confronted with individuals from the same or different populations. We discuss the significance of this concordant pattern between genetic structure, morphology and behaviour.

Population dynamics of the North African green water frog *Pelophylax saharicus* in four lakes from northern Tunisia

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Amphibians are declining more rapidly than other animals in many areas but the data on amphibian populations are usually given as unadjusted counts, which explain why it is not easy to understand their decline. Most surveys are concerned only with the presence-absence of species and not with trends within populations. To determine relationships between the density of tadpoles, froglets and adults of *Pelophylax saharicus*, many sessions of mark-release-recapture were conducted in four lakes from north of Tunisia. Densities of tadpoles were reducing between August and September, but did not differ between sites. In September and October, the froglet densities in two of the lakes were always higher than in the other two. Similarly, densities of adults remained higher in the two first lakes. These results could be explained by a smaller size of the two first water bodies, i. e. with a higher edge effect. However, for each site there was no difference between years. The yield of tadpoles ranged according to sites from 31 to 65 ind. per mature female. Survival from the egg to the froglet stage ranged from 4.9 to 8.5% and survival between froglets and subadults from 31 to 45%.

Observations of reproductive behaviour in *Salamandra* species

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Fire salamanders (*Salamandra*) mate at night, often in cold and rainy weather. They lead a secretive life and for this reason observations of their reproductive behaviour in the field are rare. Much of the salamanders' courtship behaviour has been documented from observations in captivity. The behavioural repertoire of many fire salamanders is now well-known, although not every aspect has been explained. On a recent excursion to the Middle Atlas in Morocco in December 2012, we had the chance to observe *Salamandra algira* during mating activity. Thus far, courtship behaviour in this species was documented only fragmentary, but we managed to make a video of a full courtship sequence and will present it during our talk. *Salamandra algira* behaviour appears to be similar to that of other fire salamanders. Recently various videos of fire salamander behaviour have appeared on *YouTube*. We compare some of these observations and discuss the interesting aggressive male-male interactions, which have puzzled researchers since Werner KÄSTLE's first account of male interaction during the third SEH meeting in Prague in 1985.

Influence of termitophagy on prehension mode in cordylid lizards: a morphological and kinematic analysis

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Although there has been considerable interest in understanding the complexity of prehension mode in lizards, little insight has been gained into the selective pressures underlying shifts between different prehension modes. The Cordylidae family offers ideal opportunities to evaluate whether a specialist diet may affect prehension mode, as a bimodal prehension mode is well established in the sister families Scincidae and Gerrhosauridae, and dietary specialisation is present in at least one species, *Ouroborus cataphractus*. The southern harvester termite (*Microhodotermes viator*) is the main prey item of *O. cataphractus* and has played an important role in the evolutionary history of this species. We used high-speed filmography to test the effect of prey species and prey size on prehension mode by comparing prey prehension between *O. cataphractus* and its closest extant relative, *Karusasaurus polyzonus*. In addition, we included several cordylid lizards representing the major clades in the family into our analysis to investigate whether any functional specialisations observed in *O. cataphractus* represent autapomorphies. Finally, we investigated the morphology of the lingual structure in Cordylidae, with emphasis on *O. cataphractus* and *K. polyzonus*, using light and scanning electron microscopy techniques. Our results show that termitophagy in *O. cataphractus* has resulted in the evolution of a novel lingual prehension mode, accompanied by morphological modifications of the tongue structure. Moreover, none of the other cordylid lizards tested in this study used lingual prehension during prey capture, except *K. polyzonus* which used the tongue in a very small percentage of feeding trials. This data suggest that dietary specialisation might underlie the reacquisition of a specific prehension mode or evolution of novel prehension mechanisms in lizards.

Designing screening protocols for amphibian disease that account for imperfect and variable capture rates of individuals

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Given the threat posed by the amphibian chytrid fungus *Batrachochytrium dendrobatidis*, accurate knowledge of its presence and prevalence in an area is needed to trigger conservation actions. However, imperfect capture rates determine the number of individuals tested during field surveys and increase the uncertainty surrounding estimates of prevalence. We combined a model for estimation of capture rates of individuals and a beta-binomial model of prevalence estimates to select the seasonal window of sampling that would provide the most precise estimates of prevalence. We applied the models to data from a screening program for three populations of the endangered Apennine yellow-bellied toad *Bombina variegata pachypus* in northern Italy. We estimated population size and capture rates from mark-recapture data and combined them with estimates of chytrid prevalence obtained from screening the populations in 2011. We evaluated the model by predicting the size and precision of prevalence estimates that would result from seasonal fluctuations in recapture rates, and compared predictions with data collected during additional surveys in 2012.

No individuals tested positive for chytrid: in 2011, prevalence was estimated between 0.04 and 0.07 using uninformative priors. Sampling during the period of maximum capture rate was predicted to decrease uncertainty by a maximum of 36% compared with least suitable periods, with greater gains when using uninformative priors. Using repeated, consecutive surveys was also predicted to decrease upper 95% confidence intervals by between 20% and 36%. The results of surveys carried out in 2012 closely matched the predicted figures for all populations, suggesting this method can be reliably used to plan cost-effective surveillance programs and improve estimates of pathogen prevalence. These can then be more reliably used to inform conservation actions, for example allowing managers to declare “disease-free” populations with greater confidence.

Investigating the degree of behavioural plasticity in lacertids by comparing two populations of *Podarcis carbonelli* under different disturbance regimes

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Antipredator strategies in lacertids vary across and within species. Previous investigations have documented divergent strategies between syntopic species, conspecific populations inhabiting different habitats and colour morphs and size classes within the same population. Here, we evaluate the degree of plasticity in the different components of the antipredatory behaviour by comparing two conspecific populations under divergent disturbance regimes but otherwise environmentally similar. We examined the lizard responses under direct attack from a predator (simulated by the researcher) in two populations of *Podarcis carbonelli* from geographically close sites from Doñana National Park (SW Spain). In both cases, lizards mainly occupied wooden passes on sandy soil allowing park visitors to reach fauna observatories but, while one (El Acebuche) was heavily frequented the other (Ribetehilos) was not. Field experiments were carried out during a period with optimal temperatures but out of the reproductive period (November 2010) to exclude factors other than site, sex and size class. We recorded variables describing lizard traits (sex, size class), environment (microhabitat, refuge) and behavioural responses for 128 observations throughout random walking routes. Lizards from the most disturbed population were closer to their refuges, regardless lizard and habitat features. While lizards from this site were also observed on hotter substrates and males in general escaped into hotter refuges, thermal environment was insufficient to explain the behavioural differences found. By contrast with previous studies comparing species or colour morphs, no variation between sites for either escape distance, recovery time or recovery distance was recovered. Results reinforce previous claims that individual lizards may respond to different levels of disturbance in a directional way. However, they also indicate that some components of the antipredator behaviour are more plastic than others.

Predation pressure versus antipredator behaviour: a comparative study using a lacertid model

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Predation pressure plays a determinant role on animal populations selecting antipredatory strategies in the putative prey. Among them, antipredator behaviours are of interest when analysing species interactions since selection may favour animals taking advantage of previous experiences to prevent new attacks. Lacertid lizards use escape as the most common tactics when detected by a predator. Both escape and recovery vary across and within species. Here we analysed in parallel the predation intensity and the antipredator behaviour to assess the degree of intraspecific variation and the nature of predator-prey interactions. Size and sexual variation were also considered to infer eventual interactions between natural and sexual selection and the possible contribution of experience in predator avoidance.

We studied six populations of the generalist lacertid *Podarcis bocagei* from NW Portugal, three located in open landscapes of coastal dunes and other three inhabiting agricultural areas with granite walls. During spring days with suitable conditions for lizards' activity, we recorded lizard traits (sex, size class), environment (microhabitat, refuge) and behavioural responses when simulating a predator attack for 80–100 lizards/population. Simultaneously, areal predator pressure was estimated by placing plasticine models (100/site/day) to record predatory attacks. The variation in morphology and ecophysiology of the same populations was already known.

Among populations, predation intensity rather than microhabitat use appeared to be the main source of variation in antipredator behaviour. Within populations, interaction between natural and sexual selection was observed both in escape and recovery behaviours with females tending to be shier than males. The complex variation observed appear to be in agreement with the predictions of the escape theory. Further manipulative experiments are needed to disentangle between the effects of plasticity and selection.

Size variation in Italian *Testudo hermanni*: does it follow Bergmann's rule?

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Many ecological and environmental factors, such as air temperature (T), can act on body size and shape variation within a species. Bergmann's rule, stating that size tends to increase in colder climates, has been tested on chelonians with positive results. *Testudo hermanni* matches this rule in Greece, Balkan Peninsula and Italy where however the rule was tested comparing northern and southern populations *a priori* distinguished. To verify if size variation of Italian *T. h. hermanni* is related to climate we correlated linear carapace length with latitude, mean annual T, maximum T of the warmest month, minimum T of the coldest one, using Spearman correlation test. Data derived from field sampling (7 populations) and literature (4) for a total of 610 adult tortoises (303 mm, 302 ff) from 11 localities in peninsular Italy and Sardinia. Climatic data were obtained from WorldClim dataset at a resolution of about 1 km². Interestingly size of both sexes positively correlated with Tmin that likely is a limiting factor for growth while it increased with decreasing Tmax, significantly in females (R=-0.603, P=0.037) but showing just a trend in males (R=-0.547, P=0.065). Male size positively correlated with Tmean (R=0.651, P=0.029), females not (P>0.05). Correlations with latitude were not significant for both sexes (P>0.05), challenging the use of latitude as approximation of climatic conditions. Our results seem to confirm Bergmann's rule in *T. hermanni* considering the highest T of the year, which are crucial for factors like length of growing season, water and food availability. However, in warmer climates, as in Mediterranean area, environmental temperatures may be not be the key force shaping variability of ectothermic morphology and additional factors can influence mechanisms of phenotype selection and animal survival. A complete discussion should also involve age classes analysis because results could be influenced by different survival and recruitment capacity of populations.

Grazing effects on population densities of viviparous lizard (*Zootoca vivipara*) in heathlands

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The viviparous lizard (*Zootoca vivipara*) is the most widespread and still the most abundant reptile in large parts of northwestern Europe. This small lacertid is a highly adaptable species, inhabiting a broad range of habitats. However, monitoring results (National Monitoring Network) showed a significant decline in population sizes in the Netherlands over the last 20 years. The species has almost completely disappeared from agricultural areas and populations are now confined to protected nature reserves and National Parks. Even in these protected areas the decline in population size continues.

Generally, the effects of climate change, lowering of water tables and habitat fragmentation are accepted explanations causing the decline. We additionally consider 'conservation grazing' to be an important factor causing population declines. RAVON studied viviparous lizard populations on lowland heathlands under different grazing regimes from 2010–2012. The grazing intensity in different plots is statistically negatively correlated to lizard densities, whereas sympatric sand lizard populations (*Lacerta agilis*) seem to be less affected. We additionally compared the data from this study to data from long-term population studies in the 1970's in the same areas. Population declines over 40 years ranged from 30 up to 100%. Even low grazing intensities lead to changes in vegetation coverage, microstructural changes in heathland vegetation and degradation of lizard microhabitats.

Relation between righting time and carapace shape in adult Hermann's tortoises

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Righting ability is important for survival of adult tortoises and it was suggested that particular determinants of carapace shape could be an important factor regarding their ability to recover prone position.

We measured duration of righting in 303 adult Hermann's tortoises at two different habitat types (forest and vineyard) in the southeastern Serbia. During sampling period, 5 parameters of carapace morphology (straight carapace length—SCL, curvilinear carapace length—CCL, mean carapace width—MCW, maximum carapace width—MAXCW and maximum carapace height—MAXSH) and body mass—BM were measured.

The sexual size and shape dimorphism of carapace morphology emerged up in both populations. It was not the case with the righting time (RT) where only the population effect was statistically significant ($p < 0.0001$, eta squared = 0.08). Moreover, RT was also controlled by ambient temperature ($p = 0.002$), relative BM ($p = 0.002$), and, except CCL, by all morphometric traits describing carapace shape. However, all covariates were poor at explaining the overall variation in RT with a weak effect size (eta squared less than 0.06 in all tests). Canonical correlation analysis revealed moderate and significant relation between carapace shape ("form") and RT ("function") (canonical $r = 0.30$, $df = 5$, $p < 0.0001$).

The results suggest that general carapace shape slightly contributes to righting ability in adult Hermann's tortoises. However, it seems that some other morphological and/or physiological variables or more specific components of shell structure are also important drivers of righting time.

Analyzing the impact of blood parasites in selected lizard species from Portugal and Morocco

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Numerous studies place parasites in a central role for studying populations' ecology and their dynamics. The phylum Apicomplexa is an interesting and diverse group of obligate unicellular blood parasites, with a vast distribution, that can pose serious health risks both for animals and humans. Studies conducted in lizards have been mainly focused on the analysis of parasite prevalence and intensity, using Haemogregarines as a model since it is the most common apicomplexan blood parasites in lacertids. However information about the impact of these parasites on the host is still scarce, which can be of major concern for conservation efforts.

Therefore our main goal is to assess what are the impacts of a Haemogregarine parasite on the lizard host. Particularly, we analysed the impact on the immune system. We used the simplified PHA skin-testing technique, a standard tool for estimating host immune condition. This condition is then related with parasite intensity and circulating blood cells, examined under the microscope. Identity of parasites was confirmed using 18S rRNA gene sequences.

Two assays were carried out: one performed in the field at three Moroccan sites, using two sympatric lizard species (*Podarcis vaucheri* and *Scelarcis perspicillata*); the second experiment was a laboratory based comparison, with performance tests incorporated, using *Podarcis bocagei* from four sites in Portugal.

We found all populations parasitized with overall high prevalence and intensity. For both assays no correlations were found between the PHA response, parasitemia levels or any other factor. We thus suggest that these parasites might have limited impact on lizard health and fitness. This conclusion can be of conservation significance and we discuss this in the light of different possible scenarios, particularly that these parasites might have been coevolving with the lizards for a long time, resulting in a insignificant pathogenicity for the host.

Various DNA sequence analyses of amphibian larvae in the semi-arid zone

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The molecular DNA variation among *Salamandra infraimmaculata* and *Triturus vittatus* larvae populations, representing diverse breeding sites in Israel, was analyzed by cytochrome b fragment, control region, DNA polymerase chain reaction (RAPD PCR) and amplified fragment length polymorphism (AFLP) methods. Although the molecular polymorphisms in both mitochondrial and nuclear DNA are small, they reflect a sharp ecological separation between DNA variation of seasonal breeding sites and permanent water sources. These are presumably adaptive changes caused by natural selection. Low genetic (cyt b and 12S, and RAPD PCR) variation was revealed by sequences from specimens of *Hyla savignyi*, *Bufo viridis*, *Rana bedriagae* and *Pelobates syriacus* populations, respectively, at each location, analyzed by Arlequin software. We found that both *H. savignyi* and *B. viridis* are adapted to more unpredictable breeding places than *R. bedriagae* and *P. syriacus*.

Environmental correlates of paedomorphosis and metamorphosis in palmate newts

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Paedomorphosis and metamorphosis are alternative developmental pathways expressed in populations of several caudate species. They result respectively in the development of individuals that mature in the larval stage (the paedomorphs) and of larvae that metamorphose into a terrestrial morph that acquire maturity later (the metamorphs). The ontogenetic trajectories rely on environmental cues but their effects across both space and time have not been examined yet. To determine the relationships between environmental variables and morph expression, we sampled more than 150 populations of palmate newts (*Lissotriton helveticus*) during a 10-yr study and we used an information-theoretic approach to test the likelihood of multiple ecological processes. All environmental processes influenced the relative abundance of both morphs. Paedomorphs were particularly advantaged in deep and oxygenated wetlands, without fish, and surrounded by vertical slopes. Higher forest and lower aquatic vegetation cover were also associated with a higher prevalence of paedomorphosis over metamorphosis. Analyses of paedomorph variation along time confirm these conclusions on the three variables that showed inter-annual variations (water depth, oxygen content, and aquatic vegetation). All together these results show that paedomorphosis and metamorphosis depend on multiple environmental factors and can evolve rapidly. This could explain the absence and extirpation of paedomorphosis in natural populations, particularly when affected by anthropogenic pressures. The degradation of habitats inhabited by paedomorphs and the rarity of these populations make them at a high risk of disappearance.

Ain't no mountain high enough, ain't no valley low enough? Attaining biogeographical barriers using *Cordylus cordylus* as template taxon

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South Africa, more specifically the Cape Floristic Region, is a known floral and faunal hot-spot with high levels of herpetofaunal endemism. Previous studies conducted on southern African taxa illustrated that rupicolous species show marked genetic structuring associated with habitat type. This study seeks to determine if this holds true for *Cordylus cordylus*, a rupicolous sit-and-wait foraging lizard. Samples were collected across the species range from 55 localities, yielding a sample size of 175 specimens. Four genes, two nuclear and two mitochondrial, were amplified using the polymerase chain reaction (PCR). Standard tree methods were employed to test for species monophyly, followed by population structure analyses and niche modelling. Our results confirm the species' monophyly and highlight the presence of two distinct clades. The divergence time estimates revealed a Late Miocene (6.01 Ma), Early Pliocene (4.31 Ma) divergence for each of the two clades retrieved. Furthermore, the niche modelling shows that *C. cordylus* occupies a wide range of unfavourable habitats. This is a very uncharacteristic phylogeographic pattern for a rupicolous vertebrate species, since all the southern African rupicolous taxa that have been subjected to phylogeographic study demonstrated marked genetic structuring at small spatial scales. We believe the ecological pliability and non-specialist nature of *C. cordylus* presumably contributed to the observed phylogeographic pattern and have facilitated the absence of within clade differentiation. Moreover, we suggest that microclimatic variables, rather than physical geographic barriers influence the genetic structuring of *C. cordylus*. Because reptile taxa are reliant on climatic variables to govern their distribution, this pattern may be more prominent in squamate taxa when compared to other taxa, such as small mammals.

Occupancy modelling for predicting the distribution of *Philoria loveridgei* in the face of climate change

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Climate change and disease have been strongly linked to enigmatic global amphibian declines, particularly for species and populations at higher elevations, as it can increase temperature and cause precipitation fluctuations that may act as stressors. Global warming is therefore predicted to have a wide range of effects on amphibian species, one being the alteration of distribution and abundance, with the general trend that species will shift towards the poles and to higher elevations. For mountain-top endemic frogs, global warming may have devastating effects, as it would force these species beyond the limit of their distribution into extinction. Niche modelling algorithms are powerful tools for modelling species distribution and have great potential in species conservation. However, field surveys based on occupancy models may be used to evaluate the predicted distribution models improving their potential. We present a modelling framework which combines a species distribution approach (present and future) for *Philoria loveridgei* using Maxent and verification using occupancy modelling. The highest number of *Philoria* frogs recorded in one transect was 18, with an occupancy estimate of 76.1%, describing high occupancy within the middle upper range of the predicted distribution. Detection decreased as survey season progressed with an estimate range from 0.69 to 0.07. These results reinforce the species distribution model and confirm the restricted distribution of this species. The validated model was used to predict the likely impacts of climate change on the species distribution and results suggest it will reduce in area (~10%). The method used in this study provides a new approach to verify species distribution models that is suitable for other species. Extinction risk is exacerbated for high elevation *Philoria* species as they are confined to cooler climates that could become more suitable for the fungal disease chytridiomycosis with the increasing temperatures.

Multi-species occupancy modeling of natural and anthropogenic habitats by Mediterranean amphibians: grim prospects for conservation in irrigated farmland

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In farmland landscapes, amphibians often breed in artificial water bodies, which may offset at least partly the loss of natural wetlands associated with agricultural intensification. It is possible, however, that artificial habitats provide conditions for a minor proportion of the regional species pool, benefiting just a few widespread generalists. We assessed these alternative views by documenting the decline of temporary ponds in a Mediterranean farmland landscape between 1991 and 2009, and by estimating the occupancy of natural (temporary ponds and streams) and artificial water bodies (farm ponds, irrigation channels and drainage ditches) by amphibians across the breeding season (February–June). We used hierarchical Bayesian dynamic multi-species occupancy modeling to control for differences in detectability across species, sampling occasions and habitat types. Over two decades the farmland landscape lost 56% of its temporary ponds, of which 89.3% were destroyed through agricultural activities such as cultivation, conversion to permanent farm ponds, and drainage. The survival rate of ponds was lowest within an irrigated perimeter, and there was no positive effect of protection by a natural park. Estimated species richness per site was at least twice as high in temporary ponds as in the other habitat types. From the ten amphibian species recorded, seven had the highest occupancy in temporary ponds, and were absent or occurred rarely in artificial habitats. Only a single generalist species was widespread in farm ponds and irrigation channels. The results suggest that artificial water bodies are unlikely to sustain populations of most amphibian species in Mediterranean intensive farmland. Conservation efforts should be directed at protecting the temporary ponds still remaining within the farmed landscape, and at restoring or creating new temporary ponds where these have been lost during the last decades.

An evaluation of the robustness of global amphibian range maps

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Maps of species ranges are among the most used distribution data in biodiversity studies. As with any biological datum, range maps have some level of measurement error, but this error is rarely quantified. The aim of this study was assessing the error associated with the amphibian range maps published by the IUCN's Global Amphibian Assessment. The amphibian range maps were assessed against two datasets of species point localities: the Global Biodiversity Information Facility (GBIF), and a refined dataset including recently published, high quality presence data. Range fit was measured as the proportion of presence records falling within the IUCN range polygon(s) for each species. Using the high quality point data provided better fit measures than using the raw GBIF data. Range fit was highly variable among continents, being highest for North American and European species (fit=84–94%), and lowest for Asian and South American species (fit=57–64%). At the global scale, 95% of amphibian point records were inside published maps, or within 31 km from the range edge. However, differences among continents were striking, and more points were found far from range edges for South American and Asian species. IUCN range maps represent the known distribution of most amphibians well; this study provides measures of accuracy that can be useful for future research using amphibian maps as baseline data. Nevertheless, there is a need for greater investment in the continuous update and improvement of maps, particularly in the megadiverse areas of tropical Asia and South America.

A non-invasive water-borne hormone assay shows that tadpole populations of *Alytes obstetricans* infected with *Batrachochytrium dendrobatidis* have elevated corticosterone levels

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The fungus *Batrachochytrium dendrobatidis* (*Bd*) causes the disease chytridiomycosis and is associated with amphibian declines. Populations vary in their susceptibility to *Bd* infections and this variation may be influenced by immunosuppression caused by chronic stress imposed by environmental factors. Using a non-invasive water-borne hormone technique we assessed stress levels (corticosterone) of *Bd* infected and uninfected free-living tadpole populations. We found that corticosterone release rates were higher in infected populations of *Alytes obstetricans* than in uninfected populations. The relationship between corticosterone and the intensity of infection was significantly positively correlated in some populations. The next step is to determine whether higher corticosterone levels make individuals more susceptible to *Bd* or if *Bd* infections drive the higher corticosterone levels.

Detection of olm (*Proteus anguinus*) using environmental DNA in Croatia

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The olm (*Proteus anguinus*) is the only cave-dwelling vertebrate in Europe, inhabiting the karst cave systems of the Dinaric Alps. It is a troglomorphic species, having a hidden way of living. Since it inhabits the interiors of caves, it is hardly seen on the surface and we are lacking a lot of information about its exact distribution.

Recent studies have shown that by sampling the environment, we can get information about the species living there. To gather further data about the olm, a new, non-invasive monitoring method is urgently needed.

The aim of this study was to develop a method by which we can detect olm DNA from cave waters. In the first phase, we took 30 ml samples from aquariums of the Zoo of Zagreb and from Miljacka cave in June 2012. In the second phase 10, 5 and 2 l filtered samples were taken from Rupecica cave system in September 2012. We developed specific primers to amplify short DNA sequences from the mitochondrial D-loop region (87 bp) to determine the presence of the species in different environments. The reliability of the results was tested by sequencing and the sequences were compared to the DNA extracted from olm tissue.

With this method, first time applied eDNA technique on a cave-dwelling organism, we were able to detect *P. anguinus* DNA from one sample from Rupecica (filtered), one from Miljacka (not filtered) and one from aquarium of the Zoo of Zagreb (not filtered). However, further improvement of the PCR reactions and the sequencing technique is needed.

Annual activity dynamics of terrestrial amphibians in the monsoon lowland forest in southern Vietnam

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Amphibian activity is highly dependent on temperature and humidity. As far as in Asian tropical monsoon forests temperature changes slightly during the year, we may suggest that frog activity must be regulated mostly by precipitation amount; more animals and species should be active during the rainy season (May–October) than during the dry season. To test this suggestion we studied amphibian activity during the whole annual cycle from August 2011 to July 2012 using registration of calling activity and pit-fall traps placed in seven study sites in Cat Tien National park. 2644 individuals of 17 species were found in the traps during 1152 trap-days. The number of catches was highest during the rainy season, however, some species (*Occidozyga martensii*, *Limnonectes* sp., *Kalophrynus interlineatus*) demonstrated high terrestrial activity during the first half of the dry season (November–January). Frog activity reduced greatly in the driest period, in February–March. Adults prevailed in traps in the beginning of rainy season and subadults in the end of this period.

The number of calling species positively correlates with the reduction of precipitation in the period August–February. In contrast, the number of calling species grows explosively up to a maximum of 20 registered species with the first heavy rains in April. However, some species, such as tree-hole breeding *Theloderma stellatum*, keep on calling and reproducing even during dry season.

Finally, we distinguish two main ecological groups of terrestrial amphibians: species active all-year round (*O. martensii*, *Limnonectes* sp., *K. interlineatus*), surviving the dry season in small water bodies or in the humid leaf litter, we define them as active patients; frogs active during the rainy season (*Caluella guttulata*, *Kaloula pulchra*, *Micryletta erythropoda*) with explosive growth of terrestrial activity at the onset of heavy rains and surviving the dry period in shelters are defined as aestivates.

Is expert knowledge adapted to build friction map? A landscape genetic study of the slow worm (*Anguis fragilis*)

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Landscape genetics was developed to detect landscape elements shaping genetic population structure, including the effects of fragmentation. Multifarious environmental variables can influence gene flow in different ways and expert knowledge is frequently used to construct friction maps. However, the extent of the migration and the movement of single individuals are frequently unknown, especially for non-model species, and friction maps only based on expert knowledge can be misleading. In this study, we used three different methods: isolation by distance (IBD), least-cost modelling and a strip-based approach to disentangle the human implication in the fragmentation process in the slow worm (*Anguis fragilis*), as well as the specific landscape elements shaping the genetic structure in a highly anthropized 16 km² area in Switzerland. Friction maps were constructed using expert opinion, but also based on the combination of all possible weightings for all landscape elements. The IBD indicated a significant effect of geographic distance on genetic differentiation. Further approaches demonstrated that highways and railways were the most important elements impeding the gene flow in this area. Surprisingly, we also found that agricultural areas and dense forests seemed to be used as dispersal corridors. These results confirmed that the slow worm has relatively un-specific habitat requirements. Finally, we showed that our models based on expert knowledge performed poorly compared to cautious analysis of each variable. This study demonstrated that landscape genetic analyses should take expert knowledge with caution and exhaustive analyses of each landscape element without *a priori* knowledge and different methods can be recommended.

Newts in the city: research and conservation of amphibians in Lobau (Vienna, Donau-Auen National Park)

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Lobau is part of a floodplain of the Danube River in Vienna (Austria). Due to river engineering, hydrodynamics are constrained and vary greatly among different sections. In Lobau at least ten amphibian species occur.

We synthesize results of recent surveys, highlighting the challenges for research and conservation, with a focus on the species of highest conservation priority. These investigations were carried out at different spatial and temporal scales. From 1997 to 2007 abundance of *Bombina bombina* declined to about a tenth in a study area. At another site, only five males were heard calling in 2007, but in 2008, a year with a higher water table, population size was estimated as above 500 (based on mark-recapture analysis of 392 individually registered toads). Intensive surveys in 2009, a wet year, showed that *Triturus dobrogicus* occurred in 39 water bodies throughout Lobau, in 23 of which evidence for reproduction (eggs or larvae) was found. In a few locations where the species was recorded in the 1990s no newts were observed; formerly stagnant pools had been converted into flowing channels inhabited by fish.

Due to hydrodynamics in this floodplain area, habitat availability and abundances may differ markedly between years. Population studies spanning several years are urgently needed. Reproduction of amphibians often is highest in temporary water bodies. Extreme dynamics may be disadvantageous, however, as quickly drying ephemeral pools become reproductive sinks and major floods may bring fish to formerly fish-free waters.

Lobau is still home of viable populations of these endangered amphibian species. Nevertheless, long-term trends towards terrestrialization will ultimately lead to a decline in these habitats. Therefore, restoration measures sustaining overall habitat dynamics and diversity are urgently needed but must take great care to avoid deterioration of amphibian breeding sites.

Tortoise's shell—a blessing and a curse. How tortoises cope with various obstacles

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During 200 million years of evolutionary history, all chelonians are characterized by a well developed, protective shell. Conserved during major evolutionary transitions (e.g. return to the sea), shell likely provides substantial selective advantages. Conversely, heavy and rigid shell poses a set of serious motion limitations, especially in terrestrial species during displacements in rugged and complex environments. We examined how terrestrial tortoises overcome various obstacles in their natural habitat. We compared several Balkan populations of Hermann's tortoises by placing individuals (app. 1100) in three types of challenging positions to measure their performances.

Righting ability: males were more successful in righting themselves than females. Body size influenced righting abilities only in females: smaller ones were more efficient. Individuals with markedly domed carapace (increased instability) and shorter bridges (enlarging space for leg movements) were more successful to right themselves.

Boldness to cross a steep step: animals from rugged environment were more prone to jump from 50 cm high obstacle than ones from the flat habitat. Genders had similar success, but adults showed more boldness to leap off the hedge than juveniles.

Disentangling themselves from thick vegetation: residents of Mediterranean macchia displayed moderate pulling force and released themselves quickly by backwards movements. Tortoises living in herbaceous habitats moved forward, deployed strong pulling force, ripping on the substrate and were far less successful.

Individuals from different habitats, sex and age classes exhibited divergent and apparently appropriate traits and strategies to overcome each locomotory challenge. We further speculate that behavioural responses, as a response to morphological constraints, are shaped by experience. These results may have conservation value and assist in improving translocation strategies for endangered tortoise populations.

Difference in the geographic overlap of the potential distribution of the green and ocellated lizards at continental and regional extents in the Mediterranean Basin

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The differences in the potential geographic overlap areas resulting from models fitted at continental and at regional scale for seven related lizard species in the Mediterranean Basin have been investigated. The green lizards (*Lacerta agilis*, *L. bilineata-viridis*, *L. trilineata*, and *L. schreiberi*) and the ocellated lizards (*Timon lepidus*, *T. tangitanus*, and *T. pater*) were included as target species.

The potential geographic overlap areas were derived from modelling the potential spatial distribution of the target species at continental extent using only climate predictor variables. The compilation of distribution sample points for the species mentioned above were derived from various sources (existing atlases and other sources from web). Based on these results, four zones were selected to analyse the differences with the outcomes modelled at regional extent.

In the selected zones, the potential geographic overlap areas were determined for pairs of species based on models fitted at regional extent using only climate predictor variables and another adding variables related to land cover, topography and NDVI. By comparing the performance of the models fitted, six out of eight of the models do not significantly improve the area under the curve (AUC) values by adding variables related to land cover, topography and NDVI.

The resulting potential geographic overlap areas modelled at continental extent were zoomed in on the selected zones and compared with the results at regional extent keeping the same spatial resolution. Based on this comparison, the potential geographic overlap areas do not significantly change depending on the type of predictor variables use to model the potential spatial distribution of the species at regional extent. On the other hand, the potential geographic overlap areas significantly changed depending on the extent at which the potential distribution models of the species were fitted. The potential geographic overlap areas derived from models fitted at regional extent reduced considerably in comparison with the potential geographic overlap areas from models fitted at continental extent. Therefore, results concerning modelling the potential distribution of species should be interpreted with caution and put into the right context.

Tracking Hungarian meadow vipers (*Vipera ursinii rakosiensis*) following reintroduction

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In order to stop the decline of Hungarian meadow viper (*Vipera ursinii rakosiensis*), MME BirdLife Hungary together with National Parks started a complex conservation program in 2004, supported by LIFE-Nature fund.

Hungarian Meadow Viper Conservation and Breeding Centre was started with 16 adult individuals, collected from 6 different populations. By 2012 number of vipers bred reached nearly 1400.

First reintroduction took place in March 2010, releasing 30 snakes into a reconstructed habitat in Kiskunság National Park. Additional 70 vipers were released there in February 2011, and further 42 snakes in July 2012. Snakes were released by removing them together with their artificial burrows. During regular monitoring we checked these burrows by using pipe-camera.

In 2010 we recorded vipers 54 times. Four of the observed females were gravid. Despite further releases we only spotted 40 snakes in 2011, but newborn vipers were seen. Altogether 15 individuals were identified by photos taken during these events. We found signs of predation two times.

We installed camera traps in 2012 and recorded frequent presence of possible predators, such as foxes, badgers, common buzzards and wild boars.

In order to develop a remote tracking method, pre-programmed radio-tags with a detection range of 100–150 m were implanted surgically into the abdomen of vipers. These tags also operate as temperature loggers, recording data every five minutes for a year-long operation period. After successful testing during 2010 and 2011, we released 6 tagged individuals in July 2012. All 6 snakes survived until November, even though wild boars dig large part of the site. We detected regular movements within the area, with tendencies to higher parts later in the season. On sunny spells of mid-November and late December, after emerging for basking, 3 and 2 snakes disappeared, very likely due to predation by raptors. One tag was found on the site and logged temperature data proved our theory.

Cryptic diversity in *Calotes mystaceus*: an integrative approach to unravel a putative species complex

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Calotes mystaceus DUMÉRIE & BIBRON, 1837 is regarded as being a widespread and relatively common species, which occurs from north-eastern India in the West throughout Southeast Asia to the South China Sea in the East, to the Isthmus of Kra in the South and up to 24°N in the North. To assess variation within this agamid species, an extensive dataset including 23 mensural and 11 metric characters of over 90 specimens was obtained covering the whole area of distribution. Our dataset was analyzed by both classical multivariate analyses (PCA) and spatial multivariate approaches. In addition, a selective set of specimens was sampled and analyzed genetically using the fast evolving cytochrome oxidase I (COI) to discover even small genetic distances. By our integrative approach, we were able to dismantle *Calotes mystaceus* as being composed of more than one species, by discovering a surprisingly high genetic and morphological divergence between populations.

Phylogeny of the genus *Salamandra*

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The genus *Salamandra* is widely distributed in the western Palearctic and comprises six main lineages, *S. salamandra*, *S. algira*, *S. infraimmaculata*, *S. corsica*, *S. atra* and *S. lanzai*, of which the first group has the widest distribution across Europe and at least 14 subspecies of it have been described. *Salamandra atra* and *S. lanzai* are completely black, whereas the others show different amounts of yellow coloration. While the monophyly of each of these major groups has been clearly demonstrated, the relationship among them has not yet been resolved. While previous phylogenetic analyses were based on mtDNA only, we have used sequence data from four mitochondrial and ten nuclear gene fragments and included representatives of all species and most subspecies to further address this issue. Preliminary Bayesian analyses of the combined dataset confirm the monophyly of the clade composed of the completely black *S. atra* and the yellow-blotched *S. corsica*. Contrary to previous studies, our results show that this group is the sister taxon to the clade containing all other species of *Salamandra*, with the other completely black taxon, *S. lanzai*, at the basal position of that clade. While previous studies showed—if any—only weak support for a monophyletic clade composed of *S. algira* and *S. salamandra*, our results clearly support this relationship. Within the fire salamanders, *S. s. longirostris* is clearly placed at the basal position. We are currently conducting divergence dating of the taxa and will discuss the species and subspecies level relationships in light of these results, the geographic distribution and life-history traits.

Wetland characteristics influence disease risk for a threatened amphibian

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Identifying drivers of the probability and intensity of infections is crucial for understanding the epidemiology of wildlife diseases, and for managing their impact on threatened species. Chytridiomycosis, caused by the fungal pathogen *Batrachochytrium dendrobatidis*, has decimated populations of some amphibians. However, recent studies have identified important risk factors for the disease, related to the pathogens' physiological tolerances. In this study, we identified several intrinsic and extrinsic drivers of the probability and intensity of chytrid infections for the threatened growling grass frog (*Litoria raniformis*) in south-eastern Australia, and used mark-recapture to estimate the effect of chytrid infections on the probability of survival of these frogs. Water temperature and salinity had negative effects on both the probability and intensity of chytrid infections. We coupled models of the infection process with a model of the effect of chytrid infections on the probability of survival to assess variation in the impact of chytridiomycosis between wetlands with differing temperature and salinity profiles. Our results suggest that warm, saline wetlands may be refuges from chytridiomycosis for *L. raniformis*, and should be priorities for protection. Our results also suggest that management actions that increase water temperature (e.g. reducing canopy shading) and salinity (e.g. complementing inflows with groundwater) could be trialled to reduce the impacts of chytridiomycosis on this species. This study highlights the value of research on environmental factors that influence chytridiomycosis, particularly those factors that can be manipulated in the field.

Species composition and chytridiomycosis infection of the *Pelophylax esculentus* complex (Anura: Ranidae) in the Hortobágy National Park, Hungary

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Chytridiomycosis, caused by the fungal pathogen *Batrachochytrium dendrobatidis* (*Bd*), is an emerging infectious disease implicated in declines of amphibian populations around the globe. In Hungary the presence of the chytrid fungus from elevated habitats was documented before but little is known about the distribution in the lowlands. The Western Palearctic water frogs of the genus *Pelophylax* include a series of about 12 morphologically similar species in Europe. The *Pelophylax* species complex consists three species in Hungary: *P. ridibundus*, *P. lessonae* and the hybrid *P. kl. esculentus*. Our sampling area situated in the Hortobágy National Park and we collected 29 *Pelophylax* spp. from two localities associated with flowing water and 30 specimens from the area of fish ponds and from there additionally non-invasive samples (19) becoming from skin swabbing. We used newly developed primers for distinguishing among the water frog species, and real-time PCR for detecting the *Bd* zoospores. Based on our molecular taxonomy findings the species composition of the investigated populations of water frogs consists the *P. ridibundus* and the hybrid *P. kl. esculentus*. Our results clearly showed that the population of water frogs connected with flowing water were infected with *Bd*, while the population inhabiting the fish ponds were uninfected. The prevalence was 18.9% for the whole population together, while 51.7% for the frogs from the flowing water. Prevalence was 37.1% for *P. ridibundus* and 8.3% for *P. kl. esculentus*. The mean intensity was 10.13 GE (genome equivalent zoospore quantity).

