

ECOO 2014

3rd European Congress
on Odonatology

ABSTRACT BOOK



Montpellier | France
7-10 July 2014



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3rd European Congress on Odonatology
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Organizing committee

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Organized by

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Program

Monday, 7th	09:30	Welcome gathering
	10:30	Introduction
	11:00	Coffee break
	11:30	Session 1a – ECOLOGY
	12:45	Lunch
	14:30	Session 1b – ECOLOGY
	16:10	Coffee break
	16:40	1c – POSTER presentation
		Free time for reunions and discussions
	19:30	Barbecue and welcome party
Tuesday, 8th	09:00	Welcome gathering
	09:30	Session 2a – ECOLOGY
	10:20	Coffee break
	10:50	Session 2b – GENETICS & PHYLOGEOGRAPHY
	13:00	Departure for lunch in the field
	14:30	Field excursion
	18:00	Free evening
Wednesday, 9th	09:00	Welcome gathering
	09:30	Session 3a – FAUNISTIC & BIODIVERSITY
	11:10	Coffee break
	11:40	Session 3b – FAUNISTIC & BIODIVERSITY
	13:00	Departure for lunch in the field
	14:30	Field excursion
	18:00	Free evening
Thursday, 10th	09:00	Welcome gathering
	09:30	Session 4a – CONSERVATION & MANAGEMENT
	10:55	Coffee break
	11:25	Session 4b – CONSERVATION & MANAGEMENT
	12:15	Session 4c – BEHAVIOUR
	13:05	Lunch
	14:30	Session 4d – MONITORING
	15:45	Coffee break
	16:30	Awards: best poster & best presentation by young researcher
	17:00	Congress forum & cloture session
	19:30	Exotic dragonflies: a picture show
	20:00	Congress dinner

Monday, 7th

Session 1a – ECOLOGY

- 11:30 **Robby Stoks**
Integrating fundamental and applied ecology and evolution using damselflies as model systems
- 12:20 **Lieven Therry, Dries Bonte & Robby Stoks**
Evolutionary ecology of range expansion in the damselfly *Coenagrion scitulum*

Session 1b – ECOLOGY

- 14:30 **Franz-Josef Schiel**
Flea circus in the aquarium – Habitat choice experiments with Odonata larvae of vernal pond species versus permanent water species
- 14:55 **Philippe Lambret, Aurélien Besnard, Stanislav Gorb & Natalia Matushkina**
Oviposition host plants of *Lestes macrostigma*: a preference for the sea-club rush *Bolboschoenus maritimus*?
- 15:20 **Adolfo Cordero-Rivera, M. Olalla Lorenzo-Carballa, Virgilio Vieira & Carlo Utzeri**
Terrestrial mites *Leptus killingtoni* on parthenogenetic *Ischnura hastata* at Pico island (Azores)
- 15:45 **Mickaël Le Gall, Aurélie Husté & Audrey Chaput-Bardy**
Capture-Mark-Recapture study of *Ischnura elegans* on four networks of ponds in Upper Normandy

1c – POSTER presentation

- 16:40 **Romain Garrouste & André Nel**
The griffenflies (Meganisoptera, Odonatoptera) of the late Permian of Lodève (South of France): smalls and “giants”
- 16:50 **Patricia Casanueva Gomez, Francisco Campos & Tatian Velasco**
Patterns of variation in the anal loop of the Migrant Hawker *Aeshna mixta* Latreille, 1805 (Anisoptera, Aeshnidae)
- 17:00 **Laurence Cousseau, Mathieu Mirabel, Arthur Compin, David Alquier, Amaia Iribar & Laurent Pelozuelo**
Validation of a non lethal sampling method for DNA collection in adult dragonflies
- 17:10 **Genaro da Silva-Méndez, M. Olalla Lorenzo-Carballa, Laurence Cousseau, Laurent Pelozuelo, Phillip C. Watts & Adolfo Cordero-Rivera**
Population genetics of the Western-Palearctic rare dragonfly *Oxygastra curtisii*
- 17:20 **Robert Španić, Marina Vilenica & Vedran Šegota**
Preliminary results of the *Lindenia tetraphylla* monitoring scheme in Croatia
- 17:30 **Marina Vilenica, Damjan Vinko, Klaus-Jürgen Conze, Dejan Kulijer & Saša Rajkov**
Balkan Odonatological Meeting 2013 realised in Croatia

Tuesday, 8th

Session 2a – ECOLOGY

- 9:30 **Hajnalka Anna Gyulavári, Lieven Therry, György Dévai & Robby Stoks**
Sexual selection on flight performance and the underlying physiological and morphological traits in a scrambling damselfly
- 9:55 **M. Olalla Lorenzo-Carballa, Sylvain Charlat, Thomas N. Sherratt, Hans Van Gossun & Christopher D. Beatty**
Detection and characterization of *Wolbachia* infections in natural populations of different species of the genus *Nesobasis* (Zygoptera, Coenagrionidae).

Session 2b – GENETICS & PHYLOGEOGRAPHY

- 10:50 **Phillip C. Watts**
What molecular genetic studies have taught us about odonates – Where do we go from here?
- 11:40 **Phillip C. Watts, M. Olalla Lorenzo-Carballa, Sónia Ferreira, Angela M. Sims, David J. Thompson & Cédric Vanappelghem**
Spatial genetic structure of fragmented populations of *Coenagrion mercuriale* in northern France
- 12:05 **Sónia Ferreira, David Thompson, Paulo Célio Alves, José Carlos Brito & Phillip C. Watts**
Phylogeographic structure of *Coenagrion mercuriale*: what newly developed DNA sequence markers tell us
- 12:30 **Christopher Hassall, Simon Keat, Phillip C. Watts & David Thompson**
Genetic and morphological variation at an expanding range margin in a damselfly

Wednesday, 9th

Session 3a – FAUNISTIC & BIODIVERSITY

- 9:30 **Klaus-Jürgen Conze & Mathias Lohr**
The german atlas of dragonflies
- 9:55 **Costanza Uboni**
Atlas of the dragonflies of Italy
- 10:20 **Saša Rajkov**
Public participation in recording dragonflies in Serbia
- 10:45 **Florent Prunier**
Second atlas of odonata of Andalusia

Session 3b – FAUNISTIC & BIODIVERSITY

- 11:40 **Geert De Knijf & Tim Adriaens**
Discovery of a population of *Gomphus flavipes* on the Albert Canal (Belgium):
suboptimal habitat or underestimated ecological amplitude?
- 12:05 **Saša Rajkov**
Lestes macrostigma in Serbia
- 12:30 **Marina Vilenica, Dejan Kulijer & Bogić Gligorović**
New data on distribution and threats to the populations of *Caliaeschna
microstigma* at the north-western edge of its range

