

PLENARY LECTURES

Facultative paedomorphosis in pond-breeding newts

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During their life cycle, pond-breeding newts usually undergo a metamorphosis that makes the transition between the aquatic gilled larval stage and the terrestrial metamorphosed stage. One of the characteristics of this shift is the resorption of the gills and the closure of gill slits. However, in some populations, whereas some individuals metamorphose, others retain their larval features such as gills while acquiring sexual maturity, a pattern known as facultative paedomorphosis. Although rarer than metamorphosis, paedomorphosis is expressed in numerous species and populations, making it not anecdotic. It is therefore thought to play an important role in ecology and evolution.

Facultative paedomorphosis is a polyphenism in which alternative phenotypes are produced in response to environmental variables but is also clustered in some geographic areas. Although paedomorphs are mainly found in deep and fishless habitats, such as alpine lakes, they can also be present in semi-permanent ponds. By being able to detect changes of aquatic conditions, individuals can shift tactic, i.e. paedomorphs can transform into the dispersal phenotype, the metamorph. Being paedomorphs in such risky conditions remains advantageous as it allows an early reproduction (i.e. progenesis) compared with the metamorphs. Although there are sex effects at varied levels, males and females respond to environmental change and both morphs are sexually active. This translates also in a large gene flow across phenotypes within ponds. Such an absence of sexual isolation allows the persistence of both developmental strategies in heterogeneous environments and is therefore contrasting with patterns of obligate paedomorphosis which are found in some salamanders.

Coexisting paedomorphs and metamorphs exhibit temporal, spatial and food resource partitioning, but with variations across populations. Temporal partitioning occurs in sites where metamorphs leave water for land during a part of the year whereas micro-habitat and food specializations are found during their aquatic cohabitation. Their different trophic morphology can explain the different diet patterns but also their preferences for different micro-habitats. This suggests that facultative paedomorphosis can be considered to be a trophic polyphenism and that its selection is not only caused by the advantages of life in water versus on land, but also through the heterogeneity within aquatic environments.

The low number of populations of paedomorphs and their continuous use of the aquatic habitats make them very vulnerable. Longitudinal surveys show they are declining at a very

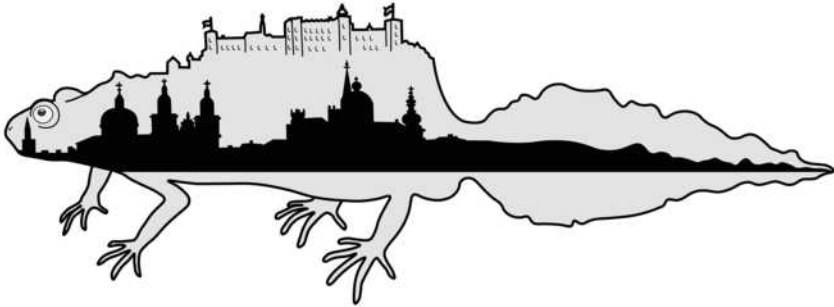
high rate across all their distribution range. For instance, the most remarkable populations of paedomorphs, previously known as subspecies in the Balkans are all gone. The main driver of this decline is the introduction of alien species in ponds and lakes, extirpating first paedomorphs and then metamorphs. The only hope is that, being a polyphenism, paedomorphosis shows fast resilience in some populations. Drought could therefore help removing fish but may also be a disaster. On another hand, because of a potential long-lasting counter-selection against paedomorphosis in some populations, specifically in alpine lakes, it is likely too late. Conservation actions should therefore take place to remove threats and protect the main populations of paedomorphs as highly valuable part of intraspecific diversity.

References

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- Denoël, M. & L. Winandy. 2015. The importance of phenotype diversity in conservation: Resilience of palmate newt morphotypes after fish removal in Larzac ponds (France). - *Biological Conservation* 192: 402-408.
- Mathiron, A.G.E., J.-P. Lena, S. Baouch, & M. Denoël. 2017. The 'male escape hypothesis': sex-biased metamorphosis in response to climatic drivers in a facultatively paedomorphic amphibian. - *Proceedings of the Royal Society B: Biological Sciences* 284: 20170176
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PROGRAMME & ABSTRACTS