The use of environmental DNA (eDNA) to monitor amphibians

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Analysis of environmental DNA (eDNA) is a new approach for monitoring freshwater biodiversity. The method is based on the limited persistence of the DNA left behind by species in their environment. This environmental DNA can be detected in water samples, thereby confirming a species' presence. In this presentation we will briefly explain the method and show the potential of this method on the bases of some case studies carried out in the Netherlands and France. In 2012 we investigated 23 historical populations of the common spadefoot (*Pelobates fuscus*) in the Netherlands with the use of eDNA. It concerned locations where the species was thought to have gone extinct, based on traditional monitoring. With the use of eDNA we found that in six locations common spadefoots were still present. The outcome meant a 15% increase in the number of known populations in the Netherlands. In a study on the crested newt (*Triturus cristatus*) in nine ponds we found that detection with eDNA was higher (five ponds) than detection with traditional methods like dip nets and amphibian traps (two ponds). Furthermore we show the results of studies on the invasive American bullfrog (*Lithobates catesbeianus*). In the Netherlands we detected bullfrogs in one out of 16 investigated locations with the use of eDNA, while the species was thought to be eradicated. In France a comparison between traditional methods (searching for eggs, adults and larvae) and eDNA was made. American bullfrogs were detected in 38 out of 49 ponds with the use of eDNA while traditional methods only found the species in seven ponds. Due to the higher chance of detection the eDNA approach offers a powerful tool in early warning systems for invasive species. Finally, we take a look into the future by (i) describing eDNA metabarcoding by which a list of species is generated from an environmental sample and (ii) suggesting areas where more research is needed.

Amphibian disease triangle: investigating interactions between disease, physiology and climate change

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Amphibian declines have occurred simultaneously around the world, and amphibians are the most threatened vertebrate group in what is described as the 6th major extinction event in history. Mass die-offs are associated with an emerging pathogenic fungus that causes the disease chytridiomycosis; however there is evidence that climate change could be the ultimate cause. The key elements of these two hypotheses have not been investigated due to the complex interactions between frog physiology (thermal biology, stress physiology, and antifungal agents on the skin of amphibians), disease ecology and host ecology. Climate change threatens amphibians restricted to mountain tops, as the cooler environmental conditions at high elevation are optimal for the growth and development of mountain-top endemic frog species, hence they are vulnerable to increasing temperatures. Cooler montane environments are also optimal for the growth of the pathogenic fungus *Bd*. Here we present the first physiological evidence suggesting (1) frogs with high intensity of *Bd* have higher baseline stress hormone levels, and (2) frog populations at higher elevation have increased stress levels (elevated baseline corticosterone levels in urine) compared to their lowland counterparts. Prevalence of *Bd* zoospores from frog skin swabs was quantified using a real-time quantitative PCR technique. Individual male frogs that were identified as positive for *Bd* infection had significantly higher baseline urinary corticosterone concentrations in comparison to *Bd* negative male frogs. Baseline urinary corticosterone concentrations were also significantly higher at high altitude sites ($P < 0.001$). These results suggest that frogs at higher elevation are stressed and hence more susceptible to the impacts of *Bd* than their lowland counterparts. So which factor is responsible for the extinction of frogs at high elevation and who came first—the stress or the disease?

From simple field observations to a model species—confessions of a taxon-oriented field biologist

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An unexpected rapid phonotactic approach of a male *Allobates* (= *Phylllobates* = *Dendrobates* = *Epipedobates*) *femoralis* to a control replay of its recording in the Yubinetto region, northern Peru, in 1978 started my curiosity-driven research on the bioacoustics of this species. Due to its stereotypic phonotactic response to playbacks of conspecific and a large variety of synthetic calls I introduced *A. femoralis* as a “handy fellow” to the herpetological and bioacoustic community at various scientific meetings. Rapidly, “my” handy fellow became the main focus of an international research team forming a cohesive group out of a diverse collection of individual scientists. Important inputs from Adolfo AMÉZQUITA (evolutionary aspects), Peter NARINS (robotics and sensory physiology), Albertina LIMA and Pedro Ivo SIMÕES (biogeography) as well as Eva RINGLER and Max RINGLER (population biology) clearly show that taxon-centered research can be a self-accelerating process. The valuable integration of various aspects have led to more fruitful insights than would have been possible with a pure hypothesis-based approach, which sometimes may narrow the angle of view on a given research question. In 30 years of trying to understand a living organism in the field I have gained increasing confidence in my scientific approach to let organisms rather than hypotheses lead me to the important questions. And last but not least: taxon-centered research is simply more fun!

Antipredatory behavior of Spanish terrapins depends on reproductive state and individual conspicuousness

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Behavioral responses to predation risk are critical to survive but, because antipredator behavior is costly, animals should flexibly modulate their responses depending on threat level as well as on their own individual characteristics. Turtles have morphological structures (shell) that may use as a refuge for partial protection but hiding can impose very high costs. Thus, after an unsuccessful predator attack, turtles should optimize the trade off between remaining hiding into their shells and active escape to safer habitat refuges. Here, we examined how reproductive state, coloration and body size influenced antipredator behavior of Spanish terrapins under different predation risk levels. We measured the time spent hiding into their own shells (i. e., appearance times) by turtles before escaping in response to simulated predatory attacks of different risk level. Results showed that gravid females spent more time hiding into their shells after a predator attack in comparison with non-gravid females and males, suggesting that a detriment in body condition and/or thermoregulation requirements constrain an active escape. Similarly, hiding response was size-dependent with larger turtles having longer appearance times. Conspicuousness of limb coloration was important for appearance times of males, but not for females. Thus, males with brighter coloration of the limb stripes had longer appearance times than duller males, suggesting that a greater visual conspicuity increased risk. However, gravidity, coloration and size had different relative importance in hiding behavior depending on whether turtles were overturned or placed in prone position after the attack, suggesting that the main factors influencing boldness depend on the risk level assessed by turtles.

On the brink of extinction? How climate change may affect global chelonian species richness and distribution

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Anthropogenic global climate change has already led to alterations in biodiversity patterns by directly and indirectly affecting species distributions. It has been suggested that poikilothermic animals, including reptiles, will be particularly affected by global change and large-scale reptile declines have already been observed. Currently, half of the world's freshwater turtles and tortoises are considered threatened with extinction, and climate change may exacerbate these declines. In this study, we assess how global chelonian species richness will change in the near future. We use species distribution models developed under current climate conditions for 78% of all extant species and project them onto different Intergovernmental Panel on Climate Change (IPCC) scenarios for 2080. We detect a strong dependence of temperature shaping most species ranges, which coincide with their general temperature-related physiological traits (i. e., temperature-dependent sex determination). Furthermore, the extent and distribution of the current bioclimatic niches of most chelonians may change remarkably in the near future, likely leading to a substantial decrease of local species abundance and ultimately a reduction in species richness. Future climatic changes may cause the ranges of 86% of the species to contract, and of these ranges, nearly 12% are predicted to be situated completely outside their currently realized niches. Hence, the interplay of increasing habitat fragmentation and loss due to climatic stress may result in a serious threat for several chelonian species.

The *Vipera berus* group: phylogeny, reticulate evolution and species borders

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Vipera berus has the widest geographical distribution of all snakes. Its tolerance to cool temperatures makes it exceptional among other European snakes and it may have had glacial refugia North of the Alpine–Black Sea–Caucasus belt.

Molecular studies (both mitochondrial and nuclear) revealed that southern isolates such as *V. b. bosniensis*, *V. (b.) nikolskii*, *V. (b.) barani* and an undescribed Alpine form are differentiated to a higher degree than even the Far Eastern *V. b. sachalinensis*.

Heterozygous individuals carrying alleles of both *V. berus* and *V. renardi* were found in contact zones of both species. Such cases raise the question of secondary introgression and reticulate evolution in these snakes.

Influence of pesticides on the development of eggs of agile frog, *Rana dalmatina*

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Amphibians, as the most threatened group of vertebrates, are very susceptible to various environmental influences. One of the factors surrounding them is the water quality and its pollution. Although some areas in Europe have intensive agriculture, the influence of various pesticides on amphibians is still very poorly studied in general, especially in Europe. In our research, we examined the influence of three widely used pesticides dimethoate, pirimiphos-methyl and glyphosate on the development dynamic of eggs of agile frog, *Rana dalmatina*. Influence of each pesticide was examined in five different concentrations, namely the lowest was ten times lower than environmentally relevant, second was environmentally relevant, third was ten times higher, fourth was 100 times and fifth was 1000 times higher than environmentally relevant. Experiment was carried out on 30 eggs in each of three replicates. We measured time needed to hatching and the hatching rate/mortality. In the highest two concentrations of all three pesticides, the eggs did not develop into tadpoles, while in the concentration ten times higher than the environmentally relevant, the hatching rate was significantly lower in glyphosate than in other two pesticides. The lowest two concentrations of all three pesticides did not show to affect the development of eggs.

Phylogeny and phylogeography of the Syrian spadefoot toad (*Pelobates syriacus*)

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The phylogenetic relationships within the genus *Pelobates*, namely within *Pelobates syriacus*, are still not sufficiently understood. There exist several different hypotheses on the systematics of the subspecies of *Pelobates syriacus*. Currently, four subspecies are recognized: *P. s. syriacus*, *P. s. transcausicus*, *P. s. balcanicus* and *P. s. boettgeri*. Previous molecular analyses questioned the status of *P. syriacus* as a monophylum. We here used DNA sequence analyses on 519 bp of the mitochondrial 16S rRNA gene to resolve the intraspecific phylogenetic relationships of *P. syriacus*. Three different tree building methods were applied (maximum likelihood, neighbor-joining and Bayesian inference). Phylogeographic analyses and molecular clock dating were performed under a Bayesian framework. We used the split between *P. cultripes* and *P. varaldii* and intraspecific separations within *Scaphiopus* and *Spea* as calibration points. In conclusion, *P. syriacus* turned out to be paraphyletic, with two major evolutionary lineages: a western lineage representing the subspecies *P. s. balcanicus*, and an eastern lineage with the subspecies *P. s. transcausicus* and *P. s. syriacus*. We suggest a Miocene separation of the eastern lineage from the rest of the genus *Pelobates* in the northwest of the current distribution range. *Pelobates s. boettgeri* does not represent a valid subspecies.

Sex colour and stress: investigating the role of stress and reproductive hormones in amphibian colour

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Some animals have the capacity to change their colour, sometimes dramatically. There are two main questions that are asked when investigating such colour change: (1) how does this animal change colour; and (2) why does it change colour? Understanding how colour change occurs will often help determine why. Here we demonstrate dynamic colour change in an anuran and investigate regulatory mechanisms of how it changes colour. *Litoria wilcoxii* rapidly changes from brown to yellow during amplexus; we show this by comparing dorsal colour of unpaired and amplexing males. Colour change involves the movement of pigments in chromatophores activated by hormones. We investigated whether the corticotropin (adrenocorticotrophic hormone [ACTH]) and the neurohormone (epinephrine) or the male reproductive hormone (testosterone) were triggering colour change. We injected males with epinephrine (n=5), ACTH (n=6), testosterone (n=5), and saline (n=5) and sesame oil (n=5) as controls. Colour was measured using digital photography from the images the Red Green and Blue (RGB) colour values were calculated, and the major correlation axis computed by a principal components analysis (PCA). Epinephrine injected frogs underwent a significant colour change to bright yellow within 10 minutes compared to ACTH and control frogs which did not change colour. Testosterone treated males underwent a much slower (1 hour) and less yellow change. These results suggest that even though the hypothalamo-pituitary gonadal (HPG) axis is important for the expression of sexual morphological traits in male frogs, it is the stress-axis, particularly neurotransmitters, that mediates the link between physiological and morphological traits (rapid color change) The results have opened up opportunities for future research to unravel the functions of physiological systems in amphibian colour change in breeding.

Mitochondrial phylogeography of grass snakes (*Natrix natrix*, *N. megalcephala*) conflicts with taxonomy and reveals an additional unexpected contact zone in Central Europe

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Grass snakes (*Natrix natrix*) represent one of the most widely distributed snake species of the Palaearctic region. Within *N. natrix*, up to 14 distinct subspecies are regarded as valid. In addition, some authors recognize big-headed grass snakes from western Transcaucasia as a distinct species, *N. megalcephala*. Based on phylogenetic analyses of a 1984-bp-long alignment of mtDNA sequences (cyt b, ND4 + tRNAs) of 410 grass snakes, a nearly range-wide phylogeography is presented for both species. Within *N. natrix*, 16 terminal mitochondrial clades were identified, most of which conflict with morphologically defined subspecies. These 16 clades correspond to three more inclusive clades from (i) the Iberian Peninsula plus North Africa, (ii) East Europe and Asia and (iii) West Europe including Corso-Sardinia, the Apennine Peninsula and Sicily. Hypotheses regarding glacial refugia and postglacial range expansions are presented. Refugia were most likely located in each of the southern European peninsulas, Corso-Sardinia, northern Africa, Anatolia and the neighbouring Near and Middle East, where the greatest extant genetic diversity occurs. Holocene range expansions led to the colonization of more northerly regions and the formation of secondary contact zones. Western Europe was invaded from a refuge within southern France, while Central Europe was reached by two distinct range expansions from the Balkan Peninsula. In Central Europe, there are two contact zones of three distinct mitochondrial clades, one of these contact zones was theretofore completely unknown. Another contact zone is hypothesized for Eastern Europe, which was colonized, like northwestern Asia, from the Caucasus Region. Further contact zones were identified for southern Italy, the Balkans and Transcaucasia. In agreement with previous studies using morphological characters and allozymes, there is no evidence for the distinctiveness of *N. megalcephala*. Therefore, *N. megalcephala* is synonymized with *N. natrix*.

Relative contribution of dietary carotenoids and vitamin E to visual and chemical sexual signals of male Schreiber's green lizards (*Lacerta schreiberi*): an experimental test

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Carotenoid-based sexual ornaments are widespread, but the role of carotenoids as honest signalers of the trade-off between coloration and antioxidant protection remains controversial. It was suggested that the role of carotenoids might not be as antioxidants *per se*, but that colourful carotenoids would just reflect the actual contents of nonpigmentary antioxidants, such as melatonin or vitamin E. We experimentally fed male lizards *Lacerta schreiberi* (n = 52) with supplementary carotenoids or vitamin E alone, or carotenoids plus vitamin E together, and had a non-supplemented control group. We examined the effects of this dietary supplementation on sexual coloration and the chemical profile of femoral gland secretions of lizards. Results showed that different sexual traits were differentially affected. Thus, both carotenoids alone and vitamin E alone increased brightness of throat coloration respect to control lizards, but brightness was greater in lizards supplemented with vitamin E plus carotenoids together. Also, all supplemented lizards had more saturated "yellowish" chests than control lizards, but lizards supplemented with vitamin E had more saturated and yellowish chest coloration. In contrast, the supplementation did not affect the dorsal green coloration. Femoral secretions also varied between treatments; lizards supplemented with vitamin E alone or combined with carotenoids had higher proportion of vitamin E in secretions than lizards supplemented with carotenoids alone and control lizards. Finally, lizards supplemented with vitamin E had greater PHA-induced immune responses, while the supplementation of carotenoids did not have any effect. Our results support that other nonpigmentary antioxidants, such as vitamin E, are needed in addition to carotenoids to increase the expression of sexual coloration of *L. schreiberi* lizards. In contrast, an increase in dietary nonpigmentary antioxidants may be directly reflected in the chemical signals.

Assessing the costs of plasticity in chemical defenses in common toad (*Bufo bufo*) tadpoles

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Various organisms can exhibit phenotypic plasticity, i. e. change their phenotype according to the surrounding environmental conditions; however, the expression of induced phenotypes is predicted to be costly. Chemical defence is thought to be a common and diverse phenomenon in amphibians, but very little is known about the plasticity and fitness costs related to this type of defensive response. Our aim was to assess the probable cost of toxin production as a function of the frequency of depletion in common toad (*Bufo bufo*) tadpoles. For inducing toxin release in tadpoles *in vivo*, we used either electric or hormonal stimulation (norepinephrine). Tadpoles were raised in presence or absence of predator cues and exposed to low or high food levels in a full factorial design, using randomized blocks. To assess potential costs of toxin production, we measured survival, time until metamorphosis and body mass at metamorphosis. We found that the frequency of toxin depletion had a significant effect on all investigated traits on those tadpoles that were raised together with predator cues: individuals that were forced to release toxins every five days had lower body mass, decreased survival and reached metamorphosis later, than those forced to release toxins only once. Low amount of food also had a negative effect on survival in all treatment groups; in addition, the type of stimulation itself also influenced costs. Our results suggest that there are considerable fitness costs related to toxin production during the larval period in common toads, and may contribute to a better understanding of the evolution and the adaptive value of chemical defences in general.

Distribution, habitat requirements and conservation of the Aesculapian snake *Zamenis longissimus* in south-eastern Poland

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Polish population of Aesculapian snake (*Zamenis longissimus*) occurs at its edge of distribution and it is probably isolated from the main range of its distribution. The largest local population occurs in the San River Valley at foothill of Otryt (Western Bieszczady Mountains). The main threat for this endangered population is a shortage of natural and anthropogenic nests to successful incubation and low number.

Distribution studies were conducted in Western Bieszczady Mountains (southeastern Poland) in 2009–2012. Population structure was studied using capture-mark-recapture method. Habitat requirements analyses were based of detailed habitat maps and monitoring of 38 locations of the Aesculapian snake. In 73 plots (100 m radius) around each observation 20 types of habitat were distinguished. Mounds with sawdust and branches (as supplementary egg-lying sites) have been built in current and historic localities and between these places along San Valley.

Current distribution of Aesculapian snake is not limited to Otryt region. Snakes were also observed in Komancza, Czarna, Wetlina and coast of Solina Lake.

The results show that Aesculapian snake inhabits mostly forested (deciduous forest dominated) and open areas with anthropogenic structures. The mean number of habitat types in plots was 11, average cover of particular habitats was: forest (50%; dominant species *A. incana*), open areas (35%), other habitats were e. g. riverbanks (7%), roads (3%), anthropogenic structures (2%). Average length of ecotonal zone was 1.15 km.

131 individuals were caught including 18 females, 85 males and 28 juveniles. Small number of females found might be a result of their lower detectability. The most of captured individuals including juveniles (>20) were caught after 2010, probably as a result of active protection.

We noticed population growth connected to active conservation. Artificial egg-lying sites were rapidly occupied, especially in locations with higher number of snakes. During four years of active protection, snakes used 15 out of 25 egg-lying sites.

Morphological insights into pulmonary evolution in reptiles

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The so-called reptiles were the first amniotes that achieved full terrestriality as they became independent of aquatic habitats for reproduction. This involved the evolution of numerous specialized structures such as extraembryonic cavities during development, absence of a larval stage, impermeable skin in adults and a urogenital system modified for obligatory internal fertilization. Lungs already evolved in their piscine ancestors, and became the exclusive site for respiratory gas exchange. Probably driven by grade/clade logic, the current textbook opinion is that the ancestral type of lung in amniotes was similar to that found in amphibians: a single-chambered and sac-like organ. Putative support of this hypothesis is the apparent presence of single-chambered lungs in the majority of lepidosaurs, including the basal Rhychocephalia. We performed a large-scale comparative anatomical study of pulmonary structure in all major amniote taxa. These were complemented by new developmental data from the geckonid *Paroedura picta* and a review of the 19th century embryological literature. We submit that the so-called single-chambered lungs of lepidosaurs in fact represent a simplification of a plesiomorphically branched and multichambered organ, and provide functional, ontogenetic and phylogenetic morphological support. The fundamental consequence is that instead of a single-chambered lung, one must postulate a multichambered lung at the dawn of amniotes. The simplifications found in the extant lepidosaurs are explained by an evolutionary scenario based on the physical properties of different pulmonary baupläne and on the fossil record of the lepidosauromorphan lineage.

A camera trap study of mass-hibernation in *Salamandra salamandra* in the Vienna Woods, Austria

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Camera traps are commonly used in animal ecology. The fact that most systems are triggered by motion detection in the infrared spectrum limits their use for poikilothermic species. This is one of the reasons why camera trapping is underrepresented in herpetology, compared to studies in birds and mammals. We tested a self-constructed camera trap that was triggered by a light barrier to monitor the activity of the fire salamander *Salamandra salamandra* in the Vienna Woods (Austria) from mid-October 2011 to mid-June 2012. The camera was installed at the entrance of a burrow that had been previously identified as a mass-hibernation site of *S. salamandra*. Out of more than 20,000 photos that were taken during eight months, over 7,340 showed fire salamanders, representing a total of 214 different individuals. 168 of them were known from a capture-recapture-study, so it was possible to determine the catchment area of this burrow and to compare the sex ratio of the fire salamanders that were found within this area and the sex ratio of the individuals that hibernate together. Based on the photos taken by the camera trap we were able to generate an activity profile for each individual and so we could estimate the number of individuals inside the burrow (up to 189 at the same time). Other vertebrate species were captured on these pictures as well, indicating a syntopic hibernation of *Salamandra salamandra*, *Ichthyosaura alpestris*, *Bombina variegata*, *Bufo bufo*, *Rana dalmatina*, *Rana temporaria*, *Anguis fragilis*, *Natrix natrix* and *Zamenis longissimus*. Recently, we tested the suitability of this camera for monitoring of an amphibian tunnel. The findings of our study point out the importance of richly structured habitats for amphibians and demonstrate the significance of detailed knowledge on specific characteristics of populations for effective conservation management. Furthermore we show the usefulness of camera traps for herpetological studies.

The effects of competition in two temperate gecko species

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Complex interspecific interactions may be important structuring agents in biological communities. Competition over spatial niche utilisation is one of most common competitive interactions between species in sympatry. We investigated the interspecific interactions between two, ecologically similar, temperate climate, gekkonid species, the Turkish gecko (*Hemidactylus turcicus*) and the Moorish gecko (*Tarentola mauritanica*). We compared populations in sympatry and allopatry on two geographically close Adriatic islands, Hvar (both species present) and Vis (only *H. turcicus*). We also compared populations of *H. turcicus* on Hvar occurring with *T. mauritanica* (in syntopy) and without *T. mauritanica* (in allotopy). We monitored species during their complete diurnal and annual cycle. The relative population density of *H. turcicus* differs depending on the presence/absence of *T. mauritanica*, but relative population densities of *T. mauritanica* are not affected by the presence of *H. turcicus*. Additionally, the two species showed differences in habitat use in sympatry. Moreover, *H. turcicus* showed ecological release in allopatry. Differences in densities between allopatric (Vis) and allotopic (Hvar) populations of *H. turcicus* point to direct competition between *H. turcicus* and *T. mauritanica*, but this competition does not occur over spatial niche since this species exhibits evasive strategies for habitat utilisation when found in sympatry. Observed interspecies interaction patterns may contribute to a better understanding of complex relations in natural communities.

Effects of climatic factors on the evolution of sexual chemical signals of the Iberian wall lizard, *Podarcis hispanica*

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Signals used in intraspecific communication are expected to evolve to maximize efficacy under a given climatic condition. For example, many lizards scent mark territories with chemical secretions that are important in intrasexual relationships between males and in female mate choice. Chemical secretions might change in the evolutionary time to ensure that signals are perfectly tuned to local humidity and temperature affecting their volatility and therefore their persistence and transmission through the environment. Thus, interspecific differences in chemical signals of lizards might partly reflect selection for the efficacy of signals in different climatic conditions. We used gas chromatography-mass spectrometry (GC-MS) to examine differences in chemical composition of femoral secretions between two nearby populations of Iberian wall lizards, *Podarcis hispanica*, separated along a 500 m altitudinal gradient with contrasting environmental conditions. Then, we tested experimentally, using tongue-flick essays, whether female lizards were able to detect by chemosensory cues alone the males' scent marks that were experimentally maintained under different conditions of temperature and humidity. We also examined whether the temporal attenuation of the chemical stimuli depended on the simulated climatic conditions. Results showed that the efficacy (i. e. detectability and persistence) of scent marks for each population is maximal under the original environmental conditions of each population, which may depend on their chemical composition. We suggest that the abiotic environment may infer a selective pressure on the form and expression of sexual signals, which might have consequences for interpopulation recognition and result in population divergence and speciation. Our study also suggests that rapid climate warming could lead to negative changes in the efficacy of sexual signals with potential detrimental consequences for the sexual selection and conservation of lizards.

Fall migration behaviour and hibernation site selection in alpine common frogs (*Rana temporaria*)

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The common frog (*Rana temporaria*) is a widely distributed, European amphibian species. In large parts of its distribution, temperatures drop below zero during winter. This bears the risk of the formation of lethal ice crystals inside cells. However, little is known about the hibernation behaviour of *R. temporaria*. Across its distribution range, both terrestrial and aquatic hibernation have been reported. Previous studies have shown that common frogs are able to tolerate mild subzero temperatures for short periods by using glucose as a cryoprotectant. Further, they are able to meet their metabolic oxygen demand during hibernation through cutaneous respiration. Therefore, for common frogs at high altitude three hibernation strategies seem possible: aquatic hibernation in ponds or streams or over-wintering in snow-covered terrestrial hibernacula.

To get a first insight in the hibernation behaviour of common frogs in alpine regions we marked 15 adult common frogs with radio transmitters in fall 2011 and followed them over a 10-week period to their hibernation sites. Migratory behaviour was assessed by calculating the line-of-sight distance between relocations. The mean distance animals moved between two relocations was 19.4 m (SE = 4.1). Migratory behaviour did not differ between males and females. Among the radio tracked frog aquatic hibernation prevailed. One frog hibernated in a pond, seven in streams or springs and none in terrestrial habitat. Overall mortality rate was 40%.

The distance travelled between relocations was significantly influenced by season, suggesting that factors such as photoperiod or availability of food might play a major role in triggering the onset of hibernation in *R. temporaria*. Hibernation in lotic water might be beneficial due to constant microclimatic conditions, allowing frogs to maintain a reduced level of metabolic rate while guaranteeing a constant supply of oxygen. Both might be crucial for their overall energy balance.

A putative cryptic species of Galápagos marine iguana on the brink of extinction

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The recent discovery of strong population structuring in the Galápagos marine iguana indicates the potential existence of a cryptic species, the Punta Pitt iguana, represented by a single small discrete population on San Cristobál Island. Though data from both mitochondrial sequences and 13 microsatellite loci indicate this population to be highly distinct and probably ancestral, the small number of sampled individuals had until recently severely limited analysis. During an expedition to San Cristobál in 2012, we collected 130 new blood samples, many from previously unknown locations. Utilising 19 highly polymorphic microsatellite loci, we analysed population structure on the island using STRUCTURE, calculated levels of genetic differentiation (Reynolds F_{ST}) in ARELEQUIN, and estimated the effective population size (N_e) using three methods: ONESAMP, MLNE and TM_3 . STRUCTURE analysis supported the existence of two strongly divergent and reproductively isolated populations on San Cristobál, separated by an F_{ST} of 0.15, the highest level of intra-island genetic distance found in this species. Though the geographical distance between the two populations is less than 12 km of coast, the level of genetic divergence is equal to that found between island populations separated by more than 140 km of ocean. We therefore suggest that the marine iguanas from Punta Pitt represent a currently undetected, i. e. cryptic, species of marine iguanas. Three separate methods estimated the N_e of the Punta Pitt population to be 50 or fewer, indicating that urgent conservation management may be required. In particular, predation by invasive feral cats is a serious concern that warrants further attention. Considering the small population size and the fact that all analyses to date indicate reproductive isolation and a deep split between this population and all others, we pose the question of whether Punta Pitt iguanas should now be considered a cryptic species on the brink of extinction.

Phylogeographic relationships of green toads (*Bufo v. viridis*) from isolated alpine populations

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Green toads (*Bufo viridis* subgroup) inhabit an enormous Palearctic range (at least 12 mtDNA clades, including polyploids: 16 forms). In Austria, the nominotypical *B. v. viridis* occurs in the eastern lowlands (type locality: Vienna), while the Alps delimit the range to the West, with only three isolated patches in Salzburg, Tyrol and adjacent Bavaria, located up to 1,400 m a. s. l. In northeastern Italy, *B. v. viridis* inhabits pre-Alpine regions and the lowland, reaching parapatric *B. balearicus* at the Po River. To understand colonization and relationships of remote populations, we studied 77 individuals from isolated and neighboring localities using mtDNA and seven microsatellites. mtDNA shows toads at some localities from the interior Alps (S Bavaria, Tyrol) to share identical haplotypes with southern pre-Alpine populations (N Venetia), suggesting a genetic contribution to Alpine ones. However, microsatellite genotypes indicate strong differentiation between populations from the South (Venetia) and the North of the Alps (W Austria, Bavaria). In addition, despite geographic proximity, N Alpine green toads form several distinct genetic groups (W Tyrol, E Tyrol, S Bavaria), testifying of strong genetic drift and population disconnection in these remote parts of the range. We also find indications for potential human introductions in at least one of these populations.

Does foraging plasticity favours adaptation to new habitats in fire salamanders? Preliminary data

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Predators often show strong plasticity of optimal foraging strategies. A major difference in foraging strategies occurs between sit-and-wait and active predators. Environmental conditions affect their efficiency, with active foraging behaviour being favoured when prey is scarce or its detection is difficult. Both phenotypic plasticity and local adaptations may cause a shift between the two strategies. Here we studied larvae of *Salamandra salamandra* originating from either typical epigeous streams and from caves. We evaluated whether local adaptations or phenotypic plasticity determine the shift of foraging strategy between stream and cave populations. The foraging behaviour of larvae was evaluated using a full-factorial design, taking into account three test conditions: light, prey availability, and starvation (larvae with and without an available prey in darkness and light, sate or starved larvae tested in light and in darkness). Behaviour was recorded both visually and through video-tracking. Salamander larvae modified their behaviour in response to environmental conditions. When in the darkness, salamanders moved longer distances. Movements also increased in starving larvae, and with prey occurrence. Furthermore, larvae from cave populations showed higher behavioural plasticity than stream larvae, as they changed more their foraging strategy according to light conditions. Cave larvae also better exploited the space available in test environments. Variation of foraging behaviour was strong, and involved complex interactions between plasticity and local adaptations. When larvae were in conditions similar to the ones encountered in caves, plasticity enabled behavioural shifts toward an active foraging strategy. The higher behavioral plasticity showed by cave larvae supports the importance of this trait for the exploitation of novel environments, as caves are for epigeous fauna.

A history of species delimitation methods applied in the *Sceloporus grammicus* species complex and what it tells us about the future

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The historical developments of species identification and delimitation methods have been played out and reflected in the *Sceloporus grammicus* species complex of México. Early morphological studies were followed by allozyme studies and soon scores chromosomal races were being described based on cytogenetic analyses in the 1970s and 1980s. These gave way to restriction fragment digest analysis in both mitochondrial and ribosomal DNA and then to DNA gene sequencing, ecological niche modeling, and now thoughts of next generation sequencing. The history of attempts to identify species boundaries in *S. grammicus* illustrates the complex nature and intrinsic difficulty of delimiting species even as our technology and analytic prowess has exploded over the last half century. In many cases there is no 'silver bullet' to delimit species boundaries and the *S. grammicus* complex reminds us of the necessity of an integrative approach in understanding this nebulous entity we call a species.

Trapped in the Iberian Peninsula: reconstructing the evolutionary history and predicting suitable refugia under climate change for the endemic *Vipera seoanei*

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Pleistocene climatic oscillations are major factors related to current species' biogeographic patterns and climate change is predicted to strongly affect species distribution patterns. Integrative approaches identifying genetic and ecological variability are needed to better understand the effect of climate on the species evolutionary and biogeographic histories, and for coherent conservation planning. The Iberian adder *Vipera seoanei* is a Euro-Siberian species restricted to northern Iberia, for which available evolutionary scenarios are solely inferred through morphological studies and suitable climatic space was predicted to disappear in 2020. This work aims to reconstruct its evolutionary history and to identify suitable areas for the future. Fifty-eight tissue samples from specimens covering the species distributional range were sequenced for two mitochondrial gene fragments (cytb, ND4) and sequences were analysed using Bayesian approaches. Ten different ecological modelling algorithms were used over 352 distributional records at 1 × 1 km and climatic variables for current, past (LIG, Last Inter-Glacial; LGM, Last Glacial Maximum) and future (2050 and 2080) conditions. *Vipera seoanei* was found to have split from *V. berus* likely in the Pliocene and its shallow phylogeographic structure indicates a single refugial population followed by population expansion. Projections to past conditions identified probable suitable areas that may have acted as refugia for the species in Iberia, being smaller in the LIG than in the LGM and present time. Predictions according to future climatic conditions suggested dramatic reductions of distributional ranges and population persistence in north-western Iberia. Contrarily to other European viper species for which population isolation and refugia are suggested during Pleistocene cold periods, this study indicates that *V. seoanei* was deeply affected by warm periods. Consequently, populations monitoring and local management actions are likely to be needed under ongoing climate change.

An integrative approach for inferring spatial and temporal patterns for snakes fatalities on electricity distribution networks: the case of *Rhinechis scalaris* in Spain

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Electricity facilities contribute to habitat fragmentation, causing mortality mainly in birds and bats. Since 1998, the Spanish electricity company Iberdrola has registered fatalities by electrocution of the terrestrial fauna, resulting in 70 cases for the ladder snake (*Rhinechis scalaris*) but this number is suspected to be underestimated. Fatalities occur as a consequence of snakes climbing to medium voltage power towers (MVPT) and could be related to their hunting activity (active foraging). In order to identify areas and times of high electrocution risk and also testing the hypothesis that fatalities are related to the number of MVPT in a given area, multivariate analyses, Geographic Information Systems, Ecological Niche-based Models and circular statistics were combined with the environmental variability associated to the fatalities and the geographic distribution of MVPT. Two environmentally coherent groups have been recognized, each one presenting specific spatial and temporal patterns. Ecological models identified probable areas of occurrence and environmental conditions for each group within the species ecological requirements. No strong correlations were found between the density of MVPT and density of fatalities or potential areas for groups, suggesting that snakes could be attracted to specific MVPT. Different seasonal patterns for both groups were related to climatic factors varying on a monthly scale, reflecting snakes' activity periods. Common corrective policies among Iberdrola and other Spanish electric companies should be performed, since areas of high risk of mortality for snakes are likely to occur inside and outside the studied electricity network. Moreover, experimental studies of snake's attraction to MVPT and monitoring studies of populations in areas of high probability for fatalities should be made for a fine identification of the factors triggering the species electrocution and for their prevention. Current methodological approach is revealed as useful for further investigations on fatalities in other terrestrial species, even with low sample sizes.

Phonotaxis field experiments on Peruvian poison frogs—do male frogs respond to modified calls of syntopic congenics?

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We studied acoustic communication in the Peruvian poison dart frog *Ranitomeya imitator*, which performs Müllerian mimicry with *Ranitomeya variabilis*. In order to avoid the risk of 'wasting' energy for territorial defense we suggest that aggressive and territorial *R. imitator* males are able to discriminate between conspecifics and its co-model species by differently structured advertisement calls. We conducted phonotaxis field experiments attracting wild *R. imitator* males towards (i) the *R. imitator* advertisement call, (ii) the *R. variabilis* advertisement call, (iii) four modified calls with the temporal call parameters note length and internote interval substituted between the two species and (iv) two *R. imitator* calls at different dominant frequencies beyond the species' range. Experiments were videotaped and the male reaction was measured in approach time, number of jumps, jump distance, jump angles and path straightness. The response intensity of *R. imitator* towards its original advertisement call was used as reference for 'normal' territorial behavior. Males of *R. imitator* neither showed responses towards *R. variabilis* advertisement call, nor to *R. variabilis* call when modified in temporal call parameters to match the *R. imitator* call. In contrast, when playing *imitator*-playbacks with properties of *R. variabilis*, frogs approached the sound source. Furthermore, approaches could be provoked when only modified in dominant frequency. Results suggested that our modified call parameters did not have significant effects on *R. imitator* males' ability to discriminate their own advertisement call from that of *R. variabilis*. Nevertheless, we could show that *R. imitator* is able to discriminate between conspecifics and its syntopic co-model species by its advertisement call. This leaves to conclude that the call parameters note length, internote interval or dominant frequency are not essential in terms of call discrimination in *R. imitator*.

Occurrence of amphibian deformities in the Egyek-Pusztakócs marsh and grassland system (Hortobágy)

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The occurrence of amphibian deformities is well known since the 18th century but reports have become more frequent in the last two decades. Several factors, e. g. parasites, were proved to cause such changes, in most cases it is unclear why they developed. Above the 2% background frequency deformities may be considered as an indicator of environmental disturbance. Though in Hungary deformities had been detected in at least 13 amphibian taxa, only limited information is available from the Hortobágy region. Our main aim was to monitor the malformation frequency of the Egyek-Pusztakócs marsh and grassland system. We have collected data since 2010 by using several field methods e. g. pitfall and bottle traps, dip netting and catching individuals by hands during several surveys. We collected more than 5,000 specimens in 2010–2012. Amphibian deformities occurred in 2010, an extremely wet year with good reproductive success, even if their frequencies were below the background value. Ectromely was present in 60% of the cases, mainly in juvenile anurans (*Bombina bombina*, *Pelodytes punctatus* complex). Besides anurans, we also collected four deformed newts (*Triturus cristatus* complex), one of them had a duplicated tail, which is a very rare morphological anomaly. In all other cases limb or tail reductions were recognized. The observed malformations may be caused by predators, such as birds or fish, which can be rather abundant in the Egyek-Pusztakócs marsh system.

The impacts of glyphosate and predation threat on tadpoles of the agile frog (*Rana dalmatina*) in different experimental venues

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The widespread application of pesticides emphasises the importance of understanding the impacts of these chemicals on natural communities. Toxicologists traditionally use laboratory-based tests to determine lethal and sublethal concentrations of pesticides. However, these tests may over- or underestimate the impacts of pesticides by neglecting possible indirect and interactive effects. For example, it is known that the presence of predators can alter the lethality of chemical contaminants. Consequently, analysing pesticide impact under more natural conditions allows for estimating realistic effects of chemicals on non-target organisms. The most commonly applied broad-spectrum herbicide in the world is glyphosate, which is usually applied together with surfactants. We exposed agile frog (*Rana dalmatina*) tadpoles to three concentrations (zero, low and high) of glyphosate, combined with three predator treatments (no predator, *Aeshna cyanea* or *Lissotriton vulgaris*) in a randomized block design. To allow for a direct comparison of results obtained in standard ecotoxicology tests typically done in the laboratory with those performed in outdoors mesocosms, we performed the experiment in both venues. We surveyed tadpole survival, behaviour, growth, and morphology. Our results showed that the type of venue influenced almost all investigated traits. Under laboratory conditions predator-stress increased the effect of glyphosate on tadpole mortality, but in the mesocosms it made the herbicide less lethal, most probably because of the interactive effects of the stratification of the chemical and of the antipredator-response shown by tadpoles. Our study suggests that the type of experimental venue and the inclusion of further stress factors can have large effects on results of ecotoxicological experiments.