Thursday, 10th

Session 4a – CONSERVATION & MANAGEMENT

- 9:30 **Raphaëlle Itrac-Bruneau, Xavier Houard & Samuel Jolivet**
The French Action Plan for Odonata: one year before the end of the program, what are the achievements and the first lessons?
- 9:55 **Florence Merlet, Xavier Houard & Renaud Puissauve**
Reporting of Habitats Directive: assessment of the conservation status of french Odonata
- 10:20 **Andreas Martens & Klaus G. Leipelt**
Crayfish on ice – Identification of invasive crayfish species threatening European odonates

Session 4b – CONSERVATION & MANAGEMENT

- 11:25 **Martin Jeanmougin, Fabien Leprieur, Grégoire Lois & Philippe Clergeau**
Fine-scale urbanization affects Odonata species diversity in ponds of a megacity (Paris, France)
- 11:50 **Christiane Jakob, Gaëtan Lefebvre & Brigitte Poulin**
Effect of *Bti* mosquito control on richness and abundance of Odonata in the Camargue

Session 4c – BEHAVIOUR

- 12:15 **Andreas Martens**
Reproductive behaviour of *Zygonyx torridus*
- 12:40 **Iago Sanmartín-Villar, Sara Debecker, Miguel de Guinea-Luengo, Adolfo Cordero-Rivera & Robby Stoks**
Behavioural syndromes across metamorphosis in four colour-polymorphic *Ischnura* species

Session 4d – MONITORING

- 14:30 **Tim Termaat, Arco J. van Strien, Roy H.A. van Grunsven, Vincent J. Kalkman & Calijn L. Plate**
Have dragonflies recovered in the Netherlands?
- 14:55 **Tim Termaat & Geert De Knijf**
Workshop: dragonfly monitoring in Europe

Abstracts

oral communications

Integrating fundamental and applied ecology and evolution using damselflies as model systems

Plenary talk by
Robby STOKS

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I will present an overview of recent and ongoing work on the integration of fundamental and applied ecology and evolution in my research team at the University of Leuven. A first topic centers around stress ecology where we have been studying how combinations of stressors may reinforce each other and how stressors may show delayed effects thereby sometimes bridging metamorphosis. For example, exposure to predation risk may increase the toxicity of contaminants and delayed effects of contaminants may shape interactions with predators. A second topic centers around the effects of climate change and evolution of species along latitudinal gradients. Both topics will be integrated as I show how latitudinal gradients can be used as a space-for-time substitution to inform how species will react to contaminants in a warming world.

Evolutionary ecology of range expansion in the damselfly *Coenagrion scitulum*

By Lieven THERRY^{1*}, Dries BONTE² & Robby STOKS¹

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The ranges of many species are currently shifting polewards triggered by global warming. Populations at the expansion front experience different selective forces than do populations in the core of their range and this can have large impacts on the evolution of phenotypic traits at the expansion front. Evolutionary processes at the expansion front may influence the rate of further range expansion, biotic interactions and fitness of populations at the expansion front. We here present a study investigating eco-evolutionary processes which take place during the poleward range expansion of the damselfly *Coenagrion scitulum*. In a first step we quantified phenotypic differentiation in flight-related traits, immune function, traits related to population growth rate and behaviour. We documented higher investment in flight-related traits at the expansion front, which is expected to evolve in response to *in situ* natural selection and/or spatial sorting whereby only the best dispersers reach the expansion front. Furthermore, higher immune function was observed in individuals at the expansion front and this likely evolved in response to selection for high investment in immune function and reduced parasite load during dispersal through the negative effect of high parasite load on dispersal ability. Animals at the expansion front had a higher growth rate and a faster development which likely evolved as responses to the low densities at the expansion front. In contrast, females at the expansion front had no higher fecundity. Larvae at the expansion front were consistently more active compared with larvae from core populations, likely driven by a higher energy demand at the expansion front for investment in flight-related traits and growth. The investigated traits may shape abiotic and biotic interactions at the expansion front. For this, in a second step we investigated the effect of food limitation, prey-predator interactions and competitive ability in larvae; and sexual selection in adults from core and edge populations. Larvae from the expansion front experienced a larger negative effect of food limitation compared with larvae from core populations likely reflecting a cost of a faster life-history. In contrast, the higher activity of larvae at the expansion did not increase susceptibility to a visual predator nor did it increase competitive ability. We found consistent sexual selection in males for a longer flight duration. Instead, sexual selection for higher fat content was stronger in populations with lower average temperature during the flight season. Knowledge about changes in abiotic and biotic interactions at the expansion front may be important to predict future species distribution under contemporary global warming.

Flea circus in the aquarium – Habitat choice experiments with Odonata larvae of vernal pond species versus permanent water species

By Franz-Josef SCHIEL

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In contrast to larvae of Odonata developing in permanent waters, those typically reproducing in temporary waters are characterized by the following traits: (1) fast growth and short larval development time, (2) high mobility with frequent transitions between micro habitats and (3) low tendency to hide in refuges in the presence of fish predators.

To find out whether there are differences in habitat choice between larvae of species reproducing typically in temporary ponds like *Lestes barbarus*, *L. dryas*, *Sympetrum flaveolum* and *Aeshna affinis* and congeneric species reproducing in both permanent and temporary ponds (*Lestes sponsa*, *L. virens*, *L. viridis*, *S. danae*, *S. depressiusculum*, *S. sanguineum*, *S. striolatum*, *S. vulgatum*, *Aeshna mixta*), the following experiment was carried out. Ten medium size larvae of each of the species listed above were transferred into aquariums with a volume of 10 litres for two hours. During the experiments the preference of each species was evaluated during binary choice trials where the complexity and darkness of the habitat were manipulated.

The experiment was conducted both with hungry larvae and with well-fed larvae in the experimental containers. The results are presented and shortly discussed with regard to the ecology of the species.

Oviposition host plants of *Lestes macrostigma*: a preference for the sea-club rush *Bolboschoenus maritimus*?

By Philippe LAMBRET^{1,2*}, Aurélien BESNARD³, Stanislav GORB⁴
& Natalia MATUSHKINA⁵

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Across the breeding sites of *Lestes macrostigma* the relative abundance of plant species and their state (i.e. living or dead) of substrates within which females oviposit is variable. *Lestes macrostigma* has been observed to lay eggs within living and dead *Juncus maritimus*, dead *J. acutus* and *Phragmites australis*, *Schoenoplectus lacustris*, dead *Tamarix gallica* and living *Carex stenophylla*, yet oviposition has been most often reported within *Bolboschoenus maritimus*. In the present contribution, we aimed at testing a preference for *B. maritimus* in the field and in a laboratory experiment.

Lestes macrostigma typically oviposits in tandem, within vertical stems and sprouts which the female protrudes with her cutting ovipositor. The oviposition site selection process begins with the “initial preference” which is assumed to be determined (1) by the male, who chooses the landing site, and (2) by the female, who chooses to bend the abdomen in order to examine the substrate with her ovipositor or to keep it straight until the pair flies to another substrate. The initial preference is then followed by (3) the choice of the ovipositor insertion site (OIS) by the female and finally by (4) the egg deposition, which can fail. During this last step, the female swings her abdomen laterally and moves continuously the valves of her ovipositor.