University of Salzburg
18th - 23rd September 2017

Thursday, September 21st – Morning

08:30 – 09:15	Plenary Lecture: Mathieu Denoel: Facultative paedomorphosis in pond breeding newts Chair: Eva Ringle		
	Room 1	Room 2	Room 3
09:20 – 10:40	Session 6c: Ecology & Behaviour of Reptiles Chair: Jelka Crnobrnja-Isailovic	Session 9a: Diseases & Anomalies Chair: Florian Glaser	Micro CT Workshop 1 Chair: Chris Broeckhoven
09:20 – 09:40	Laurane Winandy, Lucie Di Gesu, Marion Lemoine, Staffan Jacob & Julien Cote: Conspicuous attraction in a landscape of fear: How different sources of information about predation risk affect sociability in lizard	Stefano Canessa, Claudio Bozzuto, Evan H. Campbell Grant, Sam S. Cruickshank, Matthew C. Fisher, Jacob C. Koella, Stefan Lötters, An Martel, Frank Pasmans, Ben C. Scheele, Annemarieke Spitzen-van der Sluijs, Sebastian Steinfartz, Benedikt R. Schmidt: Finding evidence-based amphibian conservation strategies in an emergency	Keynote: Chris Broeckhoven & Anton du Plessis: Micro-computed tomography (micro-CT) in herpetological research: concepts, practical considerations and potential
09:40 – 10:00	Bianca M. op den Brouw, Syed A. Ali, Nicholas R. Casewell, Behzad Fathina, Parviz Ghezellou, Bryan G. Fry: Functional variation in the venom of desert vipers <i>Pseudocerastes</i> and <i>Eristicophis</i> (Viperinae: Viperidae)	Blooi, Mark, Laking, Alexandra E., Martel, An, Haesebrouck, Freddy, Jocque, Merlijn, Brown, Tom, Green, Stephen, Vences, Miguel, Bletz, Molly C., Frank Pasmans: Host Niche May Determine Disease-Driven Extinction Risk	Chris Broeckhoven, Celeste De Kock & P. le Fras N. Mouton: Sexual dimorphism in osteoderm expression and the role of male intrasexual aggression
10:00 – 10:20	Verónica Gomes, Antigoni Kallontzopoulou, Miguel A. Carretero & Anthony Herrel: Morphological trade-offs between duration and maximal capacity of bite performance in <i>Podarcis bocagei</i>	Annemarieke Spitzen – van der Sluijs, Stefano Canessa, Mark Blooi, An Martel & Frank Pasmans: The long-term cost of chytridiomycosis for yellow-bellied toads	Peter Pogoda & Alexander Kupfer: Flesh and bone: an integrative approach towards sexual size dimorphism of spectacled salamanders
10:20 – 10:40	Pantelis Savvides, Eleni Georgiou, Panayiotis Pafilis, Spyros Sfenthourakis: Ontogeny and differential substrate use among populations of the spiny footed lizard (<i>Acanthodactylus schreiberi</i>): Plasticity or an ongoing evolutionary adjustment?	János Ujszegi, Tamás Drexler, Márk Z. Németh, Judit Vörös, Ágnes M. Mőricz, Dániel Krűszelyi, Attila Hettyey: Investigating the effects of infection with <i>Batrachochytrium dendrobatidis</i> on life history traits and skin toxin production of <i>Bufo bufo</i> tadpoles	Mark D. Scherz, Hervé Philippe, Andolalao Rakotoarison, Frank Glaw, & Miguel Vences: Micro-CT, morphometrics, and phylotranscriptomics shed light on the underpinnings of convergent miniaturization in a radiation of frogs
10:40 – 11:10	Coffee Break		
11:10 – 12:30	Session 8b: Ecology & Behaviour of Amphibians Chair: Dan Cogalniceanu	Session 9b: Diseases & Anomalies Chair: Annemarieke Spitzen-Van der Sluijs	Micro CT Workshop 2 Chair: Chris Broeckhoven
11:10 – 11:30	Frank Pasmans, Elin Verbrugge, Max Sparreboom, Feng Xie, An Martel: Adaptations of the amphibian egg and hatchling for terrestrial nesting in the Wenxian newt (<i>Tylostrotiton wenxianensis</i>)	Kärverno S., Meurling, S., Laurila, A. & J. Höglund: Revealing high-risk ponds of the chytrid fungus in Swedish amphibian populations	Claudia Koch & Nadine Schwarz: Diversity of South American wormsnares of the genus <i>Epictia</i> : Analysis of internal morphological characters via Micro-CT images
11:30 – 11:50	Kathleen Preißler & Heike Pröhl: The effects of background coloration and dark spots on the risk of predation in poison frog models	Elena A. Kulikova, Vojtech Baláz, Mihails Pupins, Aija Pupina: The first records of <i>Batrachochytrium dendrobatidis</i> in Latvian Zoo	Practical Workshop
11:50 – 12:10	Sergey M. Lyapkov: Amphibian adaptation to extreme environment in statu nascendi: water frogs and brown frogs in cold climatic conditions	R.G. Bina Perl, Sarig Gafny, Eli Geffen, Miguel Vences: Detection of <i>Bd</i> and exploration of microbial communities of amphibians in northern Israel	Practical Workshop
12:10 – 12:30		Klaus Henle: A global database of anomalies in natural populations of amphibians – and global patterns derived from the database	Practical Workshop
12:30 – 13:45	Lunch Break		