Use of distribution modelling for exploring new localities of an endangered European viperid, *Vipera ursinii graeca*

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Vipera ursinii is one of the most endangered snake species of Europe and provoked strong conservation approaches, and most of its subspecies are subject to elaborate conservation programmes. The only European exception is the Greek meadow viper (*V. u. graeca*), which is the least studied subspecies in Europe. Furthermore a recent study suggest that it may be a separate, basal species to the *V. ursinii* complex, thus it may receive a novel conservation status in the future. We have modelled the potential distribution of *V. u. graeca* with MaxEnt, derived from four ecogeographical layers and 28 presence data in an attempt, to update the list of habitats for this subspecies. We tested the model at six localities, five sites in Albania and one in Greece. We identified the observed vipers based on morphological characteristics and mitochondrial ND4 sequences. We found *V. u. graeca* at three mountains in Albania and one in Greece, from which two were undocumented localities for this viper until now. Our results show that distribution models are very useful and accurate for designing field research. Furthermore, the model prediction shows further 24 potential, but yet undiscovered habitats for *V. u. graeca* in addition to 16 already known localities.

Evidence for niche conservatism in the *Vipera ursinii* complex

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The *Vipera ursinii* species complex is a group of highly endangered small-sized snakes of steppe and alpine grasslands in the Palearctic region. The systematics of this complex, comprising 10 to 17 taxa (species and subspecies), differs by whether reconstruction is based on morphological or on molecular data. Here we use phylogenetic comparisons to study the relationships between environmental properties (mainly climate) and niche overlap among members of the species complex. We modelled the ecological niche of 17 taxa (species and subspecies) derived from 11 ecogeographical (climate and topography) and 216 “presence-only” data. The ecological niche models were then used to compute pairwise niche overlap values between all taxa. Our results showed that morphological similarity was positively correlated with the extent of niche overlap. We detected a higher level of niche conservatism among the molecular sister taxa than among non-sister taxa. Furthermore, we found high niche overlap between lowland taxa and greater niche divergence among mountain taxa, which may be related to the greater local adaptation to altitudinally changing and locally more diverse environmental factors in mountain habitats compared to lowland habitats. Our study provides evidence that (i) morphological similarity is related to niche overlap, (ii) that niche conservatism may be strong and (iii) that niche overlap can be related to variation in environmental factors (e.g., altitude, climate) in the studied group of vipers.

Experimental evidence for environmental factors affecting colouration in the European green lizard (*Lacerta viridis*)

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Carotenoid colouration has been previously demonstrated to act as an honest sexually selected signal in numerous species due to costs raised by the synthesis of pigments and precursors. Since the quality of an individual determines the amount macromolecules it can consume from the environment, carotenoid signals should raise high costs for the owner, thus providing reliable information about owners' genetic quality. In previous studies, we demonstrated the role and described the information content of an structural (ultraviolet) colour patch in male European green lizards (*Lacerta viridis*), but importance of colouration on other body parts remains unknown. Our aim in the current study was to investigate, whether the carotenoid (yellow) and structural (UV) colouration of the belly had any costs associated with development or maintenance, and thus could possibly play a role in sexual selection processes. During the breeding season of 2009, we captured 60 adult male lizards and created four groups experiencing optimal or sub-optimal environmental conditions. Temperature and food treatments were applied in factorial design, and colour and morphological traits were measured before and after experimental sessions. Results showed that both carotenoid and structural components of belly colouration were affected by temperature and amount of available food, with animals experiencing sub-optimal environmental conditions elaborating duller colour. This suggests that belly colouration is highly costly to develop and maintain, therefore can possibly act as an honest sexual signal. Considering that throat colouration has been shown to function as a multiple signaling system, it is possible that other colour traits, like belly colour, are also taken into account when estimating individual quality.

The study of correlation between age, body size and pattern (number and size of spots) in some *Neureergus derjugini* (NESTEROV, 1916) population from North-West of Iran

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Number of spots and spots size has been used as a distinguishing taxonomical character between *Neureergus derjugini* (NESTEROV, 1916) and its close relatives. As a result of the present confusion in the taxonomy of the closely related taxa, *N. derjugini microspilotus* and *N. derjugini derjugini* based on number and size of spots on the dorsum of specimens, we investigated the age structure and its relationship to the number of spots and body size in some populations of *N. derjugini* from North-West of Iran.

Age structure was studied by using skeletochronology performed on the phalanges. The analysis of the age structure in five populations (45 males, 35 females) based on continuing lines of arrested growth (LAGs) demonstrated that age in males ranges from 9 to 22 years (mean = 12.14 ± 2.8) and from 10 to 20 years (mean = 14.17 ± 2.5) in females. The mean Snout-Vent Length (SVL) was 129.23 ± 8.27 mm in males and 150.23 ± 10.6 mm in females and the SVL difference between the sexes size was statistically significant. The mean spots numbers was 32.07 ± 9.5 in males and 39.69 ± 9.7 in females. The number of spots and age were significantly correlated in both males and females (Pearson's correlation, males: $r = 0.790$, $P < 0.01$; females: $r = 0.743$, $P < 0.01$). The number of spots and body size were also significantly correlated in both males and females (Pearson's correlation, males: $r = 0.644$, $P < 0.01$; females: $r = 0.607$, $P < 0.01$).

Our results show that *N. derjugini* is a long-lived species exhibiting sexual size dimorphism and younger animals have fewer and larger spots than the older ones, therefore number of spots and spots size cannot be considered a reliable taxonomic character in these taxa.

Effects of prolonged summer drought and simulated complete water and food deprivation on body condition and osmotic responses in Souss Valley tortoises (*Testudo graeca soussensis*) from an arid area of West-Central Morocco

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Because of the unpredictable availability of resources in arid environments, adult Souss Valley tortoises are able to survive long periods without food and water. We investigated the effects of summer drought and simulated complete water and food deprivation (at 25 °C for 20 weeks) on body condition (g body mass/cm³ body volume) and osmotic responses, respectively, in free-ranging tortoises in an arid steppe-land of West-Central Morocco, and captive tortoises during the summer period 2012 (June–October). Body condition in aestivating tortoises, decreased markedly from 0.211 ± 0.005 in early June to 0.166 ± 0.009 in early October. Osmolality initially dilute bladder urine in early June increased until it was isosmotic to plasma by mid-summer, after which osmolality of both fluids increased to a highest level at the end of drought period. The increase in plasma osmolality comprised increases in plasma sodium, chloride, and especially urea concentrations. Bladder urine osmolality increased due primarily to increased soluble potassium from their diet apparently osmotically stressful. When rainfall occurred, tortoises drank copiously, voided concentrated bladder urine, and stored dilute urine; body mass, plasma and urine concentrations returned back to hydrated levels. Tortoises exhibited a tolerance of temporary "anhomeostasis" and that allows them to osmoregulate opportunistically. Body mass loss during the deprivation period was only 17.28 ± 4.83% of initial body mass with an average body mass loss rate of 0.00196 ± 0.00055 d⁻¹. Body condition index decreased from 0.1762 ± 0.0336 to 0.1379 ± 0.0263. Tortoises completely deprived of water and food, drank an average of 11.16% of their body mass in a mean time interval of 14 ± 4.43 mn. The lack of, or only small, disturbances in tortoises naturally aestivating and experimentally deprived of food and water for a prolonged period is indicative of their high degree of physiological adaptation to the summer extreme dry conditions.

Divergent altitudinal phenotypes in Iberian wall lizards are not driven by different life-histories

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The interplay between ecological conditions and life histories has been widely acknowledged in vertebrates, particularly in lizards. Temperature, food availability and humidity may exert different selective pressures, and, hence, produce divergent phenotypes even in geographically close populations. In this context the Iberian wall lizard, *Podarcis hispanica*, constitutes a perfect organism model as it is considered a species complex with a complicated evolutionary history. Here we report the results of a common garden experiment to test for life-history differences of two nearby *P. hispanica* populations separated along a 500 m altitudinal gradient with contrasting environmental conditions, where adults show marked morphological and pheromonal differences instead of being closely related genetically. We specifically focus on reproductive investment, incubation time, morphology at hatching and growth rate differences. Results showed differences in clutch size and egg morphology mediated by a larger body size in highland females and size independent differences in clutch weight and volume. However, hatchling lizards only differed in head height even after controlling for body size. A mixed model ANOVA (with clutch as a random factor and population and sex as fixed factors) did not show significant differences between populations, nor between sexes, in mass-specific growth, size specific growth, head growth or femoral growth of hatchling lizards. Overall, we provide evidence that phenotypic differences are not driven by different life-history traits. Also we infer that this pattern of variation is caused by environmental differences in productivity linked to contrasting climatic conditions. Thus, we suggest that an important role of phenotypic plasticity during ontogeny could be responsible of adult morphological and life history differences between both populations.

The homing frog: orientation and homing behavior in a territorial dendrobatid frog *Allobates femoralis*

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Dendrobatidae (dart-poison frogs) exhibit some of the most complex spatial behaviors among amphibians, such as territoriality and tadpole transport from terrestrial clutches to widely distributed deposition sites. High homing performance of tadpole transporting adults can be often assumed but the experimental evidence is lacking and the orientation mechanisms are unknown.

Our study is aimed at understanding and quantifying the orientation ability of male *Allobates femoralis*, a dendrobatid frog with paternal extraterritorial tadpole transport. First, we conducted a translocation experiment to quantify the homing success and speed under natural conditions. Additionally, we tested the initial orientation of the translocated males in an arena assay. Finally, we obtained homing trajectories by tracking individuals equipped with miniature transponders.

We found that translocated *A. femoralis* return successfully from up to 400 m and show a very high homing success for distances up to 200 m. Individuals also show significant homeward orientation in the arena assay. Tracking experiment revealed that homing trajectories are characterized by long periods of immobility (up to several days) and short periods (several hours) of rapid movement closely fitting a straight line towards the home territory.

We observed that distances at which homing performance is high correspond to the longest distances covered by males during tadpole transport. Consequently, our results demonstrate strongly developed and very precise orientation ability within a potential area of familiarity.

We discuss possible orientation mechanism involved and our future plans to test them.

Resolving the publishing bottleneck and increasing data interoperability in biodiversity science

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“Publishing bottleneck” is caused by: (1) increasing amount of data due to the intensification of scientific exploration increases; (2) publishing in non-machine-readable formats, e. g. paper/PDF; (3) low uptake and inconsistent policies for data publishing; (4) pressure of administrators to publish in “high-impact” journals; (5) increasing difficulties with peer-review.

In an attempt to solve some of the problems, Pensoft has launched the Biodiversity Data Journal (BDJ) (www.pensoft.net/journals/bdj), the first journal ever to complete the cycle from writing a manuscript, through submission, via community peer-review, to publication and dissemination within a single, fully XML-based, online collaborative platform. The journal changes thoroughly the way how biodiversity information, irrespective of whether it is taxonomic, floristic/faunistic, morphological, genomic, phylogenetic, ecological or environmental data, is published.

The scientific quality and importance of the papers and data submitted to BDJ will be judged by the scientific community, through a novel community-based pre-publication and post-publication peer-review. Furthermore, the journal will provide automated registration of nomenclature acts, such as new taxa and new synonymies, in ZooBank, thus facilitating authors. To mobilize taxonomic information and increase the interoperability of biodiversity data, a technologically advanced platform called “Pensoft Writing Tool” was developed. The tool provides a set of pre-defined but flexible article templates, as well as a search and import function from external databases, electronic registries, occurrence data in Darwin Core format, reference bibliographies, track change and comments tools, revision history and version control, etc. To keep costs affordable, all manuscripts submitted to BDJ must be either written in the Pensoft Writing Tool (PWT), or submitted from integrated external platforms, such as Scratchpads or GBIF’s Integrated Publishing Toolkit (IPT).

BDJ is being launched within the EU-funded project ViBRANT (www.vbrant.eu).

Phylogeny and phylogeography of the *Podarcis tauricus* group: insights from mitochondrial and nuclear data

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The wall lizard genus *Podarcis* (Sauria, Lacertidae) comprises 20 currently recognized species in southern Europe, where they are the predominant reptile group. The taxonomy of *Podarcis* is complex and unstable. Based on DNA sequence data the species of *Podarcis* fall into four main groups that have substantial geographic coherence (Western Island group, southwestern group, Italian group and Balkan group). The Balkan species are divided in two subgroups: the subgroup of *P. tauricus* (*P. tauricus*, *P. milensis*, *P. gaigeae* and *P. melisellensis*), and the subgroup of *P. erhardii* (*P. erhardii* and *P. peloponnesiacus*). Here, we explored *tauricus*’ taxonomy and investigated the evolutionary history of the species by employing phylogenetic and phylogeographic approaches and using both mitochondrial (mtDNA) and nuclear (msats) markers. The phylogenetic relationships and the genetic distances retrieved, supported the monophyly of *Podarcis tauricus* group and suggest that *P. gaigeae*, *P. milensis* and *P. melisellensis* form a clade, which thereafter connects to *P. tauricus*. Within the previous clade, *P. gaigeae* is more closely related to *P. milensis* than to *P. melisellensis*. However, *P. tauricus* is subdivided in several lineages with high genetic differentiation, leaving insinuations whether it is a single species or species complex. The phylogeographical scenario emerging from the genetic data suggests that the present distribution of this group was determined by a combination of dispersal and vicariance events in the Balkan Peninsula dating back to Miocene and continuing up to Pleistocene. Thus, our data stress the need for a reconsideration of the evolutionary history of the *P. tauricus* group and help overcome difficulties that classical taxonomy has encountered at species level.

Habitat use of the common spadefoot toad (*Pelobates fuscus*) in Estonia— is forest essential?

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Habitat loss and degradation are the most obvious and acute factors which influence amphibian decline. Fortunately, however, habitat deterioration is potentially reversible. Recognizing the factors critical for the species is therefore essential for successful habitat restoration and maintenance. We explored the habitat requirements of the common spadefoot toad (*Pelobates fuscus*), a severely declining species in Europe. The toad is considered a typical representative of herpetofauna in open agricultural landscapes but at its northern and western range edge the species occurs also in forested areas. So far, studies on the habitat requirements of the common spadefoot toad have only focused on agricultural areas and the significance of forest habitats has remained indistinct. In order to determine the habitat characteristics vital for the species as well as the function of forests as possible sink or source habitats, we explored 34 water bodies and their surroundings comparatively in forested and open landscapes in Estonia. The fieldwork was carried out from June to August 2008 and the method used for detecting the species was dip-netting of larvae. Our study demonstrated that land cover type had no significant influence on the presence of the species or its larval abundance—the limiting habitat factors were related to soil type (sandy soils preferred) and quality of the reproduction site only. Respectively, the species preferred large fish free sun exposed water bodies in areas with sandy soil. In our study sites such conditions were best met in old growth coniferous forest areas. Thus we suggest that these types of forests holding viable populations of the common spadefoot toad should be protected with large scale clear cuttings as well as altering of hydrology avoided.

A combination of divergence and conservatism in the niche evolution of *Tarentola mauritanica* (Gekkota: Phyllodactylidae)

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The quantification of ecological niche overlap and the integration of species distribution models (SDMs) with calibrated phylogenies to study niche evolution are becoming not only powerful tools to understand speciation events, but also as proxies regarding the delimitation of cryptic species. In this study, we applied these techniques in order to unravel how ecological niche evolved during cladogenesis within the *Tarentola mauritanica* species-complex.

Ordination methods as well as SDMs are used to estimate niche differences and similarities between the lineages of *T. mauritanica*. In order to unravel the evolution of environmental niche tolerances, the SDMs are merged with a known calibrated phylogeny for the genus *Tarentola*.

Diversification of the *Tarentola mauritanica* complex involved both niche divergence and niche conservatism, with a pattern that changes depending on whether the variables involved are related to mean temperature and humidity or with the seasonality of these variables.

Between the Miocene and Pleistocene, the diversification of the lineages encompassed by *T. mauritanica* resulted from a combination of niche conservatism and niche shift, with some clades still maintaining a realized niche distinct from their relatives. Moreover, our results suggest that climatic variables related to humidity and temperature seasonality were involved in the niche shift and genetic diversification of the European/North African clade during the Pleistocene and to its maintenance in a realized niche distinct from that of the remaining members of the group. This study further highlights the need for a taxonomic revision of this species-complex.

Sometimes bigger is better: the role of body size, nuptial colouration and parental relatedness for paternity success in moor frogs

(*Rana arvalis*)

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Sexual selection is expected to favour the evolution of large male body size when there is direct male-male competition, and the development of male nuptial colouration in case of female mate choice. In the moor frog (*Rana arvalis*), an explosively breeding species, males actively search and scramble for access to females during a short reproductive period. Males express a blue nuptial body colouration and some studies revealed a large male mating advantage, but how these traits influence paternity success remains unknown. We performed mating experiments in which we exposed three females to three small and large males each, and measured male colour using a spectrometer. Four polymorphic microsatellite loci were used to determine the paternity of a subset of offspring, and to quantify genetic relatedness between successful mating partners. Males fertilizing the majority of a female's eggs were larger but not more intensely coloured than their competitors. As the males observed in amplexus not always achieved the highest siring success, and polyandry occurred in 67% of the analysed egg clutches, we assume stray sperm or clutch piracy to cause multiple paternity. Successful mating pairs were characterised by high genetic divergence, which was linked to the number of offspring sired.

New home, new life: linking the evolution of salamander larval habitat choice to ecosystem processes

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Changing environments are the main driver of evolutionary changes. Corresponding shifts in the behaviour and life history traits of species might in turn also alter ecosystem attributes. The reproduction of central European fire salamanders (*Salamandra salamandra*), in small pond habitats instead of first order streams, is one example of a recent local adaptation. Since fire salamander larvae are important top-predators in these fish free habitats, their presence changes various aspects of ecosystem functioning. Here we analysed how the ecological performance of salamander larvae in ponds changes in comparison to stream populations. Further we analysed how the presence of salamander larvae in ponds influences key ecosystem attributes such as prey biodiversity and aquatic-terrestrial linkage. To assess the impact of salamander larvae on the pond functioning, we combined detailed investigations of both salamander larvae and invertebrates in ponds of a population in western Germany with experimental manipulations of the salamander presence. Our calculations are based on biomass data of the pond fauna, as well as on the analysis of stomach content data, growth rates and population dynamics of the salamander larvae. We demonstrate that the larval behaviour and performance can have a high interannual variability. The presence of salamander larvae distinctly influenced the macroinvertebrate community composition and food web structure in their aquatic habitat. Moreover we could show that the adaptation of fire salamanders to breed in pools leads to strong net increases of animal-mediated import of terrestrial matter into the aquatic habitats. The aquatic terrestrial subsidy exchange is altered through (1) a high net-biomass import of salamanders and (2) indirect biomass import through feeding on emerging insects and terrestrial prey.

Tadpole transport logistics in the Neotropical frog *Allobates femoralis*

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The evolutionary transition from aquatic to terrestrial egg deposition has enforced the development of various parental behaviours, in order to protect the eggs from external threats and to ensure the final development of aquatic larvae. Poison-dart frogs (Dendrobatidae) have evolved a remarkable variation in courtship and parental behaviours, and forms of parental care are present in almost the entire family. Beside the knowledge that tadpole transport is obligatory in almost all dendrobatid frogs, very little is known about the underlying movement patterns and distribution strategies. We investigated the tadpole deposition behaviour in a natural population of *Allobates femoralis* in a lowland rainforest in the nature reserve “Les Nouragues”, French Guiana, during five years from 2008 to 2012. We observed in total 129 tadpole transport events. While in the vast majority of cases it were males (92.25%; n=119) who were performing this task, we also observed 10 females (7.75%) with larvae on their back. Frogs carried on average 8.43 tadpoles on their back (range=1–25). Given the average clutch size of approximately 20 eggs, this indicates that frogs do not transport entire clutches at once and/or that they distribute their larvae across several water bodies. When encountered during tadpole transport, males were on average 38.58 m (range=1.64–185.12) away from their home territories. This distance significantly correlated with the number of tadpoles on the males' back. For 114 tadpole-pairs, paternity was assigned to the male that was the respective carrying individual, while for 5 pairs paternity was assigned to either neighbouring males or unidentified individuals. For the 10 tadpole pairs that were transported by females, maternity was in all cases assigned to the transporting female. This study provides a comprehensive analysis of movement patterns and discusses costs and benefits of different tadpole distribution strategies in *A. femoralis*.

Individual genetic tracking to assess amphibian dispersal: an island experiment in the Neotropical frog *Allobates femoralis*

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The challenge to reliably mark amphibian larvae and to re-identify marked individuals after metamorphosis has hampered studies on larval and juvenile dispersal of amphibians for a long time. Current molecular methods allow establishing unique genetic fingerprints on an individual basis. While these marker-based genotypes have been repeatedly used to establish pedigrees and assess relatedness amongst individuals, they were not used in genetic mark-recapture studies in amphibians so far. In the present study, in March 2012 we released 1800 tadpoles of the Neotropical dendrobatid frog *Allobates femoralis* into 20 artificial pools on a 5-ha river island in the Nature Reserve “Les Nouragues” in French Guiana, that was previously uninhabited by this species. All tadpoles were genotyped at 15 highly variable microsatellite loci with 19 alleles per locus on average, yielding unique genetic fingerprints for all individuals. In two recapture sessions, first we encountered 43 juvenile frogs (September–October 2012) and later 36 males and 31 females (January–March 2013) that had survived on the island. Repeated genetic sampling and genotyping across all life history stages allowed us to match the microsatellite genotypes of tadpoles, juveniles, and adult frogs. The unique ventral patterns of *A. femoralis* thereby acted as a control for matched juveniles and adults. This enabled us to reconstruct dispersal trajectories from the natal pool of tadpole development over juvenile encounter locations to the final territory and perching sites of males and females. The same dataset of individually unique microsatellite genotypes will be used in further analyses to assess factors that determine fitness, in terms of survival and reproductive success, in this semi-natural closed study population of *A. femoralis*.

Learning from the past to predict the future: linking palaeophylogeographic models with future climate change risk assessments in Nearctic chelonians

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Global climate is changing and species must respond by tracking suitable habitat, adapting to the changing conditions, or becoming extinct. To better understand how species will respond to future climate change, we have investigated the historic patterns of response to fluctuating climates of the past 320 ka in North American chelonians. We further modeled the response to future climates of these species using different Intergovernmental Panel on Climate Change (IPCC) scenarios for 2080.

Palaeophylogeographic models for the past 320 ka reveal different patterns of distributional changes in Nearctic chelonians, ranging from latitudinal range shifts and range contractions to a complete modeled 'extinction' during glacial maxima. Looking into the future, species distribution models projected on different IPCC climate change scenarios also reveal significant changes in future potential ranges resulting in range shifts. Especially in the South, large areas are facing completely novel climatic conditions from the species' point of view, which might lead to increased environmental stress and even a high extinction risk.

In combination of both approaches, this study shows that estimates on extinction risk provided by assessments on prospective climate change have to proceed with caution, since even past climates lead to modeled 'extinctions' in certain species. This might happen for different reasons: (1) relevant processes are acting at much finer scale as typically assessed in macroecological studies, and (2) other parts of the species' fundamental niche which are not represented today become available during changing conditions, keeping the range still viable for the species.

Updating the distribution range of the narrow endemites *Salamandra atra aurorae* and *S. atra pasubiensis*

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Salamandra atra aurorae and *S. atra pasubiensis* are limited to narrow areas along the Southern Prealps, but the precise distribution of their population is known very incompletely. To improve knowledge, during 2012 we carried on 48 days of active exploration in putatively suitable areas, and gathered and evaluated occasional reports from people visiting the areas. *Salamandra a. aurorae* was recorded in the northern Altopiano dei Sette Comuni and Vezzena, at altitude 1200–1800 m. *Salamandra a. pasubiensis* was confirmed with a single population in Vajo del Ponte–Val di Fontana d'Oro, 1450–1800 m, in the Pasubio Massif. Undocumented reports of alpine salamanders from the Carega Massif remained unconfirmed.

Molecular phylogeography of the long-nosed viper (*Vipera ammodytes*) in the Cyclades, Greece

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Dwarf populations of long-nosed vipers (*Vipera ammodytes*) are found on 15 islands of the Cyclades in the Aegean Sea. These populations were geographically isolated about 200 thousand years ago (KYA) when a large, ancient island (Cycladia) separated from mainland Greece because of rising sea-levels. Cycladia began to fragment into several islands about 20 KYA as the last glaciation of Europe was ending and the Aegean started to rise (120 m), leaving only the higher elevations exposed creating the Cycladic archipelago. Recent molecular studies in the Cyclades have begun to uncover phylogeographic patterns and factors promoting diversification of various herpetofauna, yet much is unknown of the biota in this Mediterranean biodiversity hotspot. Here we aimed to understand how isolation and fragmentation has and continues to affect the genetic diversity and evolution of one of the top predators in the Cyclades, *V. ammodytes*. Using phylogenetic analyses of mtDNA sequences we were able to unveil the extent of genetic diversity within the archipelago, evolutionary relationships to mainland conspecifics as well as correlate those relationships to the complex paleogeography of the region. Molecular data corroborated that extensive insular isolation of these viper populations has formed a divergent group/clade in the Cyclades that possess unique haplotypes to almost each island. Our results also depict that two lineages are found within the clade that correspond to the initial split of Cycladia which created northern and southern islands. Additional support for this correlation is the clustering of haplotypes of individual islands within these northern and southern lineages as the islands continued to fragment. In conclusion, our results offer novel insights into the diversity that exists among Cycladic *V. ammodytes* and provides information for future taxonomic assessments and conservation management.

Conservation genetics tools for the spectacled salamander, *Salamandrina perspicillata*

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The spectacled salamander (*Salamandrina perspicillata*) is an endemic species of peninsular Italy, listed as Least Concern by IUCN. *Salamandrina perspicillata* is widespread in the Apennine Mountains but, due to its elusive habits and scattered distribution, more information is needed to assess its actual conservation status. We tested the resolution power of 10 microsatellite loci in order to verify their suitability as tool for conservation genetics studies, aiming to estimate the genetic diversity within and among populations, as well as to investigate for the first time patterns of paternity. We amplified the 10 loci in two multiplex PCR reactions (with five primer pairs each). Thereafter, we genotyped 129 adult individuals from Vejo Regional Park (Latium, central Italy), collected between 2007 and 2012. Observed and expected heterozygosity, deviations from Hardy-Weinberg equilibrium, probability of identity and allele frequencies at each locus were calculated in GenAlEx 6.5. We found an average of 6.2 alleles per locus. The values of observed and expected heterozygosity were $H_o = 0.617$ and $H_e = 0.622$. All loci met the expectations of Hardy-Weinberg equilibrium, except one (Sala-NC7), which was excluded. The probabilities of identity at 9 loci were $PI = 1.0E-07$ and $PI_{sibs} = 1.03E-3$. To test for the ability of the microsatellite markers to detect patterns of paternity, we genotyped eight pregnant females (collected from their natural habitat) and their offspring (278 larvae in total; 30 larvae on average for female). The reconstruction of paternal genotypes was performed in Colony 2.0.3.5, revealing that each female mated with 3 males, on average (min = 2, max = 4). Our results showed that this set of markers can be efficiently used to estimate the extent of genetic diversity and to reveal patterns of multiple paternity in *S. perspicillata*.

Morphology and advertisement call variation in the common tree frog *Polypedates leucomystax* complex in Thailand

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The common tree frog *Polypedates leucomystax* is widely distributed in Southeast Asia and has been assumed to be species complex. We analyzed and described quantitative differences in morphology and advertisement calls using univariate and multivariate statistics. We analyzed seven call parameters and twenty morphological characters from three localities in Thailand. Two morphotypes of *P. leucomystax* were found in a southern population (Song Khla) as morphotypes A and B. These two morphotypes showed high difference in call types and call characters. Morphotype A has two call types whereas Morphotype B has three call types. The northeastern population has high call diversity with six different call types. Call properties of the northeastern population are distinct from southern populations. Discriminant function analysis revealed three morphologically distinct groups and correctly classified 84.8% of individual to populations that is concordant with the bioacoustic results. Thus, our acoustic and morphological data provide evidence for recognizing species within this complex in Thailand.

Long-term dynamics of a *Speleomantes strinatii* population living underground

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Long-term ecological studies are important because they produce data on slow evolving or complex ecological processes, such as climate change and prey-predator interactions. In this study, a population of the cave salamander *Speleomantes strinatii* was studied for 23 consecutive years inside an artificial cave. In the period 1990–2012, salamanders active on the cave walls were counted in July to obtain a relative population index. Moreover, from 1996 this index was validated by absolute population abundance estimation obtained by temporary removals. The population time series was analysed by means of autoregressive moving average (ARMA) modelling. During the study, the salamander population showed large fluctuations, but its overall dynamics appeared constant. The selected ARMA (2,1) model indicated that the salamander ecological dynamics was regulated by a complex interplay between delayed density dependence and some external factor, possibly another species embedded in the same food web. Moreover, this study confirmed that the cave salamander population showed weak evidence of periodicity, this phenomenon being rarely described in underground environments.

Eleven years observation on the breeding season of the green turtle, *Chelonia mydas* at Penang Island, Peninsular Malaysia and future recommendations

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Kerachut Beach and Kampi Beach are located on Penang Island, at the northern part of Peninsular Malaysia. The coordinates of Kerachut Beach are 5°27'4"N; 100°10'58"E and 5°26'20"N; 100°10'46"E for Kampi Beach. The Pantai Kerachut Turtle Conservation Centre was built in 1995 under the government organization, Penang Department of Fisheries. It represents the only turtle sanctuary on Penang Island, providing the information and as a research unit. The objective is to study the pattern of breeding season during 11 years (2001–2011). Two types of surveys were used to verify the green turtle nests which are; the intensive nocturnal surveys (conducted at night from 1900–0600 h) and morning track counts (a morning survey from 0900–0930 h). Result showed that the nests' graph is fluctuated; the total nests detected per year ranged from 39 to 73 (mean = 54.7, $n = 11$) and the peak months are different every year. The total number of eggs collected during 11 years were 66,217 and ranged from 3985 to 7974 eggs per year. An independent-sample t-test was conducted and a significant difference of the number of nest collected for both beaches was found. During our observation, the management of Pantai Kerachut Turtle Conservation Centre was able to improvise more in order to upgrade it. We recommend to plant more *Scaevola taccada* trees in order to attract turtles to land and to provide nesting sites; reducing and restricted lighting from fishermen community and staff near the nesting beach; restricting visitors activities such as walking, fire camping, grouping near the beach; and fishermen activities should be far away from beach due to trawling, fishing, lighting and engine gear that are disturbing nesting activities. In conclusion, Penang Island has the least number of nest distribution compared to other states of Malaysia.

Malformations in Neotropical vipers: qualitative and quantitative analysis

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Organogenesis, the most complex stage in embryonic development, is particularly sensitive to exogenous agents, being therefore an important period for the occurrence of malformations, which may lead to newborn or premature death due to predation and/or diseases. This study describes the frequency and type of newborn malformations occurring in jararacas (*Bothrops jararaca*) and rattlesnakes (*Crotalus durissus*) at the Butantan Institute (IB), Brazil, from 2007 to 2013. Free-ranging pregnant specimens of these species delivered to IB were kept in captivity until the birth of their offspring. Newborns were macroscopically and radiologically analyzed for the presence of visible malformations. After natural death or euthanasia, complete necropsy was performed. Species *B. jararaca* showed a total of 95 malformed individuals from 4087 births (2.3%). Species *C. durissus* showed 36 malformed snakes from 324 births (11.1%). The most common malformations were those associated with the spine, whereas 74.8% (98/131) of snakes showed at least one malformation in the axial skeleton. The fusion of scales, leading to consolidation of body parts was found in 22.1% (29/131) of teratogenic snakes, and only two snakes, one of each species, showed fusion with no relation with spinal deformities. There was no preferential side for eye malformation (microphthalmia, anophthalmia and buphtalmos) which was observed in one or both eyes of the same snake. Brachygnathia was observed in rattlesnakes and jararacas (2 and 9, respectively), as well as upper lip malformation (2 and 1, respectively). All other congenital head malformations only occurred in jararacas. Three jararacas showed bicephaly. Schistosomia occurred in the thoracic or abdominal region of teratogenic animals and, depending on the extent, the internal organs were exteriorized. Complementary studies are necessary to properly understand the etiology and significance of these malformations.

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Back to black: the role of melanin in thermoregulation of polymorphic lizards

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Many authors hypothesized that coloration and dorsal pattern could be important for reptile thermoregulation, because skin pigmentation causes significant differences in light reflectance and some suggested that melanistic individuals could thermoregulate more efficiently. *Podarcis muralis* shows a dorsal polymorphism, with three different patterns, so the aim of our work was to test if different dorsal patterns were correlated to different thermal behaviours. We used two complementary approaches: a field study of a wild population (63 males and 30 females, ExpA) and an experimental study of heating rates in relation to dark pigmentation (22 males and 29 females, ExpB). ExpA: all lizards were sexed, measured, photographed, marked with dorsal paintings and released; each time a marked lizard was seen, body temperature (T_b) was measured using an infrared thermometer and air temperature (T_a) was measured contemporarily with a digital thermometer. ExpB: lizards were kept in terraria and heated progressively, measuring T_b and T_a at standard intervals with the same instruments. Data were analysed by means of a mixed model, using T_b as dependent variable, lizard identity as a random factor to account for repeated measures, dorsal morph (reticulated, striped and mixed), SVL, sex, T_a and reproductive period (reproductive: April–June; post-reproductive: July–October) as fixed factors. Both experiments gave the same results, highlighting the dependence of T_b on T_a , but excluding any effect of other predictors. The lack of effects of dorsal patterns is particularly interesting, since it demonstrates that darker colorations do not confer any advantage in thermoregulation. This result seems to confirm data collected for other reptiles that underlined the effect of melanism on thermoregulation only in large species.

The smell of a killer: what specific cues allow poison frogs to protect their offspring from cannibalistic conspecifics?

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Chemical communication in amphibians is especially well documented in salamanders and newts, but several studies have also identified chemical communication in anurans. Here chemical communication between adult frogs and their tadpoles in the poison dart frog *Ranitomeya variabilis* was investigated. As known for many poison dart frogs, the males of this species deposit tadpoles singly into different phytotelmata. The exploitation of these small pools is advantageous as it lowers the risk of predation, but it is more costly because of limited resource availability. Additionally, poison frog larvae are often cannibalistic, so the identification and avoidance of conspecifics represents an adaptive behaviour for these amphibians.

By conducting pool-choice experiments in the Peruvian rainforest, it could be shown that parental *R. variabilis* are able to recognise the presence of conspecific tadpoles in phytotelmata without invoking visual or physical stimuli, but are able to accurately determine the presence of tadpoles via chemical cues. Furthermore, it appears that these frogs can distinguish between different kinds of cues, produced by tadpoles of different species. While some tadpoles are avoided as well (e.g. *Hyloxalus azureiventris*), others are not considered as dangerous for the own tadpoles (e.g. *Rhinella poeppigii*) or are even preferred (presumably recognized as a food resource, e.g. *Osteocephalus mimeticus*).

Current research is focused on the identification of the specific chemical cue(s) produced by the tadpoles that elicit responses in adults. Cues of *R. variabilis* and *H. azureiventris* were extracted and fractionated and the fractions were tested by presenting them to the frogs in the field. After one fraction of each species was found to be avoided, those fractions were fractionated again into individual substances that are currently tested in the field, in order to find the cue that is responsible for the frogs' reactions towards their tadpoles.

NA2RE Project—The new atlas of amphibians and reptiles: new compilation and online system

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The first Atlas of Amphibians and Reptiles in Europe was published in 1997, and since then, numerous regional and national organisations have collected new chorological data from large parts of Europe. Furthermore, the taxonomic progress have contributed to multiple changes and new species descriptions. The Mapping Committee of the SEH presents here the New Atlas of Amphibians and Reptiles in Europe (NA2RE), a system of distributed databases. Each distributed database has a national focus and is implemented in an online network, accessible through standard interfaces, thus sharing spatial-temporal data. A Web interface facilitates the access to distributed data as if it was one virtual integrated database. Upon user request, the Web interface searches all distributed databases for the requested data, integrating the answers in an interactive map. This methodology can easily actualise the records, as well as the taxonomy and systematics. Under this approach, data duplication is avoided and national databases are maintained in its own country. This system is implemented using only open source software, for this purpose: (a) PostgreSQL database (with PostGIS extension to support spatial data and operations) to store observation data, (b) the Geoserver tool for accessing data, and (c) the OpenLayers framework to present dynamic and interactive maps in NA2RE web page (<http://atlas.ismai.pt>). The data on the NA2RE website is based in a compilation from different data sources, namely published (in books or websites) or ongoing national atlases, personal data kindly provided to the SEH, the 1997 European Atlas, and the Global Information Facility. Databases were homogenised, projected to the same coordinate system (WGS84) and transformed into a 50 × 50 km grid. Species richness maps were also calculated by the addition of all group species present in each square. The obtained database comprises more than 380,000 records distributed across 40 countries.

How evident are the co-evolutionary patterns between haemogregarines and their turtle hosts?

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Freshwater turtles belong to the most typical hosts of intracellular apicomplexan parasites of the genus *Haemogregarina*. The majority of *Haemogregarina* spp. were formerly described based on the two criteria: (i) morphology of their gamonts in peripheral blood; and (ii) presumed strict host specificity, when each new studied host species denoted description of a new parasite. Hundreds of *Haemogregarina* spp. described in this way thus represent a suitable model for genealogical study and taxonomical revisions. Number of recent phylogenetic studies elucidates evolutionary relationships among turtle hosts and thus makes the model turtle-haemogregarine very attractive for studies on host-parasite co-evolution. To investigate the relevance of host specificity in phylogenetic/taxonomic framework, we examined haemogregarines from two groups of turtles. The first group contains 89 pelomedusid turtles, belonging to 10 species, namely 9 *Pelomedusa subrufa*, 25 *Pelusios nanus*, 14 *P. upembae*, 12 *P. subniger*, 9 *P. marani*, 6 *P. rhodesianus*, 6 *P. gabonensis*, 6 *P. williamsi* and one individual each of *P. sinuatus* and *P. castaneus*. These animals were freshly imported from Angola, Central African Republic, Democratic Republic of the Congo, Gabon, Kenya and Mozambique. The second group comprised 74 turtles from the western Palaearctic, namely 15 *Emys orbicularis*, 17 *Mauremys caspica* and 41 *M. rivulata*. All isolates were subjected to phylogenetic analyses of 1500 bp long sequences of 18S rDNA. Our results confirmed a low host specificity and considerable conspecificity, when branching pattern of trees did not follow host phylogeny. Moreover, studied *Emys* and *Mauremys* were parasitized by the same *Haemogregarina*. Evolution of haemogregarines thus probably did not follow evolution of vertebrate hosts, but evolution of their definitive hosts (leeches).