We studied *L. macrostigma* oviposition behaviour in the Marais du Vigueirat protected area (the Camargue, southern France) in 2011 and 2012. For each combination of plant species and plant state we recorded: (1) the frequency of tandem landings relative to the available sprouts, (2) the frequency of female initial abdomen bending per landing, (3) the frequency of sprouts where the deposition of at least one egg was observed, (4) the egg deposition success i.e. the frequency of OIS where an egg was deposited, (5) the duration and the number of abdominal swings required to deposit one egg, and (6) the egg

deposition rate i.e. the number of laid eggs within a sprout divided by the duration of stay on this sprout. Additionally, the anatomy and stiffness of living sprouts of different plant species were studied in the laboratory.

Based on the observation of 84 initial landings, we found that males had a preference for *B. maritimus* and dead *J. maritimus* but disfavoured living *J. maritimus*. Based on the observation of 38 females landing on 1,152 sprouts and 2,996 OIS we found that: (1) females bended more frequently their abdomen to examine *B. maritimus* and dead *J. acutus* sprouts, (2) sprout fitting frequency was the highest in *B. maritimus*, (3) egg deposition success was the lowest in *B. maritimus*, (4) duration and number of abdominal swings required to deposit one egg were the lowest in *B. maritimus*. Egg deposition rate was the highest in dead *J. maritimus* and then in *B. maritimus*, suggesting a preference for these oviposition substrates by *L. macrostigma*.

The plant anatomy study revealed that in *B. maritimus*, in contrast to the other living plant substrates, the waxy cuticle is rather weak and the supporting tissues are separated by several air channels and parenchyma. Further, among living plant substrates where oviposition was observed in the field, the stiffness of *B. maritimus* was the lowest. This may explain the performance of females in *B. maritimus* during oviposition and the reason for the substrate preference by *L. macrostigma*.

Terrestrial mites *Leptus killingtoni* on parthenogenetic *Ischnura hastata* at Pico island (Azores)

By Adolfo CORDERO-RIVERA^{1*}, M. Olalla LORENZO-CARBALLA^{1,2},
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Leptus killingtoni is a terrestrial mite associated with several insects, which is known from Europe and the Azores islands. In a previous paper, we reported it parasitizing three of the four species of odonates known from the Azores. This contribution summarizes the prevalence and mite load on *Ischnura hastata* and *I. pumilio* from Pico Island. We sampled all the water bodies found in Pico (52 lakes and ponds) and recorded whether *Ischnura* specimens were parasitized by *L. killingtoni*. In addition, we carried out a mark-recapture experiment at Lagoa do Landroal, the site where mites were the most abundant, between 15 August and 2 September 2013. Half of the water bodies had either dried up or were almost dry ($n=13$), or did not have *Ischnura* populations ($n=14$). In the remaining 24 ponds (excluding Lagoa do Landroal) mite parasitism was extremely low, with only 2% of *I. hastata* females bearing one or more mites (range=0-18% per population; total $n=1197$). No mites were observed on *I. pumilio*, but this species was very rare in the study period ($n=35$). At Lagoa do Landroal, mite prevalence peaked at the start of the sampling period, with 32% of females of *I. hastata* parasitized and showed a continuous diminution until the end of the study, when only 2% were parasitized. Overall, we marked 1774 individuals of *I. hastata*, which carried 0-6 mites, and 26 of *I. pumilio* (5 with one mite). Our results indicate that *L. killingtoni* is unlikely to represent a significant selective factor on odonates at the island of Pico, because it is overall rare, although it can be locally abundant.

Capture-Mark-Recapture study of *Ischnura elegans* on four networks of ponds in Upper Normandy

By Mickaël LE GALL^{1*}, Aurélie HUSTÉ¹ & Audrey CHAPUT-BARDY²

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Dispersal is a fundamental ecological process and especially in fragmented landscapes it may determine species persistence. Indeed, it allows genetic exchanges among populations and colonization of new habitats. Interpopulation movements are often dependent on environmental variables that affect either the capacity and/or the decision of species to disperse. Species response to these variables may vary according to the spatial distribution of landscape constraints.

Odonates are freshwater invertebrates that mainly disperse at the adult flying stage. They are regularly considered to study dispersion and connectivity in aquatic ecosystems and especially river systems. However, few studies have considered dispersal of odonates among ponds.

We carried out a Capture-Mark-Recapture (CMR) study on four networks of ponds in Upper Normandy (France) in order to consider dispersal of the damselfly *Ischnura elegans* which is the most abundant damselfly species in Europe. This species particularly prefers stagnant waters such as ponds and has a flight period between late April and late September.

Capture sessions took place between 05 June 2013 and 12 July 2013 only under good weather conditions. Each session was spaced by 3-4 days for a total of 10 capture sessions. Considering the four networks, two were composed of urban ponds and two others of hunting ponds. The minimal distance between ponds in a network was 70 m and the maximal was 2600 m. Data were analyzed using the program MARK 6.2. First we considered the Cormack-Jolly-Seber model to estimate the probability of survival and recapture assuming time-dependent parameters. Because time intervals between capture occasions were not always the same, we adjusted them in MARK to avoid any bias in our estimations. Second, we added features such as sex and covariables (i.e. pond size, weather conditions and distance between ponds when transitions took place) to improve the fit to our models.

On a total of 3,766 individuals (2,475 males and 1,291 females) marked, 229 were recaptured at least once. Transitions between ponds were observed in only one of the four networks with 21 transitions on a total of 1,244 damselflies marked. As expected, recapture and survival probabilities were function of time and sex. Indeed, there was a peak of emergence during the sampling season that enhanced capture probability and females dispersed over longer distances than males. Moreover, pond characteristics, particularly pond size, were important since recapture probability was higher in smaller ponds. Finally, the transition probability was function of distance between ponds and the state of a pond. Indeed, when a pond dried up, damselflies dispersed to neighbouring ponds.

Sexual selection on flight performance and the underlying physiological and morphological traits in a scrambling damselfly

By Hajnalka Anna GYULAVÁRI^{1,2*}, Lieven THERRY¹, György DÉVAI²
& Robby STOKS¹

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Odonates are important model organisms for studying sexual selection but our knowledge on the mechanistic base of sexual selection is still limited. This is especially true for scrambling species. Despite the general belief that flight performance is important for sexual selection in this insect order, many sexual selection studies have not directly quantified flight performance. In our study we used a functional approach to investigate the links between each component of the phenotype-performance-fitness axis. We explored the links between a set of physiological and morphological traits, flight performance (flight speed and flight endurance) and short-term mating success in the scrambling damselfly *Coenagrion puella* (Linnaeus, 1758). As we expected, there was sexual selection for increased flight endurance rather than for flight speed. We found selection for a higher fat content which could be explained by the sexual selection for a higher flight endurance and a positive covariation between fat content and flight endurance. For three other phenotypic traits (size, relative flight muscle mass and wing loading) we detected selection that could not be explained via their effect on flight performance, generating novel testable hypotheses about how the covariation between these traits and mating success is generated. Integrating phenotypic traits, performance traits and the fitness component in a single study revealed insights that could not have been reached otherwise.