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Phylogeography and population genetics of a Mediterranean tortoise *Testudo hermanni* (GMELIN, 1789)

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Hermann's tortoise, *Testudo hermanni* is a medium-sized, terrestrial species spread over the Mediterranean area of the Iberian, Apennine and Balkan Peninsulas. Until now the population differentiation within *Testudo hermanni boettgeri* is unclear and some authors have suggested that the western Croatian populations might represent a distinct taxon. Population differentiation is studied using 22 polymorphic microsatellite markers of more than 150 individuals from the Balkan Peninsula.

Take time to smell the frogs—Vocal sac glands of reed frogs contain chemical cues on species identity

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Males of many reed frog species (Anura: Hyperoliidae) have a prominent colorful gular patch on their vocal sac, which is particularly conspicuous once the vocal sac is inflated. Although presence, shape and form of the gular patches are well-known diagnostic characters for these frogs, its function remained unknown. By integrating biochemical and histological methods, we found strong evidence that the gular patch is a gland producing volatile compounds, which might be emitted while calling. Volatile compounds were confirmed by gas chromatography-mass spectrometry in the gular glands in 11 species of the hyperoliid genera *Afrixalus*, *Heterixalus*, *Hyperolius*, and *Phlyctimantis*. Comparing the gular gland contents of 17 specimens of four sympatric *Hyperolius* species yielded a large variety of 65 compounds in species-specific combinations. We suggest that reed frogs use a complex combination of at least acoustic and chemical signals in species recognition and mate choice.

Identifying conservation priorities for herpetofauna in Europe

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SEH's Conservation Committee assessed the status of European reptiles and amphibians in the 1980s and categorized all species according to their degree of threat using defined criteria. As a result, the most threatened species have been the subject of habitat studies and action plans since. Generally, the outcome was published in reports to the Council of Europe and in many cases concrete management measures were taken in the field.

The status of many threatened species, habitats and herpetofaunal communities has changed (worsened) during the last decades by which an update is needed. Based on a new taxonomic species list, inquiries must be made in all European countries in order to identify at least the most threatened species and habitats. This huge work can be seen as a continuation of the project 'Important Herpetofaunal Areas in Europe' that got stuck about ten years ago, but did by no means lose its relevance. After completion, a comparison can be made with the annexes of the Habitat Directive and of the Bern Convention, which were established using both ecological and political criteria. Conservation policy as well as practical conservation management can benefit from an updated and possibly improved review.

We discuss the selection of criteria from today's viewpoint and an outline is given of the thoughts how to run such a project. Also on behalf of the SEH Conservation Committee, collaboration is sought for this project. After having assessed the actual status of all species and habitats, priorities can be set for actual and future conservation work.

Impact of colour polymorphism in interaction with thermal conditions on reproductive success in asp viper (*Vipera aspis*)

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Ectotherms' colouration plays a crucial role in many aspect of an animal life and can impact thermoregulation, metabolic pathway, animal behaviour and prey-predator interaction. Theoretically, in ectothermic animals the colouration is expected to have an important influence on thermoregulation processes. Darker individuals should heat up faster and be able to reach and keep optimal temperature longer than would lighter individuals and therefore, especially in cool areas, darker animals should exhibit longer activity periods, higher growth rate, survival, fecundity and reproductive output. The present study focused on the impact of the dorsal colouration on the reproduction of asp viper (*Vipera aspis*) in interaction with thermal conditions. In spring 2012, we collected a total of 24 gravid females of two distinct colour morphs (normal [light brownish-grey back colouration with a dark pattern] and melanistic) from a colour polymorphic population of the Swiss Prealps. In order to test for an effect of colour phenotype (melanistic vs. normal) on the response of individuals to different climatic conditions, these females were kept in captivity until parturition under two treatments simulating "cold" versus "warm" conditions during their pregnancy (by modifying basking-time availability). The reproductive output of females (parturition time, clutch size and mass) and the impact on the phenotype of neonates (body size, mass, dorsal and ventral colouration, and scalation) were analysed in relation to the temperature treatment and phenotype of the mother. Our study revealed that females from the warm treatment gave birth on average earlier than did females from the cold treatment. Interestingly, melanistic females gave birth on average earlier and produced more offspring than did normal females. As a conclusion, our study demonstrated that colour polymorphism plays an important role in the ecology and evolution of the asp viper.

Drang nach Süden: missing codons reveal unorthodox routes of post-glacial expansion and secondary contacts in the fire-bellied toad, *Bombina bombina*

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Dispersal from multiple glacial refugia resulted in a mosaic of parapatric clades in *Bombina*. In a lowland bound *B. bombina* AMOVA identified 3 geographic groups, the Northern, Southern and Anatolian, originating from presumed peri-Black Sea refugia. Upon glacial retreat the N and S lineages experienced spectacular expansions to the West circumnavigating the Carpathians and Sudety Mts. The two branches met in Central Bohemia, in a secondary contact, as revealed by lineage specific codon deletion in their divergent mtDNAs. Another area of potential contact in European Turkey, where peripheral populations of the Southern and Anatolian lineages occur in close proximity. Peculiar dispersal routes of the fire-bellied toad seem related to its specialized aquatic life style and post-glacial remodeling of the river systems resulting from global and local sea level rise. The toads may have colonized the southernmost distribution margin in the Evros Delta only after influx of the saltwater into the lacustrine Black Sea from the Mediterranean. In contrast to widespread Northern and Southern mtDNA clades, the Anatolian clade seems restricted to the Sakarya River Valley and a few localities in European Turkey. Distinctness of these marginal populations, known as *B. b. arifiyensis*, deserves not only attention but quick conservation measures.

Age limit on plastic responses? Modelling plasticity in a species with complex life history

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Various organisms can adjust their phenotype according to the environment they experience, i. e. exhibit phenotypic plasticity. Previous models suggest that plasticity is favoured by greater environmental variability and gene flow. However, temporal and spatial environmental challenges can be met with a variety of responses, and there is limited knowledge about which traits are the most likely to become plastic and in which life stages. Previous theoretical works on the adaptive significance of phenotypic plasticity in species with complex life history focus on predator-induced changes in larval traits or on optimal time for metamorphosis. In this study we used an optimality model to investigate how plasticity in adult (affecting reproduction) and larval (affecting survival) stages contribute to the prevalence of a plastic phenotype in a heterogeneous environment where two specialist phenotypes co-occur. We ran simulations for 1000 generations and analyzed the change in the proportion of 9 phenotypes (all possible combinations of 3 larval and 3 adult strategies) in the larval and adult habitats. Generations were separate, and the proportions of the phenotypes at a site in each generation changed according to their relative fitness. We found that phenotypes with adult and larval plasticity were similarly successful in the heterogeneous environment, but specialists' ability to choose the right habitat for their offspring diminished the net advantage of plasticity. These results help explain why adult plasticity affecting reproductive success is less common than larval plastic responses in species with complex life history.

Linking habitat suitability to demography in great crested newts (*Triturus cristatus*)

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Understanding the relationship between population parameters and habitat suitability is central to monitoring, management and conservation of endangered species. Habitat suitability index (HSI) models are often used to predict species occurrence and are valuable and convenient tools for wildlife management and conservation practice. The HSI is a numerical index, ranging from 0 (unsuitable habitat) to 1.0 (optimal habitat). In the application of HSI models for management purposes, habitat suitability is often used as a general indicator for demographic responses. However, whether habitat suitability is actually related to demographic parameters such as survival and reproduction has rarely been evaluated. Great crested newts (*Triturus cristatus*) are widespread in Europe but have suffered severe declines in many countries within their natural range and are therefore strictly protected under the Habitats Directive in the European Union. The HSI for great crested newts incorporates ten key habitat variables, all of which are thought to have an effect on the species. Based on a capture-mark-recapture survey over three years, we evaluated the effects of habitat suitability on apparent survival and reproduction for great crested newts, using model selection with Akaike's Information Criterion (AIC). In our study site in Krefeld, Germany, 24 ponds were surveyed for presence and reproduction of great crested newts and 1919 individual capture histories were recorded. The candidate model sets for both demographic parameters included models with and without HSI values. Models containing HSI values received more support than intercept only models for reproduction but not for survival probability. Our results suggest that the HSI can be a valuable predictor in conservation planning not only for occurrence but also for reproduction probability in great crested newts.

The adaptive value of predator-induced defences in *Bufo bufo* tadpoles

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Phenotypic plasticity, the ability of a genotype to produce various phenotypes depending on the environment, is a well-studied phenomenon in anuran larvae. However, the adaptive value of such induced responses often remains unknown, especially so in species lacking spectacular responses. It has been shown that tadpoles of the common toad (*Bufo bufo*) show relatively weak morphological and behavioural responses to the presence of predators, while probably relying on chemical defences. We conducted two experiments to evaluate if *B. bufo* tadpoles exhibiting predator-induced phenotypes have elevated survival compared to naive conspecifics in the presence of various aquatic predators (*Nepa* sp., *Aeshna cyanea*, *Lissotriton vulgaris*, *Esox lucius*) and alternative prey (tadpoles of *Rana temporaria*). We reared tadpoles in outdoors mesocosms in the presence or absence of caged predators fed with tadpoles every other day. Three weeks after start we removed tadpoles from rearing tanks and exposed mixed species tadpole assemblages to free ranging predators. We conducted bioassays in large and in small plastic boxes. Large boxes contained leaf litter and aquatic vegetation and represented natural conditions, where the full suite of induced defences was likely to affect survival probabilities. Small boxes only contained water, so that the effects of morphological and behavioural defences could only have a little effect and variation in palatability may be assumed to have played a major role in shaping survival probabilities. Induced tadpoles enjoyed elevated survival rates in both experimental venues compared to non-induced conspecifics. Furthermore, while predators varied in their effectiveness and degree of preference, they all preferred *Rana* over *Bufo*. The latter result was more evident in small experimental boxes, where palatability was presumably more important. These results suggest that chemical defences efficiently elevate the likelihood of survival in *B. bufo* tadpoles.

Age and some growth parameters in two insular populations of *Lyciasalamandra fazilae* (Caudata: Salamandridae) from southwestern Turkey

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In this study, we aim to describe some life-history traits (body size, age at maturity, longevity, and growth) of *Lyciasalamandra fazilae* from two insular populations living in the Mediterranean environment of southwestern Turkey. Samples were collected from the Tersane (30 males, 30 females and 9 juveniles) and Domuz Islands (30 males, 30 females and 23 juveniles) located in the Göcek Bay. Body sizes of salamanders were measured with a plastic ruler and the ages of juveniles and adults were estimated using phalangeal skeletochronology by counting the number of resting lines (LAG) in cross-sections. The mean SVL of males and females was calculated as 65.92 ± 0.80 mm and 65.30 ± 1.40 mm on Tersane, and 62.47 ± 0.62 mm and 57.40 ± 1.24 mm on Domuz Island, respectively. The mean SVL was significantly higher in females than in males on Domuz ($p < 0.05$) whereas the sexes did not differ significantly on Tersane Island ($p > 0.05$). This character was also significantly differed between the populations ($p < 0.05$). In this study, one hundred and forty bones were scored and 92.10% were suitable for an estimation of the individual's age. The mean age was 6.50 ± 0.28 years in males, 6.69 ± 0.37 years in females and 1.86 ± 0.26 years in juveniles on Tersane Island. These values were recorded as 5.17 ± 0.18 years, 4.31 ± 0.22 years and 2.30 ± 0.19 years for Domuz Island, respectively. No significant differences were found between the age distributions of the two sexes in the Tersane population ($p > 0.05$) but there was a significant difference in the Domuz population ($p < 0.05$). The age structure of males and females varied significantly between populations, with older mean ages to be observed on Tersane Island ($p < 0.05$). Age at sexual maturity was determined as 4 years for males and 3 years for females in both populations. Positive correlation between body size (SVL) and age was determined for both males and females in both populations. Growth was investigated according to the von Bertalanffy's growth equation. The asymptotic size of males was lower (88.99 ± 0.85 mm) than that of females (101.16 ± 1.11 mm) on Tersane, whereas the opposite was detected for Domuz Island ($SVL_{\text{asym(male)}} = 90.39 \pm 1.55$ mm; $SVL_{\text{asym(female)}} = 94.49 \pm 2.28$). Our data show that males were bigger than females in both populations. There were significant differences between two insular *L. fazilae* populations (Tersane and Domuz) for both sexes in terms of both SVL and age. This difference is thought to be resulted from the islands' own ecological factors such as predation, aggressive competitors, food etc.

Reproductive interference between *Rana dalmatina* and *R. temporaria* affects reproductive success in natural populations

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Experimental evidence suggests that reproductive interference between heterospecifics can seriously affect individual fitness and population dynamics. In mating systems ruled by indiscriminate, coercive males, sexual isolation may collapse when the number of conspecifics drops below that of heterospecifics, leading to a decrease in the average reproductive success of individuals of the rarer species. Support from field studies for such an Allee effect on reproductive success has, however, remained scarce. The agile frog (*Rana dalmatina*) and the common frog (*Rana temporaria*) are sympatric in the Pilis Hills, Hungary. Their breeding season overlaps and males of both species are often found in amplexus with heterospecific females, even though matings between heterospecifics produce no viable offspring. We monitored 25 breeding ponds during the breeding season. We estimated species abundance ratios based on the number of clutches laid by the two species and evaluated fertilization success in clutches. We assumed that zero or decreased fertilization success was caused by heterospecific males being involved in matings. We found that in populations where the species ratio was more biased towards *R. temporaria*, the average fertilization success of *R. dalmatina* eggs decreased, while fertilization success of *R. temporaria* did not decrease with increasing relative numbers of heterospecifics. This asymmetry in fitness-effects could be caused by the difference in the competitive ability of males of the two species: while males of the more competitive *R. temporaria* males are able to displace heterospecific males amplexing conspecific females, the smaller *R. dalmatina* males are not able to do so. Our results support the hypothesis that reproductive interference can lead to substantial fitness-loss and may affect population dynamics not only in experimental populations, but under natural conditions as well.

Speciation under gene flow? The case of *Mauremys caspica* and *M. rivulata*

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The stripe-necked terrapins *Mauremys caspica* and *M. rivulata* are sister species occupying similar ecological niches and occurring in more or less mutually exclusive parapatric distribution ranges. The ranges of the two species are forming a narrow contact zone over hundreds of kilometres. We used 13 quickly evolving microsatellite loci and five nuclear genes for gaining insights in gene flow and hybridization of 13 populations of *M. caspica* and 18 populations of *M. rivulata* from the contact zone and compared these to randomly chosen individuals from the whole distribution range of each species.

The role of fire in structuring reptile communities in dry sclerophyll forests in eastern Australia

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Faunal responses to fire are generally less researched than for vegetation, but are no less important. This is particularly true for reptiles that are rarely studied in fire ecology, but likely to be impacted by fires due to their reliance on microhabitat structures. Previous studies largely investigate local-scale effects in response to isolated fires, but few consider landscape level spatio-temporal responses despite fire regime parameters, mainly frequency and extent, playing an important role in shaping landscape fire mosaics. Therefore, this study compared reptile assemblages in dry sclerophyll forests with differing fire mosaic histories in southeast Queensland to determine how reptiles respond to spatio-temporal fire regimes. Unique spatial fire mosaics were identified at two forests based on: total number of fires, mean fire interval and time-since-fire. Reptile active searches were conducted at five plots within each fire history mosaic unit during two sampling periods, equating to 55 plots across the two forests. Landscape and vegetation parameters were quantified at all plots. Results show that reptile abundance, richness and composition were influenced by fires. The best models revealed a negative response to the total number of fires, as well as fire type, where top disposal (forestry management) burns had higher species richness with a different composition to that of wild-fire and prescribed burns. Habitat variables were generally not strongly correlated with reptile parameters. However some fine-scale variables appeared within models alongside fire parameters, where reptile abundance of common species was positively correlated with ground vegetation height, litter cover and log abundance and decay. The findings demonstrate a stronger relationship with fire as opposed to habitat structure, in contrast to previous work. This suggests that where land managers reduce the fire frequency, this may lead to a higher reptile abundance and diversity.

Big blues & small browns—systematics of African Agaminae

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The African agamas include several genera: *Acanthocercus* is a genus of mainly arboreal lizards widespread in savannas and woodland of eastern and southern Africa; *Agama* mainly includes rupicolous and terrestrial lizards across the entire continent; *Pseudotrapelus* is only present along the Red Sea coast, while *Trapelus* additionally occurs in northern Africa and the southern Sahara belt; and *Xenagama* is restricted to arid lowlands and mid-elevation at the Horn of Africa. For a long time the systematics of African agamas were poorly known but in the last years taxonomic research in these groups has intensified.

In this talk I will present the new taxonomic concept of African Agaminae, based on the results of several studies and I will show their relationships to other members of the subfamily. Moreover, I will demonstrate that this data can also be used to address more general questions.

The African tropical rain forests harbour a huge number of reptile species and have been well inventoried. On the other hand, the arid biomes of the continent are the worst explored habitats of the world and biodiversity and/or zoogeography is often examined on a defined geographic scale only. Therefore, agamid lizards were chosen as model group to get insights into the zoogeographic “arid history” of the continent, into migration routes and colonization events, into early stage speciation processes and the evolution of a continent wide lizard group.

Prey and microhabitat preferences of *Natrix tessellata* in a diverse floodplain along the Hungarian Danube section at Göd (1669–1671 rkm)

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Natrix tessellata (LAURENTI, 1768) is a diurnal piscivorous Eurasian snake species with a large distribution area. Along the River Danube it is present in the floodplain and along the lower stretch of tributaries. The distribution of *N. tessellata* among the different microhabitats along the River Danube at Göd and its relationship with environmental parameters, e. g. current velocity, and fish presence/absence, species composition, size distribution and abundance was studied at the eight selected sections. Samples were collected twice a month from March to October in 2008–2009, *N. tessellata* was found between May and early October. Altogether 26 *N. tessellata* sightings were recorded together with 497 individuals of 21 fish species along the same section, while another 5,547 individuals belonging to 28 species was caught in snake-free areas. Microhabitat characteristics were more decisive than the presence of fish in determining along which section *N. tessellata* stays. It favoured slow-flowing sections with aquatic macrophytes and a sandy or muddy bottom. In spite of their suitability, artificial habitats were not much used may be due to increased risk of disturbance and predation/persecution. The habitat preference of *N. tessellata* changed less between the two studied years with different water level fluctuations than those of fishes and it was not identical with any of the fish species caught. However, 15–30 mm and longer fish may influence the distribution of *N. tessellata*.

Determinants of parapatric range limits in contact zones of European salamanders

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Abrupt range limits of parapatric species are interesting systems for studying the factors that determine species' range margins. Theory and empirical studies suggest that parapatric range limits are likely to form along strong environmental gradients when there is interspecific competition. The parapatric salamanders *Salamandra salamandra* and *S. atra* meet in small contact zones in the European Alps and the maintenance of parapatry poses interesting questions to biologists. To identify determinants of their sharp range limits, this research combines species distribution and habitat modelling. Macroecological models are used to explore interspecific niche differentiation within contact zones and to assess the role of climate for the sharp range limits. To study patterns of local co-occurrence and to find evidence for interspecific resource competition, species-habitat relationships are analysed using site-occupancy models. The results reveal a strong climatic gradient across range limits and show that the salamanders generally occur at different conditions. The species show a moderate niche overlap and conditions at species' records vary among regions. On the habitat scale, the slope of a site is important for *S. salamandra*, while none of the predictors explains the occurrence of *S. atra*. There is no effect of species presence on each others' site-occupancy. The results suggest that the climate represents a determining factor for species' range limits within contact zones. Interspecific niche overlap and the observation that both species can occur in a much wider range of climatic conditions and that no habitat predictor explains the occurrence of *S. atra* propose that interspecific interaction may play a role. However, there is no direct evidence for resource competition. To fully understand the mechanisms that determine the parapatric range limits and to unravel the role of biotic interactions it is crucial to study the salamanders' life history traits.

Taxonomical developments in *Triturus* newts, driven by genetic data

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Genetic studies have revealed that the crested newt species '*Triturus karelinii*' comprises more than one species. The first clue came from mitochondrial DNA: deep genetic divergence as already hinted at over twenty years ago, in one of Europe's first phylogeographical surveys. Recently, a detailed mitochondrial DNA phylogeography revealed that *T. karelinii* comprises three mitochondrial DNA clades. A phylogeny based on full mitochondrial genome sequences showed these three clades to be as distinct as recognized *Triturus* species. Also ecologically speaking these mitochondrial DNA clades show differences comparable to those among real species. To assess the validity of these results, an analysis of multiple nuclear DNA markers was required. A study employing allozymes confirmed genetic differentiation within *T. karelinii sensu lato*, but sampling was too limited to allow firm conclusions. However, subsequently a phylogeography of three nuclear DNA markers confirmed that *T. karelinii sensu lato* indeed is composed of three species, as the mitochondrial DNA suggested. These three species are: (1) an eastern species, covering the southern Caspian Sea shore, the Caucasus and the Crimea, (2) a central species, covering northern Asiatic Turkey, and (3) a western species, covering western Asiatic Turkey and the south-eastern Balkan Peninsula. The name *T. karelinii* should be restricted to the allopatric eastern species. The central and western species occur in parapatry. We explain why the taxonomy of these two *Triturus* species is complicated and present an interim solution. Currently, only genetic data can be used to identify the three crested newt species comprising *T. karelinii sensu lato*. However, we hope our results stimulate what has been termed 'reverse taxonomy', i. e., the discovery of diagnostic morphological features for species initially identified based on genetic data only.

Anuran diversity of floating meadows in Amazonia

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The rivers of the Amazon basin harbor stationary formations of hydrophytes, known as 'floating meadows'. These ecosystems are heterogeneously structured within and among regions and underlay remarkable dynamics related from water level change. Biological diversity is enormous, but little studied. Anuran amphibians exploit floating meadows for both foraging and reproduction. From the many questions arising from this, in this study we provide survey data (species richness) from four regions in the upper Amazon basin of Peru and compare their species-turnover (beta diversity). Floating meadows were opportunistically surveyed; perhaps not all anurans found actively chose floating meadows and rather 'accidentally' occurred there (e. g. a few juvenile *Rhinella marina*). Species were identified on the basis of morphology and advertisement calls (> 25 taxa, with > 85% of all species account for those in the family Hylidae). Species richness was estimated using different incidence- and abundance-based richness estimators (ACE, ICE, Chao1, Chao2, First-order jackknife). The taxon-turnover was calculated using the Sørensen index, which was corrected by Jaccard similarity coefficient. Our results suggest that anuran species communities in floating meadows can be remarkably different (likely related to structure and size) and that the similarity between two floating meadows correlated with distance.

Distribution and genetic relationships among populations of the foam-nest treefrog *Chiromantis hansenae* (COCHRAN, 1927) in Thailand

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The foam-nest treefrog, *Chiromantis hansenae* was previously reported for the geographic distribution in northern, East-Central, and southeastern Thailand. Taxonomic status of *Chiromantis hansenae* has been unclear due to the high morphological similarity with congeneric species, *C. vittatus*. We investigated the distribution, and examined the genetic relationship among *C. hansenae* populations in Thailand using partial sequences of mitochondrial 16S rRNA gene. Analyses of Maximum-likelihood (ML), and Bayesian methods revealed two distinct evolutionary lineages of *C. hansenae* in Thailand. Our results showed that *C. hansenae* Group I is distributed across northeastern, eastern, and southern Thailand whereas *C. hansenae* Group II is distributed in northern and western Thailand. The mean pairwise distance between Groups I, and II of *C. hansenae* was 4.7%. Our study suggested that the genetic difference between two groups of *C. hansenae* could be a result of geographic barrier. Further investigation at population level should be conducted by increasing genetic data and other evidence.

Differential antipredator responses in two sympatric lacertid lizards

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Syntopic populations of overall similar lacertid species are likely to share predators. However, predation pressures might be different. Lacertids are preyed by different predators with different foraging strategies, namely avian predators attack from above, while terrestrial predators attack by approaching on ground (in the open) or by searching for prey in their hiding places. Therefore lacertids are expected to employ different antipredatory behaviours, either crypsis or early predator detection (visually or chemically) followed by escape to shelter. We conducted an integrative evaluation of both the predator pressure and the antipredator mechanisms for two morphologically and ecologically similar species: *Iberolacerta horvathi* and *Podarcis muralis*, occurring in syntopy in the Northern Dinaric region. We used three different approaches: (i) identifying and evaluating the predation pressure of avian predators with plasticine models and automatic video cameras, (ii) experimental test of chemical recognition of potential snake predators, and (iii) testing the refuge-escape tactics in the field. We have found very low predation pressure by avian predators. The recognition of snake chemicals differed between species, *I. horvathi*, but not *P. muralis*, recognizing *Coronella austriaca* as a potential predator. Interestingly, none of the species responded to the scent of *Vipera ammodytes*. Adults of both species intrinsically differed in their escape behaviour when approached by the researcher simulating a ground predator attack. Specifically, *I. horvathi* tended to escape at greater distances and spent more time in the shelter before emerging (longer recovery time) regardless the air, surface or refuge temperatures and habitat type. Implications of these differential antipredator strategies for the coexistence of both species are discussed.

Threats to the Moldavian meadow viper (*Vipera ursinii moldavica*) in eastern Romania

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One-fifth of the European reptile species are threatened because of fragmentation, degradation, and loss of habitats. *Vipera ursinii* is probably the most threatened snake in Europe. In eastern Romania *V. u. moldavica* inhabits steppe and deltaic habitats in Moldavia and the Danube Delta, respectively, which are not free from anthropogenic alteration, despite legal protection. Human impact was documented tangentially in some studies and consequently, our main objective is to inventory the anthropogenic threats and their potential harm to the Moldavian and deltaic viper populations, objective which is particularly important because it would support future conservation efforts. Thus, we processed observations spanning almost a decade and carried out in three Moldavian and three deltaic populations. Our prediction regarding the bioclimatic niche in the context of climate change scenarios indicates an extension of the species' current range in eastern Romania. However, many potential habitats, although bioclimatically suited, might be improper due to profound anthropogenic alterations. In addition, the Moldavian viper populations are currently under anthropic pressure which may lead to extinction regardless of the favourable climate or climate change. The human activities identified in the study areas are: grazing, mowing, fire, agriculture, roads, constructions, leisure activities, afforestation, cynegetic species management, persecution, illegal collection, and littering. Human impact is stronger in one population of the Danube Delta than in Moldavia, but the deltaic population is larger and therefore probably more resistant to extinction. One steppe habitat (Moldavia) is threatened by urban sprawl in the near future. The anthropogenic threats of the *V. u. moldavica* habitats and populations must be continuously monitored for identifying in time changes that may lead to population decrease and extinction.

The puzzling phylogeny of the *Vipera kaznakovi* complex

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We studied the phylogeny of vipers of the kaznakovi-complex using sequences of two mitochondrial genes, Cytb and COI, as well as the nuclear genes Bach1 and Rag1. Sampling covered most of taxonomic diversity and distribution range of the complex in the Caucasian region (*Vipera kaznakovi*, *V. dinniki*, *V. darevskii*, *V. orlovi*, *V. magnifica*, *V. pontica*), including the type specimens of *V. magnifica* and *V. pontica*. Resulting trees reconstructed in MrBayes and PhyML and TCS statistical parsimony networks show division of the complex into two clades. One (Northern) is restricted to the territory of Krasnodar region in Russia and the range of the second (Southern) covers most of the territory to the south of the Main Caucasian Ridge with some populations in the alpine zone of Northern Ossetia and Dagestan. Phylogeny does not correspond to present taxonomy: the complex is not monophyletic and the Northern clade clusters with *V. ursinii* and *V. renardi*, while the Southern clade forms the sister lineage to the former clades. Closely related haplotypes of the Northern clade were found in all samples from *V. orlovi*, *V. magnifica* and most of *V. kaznakovi* and *V. dinniki* from Russia. The Southern clade further splits into lineages from Dagestan (alpine population of *V. cf. dinniki* or *V. cf. lotievi*), the high altitude border region between Russia and Abkhazia (*V. cf. dinniki*), a high altitude population from Northern Ossetia (*V. cf. dinniki* or *V. cf. lotievi*), and the rest of high altitude and lowland populations of the *V. kaznakovi* complex from Georgia, Turkey and Armenia, including populations morphologically assigned to *V. dinniki*, *V. kaznakovi*, *V. darevskii* and *V. pontica*. Possible gene introgression has been identified by presence of heterozygous specimens in contact zones between Northern and Southern clades as well as between the Northern clade and the *V. renardi* complex. *Vipera pontica* being identical in mtDNA to *V. kaznakovi* from Turkey has nuclear alleles of *V. kaznakovi* and *V. ammodytes*, thus it represents a hybrid between these two species.

Rounded or elongated body shape? *Emys orbicularis* hatchlings—juveniles display phenotypic plasticity when under different ecological conditions

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To test if habitat could shape carapace features starting from birth, in *Emys orbicularis*, we tested randomly chosen hatchlings from four clutches of a same locality, under two treatments, firm vs running water. After initial inertia and feeding stop during winter, youngster grew rapidly in March–May, then much more in June–September. On average, size and mass increased much more in river than in pond turtles.

Biometric variables were all normally distributed (Komogorov-Smirnov test, all at $P > 0.05$) (mother, treatment, season).

The ratio carapace width/carapace length, was found as close to 1 (0.91–0.94; rounded) in pond *Emys* and was found lower (0.89–0.92; elongated) in river *Emys*. ANOVA for repeated measures (size = carapace width/carapace length, plastron width/plastron length and mass/carapace length), multifactorial (mother, treatment, season) $F_{\text{mother}} = 35.996$, $P < 0.0001$, $F_{\text{treatment}} = 7.179$, $P = 0.008$, $F_{\text{season}} = 5.157$, $P < 0.002$; $F_{\text{interaction mother*treatment}} = 22.294$, $P < 0.0001$ gave significant results. Newborns-youngsters *Emys orbicularis* reach a carapace shape on average rounded in pond treatment, and on average elongated in river treatment. The Shape-Function relationship starts at birth, and it seems adaptive, likely with a relatively low genetic inertia (this statement should be demonstrated).

Poster Presentations

Inferring the effects of past climate fluctuations on the distribution pattern of *Iranolacerta* (Reptilia, Lacertidae): evidence from mitochondrial DNA and species distribution models

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A variety of different methods are available for investigating the effects of past climate fluctuation on biota. Among them, molecular phylogeography and species distribution modeling approaches have been shown to be especially useful tools to trace past climate induced modifications of species' geographic distributions. The results of both analytical approaches are here combined to better understand the influences of past climate changes on the fragmented distribution pattern of the lizard genus *Iranolacerta* that currently occurs in the northwest and central Zagros Mountains of Iran. While *I. zagrosica* is restricted to few localities and cannot be modeled, the potential distribution of *I. brandtii* suggested a large region of unfavorable habitat between northwest and the central Zagros Mountains populations. From the phylogenetic perspective, both species display deep genetic separation likely predating the Pleistocene. However, limited genetic diversity across this divided range of *I. brandtii* implies that the current separation is recent. Deeper genetic divergences were, nevertheless, uncovered within the northwest population. Since no recent geological events explain these results, the most likely explanation for such a distribution pattern is due to past climate fluctuations. Both sources of evidence suggest that during the early Holocene the northwest and Zagros populations of *I. brandtii* were connected, and the current pattern was shaped with their disconnection in the early Holocene. Further studies may identify potential glacial refugia for other species in this biodiverse region.

Multiple dispersal out of Anatolia: biogeography and evolution of Oriental green lizards

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The Oriental green lizards of the *Lacerta trilineata* group are widely distributed in Greece, Anatolia, the eastern Mediterranean, the southern Caucasus and the Zagros mountains in Iran. We studied their phylogeography using three mitochondrial markers with comprehensive sampling from most representatives of the group. Their phylogeny and divergence times (implementing fossil-based molecular clock calibrations) were inferred using Bayesian methods, and haplotype networks were reconstructed to assess how genetic diversity and current distributional patterns were shaped. According to our phylogenetic analyses, the group constitutes a well-supported monophylum containing several distinct evolutionary lineages with high haplotype diversity. Vicariance might explain the divergences within most lineages that have accumulated by range restriction and expansion of populations due to Quaternary climate oscillations and glacial refugia. However, niche divergence seems to be a major force promoting speciation and large scale distributional patterns between lineages were shaped earlier by multiple, independent dispersals out of Anatolia during the Pliocene and early Pleistocene. Our results also suggest that the group is in need of a taxonomical revision, as identified lineages and genetic diversity are not congruent with the currently recognised subspecies.

Symmetry of the cranium in island populations of *Podarcis* lizards analyzed with a high resolution 3D geometric morphometric approach

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We explored the influence of population isolation on shape and symmetry of the cranium in *Podarcis* lizards with CT-micro-scanning and 3D geometric morphometric techniques. 13 *P. bocagei* and 17 *P. hispanica* populations were studied from 13 island and 15 mainland localities of the Ria de Arosa archipelago in northwestern Spain. The geological history generated a natural laboratory with more or less isolated populations and thus allowed the following predictions to be tested: small, random departures from symmetry (fluctuating asymmetry – FA) of the skull is higher (1) in island populations than in mainland populations, (2) on remote islands than on islands close to the mainland, (3) on small islands than on large islands, and (4) in the resident species, *P. hispanica* than in the recent colonizer *P. bocagei*. Hypotheses 1–3 were partially confirmed, indicating that FA of the lizard cranium (as a measure of developmental stability and stress) is driven by population isolation. We suggest that FA can be used in conservation biology as an early-warning system for conditions of stress.

Amietia angolensis and *A. fuscigula* (Anura: Pyxicephalidae) in southern Africa: hidden clades revealed

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The taxonomy of the African amphibians is not totally understood. Since amphibians are considered an indicator of habitat quality and may play an important role in the flow of matter and energy in the ecosystems, it is extremely important to know their systematics, in order to successfully address their effective conservation. A genetic-based study revealed that the two previously described species *Amietia angolensis* and *Amietia fuscigula* from southern Africa were in fact composed by four different clades. In this work, we used advertisement calls and morphology to evaluate this hypothesis.

Ninety-three advertisement calls, which are biphasic for this genus, were analyzed. Specimens from museum collections and sampled in Angola, Lesotho, Namibia, South Africa and Zimbabwe were analyzed for body measurements (44 adults) and coloration (61 adults and juveniles). Discriminant Function Analyses were then performed on body ratios.

Our data supports the hypothesis of four different clades. The integration of our data and those from the genetics-based study allowed to propose a new division for these species, as follows: *Amietia angolensis*, known only from Angola, *Amietia fuscigula*, from the south-western Cape in South Africa, *Amietia queckettii*, from South Africa, Lesotho and Zimbabwe, and *Amietia poyntoni* sp. nov. CHANNING & BAPTISTA, 2013, from Namibia and South Africa.

The advertisement calls were diagnostic for the four species, which could be distinguished by the duration of the first clicking phase: *A. angolensis* and *A. queckettii* have a mean duration less than a second, sometimes reaching 1.2 s, *A. fuscigula* has a duration range between under 5 seconds and 14.3 seconds, and *A. poyntoni* sp. nov. has a duration range of 15.3–22.6 seconds. *Amietia angolensis* and *A. queckettii* can be distinguished by the duration and number of pulses in the second phase: *A. angolensis* has a mean duration under 0.2 seconds, and *A. queckettii* under 0.4 seconds.

The DFA showed significant differences between *A. fuscigula* and *A. poyntoni* and also between *A. angolensis* and *A. queckettii*. Coloration pattern, namely the throat colour pattern showed differences between the clades, but there was some overlap between taxa.

Rearing conditions of tadpoles from the North African green water frog *Pelophylax saharicus*

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Humans are the principal responsible of the decrease and the disappearance of some frog species, not only by destruction of their natural habitats but also by their direct consumption. The development of frog legs market in many countries has stimulated research on frog farming. Rearing conditions of the tadpoles of the North African green water frog *Pelophylax saharicus* are studied in order to assess the possibilities of intensive farming of this species. The results showed that the temperature of 26 °C is optimal for a maximum weight gain with a maximum rate of metamorphosis between 24 and 26 °C. The highest yields were obtained at low densities from 1 to 10 tadpoles. The best survival and expedited metamorphosis is obtained with a 35% protein food. The impact of protein level on food intake and weight increase is feeble. The maximum weight of tadpoles at metamorphosis is obtained with a rate of 40% protein.

Call differences among brown frog species

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In anurans, different studies have shown that species sharing morphological characteristics also show similar call characteristics. The following main features are used by females for mate choice: call duration (CD), dominant frequency (DF) and pulses repetition rate (PRR). Underwater calls of two close related species, *Rana dalmatina* and *R. latastei*, were recorded in the same pond during one field session in Lombardy (Northern Italy), by means of a professional hydrophone (Sea-Phone) and a digital recorder (M-Audio MicroTrack II), Audio files were analysed with the software Audacity and Sound Ruler.

The CD of *R. dalmatina* was variable, with a mean of 4.0 s (± 3 s SD). Each call was formed by single impulses of 85.9 ± 8 ms, separated by an interval of 190 ± 12 ms; DF: 657 ± 11 Hz; PRR: 125 Hz. *Rana latastei* showed two different kind of call: one long “brum”, formed by several impulses, CD: 2.1 ± 0.2 s, interval 300 ± 40 ms; DF: 200 ± 27 Hz; PRR: 74 Hz. The “meow” is a frequency modulated single call, CD: 551 ± 6 ms; DF: 783 ± 25 Hz; PRR: 64 Hz. Moreover we analysed two different calls of a Ligurian population of *R. italica*: one low intensity “grongron” (PRR: 58 Hz), and a higher “squack” (PRR: 330 Hz).

The bioacoustics parameters of the calls of other 5 species of European brown frogs (*R. temporaria*, *R. arvalis*, *R. graeca*, *R. iberica* and *R. pyrenaica*) have been analysed, from reference materials. The multiple comparisons (Pearson correlation index) of such parameters showed a substantial similarity among all the calls, with the exception of the “brum” call of *R. latastei*, which revealed negative correlation with almost all the other calls. Other species, such as *R. iberica*, *R. italica* and *R. pyrenaica*, emitted two different calls, but only one kind of brum-like call of *R. iberica* was similar to that of *R. latastei* (Pearson R = 0.552).

These results can help to understand the role and the evolution of different calls in sympatric close-related species.

A preliminary study on predation pressure using plasticine models and automatic video camera traps in allotopic and syntopic populations of two lizards

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Podarcis muralis and *Iberolacerta horvathi* are small, ecologically and morphologically similar lacertid lizards who can be found living in sympatry in southern parts of Slovenia. Regionally, the only substantial difference found thus far between the two species was the exhibited difference in altitude of their preferred habitats. In order to try to recognise the mechanisms behind this kind of segregation we chose to research the effect of predators on these two species. In some systems, predation pressure can promote coexistence of prey species, while low predation pressure may be the driving force behind stronger expression of competitive interactions. The species could both be preyed on by other reptiles, birds and also mammals. Our choice for determining the strength or presence of avian and mammalian predator pressure in syntopic and allotopic locations were plasticine models of lizards, which we set up in groups of 100 in nine localities for one or two days, considering the microhabitat use of both species. Additional measures for detection of predators were provided in the forms of IR night vision automatic video camera (U-Way), focused on five plasticine models on exposed surfaces for the duration of the entire week. At the same time we also recorded presence of avian predators on all of the nine localities and estimated lizard relative abundance, along with collecting mammal scats to investigate the presence of lacertids in their diet. Preliminary results of these experiments will be presented with first analyses and photographs of predation events taken during video recording. Plasticine models had marks of small mammals on them and we recorded a beech marten (*Martes foina*) appearing to be eating one. Avian predators which we most frequently encountered on localities were raven (*Corvus corax*) and common buzzard (*Buteo buteo*).

Comparison of skull form in the snake genus *Natrix* (Squamata: Serpentes: Natricinae)

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Although snake skull structure attracts serious interest of researchers, quantitative studies on closely related species are relatively rare. Presented here is an analysis of 20 measurements of skull dimensions of members of four *Natrix* species: *Natrix natrix* (N=19), *N. tessellata* (N=23), *N. maura* (N=6) and *N. megalcephala* (N=2). Because the latter is represented only by two specimens, all analyses were repeated including and excluding this species. Besides comparison of skull shape another test has been conducted to find if aquatic specialization and piscivory of *tessellata* and *maura* and terrestrial habitats on anurophagous *natrix* and *megalcephala* are reflected in the mechanical advantage (MA) of snake jaw (ratio of the in-lever to out-lever). Principal component analysis and discriminant function analysis enable clear distinction of *natrix*, *tessellata* and *maura* specimens; *megalcephala* when considered is placed within *natrix* morphospace. The characters being most important for discrimination between these species are skull height and jaw length, which may reflect adaptation to different habitat (aquatic vs. terrestrial). The results show that *tessellata* and *maura* have slightly lower MA compared to *natrix*, which is congruent with the general trend observed in aquatic, fish-eating snakes.

Reproduction and cold hardiness of the eggs of Siberian wood frog, *Rana amurensis* in the North-East habitat

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Time periods and places of spawning, fecundity and cold hardiness of the eggs of *Rana amurensis* BOULENGER, 1886, which is the northernmost in Asia Anuran species in two populations of the Magadan region, located in the valley of the Tauy and El'gen rivers (59°45'N, 148°32'E and 62°50'N, 152°22'E), were studied. The frogs spawned in shoal of standing and weakly running oxbow and thermokarst ponds, often at a distance of hundreds of meters away from places of wintering. Egg layings (up to 20 in one site) are disposed singly without forming communal surface rafts. At the end of May, 2012, in the valley of the El'gen River embryogenesis came to the end, while near the coast of the Sea of Okhotsk spawning only began. Number of eggs in one laying was 1131 ± 93.8 ($n = 21$; 601–2152); three from 105 analysed layings were unfertilized.

Surviving, supercooling points (SCP) and dehydration in process of freezing of the whole laying, and SCP of single eggs, their jelly capsules and naked embryos, were analyzed. Stay of the whole laying is icebound results in freezing and death of the periphery eggs; those, located in the center stay unfrozen and finish their development under temperature increase. Laying eggs outside water (when the pool is dried up) freeze without supercooling between -0.2 °C and 0.5 °C, their mass halves due to dehydration. The eggs freeze with supercooling. There is a slight difference between minimum SCP of unfertilized (-5.6 °C) and fertilized eggs (-6.2 °C). Mean SCP of the eggs increase from 15–18 stages to the end of embryogenesis from -4.5 ± 0.1 °C to -3.2 ± 0.2 °C. Jelly capsules have higher SCP (up to -5.3 °C), in comparison with embryos of any state of development (up to -8.5 °C) or early larvae (up to -7.9 °C). Different layings of one state of development have mean SCP of the eggs differed by 1.3 °C, of their jelly capsules or naked embryos by 0.2 °C.

Obtained characteristics of the eggs' cold hardiness and its variation tendencies are similar to those, of syntopic *Salamandrella keyserlingii* and North American *Rana sylvatica*. The eggs of these species have ability to supercooling, that is not inherent to the whole laying as evolutionary secondary structure.

Different effect of thermal and humidity conditions on duration of chemical signals of two sympatric and sister lizard species

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The sensory drive hypothesis states that there is natural selection for signals to effectively stimulate the receiver sensory system and that the nature of the most effective signal design depends on environment characteristics. Male lizards of many species possess holocrine epidermal glands that, during the breeding season, deliver secretions used in intraspecific communication. Effective chemical communication may be also influenced by the environment and different habitats may promote chemical signal divergence even in closed related species. The aim of the present study is to experimentally explore whether temperature and humidity may determine the duration of male chemical signals of two sympatric and closely related lizard species occupying different microhabitats: *Podarcis bocagei* (ground-dwelling) and *Podarcis hispanica* (rock-dwelling). We expected that selection would favour chemical signal adaptation to each environment (physical and/or social). Tongue-flick behaviour (TF) reflects chemical investigation of a stimulus and is often used as a quantitative bioassay of detection of chemical cues in experiments addressing chemosensory discrimination in lizards. We examined signal detectability and persistence (time that signals remain detectable for the receivers) using TF rates of males to other male chemical signals that were exposed during 1, 24 or 48 hours to normal temperature (26 °C; average temperature during reproduction season in the capture area) or to 5 °C of increased temperature; and to an humidity of 60 or 85%. We found that both, temperature and humidity, affect differentially to signalling performance of each species. That is, higher temperature after 24 h and higher humidity after 1 h of exposure reduces detectability of *P. hispanica* male signals. Between species differences in mating system may explain why *P. bocagei* chemical signals seems to be more stable than *P. hispanica* ones.

A preliminary checklist of lizards of Qatar

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Qatar is a peninsula projecting from the Arabian mainland 186 km in the Arabian Gulf and sharing 85 km terrestrial borders with the kingdom of Saudi Arabia. Qatar terrestrial territory covers 11,180 km² and is represented by a relatively flat desert with ca. 100 m a. s. l. Its climate is hot and arid with an average annual mean temperature of 27 °C and 75 mm rainfall per year. Diversity of habitats is little and few natural resources are available other than abundant gas and oil reserves. Overall the harsh desert conditions, the relatively uniform habitat, the increasing industrialization and growing human impact have contributed to sparsely and locally disseminated lizard populations usually with low individual densities. Very few herpetological surveys have been conducted till now and very little is known about the distribution and the ecology of the lizard species present in Qatar. A recent survey and inventory study of lizards has confirmed the presence of 21 lizard species. The only neighbouring country is Saudi Arabia that hosts over 30 lizard species, and some of which might also exist in Qatar. The most abundant family found in Qatar is Gekkonidae with nine species (*Bunopus tuberculatus*, *Cyrtopodion scabrum*, *Hemidactylus robustus*, *H. flaviviridis*, *H. persicus*, *Stenodactylus arabicus*, *S. slevini*, *S. doriae*, *Pseudoceramodactylus khobarensis*), followed by Agamidae with three species (*Trapelus flavimaculatus*, *Uromastix aegyptia*, *Phrynocephalus arabicus*), Lacertidae with four species (*Acanthodactylus schmidti*, *A. opheodurus*, *Mesalina brevirostris*, *M. adramitana*), Scincidae with two species (*Scincus mitranus*, *Trachylepis septemtaeniata*), and Varanidae (*Varanus griseus*), Sphaerodactylidae (*Pristurus rupestris*) and Trogonophidae (*Diplometopon zarudnyi*) with only one species each. Our results will help to understand the terrestrial biodiversity in Qatar, and will lead to establishing better management and conservation activities.

Status of amphibian breeding sites in Derdap National Park, Serbia

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Derdap National Park is an internationally recognized protected area because of its diverse habitats, geological structures, archaeological sites and beautiful landscapes. Twelve amphibian species have been recorded there and additional four species were listed as potentially occurring (16 in total), which represents 76% of the overall amphibian species diversity in Serbia.

In a sample of 30 breeding sites, the commonest amphibian species in the area seems to be *Rana dalmatina* (found in 50% of registered reproductive sites). *Pelophylax esculentus* complex (47%), *Bufo bufo* (37%) and *Salamandra salamandra* (30%) are also common. *Salamandra salamandra* prefers water bodies far from human settlements ($p < 0.01$) in shady places ($p < 0.05$) with low amount of submersed vegetation ($p < 0.05$). *Pelophylax esculentus* complex choose more open landscape ($p < 0.05$), and ponds rich in submersed vegetation ($p < 0.05$). Both species are avoiding heavily exploited water bodies ($p < 0.05$). *Rana dalmatina* prefers temporary stagnant waters ($p < 0.01$) with less or no floatant vegetation ($p < 0.05$).

The highest number of amphibian species occurred in proximity of the entrance of smaller rivers into the Danube. Main local factors of threat are loss of traditional agriculture and alteration of breeding sites into fish ponds. Establishment of amphibians-friendly artificial ponds should be a priority in sustainable management.

Population dynamics and habitat use of two sympatric newt species, *Triturus dobrogicus* and *Lissotriton vulgaris* at the breeding site

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Newt populations were investigated in two small water bodies (a pond and a drainage ditch) in 2010. Newts were caught by funnel traps on nine sampling occasions during the breeding season, and were identified individually by their belly patterns. The relation of abundances and habitat characters was analyzed by a Generalized Linear Models (GLM). In total, 149 smooth newts (*L. vulgaris*) and 94 Danube crested newts (*T. dobrogicus*) were caught in the pond, while 42 smooth newt and 74 crested newts were collected in the drainage ditch. The number of *L. vulgaris* females was higher than that of *T. dobrogicus* at both breeding sites. Individuals arrived earlier, usually spent longer time at the breeding site. First and second recapture rates (RR) were quite similar for the two species in the pond habitat (*L. vulgaris* first RR 20%, second RR 4.1%; *T. dobrogicus* first RR 19.7%, second RR 5.6%). On the contrary, RR were substantially smaller and differed remarkably between species in the drainage ditch (*L. vulgaris* first RR 13.5%, second RR 0%; *T. dobrogicus* first RR 4.6%, second RR 3.0%). The average distance of moving among the traps was quite similar for both species: 9.2 m (*L. vulgaris*) and 10.8 m (*T. dobrogicus*) in the pond, and 12.2 m (*L. vulgaris*) and 10.0 m (*T. dobrogicus*) in the ditch. The abundance of smooth newt showed a positive association with duckweed and reed-mace covering alike. This finding suggests that the meso scale habitat heterogeneity is favourable for this species. The abundance of Danube crested newt showed only a weak positive association with the open water surface. Our results demonstrate that population dynamics of newt species can substantially vary depending on the type of the breeding habitat still within a single breeding season. Considering the sharp contrast between climates of subsequent years, the small, temporary aquatic habitats should receive greater importance in the conservation of newts, especially in a fragmented landscape.

Cellular bases of body size variance in the fence lizard *Sceloporus undulatus* (Phrynosomatidae) from different latitudes

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No one knows why many species of ectotherms and endotherms attain larger body sizes at higher latitudes. Mammals, birds and turtles usually follow this so-called Bergmann's rule, but not lizards and snakes. In contrast to general tendencies of lizards, in the North American lizard *Sceloporus undulatus* individuals from northern populations are typically larger than individuals from phylogenetically related populations from the south. Our study evaluates how differences in body size between four geographically distant populations of *S. undulatus* (from Nebraska, Florida, Indiana and Texas) link to changes in the size of cells in two tissue types—red blood cells and skeletal muscles. We discuss results in the context of emerging theory on changes in the adaptive value of cell size across thermal environments. Understanding how and why cell size changes with latitude in *S. undulatus* can help future work that aims at finding ultimate explanations of Bergmann's clines in ectotherms.

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How accurate do 2D geometric morphometrics quantify shell shape in chelonians?

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Among the 330 recognized extant species of turtles and tortoises, near 50% are listed as “Threatened” which makes them among the most endangered of the major groups of vertebrates. A key challenge for conservation plans is to suppress threats that may reduce the fitness of a population. For that reason it is crucial to identify straightforward and reliable methods that can recognize important units for conservation. Up to date, many chelonian studies have analyzed shell shape variation from the conservation point of view and its association with other variables (physiological, historical, and environmental) as well. The shell shape is usually quantified by traditional morphometrics and, less commonly, using geometric morphometrics (GM). Despite the recognized advantage of both 2D and 3D GM over traditional morphometrics in characterizing shapes, their utilization is limited to museum collections or dead specimens. However, long-term comparative field studies on free-living specimens are a key for conservation research and the use of GM would be beneficial. Here we compared how precise and accurate 2D GM quantifies shell shape and proposed its utilization for field studies. We analyzed carapaces (vertebral and costal plates) and plastrons of 21 specimens belonging to five chelonian species using both 2D and 3D GM. 2D GM quantified shell shape with notably high precision for the symmetric component of shape variation. In contrast, the asymmetric component of shape variation exhibited less precision probably because of confounding variation introduced by the position of the camera. Geometric properties of a shell shape matched closely between 3D and 2D GM suggesting appropriate accuracy of a 2D GM approach for the symmetric component of the shape variation. In summary, 2D GM can be used in studies of free-living chelonians giving opportunities for a more rigorous estimation of shell shape and its association with fitness in the field.

Late Pleistocene herpetofauna from the Baranica Cave (Serbia)

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Baranica cave is located in the southeastern part of Serbia, about four kilometers south of Knjazevac. Archaeological research of this cave was carried out in period 1994–1997 (Faculty of Philosophy from Belgrade and the National Museum of Knjazevac). A large amount of fossil vertebrate remains was collected during the archeological excavation. The fossil material includes remains of large and small mammals prevailing over the other vertebrates (fish, amphibians, reptiles and birds). The revealed profile has four visible layers while layers 2 and 4 showed a significant wealth of fossil remains. The age of these layers was determined as Upper Pleistocene by absolute dating of bones of large mammals (23,520 ± 110 B. P. for Layer 2 and 35,780 ± 320 B. P. for Layer 4). This paper presents the herpetofauna collected in excavations at Baranica I in 1995. The collected material is partially damaged (broken) and includes isolated bones of representative amphibians and reptiles, while the most numerous items are snake vertebrae. Following taxa were identified in analysis of remains: *Natrix natrix*, *Vipera berus*, *Elaphe longissima*, *Vipera ammodytes*, *Lacerta* sp., *Rana* cf. *ridibunda*.

Habitat preference of fire salamanders (*Salamandra salamandra*) in Stiavnické Vrchy Mountains

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In case of amphibians like fire salamander (*Salamandra salamandra*) the habitat loss and the major changes causes decline or the extinction of the local populations. That is why habitat preference surveys are becoming more important. In our survey we observed a fire salamander population in Slovakia. We captured the metamorphosed salamanders between 2007 and 2011 along a 745 m long line transect on the western side of Makoviste mountain in the Stiavnické Vrchy Protected Landscape Area (CHKO Stiavnické Vrchy). 9% of the 177 captured and identified individuals were recaptured at least one time. We managed to characterize the habitat in 5–5 quadrats in the 4 different parts of the forest using 12 environmental parameters. We have complemented these 20 quadrats with 2 × 5 quadrats, where we had information about the presence and absence of the species. We made a Principal Component Analysis (PCA) with the gained datas. According to our results the habitats differ mainly in the ratio of uncovered and gravel surface coverage, and in the average of the tree trunk circumferences. We found the highest density of fire salamanders in two habitats, where forest stands has completely different age and species composition. These habitats has nearly the same surface coverage ratios. Analysis of the data gained from the quadrats situated according to presence and absence showed, that while the species composition of the forest vegetation appears to be irrelevant, the ratio of uncovered and gravel surface coverage were those factors which influenced the presence of the species. According to the results of our survey we ascertained that in the observed area fire salamanders prefer habitats where the ratio of uncovered surface is relatively high and evade those, where the extent of surface covered with rocks and gravel is more than 50%.

Adaptive potential and phenotypic plasticity of two anuran species, *Rana temporaria* and *Bombina variegata*, from northern Steigerwald (Bavaria, Germany) in a response to thermal heterogeneity

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In order to survive, organisms have to cope with rapid, natural or human-induced changes in habitat structure. Dramatic declines in amphibian species populations worldwide are a result of the complex interaction among multiple stressors, with climate change implicated to be one of the principal factors. Our study focuses on the adaptive potential of two anuran species, the European common frog, *Rana temporaria*, and the yellow-bellied toad, *Bombina variegata*, in the region of northern Steigerwald (Bavaria, Germany), and their ability and potential to answer to the rapid changes in environmental, namely climatological, conditions. We examined the functional responses of those species to potential environmental changes, as well as the scale on which the responses are manifested: at the individual, population or species level. In order to assess the adaptive potential of focal species to variations in temperature conditions, we tested the differences in preferred temperatures among larvae of populations originating from thermally differing microhabitats (exposed vs. closed microhabitats; i. e. open areas against forest). Furthermore, we experimentally examined the larvae's developmental/growth rate adaptations to local thermal conditions, tracking the differences in developmental progress under different environmental temperatures.

What is the 'ideal' stream-adapted anuran larva?

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Stream adaptation has convergently evolved in tadpoles of about 20 anuran families. The evolutionary change enabling adaptation to lotic waters resulted in different 'morphotypes'. Based on this, gastromyzophorous, oroadhesive and pleuroadhesive larvae can be distinguished from a 'standard type' adapted to lotic habitats. But the degree of stream adaptation can also be defined stressing the habitat component. We ask if there is a common pattern of which ecomorphological characters were modified as an adaptation to the lotic environment, and which combination of adaptations may characterise an ideal stream adapted anuran larva. Based on a large and world-wide body of literature, we compiled morphological characters that have been identified as important in conjunction with stream adaptation. We statistically analysed how often these characters were in fact found in stream dwelling larvae. This allowed us to eliminate those parameters that most obviously are not of primary adaptive value for a life in lotic habitats. Degree and combination of different ecomorphological adaptations to lotic habitats vary among species, depending on the habitat itself (fast versus slow flowing water). Some characters were more often found than others, such as numerous labial tooth rows and oral sucker (e.g. *Heleophryne*), large abdominal sucker (e.g. *Atelopus*) or funnel-shaped mouth (e.g. *Leptodactylodon*). Our analysis suggests that no tadpole combined all features identified as important adaptation to life in running water. The variety of combinations realised in larvae of different anuran families reflects (i) the different types of lotic habitats and (ii) hints at numerous phylogenetic constraints on the morphological evolution of stream adaptation.

Bet-hedging in tadpole deposition in the Neotropical frog *Allobates femoralis*

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Within anurans terrestrial oviposition has independently evolved several times, presumably as an adaptation to high predation pressure on eggs and the risk of competing stray sperm from rivals in aquatic environments. Terrestrial egg deposition is observed almost exclusively in tropical regions where it is enabled by the high humidity which prevents eggs from desiccating. The dilemma between terrestrial eggs and the aquatic anuran larvae is resolved in most dendrobatid species by obligatory parental care in the form of tadpole transport. In the Neotropical frog *Allobates femoralis* (Dendrobatidae), clutches are laid in the leaf litter and tadpole transport to water bodies is mainly performed by males. Facing the risks of aquatic predators in, or desiccation of ephemeral pools, the partitioning of larvae over different pools would be a suitable bet-hedging strategy to overcome the risk of total clutch loss. In the present study we assessed the distribution of transported offspring across water bodies in a wild population of *A. femoralis* in French Guiana in spring 2010. We used seven highly polymorphic microsatellite loci and DNA samples of adults and of larvae from 30 artificial pools which had been installed in 2009. Single pools contained on average 43.25 larvae (SD = 57.40). The reconstructed pedigree revealed that of the *A. femoralis* males that were identified as fathers of more than one tadpole, 65.1% had partitioned successive clutches and 25.40% had spread single clutches across multiple pools. The partitioning of single clutches was significantly more often observed in males that were in their second or third breeding season, suggesting older males had probably more experience regarding the location of the artificial pools. Our results clearly demonstrate that *A. femoralis* males use bet-hedging in tadpole deposition by distributing single and successive clutches across several water bodies.

Home range and movement patterns of the Neotropical freshwater turtle *Hydromedusa maximiliani* (Testudines: Chelidae) in southeastern Brazil

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A key factor in conservation biology is a suitable design of protected areas. However, long-term studies are required when determining the size, structure, and shape of these areas for freshwater turtles, thereby integrating essential information to guarantee the reproductive success, recruitment of new individuals into the population and persistence of the population over the years. Nineteen adult animals (10 males and nine females) were fitted with radio-transmitters to analyze the home range, movement patterns, habitat use and selection of *Hydromedusa maximiliani*, an endemic and vulnerable freshwater turtle from Atlantic Rain-forest in Brazil, one of the most threatened ecosystems of the world. Another 18 adult animals (11 females and seven males) were monitored with thread-bobbins. Minimum Convex Polygon, Kernel, and Cluster were applied to measure home range size, which varied between 0.2 and 1.5 ha over a year of monitoring. Mean size was 0.4 ha for both the wet and the dry season. Home range measured using different methods did not differ despite the time difference in their application (72 hrs for thread-bobbins and 1 yr for telemetry). This result reflected the small scale of movements of *H. maximiliani* (3 to 138 m/day). Frequent use of burrows was associated with sedentary behaviour and strong fidelity to site by the turtles within the river. The importance of terrestrial habitat for these turtles is established, and suggests that long-term monitoring is necessary to study this aspect of their biology. Such knowledge will contribute to future conservation strategies together with identification of nesting sites, and habitat use and selection of young turtles.

Release and function of alarm pheromones in agile frog (*Rana dalmatina*) tadpoles

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In response to a predator attack, many prey species release chemical alarm signals that alert other potential prey to the threat. These chemicals, called Schreckstoff, are present in many aquatic vertebrates. While the chemicals and their release mechanisms have been identified in a few species, these seem to vary among species and we know little about how these alarm substances are released in larvae of anuran amphibians. Also, it has been suggested, that Schreckstoff may not only function to alert other individuals, but may also enhance the releaser's survival probability by attracting further predators that interfere with the primary attacking predator. Using tadpoles of the agile frog (*Rana dalmatina*), we experimentally investigated if disturbed individuals release Schreckstoff actively, and if common predators of tadpoles are attracted to chemical alarm signals. As predators, we used larvae of the southern hawker (*Aeshna cyanea*) and of the great diving beetle (*Dytiscus marginalis*), young individuals of the western pike (*Esox lucius*), and adult males of the smooth newt (*Lissotriton vulgaris*). We exposed predators and groups of tadpoles to (1) homogenized tadpoles (all types of cues released by prey), (2) the smell of tadpoles disturbed with a glass stirrer (only actively secreted chemical cues), or to (3) the smell of undisturbed tadpoles (no alarm substances) and recorded their behaviour. Our results suggest that *R. dalmatina* tadpoles can not only passively, but also actively release alarm pheromones. Further, predators moved towards the source of alarm pheromones and, thus, seemed to be attracted by the chemicals released by disturbed tadpoles. It will be interesting to see in future studies to what degree the predator attractant property of alarm pheromones enhances the survival probability of attacked individuals under realistic conditions.

The invasion potential of pet herps under climate change in Europe

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Biological invasions are driven by human-mediated dispersal of individuals beyond their native ranges and worldwide cause severe ecological and economic disruptions. The magnitude of these damages continues to grow in times of growing mobility and economic development with almost all ecosystems being heavily impacted by humans. Pet trade for aesthetic motivations or research needs accounts for the majority of herpetological introductions. Today, most amphibian and reptile species intentionally released or unintentionally escaped are not capable of building invasive populations. The main reason might be a climatic mismatch between their original habitat climate and the climatic conditions at the receiving location. We asked whether anthropogenic climate change, as predicted for the future, does increase the invasion potential of common pet herp species in Europe by employing species distribution modeling approaches. Potential ranges of 25 amphibians and reptiles originating from subtropical climates were computed under their current climatic niche (using occurrence records from both native and, if applicable, invasive ranges) and projected onto climatic simulations for the years 2050 and 2080. The majority of taxa is more likely to occur under climate change in Europe than under current climate, raising concerns that the rate of establishment and hence the magnitude of ecological and economic impacts might increase.

The effect of a common herbicide on survival of agile frog (*Rana dalmatina*) tadpoles in the presence of lethal predators

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ROUNDUP® is one of the world's most widely used herbicide. It consists of two components: glyphosate, which inhibits the synthesis of essential amino acids, and polyethoxylated tallow amine (POEA), which acts as a surfactant. This surfactant can be highly toxic to aquatic animals. It causes morphological changes in tadpoles and decreases their survival. In our study we observed how the acute and chronic presence of the herbicide affects the survival of agile frog (*Rana dalmatina*) tadpoles. We raised tadpoles in outdoor mesocosms at two ROUNDUP® concentrations (0 or 1.5 mg a. e/l glyphosate) and three predator treatments [no predator, caged smooth newt (*Lissotriton vulgaris*), caged dragonfly larva (*Aeshna cyanea*)] in a full-factorial design, using randomized spatial blocks. Twenty days after start we removed tadpoles from rearing boxes, marked them individually, and presented them to free-ranging predators in clear water or in water containing ROUNDUP®. Bioassays lasted for 24 hours. At termination, we counted survivors and identified from which rearing environment they had come from. As we expected, predator-induced responses resulted in significantly elevated survival probabilities of tadpoles. Surprisingly, however, tadpoles reared in the presence of the herbicide also enjoyed higher survival rates in the presence of free-ranging predators, compared to those reared in the control treatment. The acute presence of the herbicide during the bioassays also lowered predation rates. Consequently, while spill-over of environmental contaminants into pristine habitats can be very harmful to some species, it may also have unexpected positive effects on others. This result supports the notion that effects of contaminants need to be tested on a row of species and investigations relying on one single or just a few indicator species can be misleading.

Diversity of lateralization patterns in *Tarentola* geckos

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The existence of laterally-biased behaviours in vertebrates is traditionally interpreted in terms of saving costly duplication of neural circuitry and decreasing contradictory orders from the two hemispheres. However, when applied to antipredator behaviour, this is only valid from point of view of individuals. At higher levels, being prey behaviour lateralized could carry negative implications, especially if predators may make prediction after multiple encounters with prey. These conflicting pressures, namely between the advantages for individuals, and the disadvantages for populations could be concealed if higher-level lateralization would arise from the combination of lateralized behaviours of individuals which are mutually dependent. Here, we investigated the lateralization patterns in escape behaviour by six species of the gecko genus *Tarentola* undergoing a predatory attack simulation in a “T” maze experiment. Contrary to early claims for invariant lateralisation patterns in vertebrates, results showed that gecko populations and species displayed variable degrees of lateralization. While showing a general trend for escaping to the right refuge, some species showed left- and no refuge preference.

Phylogenetic signal of the advertisement call in tropical hylids (*Smilisca* and *Tripriion*)

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Advertisement calls are important in species recognition and reproduction in many animal taxa and, hence, sexual selection drives sound signals to be species-specific traits. However, the evolution of these sexual traits also likely reflects the evolutionary history of taxa. Here, we study the phylogenetic signal underlying advertisement calls in tropical hylids (*Smilisca* and *Tripriion*), which may provide insights into the evolution of sound signals and the debated phylogenetic relationships of species within these genera. We generate a phylogenetic hypothesis based on datasets available from GenBank and the Animal Sound Library of MNCN (Fonozoo). We compare our results with previously published studies, discussing the utility of advertisement calls in phylogenetic reconstruction. Moreover, we reconstruct, on the proposed phylogeny, the ancestral character states of advertisement calls (i. e., temporal and spectral features), and we perform phylogenetic generalized least squares (PGLS) analyses to examine the evolutionary changes in the characters and their correspondence with the phylogenetic history of the group. We discuss the results of the phylogenetic and comparative study in reference to the historical scenarios for the diversification within the group and the current distribution of species to understand the different evolutionary processes shaping the evolution of sound signals in these tropical hylids.

Sublethal concentrations of glyphosate affect the life history and antipredatory behaviour of Iberian amphibians, which could reduce their probability of survival

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Sublethal doses of glyphosate may have hidden effects which could reduce the probability of survival and cause delayed mortality in amphibians. For instance, the time to complete metamorphosis is a significant ecological pressure, especially for species occupying temporary ponds. If sublethal doses of glyphosate affect growth and delay metamorphosis, this may suppose that larvae will not conclude the metamorphosis quickly enough or that they will with a smaller size, compromising their long-term survival. On other hand, amphibian larvae reduce their activity level when they detect a predator to prevent to be localized. However, this also involves costs (lower feeding and development rate) that may affect long-term survival. Sublethal doses of glyphosate could also alter these delicate trade-offs causing indirect mortality (due to predation, for instance). Thus, first we determined by laboratory tests the lethal concentrations (LC_{50-96h}) for seven species of Iberian amphibians. The most resistant species were *Alytes obstetricans* and *Pelophylax perezi*, whereas the most vulnerable were *Pelodytes punctatus*, *Bufo calamita* and *Rana temporaria*. Second, we calculated the glyphosate concentration that is expected in small ponds following the recommended herbicide use in Spain (expected environmental concentrations, EEC). Then, we examined growth, time to metamorphosis and size at metamorphosis of *P. perezi* and *P. punctatus* tadpoles, after being exposed to EEC or clean water. We also examined growth and antipredatory behaviour (activity level of larvae before and after perceiving the odour of a predator) of *A. obstetricans* tadpoles exposed to 1/3 of their LC₅₀ or clean water. Larvae exposed to EEC presented lower rate of growth, and metamorphosed earlier and at a smaller size. In addition, *A. obstetricans* larvae exposed to sublethal glyphosate concentration presented overall lower rate of activity and a further reduction of their activity in face of a predator.

Differences in metabolic needs may relax competition and enable coexistence of several species of tadpoles within a Mediterranean anuran community

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Volterra's models suggested that n species could not coexist indefinitely on fewer than n resources, but numerous examples of coexistence apparently violate this competitive exclusion principle. The anuran community of our study area (Girona Province, NE Spain) comprises a total of 9 anuran species that, although showing different preferences, are usually forced to coexist in their larval stages. Thus, with a high niche overlap, this system is highly suitable to evaluate the mechanisms developed for their coexistence. The aim of the study was to evaluate the metabolic mechanisms that may enable coexistence by assessing food exploitation abilities of all tadpole species present in the study area. This was done using a standardized experimental protocol, analyzing metabolic and morphologic parameters of all species in the same conditions. We first determined which variables better explained the growth rate of tadpoles, so then we could explore the specific differences in the tactics used to exploit resources among species. Therefore, we were able to classify species into different general strategies and relate these strategies with ecological and evolutionary implications. Growth Rate was the response variable and unexpectedly the only one to show a significant phylogenetic signal. However, Consumption rate and Production efficiency were the most important variables defining individual Growth rate, surpassing species in importance and leaving Assimilation efficiency and morphologic aspects like Gut length a marginal importance. Consumption rate and production efficiency defined a gradient of "consumer vs. efficient" strategies in which our species are spread according to several ecological patterns. Our data on the exploitation abilities of each species may lead to a better comprehension of the guild structure of European tadpole communities in general as a good example of a competing grazers' community.

Batrachochytrium dendrobatidis detection in amphibian samples using real-time PCR with SYBR GREEN chemistry

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Chytridiomycosis is an emerging infectious disease of amphibians caused by the fungus *Batrachochytrium dendrobatidis* (*Bd*). BOYLE *et al.* (2004) developed a method for detecting *Bd* using real-time Taqman PCR assay. Starting from this method, we have set up and validated a real-time PCR assay based on the cheaper SYBR GREEN chemistry. Primers used for real-time PCR were designed on the basis of the Boyle's ITS-1/5.8S rDNA sequence with some modification for forward primer. Efficiency has been determined by a ten-fold serial dilution ranging from 100 to 0.1 *Bd* GE. By using fast real-time PCR assay we analyzed the extracted total nucleic acids from a toeclip of the invasive bullfrog *Lithobates catesbeianus*, caught near Turin (Piedmont, NW Italy) from an infected population. Histological preparations from the same individual were also performed for comparison. Primers amplified a 146-bp product in ITS-1/5.8S rDNA region with a 100% efficiency. We were able to detect 1 *Bd* GE in total nucleic acids extracted from the bullfrog in 1:10 diluted sample (final concentration detected: 10 *Bd* GE). This assay constitutes a further powerful tool to help the detection of *Bd* in the wild, thus contributing to the monitoring and the conservation of amphibian populations.

Reactions of green lizards (*Lacerta viridis*) to the defensive secretion of *Graphosoma lineatum* (Heteroptera: Pentatomidae)

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Chemical defence of true bugs (Heteroptera) is based on repellent secretions (synthesized or sequestered), which may signal the unpalatability or be directly toxic for the predator. We have tested the reaction of wild-caught green lizards (*Lacerta viridis*) as potential predators of true bugs in order to find out (1) whether green lizards avoid the chemically defended true bugs, and (2) which of the components of true bug defensive secretion are aversive for lizards. The striated shieldbug (*Graphosoma lineatum*) was used as a model prey species. The following chemicals, which form major components of shieldbug defensive secretion, were tested separately (applied on palatable larvae of *Tenebrio molitor* [mealworms]): mixture of three aldehydes (2-hexenal, 2-octenal, 2-decenal), the same aldehyde mixture enriched with tridecane, oxoaldehyde (4-oxohex-2-enal) and direct extract from metathoracic scent glands of adult *Graphosoma lineatum*. Hexane and mealworm without any chemicals added were used as controls. Aversive reactions were evaluated on the basis of latencies to the beginning of attacking/eating the prey with particular chemical components. The longer the response time, the stronger the intensity of aversive reaction. The strongest rejection of prey was elicited by direct secretion of *G. lineatum*. The results show that the mixture of aldehydes is aversive for green lizards. On the contrary, the mixture of aldehydes and tridecane has smaller effect. Oxoaldehyde caused stronger aversive response than mixture of three aldehydes and tridecane in latencies of eating the prey. The effectiveness of oxoaldehyde was enhanced by predator's experience with living shieldbugs. Unlike other chemicals tested it seems that the oxoaldehyde does not work as an olfactory signal but it becomes aversive in association with direct experience after eating the prey with oxoaldehyde compound.

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Ecotoxicological risk of cadmium, lead, and mercury to early life stages and the reproductive function of reptiles

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Cadmium, lead, and mercury are harmful environmental contaminants of global concern, with a high potential to cause developmental and reproductive disorders in humans and animals. For reptiles, high accumulation levels of these metals were reported, but related risk is unknown. Considering that such effects may directly affect population viability, the present study aimed at rating the risk of Cd, Pb, and Hg to reptiles by comparing internal exposure levels of reproductive and early life stage (RELS) compartments reported in the literature as the best available indicators of toxicological availability in target tissues with threshold levels causing reproductive and developmental effects in reptiles and birds as the established surrogate taxon. Overall 54 original publications (Pubs) reported concentrations of these metals in 18 different RELS tissues (including male and female gonadal system as well as egg, embryo and hatchling compartments) for 24 reptile species. Despite this patchy data set, maternal transfer was confirmed (10 Pubs), internal exposure of RELS was almost ubiquitous, the observed concentration levels matched those reported for birds and exceeded the thresholds causing relevant sublethal effects in birds by factors of 10–100. Regarding the effects of Cd, Pb, and Hg to RELS of reptiles, the database turned out to be particularly small as it included only 11 Pubs (9: Cd, 1: Pb; 1: Hg) out of which there was evidence for interactions with the gonadal axis of the endocrine system (for Cd and Pb), developmental disorders (Cd) and changed gene expression in ovary and embryos (Cd) at exposure concentrations at factors 100–1000 below the observed RELS tissue concentrations. In conclusion, this review indicates that for reptiles, both toxicological availability and sensitivity of RELS to Cd, Hg, and Pb may be widespread even at the micro-pollution scale, and research appropriate to understand source to adverse outcome pathways is urgently needed.

Genetic characterisation of isolated populations of Aesculapian snakes (*Zamenis longissimus*)

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Zamenis longissimus occurs over a wide range of Europe and in one separate population in northern Iran. Apart from the contiguous distribution several isolated populations can be found. Though Aesculapian snakes occur over a broad range they seem to decline in numbers in many regions. While isolated populations are most severely affected, numerous populations within the main range are also facing problems. The most serious threats to *Zamenis* are mainly human-associated like habitat loss and fragmentation. When large connected areas of suitable habitat are getting altered (e. g. by intensive agriculture, human dwelling, road-building) and only small patches of the former habitat remain. Depending on the amount of the remaining habitat patches and the distance between them, these factors are leading to a reduced population size, as well as to the fragmentation of populations. A serious problem for small and isolated populations is that they are more prone to stochastic factors like genetic drift, inbreeding and loss of genetic diversity, which can be another cause of extinction.

Within the framework of a dissertation these genetic factors are investigated more closely to evaluate the risk of extinction of *Zamenis* in isolated populations. Therefore several molecular methods have been applied already to compare isolated with non-isolated populations of Aesculapian snakes. Until now genetic samples from two completely isolated populations from Germany (Schlangenbad and Hirschhorn) and from one area within the main distribution area in Hungary (around Budapest) have been analysed. Besides sequence analyses of mitochondrial genes (CytB, ND1) different genetic markers for the investigation of genomic DNA [Inter-Simple-Sequence-Repeats (ISSR), microsatellites, multi-locus fingerprinting] have been applied. These results indicate a significant decreased genetic diversity within isolated populations.

Age structure and body size in two populations of the northern banded newt *Ommatotriton ophryticus* (BERTHOLD, 1846) from Turkey

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The aim of the current study was to determine of age structure and body size of two different populations of *Ommatotriton ophryticus* from northern Turkey.

We studied 50 samples (20 males and 30 females) from Bahçesultan/Bilecik (1015 m a. s. l.) and 60 samples (30 males and 30 females) from Tosya/Kastamonu (1239 m a. s. l.). Adult males and females caught during the breeding season all possessed external secondary sexual characters and were considered mature. We measured the snout-vent length (SVL) of individuals to compare the body size of the populations. The age was determined by skeleto-chronology performed counting lines of arrested growth (LAGs) of the phalanges.