Detection and characterization of *Wolbachia* infections in natural populations of different species of the genus *Nesobasis* (Zygoptera, Coenagrionidae)

By M. Olalla LORENZO-CARBALLA¹, Sylvain CHARLAT², Hans Van GOSSUM³, Thomas N. SHERRATT⁴ & Christopher D. BEATTY⁵

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The damselfly genus *Nesobasis* is endemic of the Fiji archipelago in the south Pacific, and it ranks among one of the most species-rich genera of Odonata found in any oceanic island group in the world: 21 species are currently described, and 14 more await description. This genus shows a large amount of morphological diversity, with species differing in overall size, coloration, and the shape of reproductive structures of males (cerci) and females (mesostigmal laminae). Despite this morphological diversity, these species show very little ecological diversity; the forested upland streams that are their habitat often host multiple species living in sympatry. In some species of *Nesobasis*, males are encountered only rarely, with preliminary data suggesting that male mortality in these species is especially high.

As a component of research investigating the diversification and sex-ratio patterns within the genus, we screened individuals of *Nesobasis* for the α -proteobacteria *Wolbachia*. These are cytoplasmically inherited bacteria found in the reproductive tissues (ovaries and testes) of invertebrates. *Wolbachia* can tremendously alter host phenotypes and it is the only one known to induce the four commonly recognized types of reproductive manipulations: male killing, feminization, parthenogenesis, and cytoplasmic incompatibility. We screened 23 *Nesobasis* species for the presence of *Wolbachia*, and found that 16 of these species were infected with *Wolbachia* bacteria belonging to two major clades, A and B. Here, we present preliminary data on the distribution of the bacterial clades among males and females of the different species of *Nesobasis* screened, and discuss the potential impacts that these endosymbionts may have on their damselfly hosts.

What molecular genetic studies have taught us about odonates – Where do we go from here?

Plenary talk by
Phillip C. WATTS

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Abstract not available

Spatial genetic structure of fragmented populations of *Coenagrion mercuriale* in northern France

By Phillip C. WATTS^{1,2*}, M. Olalla LORENZO-CARBALLA^{2,3},
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The Southern Damselfly *Coenagrion mercuriale* remains on the IUCN Red List, categorised as near threatened, largely due to population fragmentation and demographic declines that are associated with changes in land use. There is particular concern for the health of smaller populations at the margin of this species' range, as they are likely to be more susceptible to the detrimental effects of habitat fragmentation since this species is a poor disperser. We sampled 16 habitat patches of *C. mercuriale* ($n=369$ individuals in total) that represented four distinct sites in the Vallée de la Course region, northern France to better understand the factors that affect dispersal, and the concomitant spatial variation in genetic differentiation and genetic diversity.

Samples were genotyped at 12 microsatellite loci and then populations were assessed for variation in (1) genetic diversity, as well as (2) the level of genetic differentiation, (3) the potential effect of thirty-four separate landscape upon genetic differentiation and (4) for evidence of source-sink structure (i.e. a directional bias in the pattern of movement).

This analysis of spatial genetic structure of *C. mercuriale* from a fragmented habitat in northern France presents a number of interesting features about odonate dispersal within a patchy landscape. First, these data show a clear impact of habitat separation in limiting the amount of dispersal (gene flow) by *C. mercuriale*, with the outcome that there are three main population clusters that are genetically distinct, and with some divergence within the principal area (the Vallée de la Course). Second, within each of the main patches genetic differentiation is generally low, implying that the sub-sites within patches generally are connected by gene flow at scales of up to about 2 km, albeit with some evidence for a localised effect of isolation and reduced effective dispersal into some of the more isolated or marginal sub-sites. Third, given the degree of isolation of some of

the areas and a lack of apparent mixing in the intervening populations, any movement among the more distantly-separated sites must have taken place some time ago. Fourth, while there are some apparent impacts of landscape upon the pattern of genetic structure in this region that highlight the effect of landscape upon gene flow, detecting an unambiguous effect of specific variables, such as urbanisation, remains difficult due to the fairly-high degree of correlation between many of the landscape variables.

Phylogeographic structure of *Coenagrion mercuriale*: what newly developed DNA sequence markers tell us

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While the contemporary distribution of a species may be very distinct from its past distribution, the genetic data hold an imprint of past events, which allows an understanding of the role of historic factors in shaping the current geographic distribution of genetic diversity within and between populations. Understanding such processes constitutes the main aim of phylogeography. As a discipline phylogeography also provides fundamental information to the definition of evolutionary significant units (ESUs) and to prioritization of areas/populations that represent high value for conservation.

Our study focuses on the zygopteran *Coenagrion mercuriale* (Charpentier, 1840), a species with a relatively wide distribution range and currently under threat. *Coenagrion mercuriale* is one of the 19 Western Palaearctic species of the genus *Coenagrion*, and belongs to the Coenagrionidae, the largest family of Zygopterans with almost 1,100 species and present in all continents. Classified in IUCN Red Lists as Near Threatened (NT) in Europe and in the Mediterranean, and as Endangered (EN) in North Africa, *C. mercuriale* ranges its distribution from United Kingdom and Germany in the north through France, Iberia, Italy and with the southern edge of this species' range in North Africa. We aim to understand the contemporary and historical factors that have shaped the distribution of genetic diversity in *C. mercuriale*, with an emphasis on identifying ESUs and the role of historical connections between European and African continents.

Previous phylogeographic analysis (based on mitochondrial sequence markers) indicated three major genetic groups, geographically isolated: a Western European, an Italian and a North African group, with the Alps and the strait of Gibraltar being strong geographical barriers to gene flow. To improve our understanding of *C. mercuriale* phylogeographic patterns using a multilocus approach, we developed a set of new nuclear DNA sequence markers. By sequencing regions of both the mitochondrial and nuclear DNA from approximately fifty localities we unveil the pattern of geographic distribution

of genetic diversity. Higher genetic diversity is found in the Southern European peninsulas and in North Africa, a finding consistent with the patterns exhibited by other organisms with South Western Palaearctic distributions.

Genetic and morphological variation at an expanding range margin in a damselfly

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Understanding the ecological and evolutionary processes that occur at range margins is essential to predicting the impacts of a changing world on biodiversity. Climate-induced range shifts result in the movement of a sample of genotypes from source populations to new regions. The phenotypic consequences of those shifts depend upon the sample characteristics of the dispersive genotypes, which may act to either constrain or promote phenotypic divergence, and the degree to which plasticity influences the genotype-environment interaction. We sampled populations of the damselfly *Erythromma viridulum* from northern Europe to quantify the phenotypic (latitude-body size relationship based on seven morphological traits) and genetic (variation at microsatellite loci) patterns that occur during a range expansion itself. We find a weak spatial genetic structure that is indicative of high gene flow during a rapid range expansion. Despite the potentially homogenizing effect of high gene flow, however, there is extensive phenotypic variation among samples along the invasion route that manifests as a strong, positive correlation between latitude and body size consistent with Bergmann's rule. This positive correlation cannot be explained by variation in the length of larval development (voltinism). The results of this study are contrasted with a recent continental-scale study of morphological variation in the damselfly *Calopteryx maculata*, which exhibits a U-shaped latitude-size relationship consistent with Bergmann clines in the north (as seen in *E. viridulum*) and converse Bergmann clines in the south. While the adaptive significance of latitudinal variation in body size remains obscure, geographical patterns in body size in odonates are apparently underpinned by phenotypic plasticity and this permits a response to one or more environmental correlates of latitude during a range expansion. We discuss the implications of this plastic response for the biology of odonates and the systems in which they play a key ecological role.

The german atlas of dragonflies

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In March 2007 the Society of german-speaking odonatologists (GdO) decided during its annual meeting to launch an atlas of dragonflies of Germany and to publish this work as a supplement of its organ: the journal “Libellula”. So far distribution atlases were available only in a few federal states. Within the last six years, a working group organized the “making of” the atlas, which will be published in 2014. It is based on more than a million datasets collected from the 16 federal states where different institutions (administrations for nature conservation, NGO’s and a lot of volunteers) provided data on the distribution of dragonflies. Now, for the first time, distribution maps in a grid of approximately 10x10 km (10 latitudal x 6 longitudinal min) are available as the core of the atlas. Short monographs of three pages are included for each of the 81 species ever recorded in Germany. It also contains a current Red List as a result of the analysis of the new database. Furthermore a list of hitherto known introduced dragonflies is given as well as a compilation of fossil german records of Odonata. As part of the project the Libellula supplement 11 had already been published in 2012. It is a bibliography of German literature on odonatology with more than 6,000 titles. This presentation gives further information about the background, the results and the delivery of the atlas. Some information can already be found on www.libellula.org.

Atlas of the dragonflies of Italy

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The Italian Society for the Study and Conservation of Dragonflies - ODONATA.IT (NPO) is an association that promotes both basic and applied research on odonates, and the dissemination of information on dragonflies and their protection. Since 2007 a group of odonatologists has been working together with these aims in mind and in 2009 the society was officially founded. Currently it counts more than 100 members. The main activities of the society are: collection of faunistic data, organization of national conferences and organization of field camps. The society is also operating an internet site (www.odonata.it), which contains information on dragonflies and on the activities of the society (currently only in Italian).

The atlas has been published in April 2014 and provides distribution maps of all species known from Italy, a reviewed checklist and a list of common names of the Italian dragonflies. This was created with the aim of providing “user friendly” names and with the hope that it will allow more people to get interested in the fascinating world of dragonflies. This provisional atlas presents distribution maps for the 92 species reported from Italy and lists the odonate fauna of each region. Here the number of species ranges from 42 (Sardinia) to 68 (Piedmont, Lombardy). The atlas is a “working document” and is intended to provide the current knowledge on the distribution of Italian dragonflies, being aware that many existing data (literature, private collections, etc.) are currently not included. We hope that the missing records and obvious “gaps” are going to stimulate many more odonatologists to make their data accessible to ODONATA.IT. We also hope that these provisional maps will be an incentive to explore areas which are currently “white”.

Public participation in recording dragonflies in Serbia

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In the last decade, there has been an increasing number of dragonfly enthusiasts in the country, and the following number of dragonfly records. The need to facilitate collection and display of dragonfly occurrence data coming from dragonfly enthusiasts, ornithologists, entomologists, nature photographers, environmental NGOs, internet forums, etc. is becoming more apparent.

One existing database on insects in Serbia, called Alciphron (created and maintained since 2002 by HabiProt NGO, Belgrade), now encompasses over 2000 individual dragonfly records (not including data retrieved from literature). All records contain legator, species ID, coordinates and altitude, but are not linked to existing photographs and at this time the database is not publicly available in any form.

In 2013, with the aid of the Dutch Embassy in Belgrade, a portal for mapping and monitoring biodiversity in Serbia - BioRaS (www.bioras.petnica.rs) was launched by a consortium of civil society organisations. Species records (followed by an optional photograph and a set of additional information) are entered through an online user interface. Every record is verified by a group moderator. All verified records can be viewed publicly on the portal, as a map of 10x10 km UTM squares, while the core data can be requested from the group moderator. Currently, a project on improvement of the BioRaS biodiversity portal and promotion among a wider public is underway.

Both of the mentioned databases on Odonata are moderated by the author. A revision of previous records from Alciphron database is underway, after which all verified records will also be imported and publicly viewable on the BioRaS portal.

The greatest potential for collecting larger amounts of data on adult dragonfly distribution lies in on-site identification of easily recognizable species, such as *Platynemis pennipes*, *Sympecma fusca*, *Onychogomphus forcipatus*. Improving dragonfly identification skills enables independent field work, without the need of collecting samples, or even taking photographs for a larger number of species. Having this in mind, the first *Handbook on Dragonflies of Serbia – A photographic identification guide* aimed for beginners, is currently in preparation.

Second atlas of odonata of Andalusia

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Andalusia is a territory of more than 87,000 km² located at the foremost southern part of the Iberian Peninsula. In 2013, the second Andalusian atlas of dragonflies was presented (*Boletín ROLA*, 3), 25 years after the publication of the first one in 1984 by Ferreras-Romero and Puchol-Caballero. This work is based on the subsequent literature review and data of ROLA's recording scheme. For each species, a map represents the last period during which its presence has been detected (prior to 1984, 1984-2000, after 2000).

A database of Andalusian dragonflies was up-dated, abstracting 135 scientific papers and short notes along with numerous unpublished records from ROLA's project, Observado.org and the survey of endangered species by the local government. In February 2013, the database held more than 9,700 records from nearly 1,500 localities.

All the published records were summarized and added in a complementary paper in order to make available the whole information, so that it became easy to contextualize new records. Until that moment, it was pretty difficult for odonatologists to figure out the detailed distribution of most species in Andalusia, especially the common ones. It is expected that the Atlas will encourage people to carry on new fieldwork and to share information. In fact the *Boletín ROLA* was set up precisely to make possible the recollection of such data. The importance of visiting foreign odonatologists is stressed, having provided a large amount of the available records. It is recognized that a significant amount of effort has been made in Andalusia to set up a network of local observers.

In total, 58 odonata species are currently considered to be established in Andalusia (records after year 2000): three Calopterygidae, six Lestidae, two Platycnemididae, 11 Coenagrionidae, seven Aeshnidae, seven Gomphidae, one Cordulegrastidae, two Corduliidae and 19 Libellulidae. Recent records of *Brachytron pratense*, *Libellula fulva* and *Sympetrum sanguineum* are lacking (the three species were cited from the Doñana area) as well as *Coenagrion puella* and *Aeshna isosceles* and the presence of *Ischnura elegans* is poorly known, except it seems occasional. Moreover, a critical review of the literature had allowed dismissing ancient records of *Lestes sponsa*, *Aeshna juncea*, *Sympetrum flaveolum* and *Sympetrum vulgatum*; some of them could be present in Andalusia but we need further information to confirm their presence.