Results showed that the maximum lifespan was 9 years in Tosya and 10 years in Bahçesultan. Age at sexual maturity of both males and females was 4–5 years in the Tosya while 6 years for both sexes in the Bahçesultan population. No significant differences were found between the age distributions of the sexes in Bahçesultan ($t = -0.05$, $p = 0.961$) while there was a significant difference in Tosya ($t = -2.337$, $p = 0.023$). The age structure of males ($t = -2.987$, $p = 0.004$) varied significantly between populations whereas there was no significant difference in females ($t = -1.482$, $p = 0.144$). The SVL (snout-vent length) ranged from 64.09 to 78.87 mm for males and from 57.64 to 70.72 mm for females in Bahçesultan. It ranged from 58.41 to 71.55 mm for males and from 50.33 to 61.83 mm for females in Tosya. Significant differences were found between sexes and also between the populations in terms of mean SVL. A significant correlation between age and snout-vent length (SVL) was found for females while no significant relationship was determined for males in both populations.

Phylogeography of *Leptopelis* frogs across the sky islands of the Eastern Arc Mountains in East Africa

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Five *Leptopelis* species are distributed in the “sky island” system of the Eastern Arc Mountains of Kenya and Tanzania. Four of these species are confined to forest habitats scattered along different mountain blocks, typically at high elevations. The sky island system is an ideal area for a comparative phylogeographical study to investigate common patterns in shaping genetic variation in different species. We studied mitochondrial and nuclear DNA sequences of the four montane species, *L. barbouri*, *L. parkeri*, *L. uluguruensis*, *L. vermiculatus*, and one widespread species common in lower and mid-elevations, *L. flavomaculatus*. A common pattern showed the presence of numerous highly divergent lineages between most montane populations concordant with geography, while the widespread *L. flavomaculatus* is genetically relatively uniform. This pattern appears to be the result of the complex geological history of the region and Quaternary climatic oscillations. Such change affected the extent of forest habitats, and thus enabled or disabled gene flow between different mountain blocks.

Herpetofauna of northern Cambodia: biodiversity, ecology and zoogeography

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After years of civil unrest hampering any research, the recent herpetofaunal investigations in Cambodia focused on the mountainous areas in the Southwest (Cardamom Mountains) and East (the Greater Annamites Ecoregion) of the country. Between 2008 and 2011 we conducted extensive herpetological baseline surveys within the Phnom Kulen National Park and the Kulen Promtep Wildlife Sanctuary located in northern Cambodia, which revealed a surprisingly high herpetofaunal diversity taken the relative low-land character (only up to 487 m a. s. l.) of the protected areas into account. A total of 84 species (25 amphibian species, 59 reptile species) was found, of which four (*Kaloula mediolineata*, *Leiolepis rubritaeniata*, *Sphenomorphus lineopunctulatus*, *Tropidophorus cocincinensis*) were recorded for the whole of Cambodia for the first time. To get insight into the mostly understudied feeding ecology of the recorded species, stomach content analyses of 623 specimens were undertaken. Finally, based on a zoogeographical comparison of species communities with better-studied neighbouring geographical areas, we were able to integrate the revealed herpetofaunal community of northern Cambodia into a more general view of broader-scale distribution patterns in Southeast Asia.

Habitat use and daily activity of *Lacerta viridis* and *Lacerta agilis* in a cemetery

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Cemeteries tend to contain diversified habitat patches and can play significant role in temporal or permanent establishment of reptiles in urban areas due to their moderate anthropogenic disturbance. The aim of our study was to examine the population size of the lizard species occurring in an urban cemetery, and investigate their daily activity pattern. The survey was carried out in eight parcels with different age and vegetation structure of the cemetery of Dunaujváros town, Hungary, during 1–7 July, 2012. Parcels were characterized by the area of the grassy, bushy and arboraceous patches, the sunny and the shaded ground patches. Lizard observations were made in the mornings, at middays and in late afternoons. Occurrence data were analysed by a generalized linear mixed model (GLMM) using binomial distribution in which the days of observations and the cemetery parcels were used as random factors. During the survey, two lizard species (*Lacerta agilis* and *L. viridis*) were detected. In the eight parcels, the total number of the *L. agilis* observations was 178 and that of the *L. viridis* observations was 79. In general, lizards were more abundant in the more patchy, some decades old parcels than in the more homogenous, recently formed ones. However, *L. viridis* tended to occur in the more bushy parcels than *L. agilis*. Both species showed similar daily activity pattern. The probability of occurrence was associated to the temperature and observational time. According to the GLMM model, lizards showed the highest probability of occurrence between 12 a. m. (ca. 31 °C) and 14 p. m. (ca. 33 °C). The variance of occurrence probability associated to the cemetery parcels was 4.28 times greater than the variance originating from the differences of the observational days. Consequently, it seems that direct local environmental factors influence more the dial activity of lacertid lizards than the differences among the observational days do within a short (ca. one week) time period.

Amphibian parasites in the Hortobágy National Park: preliminary findings

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Parasites are becoming recognized as significant participants in the evolutionary game and are seen as perfect model systems for general evolutionary studies. Our present knowledge of the adult platyhelminth parasites of vertebrates in Hungary especially in the Hortobágy National Park is defective. Our aim of examination was to reveal the helminth fauna of the *Pelophylax esculentus* complex and compare our findings with the results of previous studies and compare the faunistic changes now with a baseline from more than 40 years ago. Fifty-nine individuals of *Pelophylax* spp. were collected between May and September of 2012 (35 *P. ridibundus* and 24 *P. kl. esculentus*) and we found the following species of parasites. Digeneans: *Haematoloechus variegatus*, *Opisthioglyphe ranae*, *Diplodiscus subclavatus*, *Pleurogenoides medians*; nematodes: *Oswaldocruzia filiformis*, *Rhabdias esculentarum*; acanthocephalans: *Acanthocephalus ranae*. *Rhabdias esculentarum* is a new species for the Hungarian fauna and *P. ridibundus* represents a new host record for *Rh. esculentarum* in Europe, while *D. subclavatus* is also a new species for the fauna of the Hortobágy. The prevalence was 84.7% [95% CI: 73.05–92.05] in the examined water frog population. The mean intensity was 2.44 (± 1.49) helminth species per host. No host contained more than 6 species: 15 (25.4%) of 59 *Pelophylax* spp. harbored 1 species, 13 (22%) harbored 2 species, 12 (20%) harbored 3 species, 6 (10%) harbored 4 species, 3 (5%) harbored 5 species, and 1 (1.6%) harbored 6 species.

The importance of direct chemical cues for predator detection in tadpoles

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The ability of prey to respond adaptively to the presence of predators depends on the availability of reliable cues. Chemical cues are generally considered the most important modality for predator detection in the aquatic environment, especially so in turbid waters. Chemical cues on predation threat include general prey metabolites that are excreted upon stress, special disturbance cues that are costly to produce and are released actively upon attack, cues that are passively released from injured prey tissue, cues originating directly from the predator, and constituents of prey tissue released through digestion by predators. While digestion released cues may reveal significant information about the predator species present and the types of prey it has been feeding on, we know rather little about to what degree prey take advantage of the information coded in the excretions of their predators. Here we investigated whether tadpoles of the common frog (*Rana temporaria*) use the information present in the excretions of predators by investigating whether tadpoles adjust their induced defences depending on the diet of predators even when cues released by prey upon attack are excluded. We reared tadpoles in the presence of caged predators (*Aeshna cyanea*). We fed predators different types of prey outside the mesocosms. Two hours after food provisioning, we removed remaining prey, washed the predators and replaced their water. Another two hours later, we placed predators back into the mesocosms. To assess variation in the induced defences of tadpoles, we monitored behaviour and assessed morphology. Our results showed that the among-treatment pattern in the magnitude of behavioural changes was very similar to that observed in the morphological changes of tadpoles. Also, the strength of the response depended on the feeding history of predators. These results support the hypothesis that tadpoles extract information from the excretions of their predators.

Reduced impact logging and climate extremes: mutual determinants of homogenisation in tropical amphibian communities?

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The analysis of variation in species composition can provide fundamental insight into the processes leading to either homogenisation or diversification of tropical ecosystems that are exposed to human disturbances and/or climatic extremes. In our study we investigate beta-diversity pattern changes of amphibian communities in the lowland forest of Guyana that are exposed to (a) selective logging and (b) extreme weather anomalies. We specifically analysed compositional change at different spatial scales and different species rarity-dominance weight ratios. Data was collected in three consecutive years (2009–2011) within a controlled poly-cyclic timber harvesting scheme implemented by our project partner Iwokrama International Centre for Rainforest Conservation and Development. In addition to the logging impacts, the study area was exposed to an extreme weather anomaly during the first sampling year, resulting in a prolonged drought period. A pressing question that needs to be addressed is thus whether such extreme events aggravate the effects of logging disturbance and consequently shape diversity patterns through an additive amplifying process? Our results show that it is important to consider these synergistic effects when interpreting diversity pattern changes. Both extreme climatic events and selective logging had a rapid but also complex effect on amphibian composition. Beta-diversity patterns differed not only depending on time since logging, but also with regard to the emphasis given to rare or abundant species in the analysis. As particular species disappeared, others colonised or increased in abundance. And while impacted communities remained stable under the climate extreme event, pristine communities were very sensitive to drought. The next step in our analysis will be to investigate how changes in species composition will affect trophic networks in our study sites and how this in turn will impact ecosystem processes.

Occurrence of blood parasites in Spanish terrapins (*Mauremys leprosa*) from the southwestern Iberian Peninsula

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Studies of blood parasites of turtles have been scarce and were based on visual examination of blood smears to detect parasites. Here, a total of 54 adult Spanish terrapins (*Mauremys leprosa*) from two localities on Southwestern population of Iberian Peninsula, were screened for apicomplexan parasites of the three genera *Haemoproteus*, *Plasmodium* and *Hepatozoon* using a recently developed polymerase chain reaction method. Overall prevalence was 57%. Prevalence of *Hepatozoon* spp. (54%) and *Plasmodium* spp. (9%) was detected. No individual was infected with *Haemoproteus* spp. Of the infected turtles, 6% carried mixed infections. We also found four genetically distinct parasite lineages infecting terrapins (2 *Plasmodium*, 2 *Hepatozoon*). Turtles from different localities significantly differed in their overall prevalence. However, overall prevalence did not differ between sexes. These new methods might have strong impact on several aspects of research on turtle blood parasites and could be applied for management and conservation of wild populations.

Are alien tree plantations ecological traps for amphibians? Effects on immune response and secondary sex characteristics of palmate newts

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In the last century, the natural environment has been converted to anthropized environment on an unprecedented scale. The new simplified habitats have different selective pressures comparing with natural ones, so they are exploited by species adapted to them that can tolerate dramatic changes. However, although some species identify these habitats as right ones, when they are not able to adapt to the new environmental conditions, anthropized habitats may act as ecological traps. The palmate newt (*Lissotriton helveticus*) has a wide distribution, often appearing in eucalyptus and pine plantations. However, since tree plantations may be acting as ecological traps, the health condition of individuals could be worse than those living in natural habitats. To examine this hypothesis, we studied the health status in breeding males captured in six eucalyptus and six pine plantations, and six oak forests. We estimate the capacity of response of the immune system with phytohemagglutinin tests. Moreover, males show secondary sex characteristics as hind feet webs, caudal crest and caudal filament. These seem to be honest signals that depend on the quality of the individual and the reproductive success of each individual will depend on them. Therefore, they can also be used as quality indicators of the individuals living in different habitats. Hence, we measured the caudal filament's length and the crest's height of the captured individuals. We found that both health status and sexual signals were different between populations: those living in eucalyptus plantations had worse immune response and less development of sex characteristics. Our results indicate that eucalyptus plantations have a negative effect on this species, with direct consequences, as worse immune capacity, and evolutionary ones, as the alteration of sexual selection mechanisms.

Home range and habitat selection of the endangered Euphrates softshell turtle *Rafetus euphraticus* (DAUDIN, 1812) in a fragmented habitat in southwestern Iran

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We present the first information on home range size, space use and habitat selection for the endangered Euphrates softshell turtle *Rafetus euphraticus* (DAUDIN, 1802) from Karkheh Regulating Dam Lake in southwestern Iran. Fourteen turtles were trapped, including two juveniles and 12 adults, and subsequently fitted with radio tracking transmitters. Each turtle was relocated between 21 and 51 times between May 2011 and July 2012 resulting in a total of 254 fixes. The mean home range length (LHR) was 2.54 ± 0.83 km. The LHR was variable (CV = 33%) among individuals but there was no statistically significant relationship between linear home range size and straight carapace length (SCL) and linear home range size and body mass. The mean river channel area was 55.35 ± 17.98 ha. The mean minimum convex polygon home range size (MCP) was 47.49 ± 23.36 ha and the mean 95% kernel home range size was 21.75 ± 9.44 ha. Home range overlap was high. On average, individual MCP home ranges overlapped with MCP home ranges of 7.5 other turtles, individual KDE home ranges overlapped with those of 7.3 other turtles, and core areas overlapped with those of 5.5 other turtles.

What limits range overlap of common and Syrian spadefoot toads: climate or competition?

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Four species of the spadefoot toad genus *Pelobates*, mostly allopatric, are distributed over parts of Europe, North Africa, Caucasus, and the Middle East. Ranges of *P. fuscus* (*Pf*) and *P. syriacus* (*Ps*) overlap over a narrow strip in Dagestan and along Danube, in the Balkans. Our study focused on investigating (i) factors limiting the range overlap of the two species (climate or competition), and (ii) possible changes in their geographic ranges under future climate change scenarios. We computed climatic suitability models using MaxEnt and projected their distribution onto future (i. e., A1B, A2, B1 scenarios) and past conditions (i. e., Last Interglacial and Last Glacial Maximum). Additionally, we used fossil occurrences to test the predictive accuracy of past projections. Finally we assessed the degree of range overlap between the studied species using metrics implemented in ENMTools. The present climatic niche was slightly extended outside the known geographic range, in the Caucasus and the Balkans, south for *Pf* and north for *Ps*. The last interglacial distribution of *Pf* included British Isles, and broad areas in western, central and northern Europe, and extended farther north in the Balkans for *Ps*. Validation with fossil records revealed an excellent predictive performance (Omission error = 4.1% for *Pf* and 16.6% for *Ps*). Last Glacial Maximum maintained only isolated refugia in southern Europe, Pannonian Basin and Caucasus for *Pf*, and Israel, Southern Balkans, and Caucasus for *Ps*. Present potential distributions revealed a narrow range overlap (Range Overlap = 0.44), while under Last Glacial Maximum the two species had nearly disjunct allopatric distributions (Range Overlap = 0.17). The range overlap is projected to increase towards the end of this century. The species' absence from climatically suitable areas supports the hypothesis that dispersal barriers and competition limit their geographic range.

Mitochondrial phylogeography of three species of slow worms (*Anguis*) in the Balkans

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The Balkan Peninsula has played a role of a speciation and radiation centre in evolutionary history of slow worms (*Anguis* spp.). Four from five known species are present in the region. However, knowledge of the detailed distribution ranges of the species and their contact zones in the Balkans remains insufficient. In the first step of this project we genotyped 193 individuals from 152 localities of this region based on mitochondrial DNA (ND2) to map distributions and contact zones of mitochondrial lineages/species and to screen their mtDNA diversity. According to our results, *A. fragilis* is relatively widespread in the north-western and central Balkans, south-westward from the Danube River. Relative genetic uniformity of this species suggests a recent dispersal within the Balkans. *Anguis colchica* has been identified in the north-eastern and eastern Balkans in Romania, Serbia and Bulgaria. This species forms several divergent evolutionary lineages within the Balkans, probably related to different Pleistocene refugia. *Anguis graeca* was, beside Greece, Albania and southernmost Montenegro, newly detected in Republic of Macedonia. In comparison to the other species, this Balkan endemic shows much higher and complex genetic variation. This finding corresponds to the hypothesis of multiple Pleistocene microrefugia in the southern Balkans, the pattern similar to other endemic species. Further investigations will evaluate variation in nuclear genes allowing detection of historical or recent hybridization events.

Phylogeography of *Stellagama stellio*: resolving the relationships within its subspecies

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The rougntail rock agama *Stellagama stellio* (LINNAEUS, 1758), until recently one out of 20 species of the genus *Laudakia*, comprises the commonly recognized subspecies: *stellio* (Greece, Turkey, Syria, Lebanon, Israel, Jordan), *daani* (Greece and Turkey), *cypriaca* (Cyprus), *vulgaris* (Egypt), *brachydactyla* (Jordan, Saudi Arabia, Sinai, Israel), *picea* (Jordan, Syria, Saudi Arabia) and *salehi* (Sinai, Israel). Despite extensive research focusing on the morphology-based taxonomy of *S. stellio*, the phylogenetic relationships among the aforementioned subspecies remain unclear. This is the first study aiming to resolve the phylogeography of the *stellio* complex along the species' distribution and illustrate the resulting taxonomic consequences. For this purpose, we used more than 80 *Stellagama stellio* specimens belonging to all above subspecies. Two partial sequences of a mitochondrial (ND4) and a nuclear (Nktr) gene were targeted and several phylogenetic (Maximum Likelihood and Bayesian Inference) and phylogeographic (BEAST) approaches were performed. Taxonomic implications regarding the status of the various subspecies and the distribution of the produced phylogenetic lineages in view of the known palaeogeography of the region are discussed.

Creating open water surfaces substantially increases amphibian biomass in eutrophic wetlands

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Amphibians and reptiles could have vast biomass and usually play a crucial role in trophic networks in wetland areas, therefore suitable habitat management for herpetofauna is vital in wetland ecosystems. In 2012 open channels had been created by sweeping in an exceedingly eutrophic area of the Ócsai Öregturján, a Natura 2000 Habitat Directive site, which had improved habitat complexity. In this research we made herpetofaunistic assessments in fixed transects along the newly swept and older channels to follow changes in species composition and biomass during vegetation periods and between years. We investigated if species abundance and colonization in the channels depended on the distance to undisturbed habitats, aquatic and riparian vegetation cover, channel size parameters and regulation of water level. In the area members of the water frog group (*Pelophylax* spp.) were the most abundant. Density of water frogs had been already increased in the first year after sweeping. The greatest number of metamorphs appeared in channels with dense vegetation and transects in the vicinity of undisturbed habitats. Colonization of new habitats had already started in the first year, nevertheless unbalanced population density remained between channels with different vegetation cover, size parameters and habitat surroundings. Further monitoring may reveal if aggregated distribution of anurans is the consequence of habitat alteration, and hence to be compensated in the following years, or caused by other ecological background variables and will persist for a long time period. Our research supports that amphibian populations can be corroborated rapidly by sweeping in eutrophic habitats, and undisturbed habitats should be also preserved as they act as primer sources of colonization.

On the status of water frogs *Pelophylax* sp. (FITZINGER, 1843) in the Austrian state of Salzburg: morphological and preliminary molecular data

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Three water frog taxa occur in the Austrian state of Salzburg: *Pelophylax ridibundus*, *P. lessonae* and their hybrid *P. esculentus*. Due to the complexity of exact species identification, earlier records and studies most often did not differentiate between those three taxa. *Pelophylax lessonae* is strictly protected by means of the EU Habitats Directive (Annex IV) and presumably declining in many parts of Austria, while *P. ridibundus* showed a recent spreading there, most likely due to human induced habitat changes.

To gain insight into the current distribution and taxa composition, we sampled 268 water frogs in Salzburg and Upper Austria in 2011 and 2012. Morphometrical parameters of frogs were measured and species identification was carried out accordingly. Additionally tissue was sampled via buccal swabs for subsequent genetic analyses.

Morphometrical results indicate that *P. lessonae* is present only in few isolated and natural wetlands, while *P. ridibundus* is more widely distributed than assumed previously. The distribution as well as the recent spreading of *P. ridibundus* leads to the hypothesis that it could be an introduced and potentially invasive species for Salzburg.

Preliminary genetic analysis of mtDNA and microsatellite markers test for this hypothesis and also aim to affirm morphometrical species determination, obtain data on phylogeographic relationships and evaluate genetic diversity of sampled populations.

Herpetological education projects in Hungary: effective tools for protection and a meaningful support for research projects

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Regular herpetological education started in the 1980s in Hungary with toad rescues over roads and ad hoc translocation projects including highly conflicting areas between humans and herps such as swimming pools in villages and snake nesting areas under motorways. By today, many people are also active in less demanding herp-related citizen science activities such as mapping species distribution by sending photos with the indication where they were shot to Varangy Akciócsoport Egyesület, a 28 year old NGO working in amphibian and reptile conservation, research and education. Besides traditional talks and nature walks unusual activities, such as “Frog concerts”, also generated much interest. Similarly, launching the Amphibian of the Year, followed by the Reptile of the Year, was also an international award-winning event. In some cases, where there is a strong educational element, it may be advisable for scientists to give the lead in that sub-project for educators, as it turned out to be often the best way while making Carpathian Basin Children Competitions in Hungary, Romania, Slovakia and Ukraine. It is especially advisable with young children, e.g. in programmes made for kindergartens. In such events, the co-operation of professionals and educators is a key element of success. In any case when scientists work with volunteers, however, easily understandable protocol and data validation is needed, and if the organizers fail to make these steps, more difficult changes had to make later, as another organization experienced it facing a high number of obviously incorrect herpetofauna species determination by its volunteers. Consequently, participants have to be informed and trained about what to do and they need to be informed about the results, too. With no doubt volunteers can successfully be involved in data collection, however, species determination and data analysis are still predominantly the field for professionals.

Ecological survey of a rediscovered urban fire salamander (*Salamandra salamandra*) population in Budapest

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The fire salamander, *Salamandra salamandra* was thought to be extinct for the last 100 years from the Buda Hills. In 2008 a small population was rediscovered in Budapest in an isolated habitat along a stream surrounded by family houses. The goal of our study was to measure the sex ratio, age classes, body size pattern, seasonal activity, migratory movement, and larval development characteristics of the population.

The study was performed between 2008–2012. The juvenile and adult salamanders were surveyed after rain or the day after, from March to November. We identified the sex, measured the body size, body weight and saved the GPS coordinates of the exact location of every specimen. Individuals were identified by the colour pattern that is characteristic to every specimen. Larvae were surveyed every 10 days between April and September, on a 500 m long section of the stream, during the night, using flashlight.

From 2008 we caught 1860 specimens (juvenile or adult). In the last 3 years adult sex ratio was male-biased and varied between 1:1.1 and 1:1.3. The average body size did not differ between males and females, but body weight was higher in females. We defined three age classes: recently metamorphosed, juveniles (1–3 years), adults (over 3 years). Half of the population consisted of adult specimens. Every year we observed one activity peak in spring and one in autumn. The sampling success and number of captured individuals was concordant with the quantity of rainfall. According to the capture-recapture locations we tracked the movement pattern of individuals. The movement of the most commonly recaptured individuals suggested that salamanders in this population use a 869–1125 m² area. The females started to deposit their larvae at the end of March and finished within a week. Due to heavy rainfall in 2011 the number of larvae reduced with 44%. The larvae were inhabited mostly those sections of the stream where small pools were formed.

Isolation by time in the yellow-bellied toad, *Bombina variegata*?

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In species with prolonged breeding season groups of individuals might reproduce at different time periods. Gene flow could be restricted between early and late reproducers even within a population in the same habitat when the reproductive time period is heritable. This restriction of gene flow caused by reproduction in different time periods is called “isolation by time”. The reproductive period of the critically endangered yellow-bellied toad (*Bombina variegata*) in Germany starts in April and runs until September. The long reproductive period allows that groups of yellow bellied toads might be behaviorally and genetically isolated from each other due to isolation of time, as it was found in other amphibian and vertebrate species. For this study we collected buccal swabs at four different time points in two consecutive breeding seasons from one population of *B. variegata* in southern Lower Saxony. Using ten highly variable molecular markers (microsatellites) we measured the genetic differences within and among the different groups of toads. Here we report our first results of this study and discuss the importance of our findings for the conservation of *B. variegata*.

Escape strategy of Schreiber's green lizards (*Lacerta schreiberi*) is determined by simple environmental factors but not ecological context or sex

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Antipredator behaviour is a key behavioural component of animals' fitness. Antipredator escape behaviour shows great variation not only between, but also within species or even within populations and individuals. One well-established source of variation is the physical environment, including factors such as the distance to the nearest. Another important source of variation is the ecological context such as being in reproductive vs. non-reproductive state. However, the relative roles of the above sources are rarely assessed within the same study. Here, we studied the escape strategy of Schreiber's green lizards, *Lacerta schreiberi*. We measured the distance that lizards allowed a potential simulated predator to approach before fleeing in the field (approach distance) to test whether the physical environment, the ecological context, or their interaction are the most important determinants. The environment had strong direct effects on the lizards' escape strategy; approach distance showed strong positive correlation with distance to refuges on grass substrates, whereas no such correlation was observed on rocky substrates. Further, refuge distance and the escape angle had a complex, but substrate-independent, effect on escape strategy: either short refuge distances or high escape angles resulted in short approach distances. In contrast, neither season (reproductive vs. non-reproductive), nor sex had any effect on the escape strategy. Our results suggest that the escape strategy of Schreiber's green lizards is determined by the environmental settings, irrespective of the ecological context or sexual roles.

Photographic method for the European snake-eyed skink (*Ablepharus kitaibelii fitzingeri*) individual identification

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The snake-eyed skink occurs only in the Carpathian Basin. Its main distribution area is located in Hungary. Due to its secretive life and under-researched status, our knowledge about its life, history and population biology is quite deficient. It is essential to develop a harmless, safe identification method for surveys. Until now, there had not been reliable methods for the individual identification of this subspecies.

Our object was to test the I3S (Interactive Individual Identification System) software utility in the identification of the European snake-eyed skink. The photographic capture-recapture method has previously been successfully used in several surveys. The identification procedure assumes that the shape and size of the reptile scale patterns are various with unique distinguishing marks and the probability of finding two identical ones is low.

Field sampling was carried out during the summer and autumn of 2012. We took photographs of the supralabial scales on each individual. The use of the software is based on pointing out a minimum of twelve connection points among scales. In total, 25 *Ablepharus kitaibelii fitzingeri* individuals were caught. We collected 84 images to a database and we were able to recapture 13 individuals.

We concluded that the unique size and shape of the supralabial scales are suitable for individual identification. The requirements for application are good quality photos, and the precise digitalization of the pictures. The accuracy of the identification was 92%. We could eliminate the program errors by visual comparison of the unique shape and size of the supralabial scales' pigmentations. We found that the supralabial pigmentations of the recaptured individuals did not change in shape after shedding, or we observed very slight differences. A combination of the software and pigmentation identification increased the accuracy of the identification of individuals to 100%.

Mapping Budapest herpetofauna using GIS techniques

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Budapest harbours a remarkable herpetofauna including 18 amphibian and reptile species. The territory of the Hungarian capital contains extended semi-natural or natural and protected areas. Cultivated fields, grasslands, wetlands and forests cover more than 25% of the city and the proportion of gardens and parks is also significant. This relatively airy architecture allows the persistence of amphibian and reptile species occupying different habitat types and so raises both their numbers and species richness compared to other big cities. The Amphibian and Reptile Conservation Group of MME-BirdLife Hungary initiated a survey program on Budapest herpetofauna in 2010 involving six guided and couple of dozens unguided volunteers who uploaded their observations on our herp-mapping portal www.herpterkep.mme.hu.

A total of 1598 occurrence records were exported from the online portal and imported in a file geodatabase using ArcGIS Desktop 10.1 for mapping and spatial analysis. Species richness or number of records were calculated in a 1×1 km grid covering the Budapest city boundaries.

Highest values of species richness (7–10 species) occurred in 8 grid cells, all located in forests or wetlands. The most common reptile species was the common wall lizard (*Podarcis muralis*) occupying densely built up areas too, even in the downtown or bare blockhouse estates. Among the amphibians, the green toad (*Bufo viridis*) showed a similarly high level of urbanization, although its observed number was considerably less. The green lizard (*Lacerta viridis*) was also a dynamic conqueror intruding suburban gardens. Even the Natura 2000 species European pond turtle (*Emys orbicularis*) formed stable populations within the boundaries of Budapest.

Further spatial analysis and predictive modelling is planned to estimate the potential distribution of herpetofauna species in Budapest.

Czech action plan activities for *Zamenis longissimus*

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Zamenis longissimus is the rarest snake in the Czech Republic. There are three distinct populations which differ in the abundance, area and isolation from other populations. Best known is the smallest and most isolated one living in Poohří in West Bohemia. The biggest one lives in Podyjí National Park in South Moravia. Third one lives in Bílé Karpaty in East Moravia on the border with Slovakia. All of them are strongly related to human activities such as small scale agriculture, non intensive forestry and keeping of animals.

Action plan (AP) for this species was approved by Ministry of the Environment of the CR in 2008. Maintenance of special biotopes, migration corridors and breeding sites and protection of individuals on and near roads are the most important activities of AP. Of course, regular monitoring, searching new potential localities and diverse research are not missing.

Most diverse spectrum of activities is used in Poohří where 400–600 individuals are living in area of only 970 ha. This population faced two main problems which have been solved. There is a main road where a lot of snakes were dying, particularly juveniles. The most dangerous part has been modified and special device has been installed there, so that snakes are not able to move to the road and they have to go through holes going under the road. The second problem was deficiency in natural breeding facilities, which is why 26 artificial ones have been built to enhance reproduction success.

There are 3000 to 4000 individuals living in Podyjí (77 km²), where the most important activity is clearing of special biotopes (old watermills, agricultural terraces and vineyards). Area of this national park was formerly strongly influenced by man, but after WWII forest has regrown it what causes problems today. In Bílé Karpaty population size and inhabited area are not clear yet. Thus we concentrate on gaining more information there.

Amphibian egg mortality in the Białowieża Forest, Poland

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The Białowieża Forest is the last remnant of lowland deciduous forest of primeval character in Europe. Central part of the forest is strictly protected for over 80 years and human activity is very limited. Selected water bodies were monitored in the spring during the breeding season of two most common in the Białowieża Forest amphibian species: *Rana temporaria* and *Rana arvalis*. Sites were visited every second day to assess the survival of embryos. At each site there were ten randomly selected egg clumps which were studied carefully for visible changes. Number of developing eggs and those which failed to develop in each of selected clumps were counted. The study shown that up to 86% of eggs failed to develop.

Samples of eggs were taken to the laboratory. As the substratum for growing fungus-like organisms, cannabis seeds and eggs of *R. temporaria* and *R. arvalis* were used. After 72 hours of incubation in the temperature of 15 °C, the first microscope analysis were carried out. Then, the samples of mycelia were transported onto Sabouraud [bioMerieux] substratum where the culture continued to grow. The samples were examined every seven days. The experiments were carried out for three weeks. Identification of fungus-like organisms was based on their morphology and biometric data of antheridia and oogonia. There were seven *Saprolegnia* species isolated from the collected material. These were *Saprolegnia anisospora*, *S. diclina*, *S. ferax*, *S. hypogyna*, *S. monoika*, *S. parasitica*, and *S. uliginosa*. The most often isolated species was *Saprolegnia ferax* which was present in all analysed samples.

It is presumed that fungi-like organisms contributed to the high mortality of amphibian eggs as there are several species of Saprolegniaceae reported so far as causing mortality of amphibian eggs but two species are most frequently blamed: *Saprolegnia parasitica* and *S. ferax*.

Species composition of *Triturus* populations in a three way contact in the Waldviertel (Lower Austria)

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The crested newt *Triturus cristatus* superspecies consists of seven members and is distributed in western Eurasia. The mostly parapatric species distributions are delimited by sharp contact zones. In such zones, hybridisation and mitochondrial DNA introgression occur. Lower Austria is characterized by a transition of climate and biota. Here, three *Triturus* species meet: the great crested newt (*T. cristatus*), the Danube newt (*T. dobrogicus*) and the Italian newt (*T. carnifex*).

In the Waldviertel, the north-western part of Lower Austria, *Triturus* species distribution is still unclear. In general, morphology is quite reliable for species identification but in contact zones mixed phenotypes appear, due to hybridisation, which makes this method less useful. The aim of our study is to clarify the situation of species composition and hybridisation. Therefore tissue samples of 93 individuals from 6 populations (covering the Waldviertel from the East to the West) were collected. Next to morphological examinations, genetic analyses were done, using 52 nuclear markers and one mitochondrial DNA marker.

Based on morphology, the *Triturus* newts mostly resemble *T. carnifex*. However, only *T. dobrogicus* (eastern) or *T. cristatus* (western situated populations) mitochondrial DNA haplotypes are present. These results are a clear indication that hybridisation must have occurred in the recent history of these populations. Analysis of the nuclear markers provides a more detailed insight into the gene flow among the three *Triturus* species and allows us to formulate a historical biogeographical scenario.

Systematics of the ‘flap-headed frogs’ of the dicroglossid genus *Limnonectes* FITZINGER, 1843

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Most of the 55 currently recognized species of *Limnonectes* (Ranoidea: Dicroglossidae) are rather unremarkable, medium-sized brown frogs. The males of four species (*L. dabanus*, *L. gyldenstolpei*, *L. macrognathus*, and *L. plicatellus*), however, possess a conspicuous dorsal ornamentation of their heads. To date, no study has examined this structure in detail. The goals of this study were to address the systematics of the flap-headed species and assess the functional and evolutionary significance of this feature. Morphological analyses of these structures (via gross anatomical, histological, and radiographic means) in all four species revealed great differences in external characteristics such as shape and extent. Histological architecture, however, was nearly identical in all species, suggesting that the appendages indeed could have a common evolutionary origin. Additionally, we found that all four species have a concave lateral curvature of the anterior ramus of the pterygoid bone, which is convex in all other *Limnonectes*. Results of molecular phylogenetic analyses of the 12S–16S mtDNA gene region provided well-supported evidence for the monophyly of this group. Based on these two independent lines of evidence, we conclude that these four species represent a monophylum and that the head appendage is a reliable diagnostic feature of this group.

Phenotypic variability in the *Pelophylax saharicus* complex along an altitudinal gradient in the region of Marrakech and its surroundings (Morocco). Discriminant analysis and implications in terms of conservation

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The influence of climate and space global change has been studied by comparing the size and color morphs of the North African green frog (*Pelophylax saharicus* BOULENGER, 1913) in Morocco. We examined the morphological variation of four populations subject to different environmental variables in the region of Marrakech and its surroundings. The processing of morphometric data using the univariate (ANOVA) and multivariate (ACP and AD) statistical analysis, revealed the existence of at least two morphotypes of this species which are clearly separated by the ACP. The use of discriminant analysis determined that the most discriminating variables are the first toe of the left foreleg and the length of the femur of the posterior leg of the same side.

Overall, frogs from medium and high elevation sites (respectively Oukaïmeden and Tighadouine) are larger than those from the Atlantic coast (Had Adra). Many various coloration patterns were noted in the different surveyed sites. These variations in size and color may correspond to a phenotypic plasticity in response to the instability of the habitat and therefore a substantial taxonomic differentiation like what is observed in Europe, and thus could be of considerable conservation interest from which this interest in arid areas where this type of study, in our knowledge, done before.

Habitat effect on the digestive efficiency of a Mediterranean lizard

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The particular ecological and environmental features of a given habitat have a direct impact on numerous aspects of the overall animal biology. Among them thermal quality and predation pressure play a pivotal role in shaping the performance of physiological traits such as digestion. The later represents a measure of successful survival and, especially in ectotherms, has been proved to be strongly temperature dependent. Digestive efficiency is an important link between the gut physiology and the ecological aspects of energy budgeting. Apparent digestive efficiency (ADE) is defined as the ability to absorb energy through food and depends on gastrointestinal motility, enzymatic activity and body temperature.

In this study we aimed to clarify whether habitat quality (in terms of temperature and predation regime) affects digestive efficiency in the roughtail rock agama (*Laudakia stellio*). We presumed that environmental temperatures (as they are sketched by operative temperatures) and predation would induce shifts in ADE. ADEs of the three major nutrient components (proteins, lipids and sugars) were examined in 20 individuals from two eastern Mediterranean islands differing in climate conditions and predation pressure, Cyprus and Naxos (Cyclades, Aegean Sea). Higher temperatures have been repeatedly reported to favor effective digestion. On the other hand predation restricts the time dedicated to foraging and thus ADE should be high to ensure that animals would take the most of every meal.

ADE_{lipids} and ADE_{sugars} did not differ between the two populations. ADE for proteins was marginally higher in the case of Cyprus and the difference disappears if excluding one individual from analyses. Both populations are well adapted in their habitats and achieved high digestive performance. Future experiments that will focus on gut passage time will reveal the full repertoire of digestive procedure.

Spatial and temporal patterns of the ladder snake (*Rhinechis scalaris*) in a human modified landscape: preliminary results from a radio-telemetry monitoring program in eastern coastal Spain

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The ladder snake (*Rhinechis scalaris*) is a Mediterranean snake, widely distributed in the Iberian Peninsula. Its secretive behaviour has hampered a good knowledge of populations' ecological patterns which were inferred using radio-telemetry monitoring but for limited periods over the annual cycle of activity (e. g. in spring). Here we present the preliminary results of spatial and temporal patterns for four specimens (two males and two females) inhabiting a human modified landscape (mostly consisting of citric cultures, area = 132 ha) in eastern coastal Iberia (Castellón, Spain) throughout an annual cycle of activity (2012–2013).

Snakes (avg. SVL = 986.5 mm; avg. weight = 558.75 g) were captured in spring 2012 and radio-transmitters (SOP1 2380; weight = 10 g) were implanted by surgery (assisted by a veterinarian). After 5 days of post-surgery, snakes were released and radio-telemetry monitoring was performed 20 days per month till the end of March 2013. A total of 817 records were obtained, including GPS coordinates and data on habitat and micro-habitat composition and activity parameters of snakes. Geographical Information Systems were used for inferring spatial patterns whereas linear regression analyses were performed for habitat descriptors.

Snakes were mostly found on citric cultures (48.95% of records) along the year, without differences among individuals and sexes. Selected micro-habitats for the four individuals were mostly composed by herbaceous vegetation in the surroundings of stone walls, but each individual used different micro-habitats according to the period of year (log-lineal; $p = 0.98$). Home range sizes were different for males (kernel estimator = 1.48 ha) and females (kernel estimator = 0.53 ha). Movement rates revealed a winter dormancy with low movement (December–January: 1 m/day) and several peaks of activity February–March (69.63 m/day), June–July (95.9 m/day) and October–November (56.8 m/day).

Considering that these results are a preliminary approached, new data is shown about the ecology of this species, especially those related with spatial and temporal patterns along whole one year.

An experimental approach for testing the role of olfactory and visual stimuli in snakes climbing towers behaviour

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Ladder snakes (*Rhinechis scalaris*) are suffering an unusual non-natural mortality due to electrocutions in the largest electricity network of Spain (Iberdrola S. A.). Research has shown spatio-temporal patterns in electrocutions consistent with the hypothesis that the snakes climb to medium tension power towers (MPVT) attracted by prey's stimuli. However, experimental works are required to confirm this hypothesis. Here, we used a captivity experiment for studying ladder snakes' preferences (28 individuals) for two 3 m replicas of MPVT (one control and the other treatment) with different attractants: prey odours (olfactory detection), preys (visual detection), heat emitters (heat detection, simulating wires from MPVT) and different combinations. Snakes' body size and activity rhythms were also analysed.

Ladder snakes climbed significantly more often to the MVPT with prey odour in light conditions (hurdle GLM model: $p < 0.03$), but there were no significant differences regarding other attractants and conditions. Moreover, activity of the snakes had significant effects (hurdle GLM model: $p < 0.01$ in both cases). Additionally, the proportion of snakes that climbed to the treatment MPVT was significantly higher for prey odour treatment in either light or dark conditions (Binomial test: $p < 0.05$ in both cases). Finally, there were no statistical significant patterns in the time since the beginning of the experiment to the first climbing event to the treatment tower for any of the conditions and treatments (Kruskal-Wallis test: $p = 0.36$).

These results support the hypothesis of an olfactory attraction to MPVT. However, how snakes can detect odours from birds located at 16 m height is still unknown.

Activity patterns and habitat preference of European pond turtles (*Emys orbicularis* L.) in Lake Naplás

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Lake Naplás of Budapest is a remarkable habitat of the European pond turtle in spite of the fact that its vicinity is highly disturbed by human activities. The goal of our investigation was to count and estimate the number of specimens living in the lake and the surrounding swamp, to study sex ratio, seasonal activity, fidelity to locations where trapping took place and recapture rate. We intended to reveal the relationship between these variables and the morphometric data of the captured specimens.

In 2008, we trapped turtles at 21 occasions using 4 cage-traps at each trial while in 2009, we used traps with changing numbers at 18 occasions. In 2008, we collected 146 and in 2009, 73 turtles. Altogether 113 specimens were identified, out of which 69 were females and 36 males. The recapture rates were low, the number of turtles recaptured once was 7 in 2008 and 6 in 2009 while multiple recaptures were rarer. Mainly males were recaptured.

The estimated size of the population was 129 specimens (95% confidence interval ranged between 72–289). The hypothesis that smaller and therefore younger individuals showed higher recapture rate could not be proven. The average carapax length of females was 157.2 (± 42.4 SD) mm while that of the males was shorter 138 (± 18.6 SD) mm. Also the average bodyweight was bigger in females (mean \pm SD: 643.6 \pm 330.2 g) than that of the males (mean \pm SD: 416.5 \pm 142.4 mm).

Trapping seemed to prove that most of the turtles occurred in the willow swamp habitat patch and in the sunny edge of the reed bed. These habitat patches were used mainly by the smaller individuals. The majority of the turtles appeared in another habitat only once during the study year and this change was observed in both sexes. The highest activity of the turtles.

Three years of population monitoring of newts (Lissamphibia, Salamandridae) in isolated karstic ponds

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We conducted a population study of two syntopic salamandrids, the smooth newt *Lissotriton vulgaris* and the Italian crested newt *Triturus carnifex*, at six ponds in Karstic Plateau, SW Slovenia. Both newts, which are classified as “vulnerable” in the national Red list, are particularly under threat in the study area due to rapid habitat loss in karstic landscape which lacks the surface water outlet. A detailed CMR survey was conducted in a pond in the village Kastelec during breeding seasons 2006–2008 and population abundance was estimated using model POPAN available in MARK. Abundance in further five ponds with less intense field sampling was evaluated using the Petersen index. Populations of both species, smooth and Italian crested newts, were most abundant at Kastelec pond. Over three years of survey, the abundance of smooth newt was quite stable at about 300 males and 300 females which suggest this population to be above the minimal viable population (MVP) threshold. The population of Italian crested newts at Kastelec was estimated at about 150 individuals in 2007. The number of captured individuals in the remaining years was too low for statistically robust population assessments. Populations of the Italian crested newt in karstic ponds allegedly do not meet the MVP threshold which may pose risk on their long-term persistence. Populations of both species are further threatened by introductions of fish in some of the ponds. An ongoing population genetic study based on microsatellite loci is expected to shed light on the metapopulation structure of newts in a system of karstic ponds. The final goal is to better define conservation status of the two newt species in an area, which is hostile to amphibians with limited dispersal potential.

Habitat features and syntopic species of crested newts ponds in South Moravia, Czech Republic

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Crested newt use different habitats throughout their lives; knowledge about habitat features are useful and important for their continued protection. Previous investigations proved coexistence and hybridization among three crested newt species: *Triturus cristatus*, *T. carnifex* and *T. dobrogicus*. We studied ponds features and species richness of amphibian populations in 31 breeding ponds in the Czech region of Znojmo. Data for analysis was collected during seasons 2010–2012, during which time we recorded eight habitat features: pond area (<100, 100–1000, 1000–5000, >5000 [m²]), maximum depth (<30, 30–100, >100 [cm]), fish presence or absence, origin (natural or man made) and presence or absence of human use. Also we assessed density of submerged vegetation and shade (both in 25% class). Each pond was categorized on type (natural pond, urban pond, quarry, stagnant ditch). The effect of this eight pond features on crested newt pond occupancy and frequency of syntopic species was calculated. According to our results, pond depth between 30–100 cm, shade between 26–50%, type of pond and area between 100–1000 m² was evaluated as the essential parameters increasing attractiveness of the ponds for the occupancy of adult crested newts. The smooth newt (*Lissotriton vulgaris*) and agile frog (*Rana dalmatina*) were recorded at 22 and 20 ponds, respectively, together with crested newt. Our conclusions about optimal habitat features of pond from the point of view of crested newts correspond in general with results of similar studies. Unlike to other studies, fish presence and absence of submerged vegetation were found to be the major causes for population density of crested newts. It seems that the population structure of syntopic species is unique for different areas within distribution of crested newt. Further data collection and analyses are required to support the outcomes of this study.

The genetic mating system of *Hyalinobatrachium valerioi*

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The reticulated glass frog *Hyalinobatrachium valerioi* (Centrolenidae) is a small leaf-breeding frog which occurs in the tropical rainforests of Costa Rica, Panama, Columbia and Ecuador. There are a few studies focusing on the reproductive behavior of this frog species, but to date the genetic mating system has not been resolved. The *H. valerioi* population under study occurs along the Quebrada Negra, a small lowland stream close to the tropical research station La Gamba, at the edge of the Piedras Blancas National Park, Costa Rica. Field data and samples were collected from August to November 2012, covering almost one entire breeding season. Along a 400-m river transect, we monitored 144 individual frogs (96 males, 48 females) during the whole study period and took tissue samples of all adult frogs and clutches for the subsequent molecular analyses. The integration of observational field data as well as molecular parentage analyses allowed us to gain precise insights in individual mating patterns, the adult sex ratio, potential reproductive rates, the effective number of breeders and also data on site fidelity of a *H. valerioi* population.

Spatial distribution and population density of *Pelophylax perezii* (Ranidae: Anura) in Tablas de Daimiel National Park (Central Spain)

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The present work establishes the population density and spatial distribution of *Pelophylax perezii* in Tablas de Daimiel National Park, Ciudad Real (Central Spain). The project was promoted by the Management of the National Park, and it is related with I+D+I initiatives of the Department National Park belonging to the Spanish Ministry of Environment. The field data were obtained through several “listening stations” carried out during 2011 and 2012. The samplings were done in March, April, May and June. May was divided into another two periods “May 1” and “May 2”, due to the high amount of activity, doing samplings every 15 days. For this specie the sex-ratio is established by 1.9:1 in favor of males. Similar results have been obtained in different points of the country. For the data processing is used the following expression $D = \ln(n/n_1) * n/m(r^2)$, with D being the number of individuals/ha, n the number of individuals found in the sampling plot, n_1 the number of individuals found out of the sampling plot, m the number of plots in each station and r the radius of each of it. Using the correlation coefficients we could observe the amount of relationship between the different variables and the density of *P. perezii*. However, this only indicates a slight influence of any of these variables. For a deeper understanding, the use of statistical models, particularly regression models, could help us to make predictions of the presence and density of that species. Furthermore, these models are useful to analyze which variables alone or related have influence over the presence and abundance of *P. perezii*. In case of not having enough record inference it could be the best option to find a reliable data distribution, augmenting to simulate and obtain good predictions and strong understanding of the environmental variables.

Population density and spatial distribution of *Hyla arborea* (Hylidae: Anura) in Tablas de Daimiel National Park (Central Spain)

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The present work establishes the population density and spatial distribution of *H. arborea* in Tablas de Daimiel National Park, Ciudad Real (Central Spain). The project was promoted by the Management of the National Park, and it is related with I+D+I initiatives of the Department National Park belonging to the Spanish Ministry of Environment. The field data were obtained through several “listening stations” carried out during 2011 and 2012. The samplings were done in March, April, May and June. May was divided into another two periods “May 1” and “May 2”, due to the high amount of activity, doing samplings every 15 days. For this specie the sex-ratio is established by 1.66:1 in favor of males. For the data processing is used the following expression $D = \ln(n/n_1) * n/m(r^2)$, with D being the number of individuals/ha, n the number of individuals found in the sampling plot, n_1 the number of individuals found out of the sampling plot, m the number of plots in each station and r the radius of each of it. Using the correlation coefficients we could observe the amount of relationship between the different variables and the density of *H. arborea*. However, this only indicates a slight influence of any of these variables. For a deeper understanding, the use of statistical models, particularly regression models, could help us to make predictions of the presence and density of that species. Furthermore, these models are useful to analyze which variables alone or related have influence over the presence and abundance of *H. arborea*. In case of not having enough record inference it could be the best option to find a reliable data distribution, augmenting to simulate and obtain good predictions and strong understanding of the environmental variables.

Amphibian road mortality: comparing spatial statistical methods to detect hotspots

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Due to their habitat requirements, amphibians became one of the most commonly road-killed group and this may affect their population viability. Implementation of mitigation measures (e. g. crossing structures) may overcome the problem, still several factors influence measures effectiveness. Crossing structures location is the most influential factor forecasting effectiveness. However, road network density and dimension requires a cost-effective application and a better understanding in where they should be implemented. As amphibians present a clustered road-kills distribution, their mortality hotspots can be identified using GIS (Geographic Information Systems). Hotspots or critical sites can be predicted using spatial statistical methods that are available and have been tested in several road-kill studies. Nonetheless it is lacking a comparison analysis of them in order to understand their pros and contras. The aim of this study was to analyse possible differences between global, multi-scale and local spatial analysis methods in defining hotspots using amphibian road fatality data collected in northern Portugal country roads. Nearest neighbor index, Moran's I were calculated in order to compare the global clustering of points in seven sampled roads, and three were identified as clustered. We used Ripley K-function the best scale for Malo's equation, Kernel density analysis in detecting hotspots and we compared their detection performance with Local Indicators of Association (LISA) (i. e. Local Moran's I and Getis-ord G_i^*). Three different GIS software applications were used: ArcGis, Quantum GIS with R (opensource) and GeoDa (opensource). Results showed the importance of using multi-distance spatial cluster analysis to define the best scale for hotspot detection with Malo's equation and Kernel density analysis. Here we also suggest the advantages of Local Indicators of Association (LISA) for detecting clusters with the contribution of each individual observation (Local Morans I and Getis-ord G_i^*).

Educational work and protection of salamanders in three European countries within a Sparkling Science project

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The Alpine salamander (*Salamandra atra atra*), an endemic amphibian species to the Alpine regions across Europe, and the fire salamander (*Salamandra salamandra salamandra*), the best known salamander species in Europe because of its eye-catching coloration, are among threatened species in Austria because their habitats are prone to destruction due to human invasions. The golden Alpine or Aurora salamander (*Salamandra atra aurorae*), the Pasubio salamander (*Salamandra atra pasubiensis*) and the Lanza's salamander (*Salamandra lanzai*) live at the south-eastern and western border of the Alps. Their distribution areas are very small and they are threatened by forestry, tourism and illegal collection. The Aurora salamander is a priority animal in Europe, listed in Annex II and IV of the European Habitats Directive. *Salamandra lanzai* is also listed in Annex IV. The south of the Iberian peninsula houses two subspecies of the fire salamander, the Penibaetic salamander (*S. s. longirostris*) and *S. s. morenica*. *Salamandra s. longirostris* is one of the most localized and scarce amphibians in Europe. It is considered as "Vulnerable" in its distribution area, with very small populations, some of them totally isolated, owing to the disappearance of its breeding areas. Within the framework of a Sparkling Science project, Austrian, Italian and Spanish herpetologists work together and involve more than 25 schools to bring the knowledge of salamanders into the children's mind. The children become aware of the importance of salamanders by means of workshops, excursions and exhibitions. With the children's help, measures will be designed to protect salamanders and their environment. The networking platform for children and scientists within the project is www.alpensalamander.eu, where salamander observations all over Europe are collected on a database. We believe that the protection of amphibians and their habitats is only possible by actively involving the public, starting with the youngest ones.

Ant predation by the wall lizard (*Podarcis muralis*)

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Podarcis muralis, the wall lizard, is widespread in western and southern Switzerland. It is an opportunist predator, mainly on arthropods, but also on earthworms and small molluscs. Analyses of alimentary diet show that ants are an important part of the lizard diet. During an eighth year monitoring of a small population (about 200 days of observation per year) capture of winged adults was observed in ten occasions. However, we never ascertained predation on workers ants. Although several ant species inhabit the area, this behaviour was directed only against one species, *Diplorhynchus (Solenopsis) fugax*. Workers are very small (1.5–3 mm), pale yellow, but winged females and males measure 4 to 6 mm and are black. For most of the year, these ants live under stones or pavement. They steal brood of other ant species entering their nest and inducing workers to flee by emitting a repulsive substance. Swarming takes place between July and September. On these occasions, a great number of workers accompany winged males and females above ground, and are very active during about 30 to 90 minutes. Lizards are attracted to the spot of swarming and rush to capture winged individuals. From three to seven lizards, males, females and young participate in this rush, without any show of aggressive behaviour among them. They often come from more than 20 to 40 meters away, since most of the observed individuals were not residents of our study site. We suppose that they are attracted by chemicals (pheromones?) emitted by ants during swarming. All along this predation, lizards are totally indifferent to the presence of worker ants. After the end of the swarming episode, lizards forage further for some minutes on the spot, before scattering and disappearing.

Effects of burning and grazing on anurans in the Fekete-rét alkali marsh (Hortobágy)

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Due to pollution, fragmentation, loss of habitats and diseases amphibians have been declined since the last three decades. Habitat restoration and conservation management of wetlands can have an important role in the protection of amphibians, which may be useful indicators to monitor post-restoration success. Our goal was to examine how the controlled burning of reed and year-round cattle grazing affect the species richness and abundance of anurans in Fekete-rét alkali marsh (Egyek-Pusztakócs marsh system) during the spring of 2010. We surveyed anurans along five transects each in six differently managed areas: (i) long-burnt (fire in 2007) and grazed, (ii) long-burnt and not grazed, (iii) recently burnt (fire in 2009) and grazed, (iv) twice burnt and grazed, (v) unburned and grazed and (vi) control area with no management. Twice-burnt and recently burnt areas had significantly higher numbers of species and individuals than other areas, mainly due to the eradication of reed by recent burning. By summer, reed grew back in most areas, except in grazed sites, in which density of anurans was as high as 20,000 individuals per hectare. Late-summer burning of reed provides short-term effects by creating suitable breeding sites the next spring. In contrast, cattle grazing can have an important role after the re-colonization of reed by maintaining diverse habitats.

Blood parasite load and individual quality in male European green lizards (*Lacerta viridis*)

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During mate choice, the selecting gender (usually females) use these traits to estimate male quality and choose the male which they can produce the highest quality offspring with. These features are called sexual signals and can be connected to individual quality in various ways. One possible mechanism is parasite-mediated sexual selection (Hamilton & Zuk hypothesis), which presumes that parasite infection can influence the elaboration of sexual signals. Anti-parasite defence is less expensive for more resistant individuals, so these can invest more energy into the expression of sexual signals; hence, more intensive signals indicate better individual quality. Females should therefore prefer males with intensive signals, as this way their offspring would also inherit better genes. Previous research showed that male European green lizards' (*Lacerta viridis*) ultraviolet-blue throat colour affects female mate choice (intersexual selection) and male-male competition (intrasexual selection) positively, as a condition dependent complex multiple signalling system. The aim of this study was to test the predictions of the Hamilton & Zuk hypothesis on male European green lizards. In order to do so, we took blood samples from 30 adult male green lizards during the breeding season and, after fixation and Giemsa staining identified the blood parasites under microscope. We found different morphotypes from the Haemogregarinidae family, with prevalence being 96.7%. The infection intensity showed negative correlation with throat and belly colour intensity in line with the predictions of the Hamilton & Zuk hypothesis. Furthermore, we found positive correlation between the amount of parasites and body size and condition and negative correlation with the level of asymmetry and number of ticks. This study shows that throat patch colour of European green lizards possibly acts as an honest sexual signal of health state in accordance with the Hamilton & Zuk hypothesis.

Relationship of *Scaevola taccada* tree with the nest site selection of *Chelonia mydas* at Penang Island, Peninsular Malaysia

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The study site is located at Penang Island, the northern part of Peninsular Malaysia. The coordinates of Kerachut Beach are 5°27'4"N, 100°10'58"E. The objectives are to determine the preferable nest site selection located between vegetation zone, open beach or grass areas, and the preferable nest site selection located between intervals 0–10 m, 10–40 m, and >40 m from high tide line. Research was conducted from December 2009 to August 2010. During the season, all 43 nests laid were identified by intensive nocturnal survey. Results show that green turtles preferred to nest in the shade of *Scaevola taccada*, compared to open beach or grass areas (Kruskal-Wallis: $p < 0.01$), and at interval of 10–40 m from tide line, compared to intervals 0–10 m and >40 m (Kruskal-Wallis: $p < 0.01$). 61.9% of the nests were located in the shade of *S. taccada*, and 85.7% nests located between intervals 10–40 m. We conclude the reasons are due to vegetation of *S. taccada* gives a shelter and dark environment, the sand temperature and relative humidity within the *S. taccada* are optimum and suitable for green turtle to nest, which are 29 °C and 0.9–1.0%. The reasons turtle fail to dig nest at open beach are due to nest could easily rupture due to sand lack of binding from roots, disturbances by smooth-coated otter and feral dogs, and expose to human disturbances, while turtle fail to build nest at the grasses areas are due to the rough, dry, and low humidity of the sand, and less shelter. Therefore, we suggest that the vegetation of *S. taccada* should be preserved, protected and increase the plantation to up growing the distribution, and as well as to maintain the natural habitat.

Evaluation of metal accumulation and its effect on shell deformations in the European pond turtle (*Emys orbicularis*)

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Turtles have been reported as useful biomonitors of metal contamination in the environment; especially, carnivorous species may accumulate greater concentrations of chemicals through trophic transfer during their long life. The aim of the recent investigation was to estimate the relation of heavy metal contamination and the occurrence of scute anomalies and ulcerative shell disease (USD) in two European pond turtle (*Emys orbicularis*) populations.

Turtles were collected in Boronka and Csombárd Nature Protected Areas (N = 205 and 62, respectively). The number of scute anomalies and the severity of USD were determined. Furthermore, liver and muscle samples from 19 perished turtle bodies were examined by inductively coupled plasma mass spectrometry (ICP-MS) to evaluate the heavy metals contaminations.

The occurrence of scute anomalies and USD in the Boronka population (N = 5.3% and 59%) was higher than in Csombárd (N = 1.6% and 41%). The Cd (2.12 ± 0.5 and 1.49 ± 0.1 mg/kg) and Hg (2.27 ± 0.9 and 1.29 ± 0.2 mg/kg) and Zn (45.9 ± 7.8 and 34.6 ± 10.8 mg/kg) content in the liver samples was significantly higher in Boronka population while As (0.64 ± 0.5 mg/kg) was found only in the Boronka population. In case of Pb (3.86 ± 4.9 and 1.43 ± 1.7 mg/kg) and Cu (25.4 ± 9.3 and 18.29 ± 2.9 mg/kg) the differences were not significant due to the high deviations. The sex of the turtles had no significant effect. Based on our preliminary data the higher occurrence of shell deformations and USD in Boronka population could be the result of higher environmental contamination. Further examinations are proceeded including more neighbouring populations and the examination of the status of turtles' immune system.

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Notes on the herpetofauna of western Bas-Congo, Democratic Republic of the Congo

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While we have fairly comprehensive knowledge on the herpetofauna of Europe, North America and some other temperate zones of the Earth, data deficiency in tropical regions is still a major problem in herpetofaunistic research. During the last few years we conducted several field expeditions to Central Africa, including the Congo Basin. In 2012 we visited four sites in the westernmost part of the Democratic Republic of the Congo. These included the Mangroves National Park in the region of the Congo River estuary as well as the Mayombe region characterized by low mountains covered by rainforest, all north of the Congo River, and an additional site south of the Congo River with savannah habitats. Remarkably, no recent herpetological research was done in this part of the country. Regular visual and acoustic encounter surveys were carried out during day and night in order to collect amphibian and reptile specimens. We surveyed a wide spectrum of habitats including mangroves, savannah, forests, village surroundings and agricultural sites. Approximately 21 species (or representatives of species complexes) of amphibians and 23 species of reptiles have been recorded. Voucher specimens are deposited in the RBINS. Tissue samples are used in DNA barcoding and phylogeographic studies focusing the Congo Basin. For some widespread species (e. g. selected colubrid and viperid snakes), remarkable 'intraspecific' divergence was observed.

Clutch size and egg characteristics in the Souss Valley tortoise, *Testudo graeca soussensis* PIEH, 2001 (Testudines: Testudinidae) from a coastal and an arid inland area in West-Central Morocco

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Reproduction in female Souss Valley tortoises (*Testudo graeca soussensis*), the family Testudinidae, in two populations from a coastal (North to Essaouira) and arid-inland (Central Jbilet mountains) areas of West-Central Morocco, was studied in April–May 2012 using oxytocin to induce egg deposition in individuals (n = 5 and 4 females with eggs, respectively). Clutch size varied from 1 to 5 eggs with no significant difference between the two populations and averaged 3.44 ± 1.33 eggs. Carapace length and mass of females, which were lower in the females from arid-land (172 ± 4.4 vs. 185.1 ± 7.7 mm, and 1157.1 ± 91.7 vs. 1486.9 ± 223.4 g), were not significantly correlated neither with clutch size nor with any egg variable in both populations. Eggs averaged, respectively in the arid and coastal populations, $36.24 \pm 2.49 \times 29.99 \pm 1.33$ mm and $32.06 \pm 2.21 \times 28.96 \pm 0.88$ mm in dimensions, 17.05 ± 1.87 and 14.13 ± 1.81 cm³ and 19.34 ± 2.14 and 17.28 ± 1.09 g, respectively in volume and in mass. The eggs were significantly longer in the arid-land tortoises. The relative egg masses and relative clutch masses were significantly higher in tortoises from arid-lands (1.70 ± 0.28 vs. 1.15 ± 0.15 and 4.06 ± 1.32 vs. 3.09 ± 1.52 , respectively). The obtained data were compared to those on other populations of *T. graeca* across its distribution range and the differences between the studied populations are discussed in terms of adaptation to their corresponding environments.

Niche partitioning in seven syntopic anuran species in a pond in Benin City, Nigeria

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Very few diet studies on anurans exist in Nigeria and that only recently. To add to the existing knowledge, the diet of seven syntopic anuran species belonging to four families—Amietophrynidae, Arthroleptidae, Dicroglossidae and Ptychadenidae—was determined using stomach flushing method. The most important prey category for *Hoplobatrachus occipitalis* were molluscs ($V = 4545.07 \text{ mm}^3$) while *Ptychadena mascareniensis* had arthropod parts ($V = 2698.34 \text{ mm}^3$). *Ptychadena oxyrhynchus* and *P. bibroni* both had coleoptera as most important prey ($V = 3899.96 \text{ mm}^3$ and 616.64 mm^3), respectively. *Leptopelis occidentalis* and *L. hyloides* both had molluscs as most important prey ($V = 3261.66 \text{ mm}^3$ and 1650.99 mm^3), respectively. Niche breadth was highest in *H. occipitalis* (6.42), a generalist feeder and lowest in *L. hyloides* (1.6), a tree frog. *Amietophrynus maculatus* which is a sit-and-wait forager had a niche breadth of 2.56 and Hymenoptera as the most important prey ($V = 1830416.04 \text{ mm}^3$). Though living syntopically, niche partitioning is observed based on their food preferences and niche breadth.

Edge effect on leaf-litter anuran of the Atlantic forest of southeastern Brazil

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Anurans are extremely sensitive to abrupt transitions of microhabitats and microclimates. Fragmentation and habitat loss threaten tropical forests. Much damage found in forest patches can be attributed to edge effects, which changes the forest structure and faunal composition. We intended to measure the edge effect on leaf-litter anurans of a continuous fragment of Atlantic Forest in southeastern Brazil. We sampled five transects positioned perpendicularly to the forest edge. Each of them had seven 25 m² plots, systematically distributed every 25 m. Besides, we sampled the anurans along a transect located >1 km from the forest edge. To identify differences in species diversity along the edge distance gradient, the Shannon and Pielou indices were used. We assessed the influence of temperature and air humidity on species richness through regression analysis. Preliminary records presented 26 species from seven families. Species richness varied from four (in the edge) to 12 species (75 m from the edge). Species diversity was lower in distance zero ($H' = 0.92$) and increased considerably only 75 m further in the forest ($H' = 1.82$). The highest level of diversity was recorded 150 m inside the forest ($H' = 2.06$), which was higher than that found >1 km far from the edge ($H' = 1.86$). Low diversity found in the edge is even lower than the patterns found in open areas of other tropical forests. Furthermore, the equability in the edge ($J' = 1.52$) was lower than 150 m inside the forest ($J' = 1.97$), and temperature ($p = 0.50$) and air humidity ($p = 0.62$) did not correlate to species richness. Our results suggest negative effects on species richness until 50 m from the edge, where just a few species are favored, leading to a simple structure of the anuran community. Thus, the edge effects could influence the spatial distribution of the anurans.

Testing new methods to extract skin toxins from common toad (*Bufo bufo*) tadpoles

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Previous studies investigated the behavioural, morphological and physiological aspects of the predator-induced phenotypic plasticity, but plasticity in chemical defences—which is thought to be important in amphibians—has been rarely investigated. In order to study plastic responses in chemical defence both qualitatively and quantitatively, and without killing the study subjects, non-invasive methods are needed. With such methods, one may investigate the extent of plastic responses accurately and design repeated measure experiments e. g. to examine their fitness costs. In this study, we used a hormone (norepinephrine), hormone-like substances (phenylephrine and oxymetazolin) and electro-stimulation *in vivo* to extract skin toxins from common toad (*Bufo bufo*) tadpoles and analyzed the quantity and quality of the obtained toxins and investigated the effect of these treatments on individuals' behaviour and survival. We also used the standard invasive method, which requires to sacrifice the study subject, as a control, to which we could compare the accuracy of the tested alternative methods. We found decreased survival and reduced activity after the electro-stimulus and oxymetazolin treatments, which implies that these methods are harmful for the tadpoles and therefore should not be used in further experiments. On the other hand, norepinephrine and phenylephrine treatments had no adverse effects thus can be considered as suitable methods for non-invasive skin toxin extraction in future studies. We expect to get the results of the qualitative and quantitative analysis of the extracted toxin later this year.

Disentangling the *Pelomedusa subrufa* complex

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In our project we investigated the differentiation of the widely distributed African helmeted turtle (*Pelomedusa subrufa* complex) by means of morphological and molecular genetic analyses. Recent studies identified approximately 10 deeply divergent mitochondrial lineages, which could represent distinct species. The aims of our research are (1) to correlate possible morphological differences with genetic lineages and (2) to unravel the genetic identity of previously described taxa to allocate the available names to genetic lineages by using DNA sequences of historical type specimens.

Population size, survival and viability of the fire salamander (*Salamandra salamandra*) in Central Croatia

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Population viability analysis (PVA) has become a commonly used tool to estimate extinction risk and to model population dynamics of stage-structured populations, such as amphibians. There have been no studies of long-term population dynamics in Croatia. In this study I combined capture-mark-recapture data collected over a 3 year period with population viability analysis. The aim of this study was to analyse data on population size and adult survival of the fire salamander (*Salamandra salamandra*) and use it to confirm the predictions of population model. Population sizes, annual survival and viability of the fire salamander were estimated in an area of 4.25 ha in the temperate forest in central Croatia, where 4 permanent plots were installed. Drift fences and pitfall traps were used as sampling technique. Jolly-Seber mark-recapture model was used for the estimation of population density and survival. Data describing survival rates for distinct salamander population, complemented by a literature review on additional demographic parameters, were used to define population matrix and carry out simple viability analysis using a stage-structured model in the RAMAS GIS platform. Estimated population density ranged between 12.5 and 90 ind. ha⁻¹. The mark-recapture analysis of adult salamanders showed low rates of annual survival of 0.393. These trends are consistent with simulations of the system, which predicted that studied population had high extinction risk. Estimated quasi-extinction risk within a 50 year period ranged from 88.2% to 100%. Simulation predicted median time to extinction of 17 years. The PVA model simulation estimated also a negative trend in abundance for the *S. salamandra* population. These data offers some insight into the likely viability of the study population and suggests a link between local adult survival and salamander population trend. Predictions of PVA can be used as a tool to better understand the demography of amphibian populations.

Phylogenetic signal in vocalizations of Neotropical harlequin frogs (*Atelopus*)?

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Acoustic signals are important in intraspecific communication of most anuran species. To optimize the cost-efficiency balance, natural and sexual selection often blur phylogenetic signals. We study advertisement calls and their evolution in harlequin frogs (*Atelopus*). Vocalizations in this bufonid group are suggested to be 'conservative', perhaps because *Atelopus* species are largely allopatric and probably are only weakly affected by competition with non-congenerics, given that in general there are only few diurnal riparian anurans. Moreover, streams may be noisy and many taxa lack a middle ear. We here test the hypothesis that in these anurans acoustic traits reflect phylogenetic signal. By using simple Mantel tests, we compare Euclidean distances derived from quantitative call characters of so called 'pulsed calls' (i. e. advertisement calls) from 12 harlequin frog populations with genetic P-distances derived from mtDNA markers and relate traits to a phylogeny. Although sampling is limited, our results show significant correlations in two out of four traits studied. This leads us to tentatively confirm our hypothesis.

Adaptive variation in development time in response to habitat type in *Rana temporaria*: a joint assessment of inter- and intrapopulation variation and variation within clutches

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In anurans the timing of metamorphosis is a crucial life history trait with important fitness consequences. For instance, postponing metamorphosis can result in fitter adults, but also increases the risk of larval mortality when the habitat dries out. To assess the relative importance of local adaptation, phenotypic plasticity and bet hedging contributing to the reproductive success of pond breeding frogs, we set up a large scale laboratory common garden breeding experiment for 9 populations of the widespread generalist breeder *Rana temporaria* (the common frog), from habitats that differ in permanence and habitat predictability. More specifically, freshly laid eggs were collected from shallow wheel tracks with short hydroperiods, from permanent fishless habitats and from semi-permanent ponds that typically dry up once a year but may experience variable hydroperiods and both development time and developmental plasticity in response to a water drop were quantified. Results revealed adaptive variation in development time with frogs metamorphosing earlier in more short lived habitats. Simulated pool drying reduced development time in all populations but there were no significant differences among populations or habitat types. Intra-population variation in development time was higher in populations from semi-permanent breeding ponds and resulted mainly from variation among, rather than from variation within clutches. Overall, these results suggest that *R. temporaria* uses a combination of strategies to buffer against reproductive failure, including variation in life history traits within populations, local adaptation and a base-level of developmental plasticity. Bet-hedging via life history variation within clutches seems to be relatively unimportant in this system.

A spatial approach for testing the cryptic role of dorsal pattern design in *Vipera seoanei*

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Crypsis and aposematism are opposing evolutionary strategies derived from predator-prey interactions which have been ascribed to the zigzag pattern of European vipers. Previous experiments using plasticine models have demonstrated its aposematic role, while no evidence has been found regarding a possible cryptic function. Moreover, the high frequency of melanistic specimens at high altitude or latitude was suggested to play an important role in specimens' thermoregulation. *Vipera seoanei* is an endemic species to Iberia restricted to the northern region and with Euro-Siberian affinity. It is highly polymorphic showing four types of dorsal colouration patterns (*bilineata*, *cantabrica*, classical and uniform) and high frequency of melanistic specimens in mountains. In this work we aim to give insights into the cryptic role of *V. seoanei* dorsal pattern phenotypes by checking its relationship to environmental and habitat factors. A total of 490 georeferenced specimens from all of its Iberian range were double-blind classified according to a dichotomic key dealing with diagnostic characters of dorsal colouration. Then, the geographical coherence of phenotypes distribution was tested using Geographic Information Systems, and Ecological niche models using 19 low correlated variables (lithological composition, solar radiation, climate and habitat variables). Five clear phenotypes were identified for 448 specimens. Intermediate phenotypes for classic with *cantabrica* and *bilineata* were also identified (n=42). Each phenotype had a strong geographic coherence with intermediate phenotypes mostly occurring in contact zones. Environmental (e.g. temperature, precipitation) and habitat (e.g. abundance of pastures and grasslands) variables were related to one or more phenotypes but showing distinct response curve profiles. It is discussed the role of these factors as drivers of crypsis and thermoregulative performance and also the relation of phenotypes distribution to the genetic structure of the species.

Systematics, niche evolution and biogeography of the Middle Eastern newt (*Neurergus*)

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It is well known, that evolutionary specialization of taxa to a particular climatic regime limits their dispersal. Especially slowly and conservatively evolving organisms like ectotherm newts are likely to be strongly affected by environmental variables. Herein, we studied the correlation of environmental niche overlap and molecular similarity to reveal insights of the systematic relationship within the Middle Eastern newt, genus *Neurergus*. A molecular phylogenetic analysis based on two mitochondrial genes including all known taxa and recently discovered geographically distinct colour morphs of the salamandrid newt genus *Neurergus* was computed to reveal the valid species of *Neurergus*. Species distribution models of the genetically validated species of *Neurergus* were calculated to gain well-defined potential distributions for each species and provide a detailed zoogeographic picture. Based on this, niche occupancy profiles were created to evaluate niche conservatism between species of the genus *Neurergus* and show the correlation of environmental niche overlap and molecular similarity. Eight morphologically distinguishable and geographically separated taxa respectively colour morphs of *Neurergus crocatus* were included in the molecular analyses. Discovering discordance between mtDNA and morphology, our molecular analyses identified only four well-defined evolutionary lineages which represent valid species of *Neurergus*. Niche overlaps among these four species are low, suggesting only a minor degree of niche conservatism in *Neurergus*. Still, a tendency towards slightly higher niche conservatism was discovered comparing the more closely related taxa.

Population structure dynamics of a common frog population at the northern limit of its range

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Populations from high latitude, at the limit of their geographical range experience extreme climate. These populations are the most vulnerable to climate changes and require special conservation measures. We studied the temporal variation of age and body size in an isolated population of the common frog (*Rana temporaria*) from Kilpisjärvi, Lapland, Finland. Body size and age (estimated by skeletochronology) were measured for 120 adult frogs and 51 subadults captured in 2003, 2009 and 2010.

Age ranged between 4–9 years for females, 3–10 years for males and 2–7 years for subadults. Males were on average younger than females, but the median age for males was significantly higher in 2010 than in 2009. We found no significant difference between sexes in age at sexual maturity, males and females reaching the sexual maturity at 3 to 5 years. Body size varied highly within age classes and although a consistent positive relationship between body size and age was found, the relationship was not significant for either sexes or subadults.

The results of our study indicated that males have a slight tendency to live longer. Body size was a poor predictor of individual age possibly because of different resource allocation during growth periods.

Frog biogeography and evolution in the Congo Basin: some preliminary insight

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The biogeography and evolution of biota in the Congo Basin continues to be among the most enigmatic among the worldwide tropical rain forests. Most likely this vast lowland has been substantially impacted by past climatic oscillations leading to dramatic dynamics in ecosystems over time. We study these events using vertebrates which are generally sensitive to temperature and humidity: anuran amphibians. In the course of an ongoing collaborative project, we aim at linking information from phylogenetic and distribution studies using widespread species (or species complexes) in the genera *Hylarana*, *Hymenochirus* and *Hyperolius*, showing distinct differences in key elements of their life history (i. e. habitat requirements, body size, reproductive biology, dispersal capacity, etc.). At the current state, we have been able to investigate mtDNA samples from all over the basin and its peripheries and have developed climate-based statistical models on species' potential distributions. The results enable us to catch a preliminary glimpse of possible patterns of dispersal and vicariance events. Our findings tentatively support a general dispersal tendency from West to East but also the potential existence of a refuge within the center of the basin and can be used to formulate further hypotheses.

Phylogenetic relationships and phylogeography of the genus *Lacerta* in Greece

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The green lizards of the genus *Lacerta* (Sauria, Lacertidae) consist of 8 species which are almost restricted to the southern European peninsulas. The taxonomic assignment in species and subspecies level is problematic and their taxonomy is complex and constantly revised. Three species are present in Greece: *L. trilineata* in continental and insular Greece, *L. viridis* in northern and central continental Greece and some Aegean islands, and *L. agilis* in northern Greece. Here, sequence data derived from two mitochondrial (cyt-b and 16S rRNA) and one nuclear (NKTR) genes, were used to infer the phylogenetic relationships and evaluate the taxonomic status of the genus *Lacerta* in Greece. All phylogenetic analyses (Maximum Parsimony, Maximum Likelihood and Bayesian Inference), produced a tree with three major clades; the first clade corresponds to *L. trilineata*, the second to *L. agilis*, and the third to a complex of *L. viridis* and *L. bilineata*, raising questions about the current taxonomy and the distribution of the two latter species. Moreover, *L. trilineata* appears as a monophyletic group composed of six allopatric lineages. However, the eight *L. trilineata* subspecies, previously defined on the basis of morphology, do not correspond to the different lineages inferred. Thus, their status should be reconsidered. In conclusion, our data of Greek *Lacerta* stress the need for a reconsideration of the taxonomy of this main reptile group of Greece and highlight the difficulties that classical taxonomy is faced with when attempting to infer the relationships at species and subspecies levels.