Despite a lack of information in numerous areas, a first analysis of richness shows the importance of various natural areas for dragonflies in Andalusia: the Alcornocales and

surroundings (Cadiz and the western part of Malaga), the Segura limestone mountain range (Jaen) and the Doñana region (Huelva). To the opposite the lowlands within the Guadalquivir valley are relatively species poor. Eastern Andalusia is extremely under-recorded but this situation reflects the minor quantity and diversity of aquatic habitats in comparison with western Andalusia. The region is indeed home to numerous African species, of which *Trithemis kirbyi* is expanding dramatically its range since 2007 and currently one of the commonest Andalusian species.

Discovery of a population of *Gomphus flavipes* on the Albert Canal (Belgium): suboptimal habitat or underestimated ecological amplitude?

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The River Clubtail *Gomphus flavipes*, a typical lowland river species, disappeared in many parts of western and central Europe as a result of deterioration of the water quality. Since the beginning of the 1990s however, *G. flavipes* has recolonized several rivers in western Europe, first in Germany and The Netherlands. In Belgium, the species was first observed in 2000 on the River Meuse. Several observations of imagos were made there, but larvae or exuviae were never found. Since 2002, the species had also been observed regularly in the province of Antwerp. These were all regarded as vagrant individuals from the supposed Meuse population, from The Netherlands or the Rhine in Germany. In July 2012 a population of *G. flavipes* was discovered along the Albert Canal in the province of Antwerp, Belgium. First a freshly emerged individual was found followed by exuviae the following days. A subsequent intensive search in August yielded 70 exuviae, all of which were found along a stretch of the Albert Canal over a distance of 9.5 km. More exuviae ($n=159$) were found the year after, proving presence of the species over nearly 80 km, about the total length of the Albert Canal from Antwerp to the River Meuse. Adults were observed hunting in the vicinity of the canal, hovering over corn fields and tall herb humid meadows and were found to disperse over relatively large (>20 km) distances. The average density of exuviae found per trajectory with larval skins present was 1.2 (min=0.1, max=3.3) per 100 m. Sex-ratio was 1:0.6 in favour of females, which is reported normal in Gomphid populations. This could also be explained by the late sampling date, as in some dragonflies males are the first to emerge. Emergence substratum was highly artificial. Most exuviae were found on the concrete sheet piling of the bank, and to a lesser extent also on poles or vertical walls. Data on the exact larval habitat are currently lacking. The discovery of this population on one of the busiest canals in Europe is unique and sheds new light on the potential range of the species in Flanders and its potential habitat in large parts of Europe. This local shift in habitat preference from rivers towards canals with concrete banks is probably a consequence of the recent range expansion of *G. flavipes* in western Europe. In the coming years, the population of this Annex II species will be monitored more closely.

Lestes macrostigma in Serbia

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Until recently, published records of *Lestes macrostigma* in Serbia have been scarce and the species was not known from the main salt marshes in the country. In 2013 several localities were investigated by the author for the presence of *L. macrostigma* adults. Populations were discovered in two mutually remote parts of the Pannonian basin in Serbia. Together with these new observations, a critical review of previously published data on *L. macrostigma* in Serbia is presented. Some field observations on the species' behaviour, other recorded dragonfly species, as well as possible habitat disturbances, are also pointed out. According to these new data, the main distribution of *L. macrostigma* in Serbia is confined to the salt marshes of the Pannonian basin. Having in mind the current conservation status of the species and some of the available habitats, the legal protection of the species at the national level should be an imperative

New data on distribution and threats to the populations of *Caliaeschna microstigma* at the north-western edge of its range

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The distribution of *Caliaeschna microstigma* (Schneider, 1845) in Europe is small and restricted to the Balkans. As in the last years its populations are declining, the species is classified as Near Threatened (NT) in the European and the Mediterranean Red Lists.

It occurs only in the Mediterranean region inhabiting springs, brooks and small rivers. These habitats are critically endangered by human activities and climate change. In Bosnia and Herzegovina and in Croatia the species reaches its north-western edge of distribution.

As population trends of the species are still insufficiently known, a study on the distribution and threats to the populations of *C. microstigma* in the North-West Balkan region was conducted. The study covered localities in Bosnia and Herzegovina, Croatia and Montenegro, and has revealed more detailed and wider distribution of the species. Its habitat preferences in the researched area were inspected as well. However, it was also recorded that these habitats are highly and primarily endangered by the plans of placing the additional hydro power plants and the water extraction projects. In Croatia the species is classified as Critically Endangered (CR) and strictly protected by the law, while in Bosnia and Herzegovina and in Montenegro it is still considerably underevaluated.

Our work will contribute to the development of monitoring and protection plans and long term conservation of *C. microstigma* in the North-West Balkan countries.

The French Action Plan for Odonata: one year before the end of the program, what are the achievements and the first lessons?

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From 2011 till 2015, France deployed countrywide a specific program to conserve its most threatened dragonflies (18 species). In order to promote their study and incorporation in government policies, a National Action Plan (NAP) for Odonata has been implemented. One year before the end of this program, a first assessment since the implementation was made.

With 21 of the 22 regions involved, this plan is well deployed. Out of the 15 main actions, six are completed and seven are still under implementation. Among them, several major projects have well turned out. The French dragonfly monitoring scheme (Steli), which aims to get dragonflies' populations trends at the national scale, and the reporting to the European Commission of the 10 French species considered to be of European interest are the main examples.

Coordinated actions have been developed for watershed areas or large natural regions to ensure national consistency. In the Loire watershed area, during meetings dealing with two species which are closely related to this river (*Ophiogomphus cecilia* and *Gomphus flavipes*), specialists have established a standardized monitoring protocol that is to be tested this year. It should allow them to gather data on habitats in a permanently changing natural environment.

The dissemination of knowledge is one of the cornerstones to ensure the success of such plan. To reach a maximum of audience –professionals and amateurs– a website has been created (www.odonates.pnaopie.fr) on which a specific bibliographic page is dedicated to the priority species and information, both scientific papers and grey literature, about these species can be downloaded for free.. Since going online several research reports have been transmitted, thus enriching the website.

Since the launch of the plan, the enthusiasm that was created around these 18 threatened species has given a new impetus to both national and regional networks of French odonatology. Both attracted by the species sensitivity and the assurance of effective actions, an increasing number of naturalists are actively searching for these species to fill the gaps of knowledge about their distribution, so significantly increasing

the available data. Due to the many accumulated data, the distribution maps developed during the drafting of the NAP have been updated this year. At the same time, work is going on to set up a National Red List of dragonflies. With a total of 600,000 data in the NAP database, the call for participation has been widely supported, also outside France.