Ovarian cycle of *Bothrops atrox*, a Neotropical viperid

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The reproduction of venomous snakes in captivity has become increasingly necessary. Several species are difficult to obtain or are even threatened with extinction, making studies of their poisons very difficult. Knowing the cycle and determining the best reproductive management of these species in captivity increases breeding success. *Bothrops atrox* is a species found in northern South America east of the Andes, where it is responsible for most snake bite accidents that occur in these locations. The aim of this study was to monitor the ovarian cycle of females of *B. atrox* to determine the best reproductive husbandry of this species. During a period of 17 months (March 2010 to July 2011) six females of *B. atrox* were monitored monthly by ultrasound equipment, using a linear transducer of 6 to 13 MHz, to observe the development of their ovarian follicles. The follicles were divided into four stages according to their size: stage I (follicles <0.6 cm), stage II (0.6 to 1.1 cm), stage III (1.2 to 2.0 cm) and stage IV (≥ 2.1 cm). The follicles in stages I and II were present in all months of the year, but in a larger percentage in the months of December to March (summer), follicles in stage III were seen mainly from April to December (autumn, winter and spring) and stage IV follicles were seen in the months of June to October (winter and spring). From May to August 2010, groups of two males and one female were released into a heated room with a 24-h monitoring system. In June 2010, two females were mated and in September of the same year fertilized eggs could already be seen in the oviducts. In December 2010, the offspring of both females were born, a clutch with 6 and another with 9 healthy babies. It was observed that the month of June had a higher success of mating rate, coinciding with the greatest amount of ovarian follicles in stage III encountered in the females that copulated.

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Complex origin of some bones in the grass snake *Natrix natrix* skull embryogenesis

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In order to study the peculiar properties of *Natrix natrix* skull formation and the way of its primordia appearance in embryogenesis 35 embryos of successive stages of development were investigated. The stages of development were determined in accordance with the table of the stages of normal development by D. R. Zehr. Pregnant females were caught in their natural habitat. Egg clutches were incubated in wetted vermiculite. To obtain embryos at different stages of development several embryos were taken every day. After oviposition the females were released in the places of their catch. Serial histological sections and double stained embryos were made.

As a result it was found that the maxillary and prefrontal bones have two, and post-orbital, parietal, supraoccipital, septomaxillary bones and basisphenoid three centers of ossification.

According to the classical theory separate centers of ossification in bones are the vestiges of independent ancestral bones. The formation of some bones in *N. natrix* skull from several centers of ossification confirms their complex origin. We assume that the maxillary bone in *N. natrix* is formed as a result of the confluence of maxillary, zygomatic and quadrate-zygomatic bones; septomaxillary—of septomaxillary and supraethmoid bones; prefrontal bone—of supraorbital, prefrontal and lacrimal bones; postorbital bone—of postorbital and post-frontal bones, supra-occipital—of two supraotic bones, which were independent in ancestors.

Probably in snakes phylogeny the decreasing number of skull bones was not due to their reduction, but as a result of their merging into monolithic ones.

Effects of thermal spring on elemental concentration of frog toe bones

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The aim of our study was to analyze the effects of thermal spring on elemental concentrations on frog toe bones in the Balkan frog (*Pelophylax kurtmuelleri*). There were collected 60 adult frogs from five thermal spring and one control pond (10 specimens from each pond) in southern Albania in 2011. The control pond was about 20 km from the thermal springs. Weights and body length of each frog were measured. The following elements were analysed in toe bones Ba, Ca, Mg, P, S, Sr and Zn, respectively. Our results showed that significantly smaller frogs were found in the thermal spring than in the control pond, except one thermal spring. Principal component analysis (PCA) showed a weak separation of thermal springs and control pond based on the elemental concentration of frog toe bones. Higher Ca and P concentrations were found in frogs from the control pond than in frogs which were collected from thermal springs. In the cases of other elements such as Fe, S and Ba the highest concentration was in frogs from thermal spring. Our results indicated that the bioaccumulation potential was high for frogs from the sediment, because of strong correlation was found between elemental concentration of sediment and toe bones ($R^2 = 0.792$). While, weakly interaction was between elemental concentration of thermal spring and river water and toe bones (thermal spring: $R^2 = 0.393$, river: $R^2 = 0.180$). In summary, the analysis of toe bones demonstrated that thermal springs may have effects of frog morphology size and elemental concentration of toe bones, and bones are useful to assess the environmental load and the quality of aquatic environment.

Societas Herpetologica Slovenica's activities for helping amphibians at road crossings

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Road mortality during spring migrations is a major threat to the survival of amphibian populations. In Slovenia, there are more than 1500 amphibian road mortality hotspots. Societas Herpetologica Slovenica has put much effort into addressing and raising public awareness on this issue. As a part of this, several projects of helping amphibians at road crossings are carried out annually. Since 2008, mitigating measures are implemented and temporary amphibian fences of varying length (no fence in 2009) are set up during spring migrations in Ljubljana, and from 2010 on also in Maribor. Both locations are set in an urban area. This enables the society to attract a large number of volunteers to help carry the amphibians across the road.

The data on the number, species composition and the exact location of amphibians crossing the roads is gathered yearly. The number of amphibians that were carried over the road in Maribor has been increasing each year, together with the increasing number of volunteers helping with the project. In Ljubljana, the number of volunteers is also increasing, but the number of amphibians varies from year to year. Altogether, more than 11,000 individual amphibians were carried over the road at the above mentioned locations, most of which belonged to the common toad (*Bufo bufo*) species. In Maribor, more young *B. bufo* specimens are observed each year—a potential positive effect of the project.

As an addition to the above mentioned activities, a support page with a “frogphone” telephone number was established in 2011, giving information about amphibians and roads to other amphibian conservation initiatives and to the general public.

The attention gained from the public and the media shows that these kinds of activities are a good conservation measure in terms of raising public awareness. The gathered data can serve as the basic information needed for long-term conservation measures, such as permanent fences and tunnels.

New distribution data and conservation status of *Vipera ursinii rakosiensis* (MÉHELY, 1893) in Transylvania, Romania

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The rare and endangered *Vipera ursinii rakosiensis* is a small-sized (up to 60 cm long) lowland steppe subspecies of the *V. ursinii* group. Its distribution is strictly associated with the natural or semi-natural steppe grassland remnants, and it displays a similar insular distribution pattern. Until now, the only extant population of the subspecies had been recorded in the district of Lopadea Nouă locality, Alba County. Previously, *V. u. rakosiensis* has been recorded from six localities: Fânațele Clujului, Făget forest and Florești (all in the vicinity of Cluj-Napoca), between Bonțida and Sic, Valea Florilor and Bogata, all in Cluj County. Here we report on a new locality for the taxon in the administrative territory of Rădești (Alba County) and also reconfirm the presence of the meadow viper outside the borders of the Fânațele Clujului Nature Reserves and in the hayfields neighbouring Bogata. The newly discovered sites occupied by meadow vipers at Fânațele Clujului, Rădești and Lopadea Nouă have been totally or partially included within the existing Natura 2000 network. One of the most important results of the 11–12 October 2012 biogeographical seminar in Bucharest was the acceptance of the proposal for the Bogata population to be included within a new Natura 2000 site.

Although covered by the Natura 2000 network, all known Transylvanian viper populations are still significantly threatened by habitat loss caused by human agricultural activities. Habitat destruction and fragmentation by ploughing and breaking the natural and semi-natural grasslands for the extension of cultivated fields remains a significant threat. Most existing secondary grasslands are still recorded in the official cadastral documents as ploughlands, allowing owners to plough them, even when the land has not been ploughed for decades. Overgrazing and deliberate or accidental burning destroy the vegetation cover. Illegal collecting and harassment of snakes, which often end with their death, and associated effects of urban and tourism developments, also play an important role in the population decline.

In order to preserve the viper populations in Transylvania, the only suitable solutions would be: (1) to persuade private owners to manage lands traditionally—but with restrictions—through the use of subsidies for Natura 2000 sites, and to encourage them to benefit similar payments under the agro-environmental schemes outside the Natura 2000 network; (2) to create an administrative structure financially supported by the state, in order to ensure proper management of the three large Nature 2000 sites: "Pajiștile lui Suciu" (ROSCIO187), "Dealurile Clujului de Est" (ROSCIO295) and for the newly proposed "Dealurile Bogatei" site, or (3) for the state or NGOs to lease or purchase these lands in order to implement an appropriate management regime. Further intensive surveys are needed across the whole region to identify remnant meadow viper populations for immediate protection.

Acoustic communication in two syntopic spadefoot toads

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Although most of the studies in anuran acoustic communication focus on advertisement calls, release vocalizations are also an important component of the mate-recognition system, by allowing energy conservation in cases of erroneous amplexus during reproduction (e.g. male-male, male-unreceptive female). Release calls are emitted both during and outside the reproductive season and provide their receivers information about the species, sex and size of the emitter. The genus *Pelobates* consists of four fossorial and nocturnal species. Two of these species, *P. syriacus* and *P. fuscus*, occur in south-eastern Europe, and their ranges overlap in the Balkan Peninsula. We quantitatively described the typical release calls (i. e. first order) of both species and tested for intra- and interspecific differences of the calling pattern. The sound samples were obtained under laboratory conditions by amplexus simulation, from 25 adults: 12 *P. fuscus* (8 males, 4 females) and 13 *P. syriacus* (7 males, 6 females). The animals were collected from two syntopic populations in Dobrudja region (Vadu, Romania). We used Raven Pro 1.4 software for sound analysis. We measured a series of temporal and spectral parameters from 497 calls: call duration, frequency range, dominant frequency and other parameters useful in pattern differentiation. In both species, the release vocalizations consisted of series of pulses and harmonic complex tones and the general structure of the call was approximately the same. We found no significant differences in the frequency range and dominant frequency of the calls, which indicates that the two species share the same acoustic niche. We found significant differences in the temporal and spectral patterns of the calls, between both sexes and species. We suggest that release vocalizations are important in mediating intra- and interspecific interactions and their communicational potential requires more attention.

Distribution and status of *Rana arvalis* in Central Slovenia

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Rana arvalis is one of the 19 amphibian species that are found in Slovenia. Until recently it has only been recorded in north-eastern and south-eastern lowlands of Slovenia, parts of the Pannonian and Sava Basin. Here we report on the first indisputable record of this species from the Central Slovenia, give preliminary results on the size and the distribution of the sub-populations and try to estimate present threats and status of the population and habitat. The data presented here was collected between 2009 and 2013.

On the 25th of March 2010 the presence of the moor frog was confirmed for the first time in Ljubljansko barje. The closest known population is located about 100 km SE in Krakovski gozd near Novo mesto. In the breeding season of 2011 an extensive field survey was carried out. Twelve potential areas where *R. arvalis* could be breeding were examined and on five areas breeding was confirmed. Altogether 6,112 spawn clumps of *R. arvalis* were counted, while additional 3,669 clumps could either belong to *R. temporaria* or *R. arvalis*. The highest ecological density was 84.67 adult frogs/ha.

Major threat for *R. arvalis* in Central Slovenia is fragmentation and habitat destruction due to urbanization. This area is in the immediate proximity of the capital city and the municipal landfill site which is planned for expansion. Because of its close vicinity to the capital this population is under the strong influence of human recreational activities. Here, visitors are frequent especially during the spawning time, when they often approach the animals up close and scare them.

Amphibians and reptiles in drinking water manholes: a supplementary method for herpetofaunal data collection

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Drinking water manholes with concrete plate cover are ecological traps and act like pitfall traps for amphibians and reptiles. They get inside by falling down when seek for shelter and stuck in. Hence manholes serve as data gathering sources for us. On the other hand they are a possibly global threat for animals that will die if not rescued. We visited 29 manholes along roads in a landscape of varied topography in north-eastern Hungary and counted and rescued fallen amphibians and reptiles. We checked manholes at least once a month for six years (northern site, river floodplain and hills with forests and vineyards) or for four years (southern site, mainly croplands, grasslands and wetlands). We found a total of 1726 individuals of ten amphibian and six reptile species (1455 and 271 individuals, respectively), roughly half (47%) of the herpetofauna of Hungary. We found every species reported in the literature, or were expected from each area, except one. *Bombina bombina* was by far the most frequently encountered amphibian (59%), followed by species of the *Pelophylax esculentus* complex (14%), *Pelobates fuscus* (9%), and *Triturus dobrogicus* (8%). *Natrix natrix* was the most frequent reptile (63%), followed by *N. tessellata* (20%) and two *Lacerta* species (*L. agilis*, *L. viridis*, 5% each). Most amphibians (74%) were found at the southern site, whereas most of the reptiles (77%) were found at the northern site. Daily capture rates (number of animals trapped divided by the number of days passed since the last check) of amphibians varied by season (autumn > spring > summer) and there was a significant interaction between season and year, whereas at reptiles only depended on site (northern > southern). These results draw attention to the potentially harmful impact of manholes, but also show that counting and rescuing trapped animals in appropriately short time intervals can be a useful tool for monitoring amphibians and reptiles.

Differences in locomotor activity in two syntopic spadefoot toad species (genus *Pelobates*)

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Understanding the coexistence of related species in ecological communities is a challenge for ecologists. The spadefoot toads (genus *Pelobates*) from Dobrudja (Romania) provide a very interesting study-case: the ranges of two species of the genus overlap at the limit of their distribution ranges—southern limit for *P. fuscus* and northern limit for *P. syriacus*. Both spadefoot toad species are nocturnal, fossorial, and exploit a similar ecological niche. They have similar sizes at metamorphosis, reach sexual maturity at a similar age but *P. syriacus* becomes significantly larger than *P. fuscus*. We examined the adaptive value of interspecific variation in behavioural patterns, such as level of activity (locomotor behaviour), since any type of movement includes trade-offs, in terms of energetic costs, exposure to predation and drought, but at the same time provides increased access to food. The nocturnal activity of 6 adult *P. fuscus* and 6 *P. syriacus* (3 females and 3 males for each) was monitored in a laboratory setting for a period of 30 days. We used webcams to capture time-lapse photographs of the toads' movement, which were then used to obtain tracks for each individual (a total of 48 tracks and over 260 hours of activity). Our results showed that *P. syriacus* was significantly more active than *P. fuscus* with almost 2.5 overall distance covered and more than twice the speed achieved, but with approximately the same time spent outside burrows. Our preliminary results suggest that the closely related *Pelobates* species from Dobrudja differ in patterns of foraging behaviour, *P. fuscus* being relatively sedentary ('sit-and-wait') whereas *P. syriacus* is more an active ('widely-foraging') predator.

Variation in body size and sexual size dimorphism in two *Pelobates fuscus* populations

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The analysis of intra- and interspecific patterns of geographic variation in body size have played and still maintain an important role in evolutionary biology. In amphibians body size is often closely related to fitness due to its association with longevity, fecundity, metabolic rate and tolerance to environmental stresses such as starvation and desiccation and is mostly consistent with variation of some characteristics of the environment. Here we investigate the variation in body size and sexual dimorphism of common spadefoot toads (*Pelobates fuscus*) collected from two bioregions in Romania that lie 470 km apart: the Continental (Sălicea, Transylvania) and the Pontic (Vadu, Dobrudja) bioregion, respectively. Eight morphometric measurements, body length (L), head width (Ltc), femur length (F), tibia length (T), tarsus length (Ltars), first toe length (Dp), forearm length (Lma) and mass (G), were recorded for 324 (137 females, 187 males) individuals from Sălicea and 74 (32 females, 42 males) individuals from Vadu. Significant overall differences between mean trait size for females and males were found, with a considerable reduction in size from the Sălicea, to the Vadu populations. Results showed significant differences between populations for F, T, Dp and G (females) and Ltc, F, T, Dp, and G (males). We found sexual dimorphism in mean Ltc, F, T, Dp and Lma size, females being significantly larger than males in both populations. The main implication of this study is that the populations differ in the magnitude of geographic variation of the body size. The differences are most likely due to the different environmental conditions: i) drier and harsher environment, ii) availability of food resources and iii) possible competition with the larger Eastern Spadefoot Toad, *Pelobates syriacus*, in the Vadu population.

Genetic connectivity of (meta-) populations in *Hyalinobatrachium valerioi*

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The reticulated glass frog *Hyalinobatrachium valerioi* (Centrolenidae) is a small leaf-breeding frog in tropical rainforests of Central and northern South America. The species typically occurs in small aggregations of breeding individuals along forest streams. While some studies have investigated the reproductive behavior of this frog species, little information is known about individual migration rates and gene flow between such patches. We monitored a population of *H. valerioi* at the tropical lowland stream Quebrada Negra near La Gamba, Costa Rica, during their reproductive season between August and December 2012. Along a 400 m river transect we identified 10 spatially clustered breeding aggregations, with on average 16 individuals per patch, separated 5 up to 50 meters. We recorded precise spatial locations of all frogs and clutches, took dorsal pictures of all frogs for individual identification, and collected tissue samples from the adults and clutches for subsequent molecular analyses. The integration of observational field data and molecular analyses of highly polymorphic microsatellite loci provides valuable information about gene flow between the patches and also the genetic relatedness among the individuals within single patches in the *H. valerioi* population under study.

The Active Protection Program of the common toad (*Bufo bufo* L., 1758) with the population's condition analysis on the migratory routes in Wrocław, Poland

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Bufo bufo is the most common species of toad in Poland and one of the first active amphibians in early spring. They usually cross many routes during their migration to the mating sites. The Active Protection Program in one of the biggest common toad populations in Wrocław has started in 2010. The main goal of our activities is to reduce amphibian mortality caused by traffic. Migrating individuals are collected from the roadway and transported safely to the vicinity of breeding ponds. In 2010, we found 1129 individuals, including 521 males, 301 females and 307 dead individuals (sex undefined). Mortality was about 27%. A year later, condition of population was similar with total of 1279 individuals collected (701 males, 378 females), mortality decreased to 15.6%. In 2012, a strong reduction of the migrating individuals, was observed, most likely caused by adverse and unusual weather conditions. Even if there was snow, migration of amphibians started, but temperature dropped below 0 °C again. Migration, normally lasting about two weeks, extended to four weeks. Only 306 toads were found (241 alive and 65 dead individuals), so the number of population decreased four times. In 2012 action was extended by morphometric studies of carries amphibians. In 2013, data are still collected. This year migration was hampered by a long winter and began about three weeks later than usual.

Spatial niche segregation among three lacertid taxa living in close proximity in Bulgaria

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The three lacertids subject of this study (*Lacerta agilis bosnica*, *L. a. chersonensis* and *L. viridis viridis*; 350 individual locations with equal sampling effort among the three taxa) share the catchment of the Sofia Valley (259,343 ha, altitudinal range between 550 m and 2,290 m a. s. l., western Bulgaria). Our main goals were to calculate the overlap between their spatial niches and to evaluate the dominant factors defining the spatial niches. Environmental predictors used for spatial distribution models (SDMs) included climate parameters, geographic characteristics of the relief and habitats. The dataset was processed with the softwares Maxent and NextGIS. The output rasters were then reclassified to four classes: unsuitable, with low suitability, medium suitability, and optimal.

Spatial niche overlap was lowest between *L. a. bosnica* and *L. a. chersonensis* (0.28% for low and 0.02% for the medium suitability classes); between *L. a. bosnica* and *L. v. viridis* was slightly higher: 2.85% (low suitability), 0.78% (medium suitability) and 0.19% (optimal); between *L. a. chersonensis* and *L. v. viridis* was with the highest values, respectively 19.95%, 4.15% and 0.54%.

The most important for the SDMs for all taxa were altitude and habitats. For each taxa different climatic parameters were most important: for *L. a. bosnica*, maximum temperature of the warmest month, mean temperature of the driest quarter and precipitation of the wettest month that correspond to its mountainous distribution; isothermality and precipitation of the driest/warmest quarter explain well the present distribution of *L. a. chersonensis* which is confined to the western Sub-Balkan valleys; for the more thermophilous *L. v. viridis* minimum temperature of the coldest month and annual precipitation explain best its distribution.

In conclusion, the spatial niche segregation between the three taxa is well pronounced and is determined by common geographical factors but different specific climatic requirements.

The effect of the pesticide GLYPHOGAN CLASSIC® on two common aquatic predators

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Pesticides containing glyphosate and POEA (e. g., GLYPHOGAN®) can have a negative impact on non-target animals in aquatic habitats. Cladocerans, fishes and larvae of anuran amphibians are commonly used indicator organisms in ecotoxicological studies of pesticides. However, little is known about the influence of these chemicals on other taxa inhabiting small water bodies. Our aim was to directly examine the impacts of a frequently applied pesticide (GLYPHOGAN®) on two top predators of temporary ponds. We used adult males of the smooth newt (*Lissotriton vulgaris*) and larvae of the dragonfly *Aeshna cyanea*, which are common in central European wetlands. We kept predators individually in outdoors mesocosms containing either no or a low dose of GLYPHOGAN®. We fed predators with two *Rana dalmatina* tadpoles every other day. We measured the effect of the pesticide on survival and behaviour of individuals. We also evaluated changes in body mass by measuring predators before and after the three weeks of the experiment. Finally, we tested for potential effects of GLYPHOGAN® on predation efficiency by providing predators with 10 *R. dalmatina* tadpoles and counting survivors 24 h later. We performed this bioassay both in clear water and in water containing GLYPHOGAN® with all predators in a random order. At the concentration applied and in the conditions of our experiment, we did not observe significant effects of GLYPHOGAN® on changes in body mass, survival, behaviour or feeding activity either in *L. vulgaris* or in *A. cyanea*. Comparing the two predators, we found that larval dragonflies killed more tadpoles, than did newts, but this result did not depend on the chronic or the acute exposure to GLYPHOGAN®. From our results it seems that GLYPHOGAN® has no direct effects on the studied top predators of temporary ponds. It remains to be seen if the chemical still affects predators via indirect effects, acting through the trophic cascade.

Behavioural consistency and life history in *Rana dalmatina* tadpoles

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Recent interest in evolutionary behavioural ecology has turned towards understanding the causes and consequences of behavioural consistency, manifesting either as animal personality (i. e. consistency in a single behaviour) or behavioural syndromes (i. e. consistency across two or more behaviours). Further, behavioural consistency has been linked to life-history strategies currently, possibly forming integrative pace-of-life syndromes (POLS). However, empirical tests of this theory are extremely scarce. Here, we tested, using agile frog (*Rana dalmatina*) tadpoles as model, if POLS could be detected in the larval stage of amphibians based on a common garden experiment targeting two ontogenetic stages and measuring three behavioural traits. Activity was consistent in the early stage and was negatively related to age at metamorphosis. In the later stage, activity, exploration and risk-taking was all consistent, but their relationship with life-history depended on whether the studied individuals were tested in the earlier stage or not. Already tested individuals showed no POLS, but both activity (negatively) and risk-taking (positively) was related to age at metamorphosis in their previously untested conspecifics. Individual-level estimate of consistency in exploration (not the mean behaviour) was also negatively related to age at metamorphosis in the previously untested individuals. We only detected one behavioural syndrome: activity and risk-taking was strongly negatively correlated in the previously tested (i. e. disturbed) group. Our results provide evidence for (i) animal personality in tadpoles, (ii) an activity–metamorphosis-timing POLS and (iii) an unexpectedly strong effect of moderate disturbance related to standard behavioural testing on later behavioural consistency.

Distribution of *Polystomoides ocellatum* (Monogenea: Polystomatidae) in Spain parasitizing the European pond turtle (*Emys orbicularis*)

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The genus *Polystomoides* is an oixenic parasite of freshwater turtles, with more than 30 described species. *Polystomoides ocellatum* parasitize the buccopharyngeal cavity of the European pond turtle. This species has a wide distribution range, after having been recorded in several countries; Old USSR, Ukraine, Romania, Bulgaria, Italy, France, and perhaps Tunisia.

In Spain, *P. ocellatum* was recorded in European pond turtles from Tudela (Navarre, northern Spain) three years ago. Since then, more samplings have been carried out in several populations of the Ebro basin, and in other locations in Spain. Buccal swabs were used to detect adult parasites in the buccopharyngeal area of the pond turtles, and *Polystomoides* were located without causing any damage to the turtles.

In Cuenca (Central Spain) samplings *P. ocellatum* was not found, while its presence seemed to be widespread in the *Emys orbicularis* populations from the Ebro basin. Two specimens were found in a population located in the region of Valencia (eastern Spain), and one in Galicia (Northwestern Spain).

In this study we show the confirmed presence of *P. ocellatum* in relation to *Emys orbicularis* in a distribution map of 10×10 km UTM squares. More samples are needed from other Iberian and North African populations to elaborate further this hypothesis about the natural history of this species.

Evaluation of the evolutionary history of *Podarcis cretenis* (Sauria: Lacertidae)

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Recently, several works have focused on lacertid lizards of the genus *Podarcis*, revealing cases of hidden diversity and paraphyly, and offering evidence that suggests the alteration of the extant taxonomical arrangements within the genus. The Balkan species *P. peloponnesiaca* and *P. erhardii* fall in such a case of hidden diversity and paraphyly. To deal with this taxonomic problem, the populations from the island of Crete and its satellite islets were assigned to a new species (*P. cretensis*), which is endemic to this island group. On the island of Crete, its distribution pattern is peculiar since the species is present only on the western part, grossly to the west of a N–S axis “cutting” Crete at the town of Rethymno. Here, we inferred intraspecific relationships, and tested hypotheses for historical patterns of population expansion, with phylogenetic and phylogeographic approaches using both mitochondrial (mtDNA) and nuclear (msats) markers. The phylogenetic relationships supported the monophyly of *P. cretensis* and suggest that three main haplogroups are present on the island. These groups have diverged in Pliocene indicating that present distribution of *P. cretensis* was determined by a combination of dispersal and vicariance.

Common lizard: microhabitat choice in a subarctic habitat

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Common lizard (*Zootoca vivipara*) is a reptile inhabiting the northernmost parts of the world, in Scandinavia and Siberia crossing even the Arctic Circle. In spite of the fact being an ectotherm, it adapted very well to harsh climatic conditions. Thermoregulation in subarctic habitats can have substantial costs, still on the basis of our earlier surveys it is worth for lizards to keep accurate thermal control. Temperature distribution is not the only condition having a significant role in thermal control; solar radiation and the choice between various microhabitats are just as important. In our survey conducted at the latitude of the Arctic Circle in Finland, we wanted to explore to what extent solar radiation and the physical structure of vegetation influence the habitat choice of lizards. Only open or semi-open microhabitats of a meadow abandoned 40 years ago were involved in the survey. We developed a radiation model and a vegetation map of the lizards' habitat, and then compared the solar radiation and microhabitat distribution of the detection points of lizards and of all the points of the habitat. According to our results, the radiation values of the individual microhabitats do not differ; therefore the character of vegetation is influenced by other ecological variables. However, neither because of solar radiation nor on the basis of habitat is the distribution of lizards random. The lizards preferred the points extended to solar radiation for longer periods, and occurred more frequently in areas covered by high grass. According to our results we can state that lizards do have preferences based on solar radiation and microhabitat, and these two choices are independent from each other. Thermoregulation, as well as other physiological constraints, such as food supply and shelter availability can be decisive criteria.

Higher than expected genetic diversity in a small area: *Zootoca vivipara* in the eastern part of Hungary

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The Eurasian common lizard, *Zootoca vivipara* (LICHTENSTEIN, 1823), is the lizard with the largest distribution area on Earth. It has several subspecies/clades, some with extremely large, others with more limited distribution areas. Several papers were published recently about the phylogenetic relationships of the viviparous and oviparous haplogroups of the species describing clades living only in Central Europe. Our aim is to describe the phylogeographical structure of *Z. vivipara* in the Carpathian Basin. As a first step we studied Hungarian populations. Samples were collected from eight locations. Total DNA was extracted from small tissue samples of the tail. Two target genes were selected for the phylogenetic analysis: a partial sequence (appr. 300 bp) of the protein encoding cytochrome b (cyt b) and a partial sequence (appr. 500 bp) of the non-protein coding 16s. Sequences of four lacertid species were downloaded from the GenBank and were used as outgroups. Maximum likelihood analyses of the data revealed a congruent overall topology that is characterized by five main groups: the PA haplogroup is present in the northwestern, the VH haplogroup in the central part of the country. The other samples collected from the northeastern part of Hungary are in the contact zone of VB and VU haplogroups and were divided into three groups. Our study supports the model of four haplogroups being present in the Carpathian Basin, but comparing our results to the previous studies we detected higher presence of the VU haplogroup in the eastern region of the country. Furthermore, the VU haplogroup is divided into two main groups, representing high genetic diversity in a relatively small area.

Mitochondrial DNA diversity of the Alpine newt, *Mesotriton alpestris* in the Carpathian Basin

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The Alpine newt, *Mesotriton alpestris* occurs with isolated populations in the low-elevation mountains of the Carpathian Basin, surrounded by the Carpathian Mountains and the western Alpine domain. Using 1407 bp of the mitochondrial genome (fragments of the ND4 plus adjacent tRNAs and 16s genes) we inferred the genetic diversity and evolutionary relationship of these isolated Carpathian Basin populations. We collected samples from five regions of the Hungarian mid-elevation mountains (Őrség, Bakony Mts., Mátra Mts., Bükk Mts., Zemplén Mts.) covering the distribution of the species in Hungary, plus from Mt. Apuseni in Romania. Our sequences were compared with unpublished sequences representing the rest of the species' range in Europe. The phylogenetic analyses split our samples into two major clades representing the Eastern and Western European clades. The samples from Apuseni Mts. are closely related to the Southern Carpathian lineage being part of the Eastern clade. All the Hungarian samples belonged to the Western clade, but with significant substructuring among the Alpine (Őrség), Western Transdanubian Range (Bakony) and Northern Mountain Range (Mátra, Bükk, Zemplén) samples. Within this clade Bakony Mts. is a sister taxa of the rest of the clade, suggesting that this population might have survived Pleistocene glaciations within the Carpathian Basin in a separate glacial refugium.

Effects of water contamination on site selection by amphibians: experiences from an arena approach with European frogs and newts

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Pesticide residues in breeding ponds can cause avoidance by at least some amphibian species. So far, outdoor experiments have been performed only with artificial pools in areas where a target species occurs and new colonizations of water bodies have been observed. Results of this kind of study are potentially influenced by natural disturbances and therefore are of limited comparability. We used an easily-to-establish standardizable arena approach, in which animals in reproductive condition for some hours had the choice among pools with different concentrations of a contaminant. Because of an ongoing debate on the potential environmental impacts of glyphosate-based herbicides, we investigated the impact of glyphosate isopropylamine salt, ROUNDUP® LB PLUS and glyphosate's main metabolite aminomethylphosphonic acid (AMPA) on individual residence time in water. The following European amphibian species were tested: common frog (*Rana temporaria*), palmate newt (*Lisotriton helveticus*) and Alpine newt (*Ichthyosaura alpestris*). A total of each 60 pairs of palmate and Alpine newts ($n = 240$) and 50 male common frogs were sampled in two ponds near Trier, Germany. Experiments were performed in arenas with 10 replicates/night from March 12 to 28. An arena (1.5 × 1.5 m) was defined by an amphibian drift fence and consisted of a hiding place (leaves and planks) and four artificial pools (plastic pans of 34 × 34 cm, each with a 10-L capacity and a 13-cm maximum depth). Beside controls, tested AMPA concentrations were 0.5 (slightly above the European Environmental Quality Standard for AMPA: 0.45 mg/L), 0.05, and 0.005 mg/L; tested glyphosate and ROUNDUP® concentrations were 1.0 (slightly above the German 'worst-case' expected environmental concentration: 0.9 mg a. e./L), 0.1 (the European Environmental Quality Standard for glyphosate), and 0.01 mg a. e./L. To compare the residence time (min) of individuals in the four groups of contamination, we used Kruskal-Wallis tests followed by Wilcoxon rank sum tests (data were not normally distributed). In addition, we tested with generalized linear models (GLMs) if the different concentrations or considered environmental cofactors influenced the percentage residence time of animals of each trial (i. e., percentage residence time of all individuals tested in one night) as proposed for such behavioral studies where uninteresting behavior (here, time spent on land) was excluded from analyses. Considered environmental cofactors were average water temperature, nightly minimum ground temperature, precipitation, relative air humidity. The residence time in water was not significantly affected by any concentration. Occasionally, microclimatic cofactors (nightly minimum ground temperature, water temperature) apparently influenced the residence time. The major drawback of such quick arena approach is that results can be transferred to perception and avoidance of contaminated water rather than to site selection by the specimens. Testing for oviposition site selection may require more natural water bodies and a longer study period. Hence, for the development of a standard procedure in risk assessments, an intermediate design between an arena approach, as presented here, and previously performed field studies may be applicable.

Resolving sky island speciation of East African *Adolfus alleni* (Sauria, Lacertidae)

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The genus *Adolfus* STERNFELD, 1912 currently contains three species from Equatorial Africa. Two of these occur in widespread, low to mid-elevation, habitats but *Adolfus alleni* is only known from four montane peaks (Aberdares, Mt. Kenya, Cherangani Hills, Mt. Elgon) in Kenya and Uganda. An integrative approach using 58 morphological characters and genetic analyses of mitochondrial (16S and cyt b) and nuclear (*c-mos* and RAG1) DNA sequence data revealed differences between these populations, and indicates that *A. alleni* is a complex of at least two cryptic species. Herein, we describe the populations from the Aberdares and Mount Elgon as a new species, and restrict *A. alleni* to Mount Kenya. This action underscores the importance of conservation strategies to protect these montane peaks, which may harbor additional, unique evolutionary lineages.

Island zoogeography at a continental scale

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Africa is well-known for its biodiversity and especially for its endemism of restricted zoogeographic areas or single mountain systems. Opposite, little is known about widespread groups occurring across the continent, such as *Hemidactylus* (Gekkonidae), *Trachylepis* (Scincidae), or *Boaedon* (Colubridae). Lizards in the genus *Agama* (~ 45 species) have a pan-continental distribution and the evolution of conspicuous sexual dimorphisms accompanied by a variability in social systems among colorful versus drab species suggests that these traits may have had a profound impact on lineage diversification. The poster presents a comprehensive time-calibrated species tree for most African *Agama* species using five independent loci augmented with anchored phylogenomic data from nuclear genes for 23 species to strengthen the backbone of the phylogeny. The origin, diversity and evolution of African agamas are discussed in the light of these new phylogenetic relationships.

An extraordinary tail—integrative review of the agamid genus *Xenagama* BOULENGER, 1895

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Approximately 120 years after its description, this is the first thorough systematic review of the agamid genus *Xenagama*. Currently, the genus includes two extraordinary species, characterized by strongly discoidal tails. Both species are only known from a few localities in northeastern Ethiopia and northern Somalia and are represented by a small number of specimens in museum collections. Morphological and mitochondrial (16S) DNA sequence data revealed that *X. batillifera* is a complex of two cryptic species and the reassignment of *Acanthocercus zonurus* to the genus *Xenagama* is supported by morphological analyses. Herein, we present the results of a recent paper in which we described specimens previously recognized as a geographic variant of *Xenagama batillifera* as a new species and compare it to other whorl-tailed lizards of the genera *Xenagama* and *Acanthocercus* from the Horn of Africa, underscoring the significance of this poorly known but important region for agamid evolution. Among other features, the new species is characterized by possessing heterogeneous body scalation, no nuchal crest and no tufts of elongated scales around the ear. Similar to *X. batillifera* or *X. taylori*, and distinct to other African agamid lizards, the tail is shorter than the body and head, but the tail base is less discoidal than in *X. batillifera* or especially *X. taylori* and gradually merges into the terminal filament. The discoidal part of the tail is arranged in whorls with one scale ring each, whereas the filament is not distinctly whorled.

Amphibian diversity in Tarutao National Park and capacity-building in amphibian research and conservation in peninsular Thailand

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The project seeks to promote anuran conservation in peninsular Thailand and in particular in the islands of Tarutao National Park. Our team is led by staff from the Prince of Songkla University and the Hungarian Natural History Museum and comprises students from the Prince of Songkla University and staff of the Tarutao National Park. All are being trained in anuran identification, ecology and disease, with particular reference to the fungus disease *Batrachochytrium dendrobatidis*. From the initial field research, 12 amphibian species were found, including a new form of *Hylarana eschatia* and *Ingerophrynus parvus*—the morphometrics and ecology of all species were studied. To date, *Bd* fungus infection has not been found in Tarutao National Park; however, we continue to monitor for this. We intend to expand this project to other national parks in peninsular Thailand and have already undertaken a provisional study at Hala Bala Wildlife Research Station.

Fish introduction affects amphibians by increasing avoidance behaviour and inhibiting sexual activity

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Amphibians are currently declining worldwide for a variety of reasons. One of the major causes is the introduction of fish in their natural habitat. Since many amphibian populations do not usually share a common evolutionary history with fish, the detrimental impact of these introductions is understandable. A way for amphibians to persist in such altered environments is to adopt adequate behavioural tactics. However, although it has been shown that avoidance behaviour may decrease the probability of being detected by a potential predator, little is known on fitness consequences, particularly in terms of sexual behaviour. In this study, we aimed at testing the impact of goldfish (*Carassius auratus*) on sexual activity and mating tactics in adult Alpine newts (*Ichthyosaura alpestris*) in risky and safe micro-habitats. To this end, we compared behavioural patterns of newts in function of fish presence in a replicated laboratory design. Consistently through the whole breeding period, there was a significant effect of fish on the behaviour of newts. Fish presence caused an increased shelter use and a decreased sexual activity; this particularly in risky habitats. Moreover in the presence of fish, courtship displays varied and encounters were less successful than in their absence. These results show that fish presence can affect newts in complex ways, including the inhibition of their reproduction. They also highlight the importance of integrating behaviour into conservation studies for a better understanding of the interactions between native amphibians and introduced fish.

Geometric morphometric analysis of cranial variation in paedomorphic and metamorphic forms of the northern banded newt, *Ommatotriton ophryticus*

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The northern banded newt, *Ommatotriton ophryticus* has been listed as Near Threatened (NT) in the Red List of IUCN. It belongs to the family Salamandridae and can be found in northwestern Turkey, northwestern Armenia, Georgia, and southern Russia.

An aquatic larval stage is followed by metamorphosis to reach terrestrial juvenile and then adult stage in amphibians. However many species of salamanders exhibit paedomorphosis, i. e. retain ancestral juvenile characteristics by adult stages of descendants. Paedomorphic forms of *O. ophryticus* were first described in 2008 from near Karasu, in the vicinity of Sakarya, Turkey. Also, there are many species of European newts that show paedomorphic form such as *Lissotriton vulgaris*, *Triturus macedonicus*, and *Ommatotriton vittatus*.

Patterns of cranial variation in 27 paedomorphic and metamorphic specimens of *O. ophryticus* were analyzed using geometric morphometric methods. Dorsal views of the cranium of all specimens were photographed with Olympus SZ61 Stereoscope equipped with an Olympus digital camera. The analysis was performed on the coordinates of 13 landmarks defined on one side of the cranium of each specimen (tpsDig V.1.40). The relative warps analysis was done tpsRelw programme, version 1.42. Patterns of cranial shape change were analyzed by tpsSpln (tpsSpln V.1.20) to demonstrate cranial shape changes as deformations. Shape analysis showed that there was no significant differentiation between paedomorphic and metamorphic specimens of *O. ophryticus*.

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