The success of the NAP is based on the animation of an active network but also on the strong involvement of national, regional and local institutional and non-institutional actors. After a one year assessment (2015), a new NAP could be launched with new aims. The fulfilment of the primary objectives of increasing the knowledge and structuring the network of French odonatologists allows to consider the long-term establishment of favorable conservation management actions for dragonflies and their habitats.

Reporting of Habitats Directive: assessment of the conservation status of French Odonata

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Every six years, all EU Member States are requested by the Habitats Directive to assess the conservation status of the habitats and species of community interest. The European Commission is requested then to produce a consolidated EU report which is based on the national reports. In France, this concerns 10 Odonata species (two Zygoptera and eight Anisoptera). Their conservation status should be evaluated in each biogeographical region (namely Alpine, Atlantic, Continental and Mediterranean) where they are present (non-marginally). At all, there are 26 species-region couples, and for each of them, four parameters have to be reported: range and its trend, population size and trend, habitat of the species and future prospects. Each parameter was assessed through several questions that resulted in its conservation status (Favourable, Unfavourable-Inadequate, Unfavourable-Bad and Unknown). These assessments were then combined to obtain the conservation status of the species for each biogeographical region.

A first evaluation was conducted in 2006, but little objective data and information sources were used: the parameters required by the methodology were mostly evaluated in expert opinion. In 2012, for the second assessment, the objectivity was improved. The implementation in 2011 of the National Action Plan for Odonata has facilitated the exchange of knowledge among French odonatologists. This resulted in many geographic data that were integrated and in the consultation of many regional and national experts. All this information was synthesized using the online form developed by the National Museum of Natural History in Paris.

The difference between the two reports is mainly due to the enhancement of knowledge. Several situations can be given. The most frequent (50% of all cases) is pretence of improvement of the status, mostly from Unfavourable-Bad to Unfavourable-Inadequate (80% of improvements). The real species conservation status is not necessarily better but our knowledge is improved and more accurate data, especially about range and habitat of the species, are available. Population's parameters and future prospects are still often unknown. This knowledge's uncertainty is better taken into account than in 2006, when the lack of knowledge was balanced by expert opinion, necessarily more subjective.

Conversely, thanks to the improvement of our knowledge, few conservation statuses could be assessed in 2012. For example, new prospects have increased the known range of several species. *Gomphus flavipes* was previously only known from the Atlantic and Continental regions. Following its discovery along the River Rhône, the Mediterranean region was added in the assessment. Except for population's status which is still unknown, other parameters were considered as favourable. Another illustration of knowledge's improvement concerns *Leucorrhinia albifrons* in the Alpine region and *Macromia splendens* in the Atlantic region. Whereas in 2006 they were assessed as unknown, they are now considered as having a bad conservation status: the monitoring of populations and habitats is sufficient to assign the Unfavourable-Bad status to them for sure.

In 2018, for the next report, the knowledge should be even better and the assessment therefore even more precise. Because of the consistency of the methodology, results could be compared over time. The implementation of a large-scale monitoring would also help us to better understand the trends in range and population and so in a better assessment.

Crayfish on ice – Identification of invasive crayfish species threatening European odonates

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Invasive crayfish will become one of the major threats to European odonates. Beside the Signal Crayfish *Pacifastacus leniusculus* and the Red Swamp Crayfish *Procambarus clarkii* there are several other species spreading in Europe, e.g. the Calico Crayfish *Orconectes immunis* and the Marble Crayfish *Procambarus fallax*. We would like to give a brief introduction in the identification of these species. For identification purpose we additionally will offer illustrated identification keys and frozen specimens of several species on ice.

Fine-scale urbanization affects Odonata species diversity in ponds of a megacity (Paris, France)

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Although ponds are recognized as biodiversity hotspots, very few studies focus on pond ecosystems in urban ecology and urban developments. Using Odonata as an indicator group, we explored changes in species composition in ponds localized along an urban gradient of a megacity (Paris, France). We assessed the relative importance of local- and landscape-scale variables in shaping Odonata α -diversity patterns using a model-averaging approach. Analyses were performed for adult (A) and adult plus exuviae (AE) census data. At 26 ponds, we recorded 657 adults and 815 exuviae belonging to 17 Odonata species. The results concerning both A and AE showed that the species assemblage composition was not determined by pond localization along the urban gradient. Similarly, pond characteristics were found to be similar among urban, suburban and periurban ponds. The analyses of AE census data revealed that fine-scale urbanization (i.e. increased density of buildings surrounding ponds) negatively affects Odonata α -diversity. In contrast, pond localization along the urban gradient weakly explained the α -diversity patterns. Several local-scale variables, such as the coverage of submerged macrophytes, were found to be significant drivers of Odonata α -diversity. Together, these results show that the degree of urbanization around ponds must be considered instead of the localization of a pond along the urban gradient when assessing the potential impacts of urbanization on Odonata species diversity. This work also indicates the importance of exuviae sampling in understanding the response of Odonata to urbanization.

Effect of *Bti* mosquito control on richness and abundance of Odonata in the Camargue

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Due to its high selectivity and low toxicity to non-target organisms, *Bacillus thuringiensis* var. *israelensis* (*Bti*) has become the most commonly used microbial agent to control mosquitoes worldwide. *Bti* is considered non-toxic to mammals, birds, fish, plants and most aquatic organisms, at the exception of non-biting-midges (chironomids), which are considered as a major prey item in wetland food webs. Although Odonata are important predators of mosquitos and midges at both the larval and adult stages, no study has ever considered the potential indirect effects of *Bti* on Odonata through trophic interactions. This topic was addressed within the frame of a control program encompassing 2,500 of the 25,000 ha of mosquito larval biotopes in the Camargue. Since 2006, *Bti* spraying (aqueous solution of VectoBac 12AS at 2.5 L/ha) occurs on these areas whenever *Aedes* mosquito larvae appear in water bodies, resulting in 30-60 aerial treatments annually. Odonata imagines were surveyed along a 100 m line transect in spring, summer and autumn at three control and three treated sites over a five years period. Transects were located close to wetlands providing good foraging and breeding habitats. Our results reveal significant differences in the mean number of species (range 9-12 vs 4-6) and of individuals (range 96-137 vs 23-95) observed at control vs *Bti*-sprayed areas. According to nested ANOVAs, *Bti* treatment contributed to 85-95% of the explained variance compared to 5-15% for site and year effects. Significant differences were also detected in mean abundance of Anisoptera (62 vs 34) and Zygoptera (53 vs 18) when considered separately, in spite of the larger dispersal capabilities of Anisoptera. These results are coherent with other studies on *Bti* effects carried out in the same area and time period, which highlight a lower abundance of prey available to Odonata (mosquitoes and midges), as well as lower intake of Odonata by breeding birds (House martins) in treated areas.

Reproductive behaviour of *Zygonyx torridus*

By Andreas MARTENS

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Zygonyx torridus is widely distributed in Africa and reaches southern Europe. The species was studied in Namibia, the Cape Verdes and the Mascarenes islands. The main study has been conducted in Mauritius in 1997 and 2014. *Z. torridus* inhabits waterfalls and rapids. Males patrol over those sites. After copulation the partners perform an extensive searching in flight within a wide range. There is a strong plasticity in oviposition. One may distinguish between three general types: (1) egg-laying in tandem during flight, (2) the female placing the eggs without physical contact with the male while dipping in flight or (3) similarly to the previous but while sitting in the vegetation. Several times adults perform all three types within one oviposition sequence.

Behavioural syndromes across metamorphosis in four colour-polymorphic *Ischnura* species

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There is increasing awareness that animals show behavioural syndromes (persistent sets of behaviours across situations). Several aspects of these syndromes are, however, largely unknown: (1) are they consistent across metamorphosis, where nervous system changes? (2) are they decoupled by neurotoxic chemicals, such as certain pesticides?, and (3) do they differ between colour morphs? To address these topics, we measured the behavioural syndromes in larvae and adults of four related *Ischnura* species with female colour polymorphism (*I. pumilio*, *I. genei*, *I. graellsii* and *I. elegans*) in the presence and absence of the neurotoxic insecticide chlorpyrifos. To characterize the behavioural syndromes, we registered different key behaviours of 518 lab-reared F-0 larvae, to analyzed general activity (test with food) and boldness (one test with food and predator kairomones and other after a simulated predator attack), all of them before and after the exposure to the pesticide. After metamorphosis, we quantified related behaviours in 381 imagines.

In general, larvae reacted to predation cues by increasing escape movements and grooming and reducing their feeding behaviour. After exposure to the pesticide, larvae decreased their travelled distance and increased apparently stereotypy behaviours. General activity was correlated between larval and adult stages, yet only for larval behaviours scored close to metamorphosis. Adults that were bold as larvae responded to a simulated predator attack by flying longer than shyer adults. Nevertheless, the anti-predator response (latency time in larvae and escape in adults) is not correlated, as well as the response to the manipulation in both stages. Larval and adult behaviour is affected by several factors, including species, population within species, maternal and adult colour morph, larval colour (only green was tested), the presence of observers (tested with video registration), and sex, but we did not observe effects of the pesticide.

To conclude, metamorphosis does not disrupt the behavioural syndromes in *Ischnura* damselflies. We did not observe changes with pesticide. Morphotype affect the behaviour of *Ischnura* females. We show possible stereotypy behaviours, being the first description of this behaviour in insects.

Have dragonflies recovered in the Netherlands?

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The dragonfly fauna of the Netherlands has experienced dramatic changes during the 20th century. Many species have declined due to acidification, eutrophication and desiccation of both lotic and lentic habitats and canalisation of streams and rivers. These impacts reached their peak in the 1970s and caused 42% of the species to be listed on the 1996 Dutch Red List of threatened species. Since the 1980s however, considerable environmental improvements have been made and many habitat restoration projects have been carried out. We investigated whether these improvements have resulted in the recovery of dragonfly populations on a national scale. We did this by analysing trends in both abundance (based on a monitoring scheme) and distribution (based on occupancy models).

To assess whether habitat types differ in this perspective we compared groups of dragonfly species representative for different habitat types. Similarly we compared the trends of species with a southern or a northern distribution in Europe to get insight in the effect of climate warming on the Dutch dragonfly fauna.

Workshop: dragonfly monitoring in Europe

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This workshop deals with the possibilities of dragonfly monitoring on a supranational level in Europe. First, we give an overview of the current monitoring schemes for other species groups in Europe, before discussing the potential purpose and usefulness of such a scheme for dragonflies. In general two main methods can be distinguished: monitoring of species abundance and monitoring of species distribution. What are the advantages and disadvantages of both methods and what type of data do they require? Under which conditions can those data contribute to a joint project? Both methods are already running in a few individual countries and an overview of the current situation is given. Instead of monitoring all species, we want to discuss the opportunities of monitoring a group of species, or typical species of a certain habitat or for a specific biogeographical region. Finally, we shall discuss a possible step-by-step plan to create more synergy in the current initiatives and to increase the number of countries involved.

Abstracts

posters

Patterns of variation in the anal loop of the Migrant Hawker *Aeshna mixta* (Anisoptera, Aeshnidae)

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Aeshna mixta Latreille, 1805 is a dragonfly widely distributed through the Western Palearctic. Several publications have described that the anal loop of the hindwings is made up by a variable number of cells arranged in two columns. In this research, we present data on variable patterns of the structure of the anal loop (cells number and its disposition / lay out). To achieve this, 139 samples from the Iberian Peninsula were analyzed. These came from the National Museum of Natural History from Madrid ($n=51$), the Department of Biology of Organisms and Systems of the University of Oviedo ($n=69$) and the European University Miguel de Cervantes of Valladolid ($n=19$). Dragonflies were collected from 1930 to 2013.

The number of cells in the anal loop of the right hindwing ranged 7-11 and in the left hindwing they ranged 6-12. The samples with eight or nine cells were the most abundant (56.1% and 25.9% of the total, respectively). Fluctuating asymmetry (FA) was measured as right minus left difference in the number of cells of the anal loop. This value was zero in 66 individuals (47.5% of the total).

Cells of the anal loop are arranged in two columns with two-five cells each. In several samples, one or two central cell(s) exist(s) between the columns. The combination of these characters provides up to nine different patterns of the anal loop. From these, the two most frequent present eight cells in two columns without central cell (49.6% of the samples) or nine cells in two columns and one central cell (16.5% of the samples). The patterns of the anal loop were not related with the geographic position (UTM coordinates) or altitude of the place of origin. Only 51 samples (36.7% of the total) had the same pattern of anal loop in the hindwings of each side.

We concluded that in *A. mixta* there is profound individual variation in the structure of the anal loop and that the FA of the anal loop is also high. More research is necessary to confirm whether the FA influences other biological traits (for example mating success) of this species.

Validation of a non lethal sampling method for DNA collection in adult dragonflies

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Developing genetic studies on threatened or protected Arthropoda species require poorly- or non-invasive DNA sampling methods in a way to fulfil both technical (i.e. obtaining sufficient amounts of good quality DNA), ethical and legal conditions (i.e. minimizing the impact on sampled individuals, obtaining administrative authorization). Tibia sampling is among the most promising methods; however, genetic conservationists still lack information about its impact on sampled individuals. We used a Capture-Mark-Recapture protocol to estimate the impact of DNA collection through tibia sampling on the scarlet dragonfly *Crocothemis erythraea*. Results indicate no impact of this method, thus providing a good argument to use it for DNA collection in studies of threatened or protected dragonfly species.

The griffenflies (Meganisoptera, Odonoptera) of the late Permian of Lodeve (south of France): small and “giants”

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Odonoptera (a superorder that comprises extinct groups such as griffenflies, extinct and extant dragonflies and damselflies) are, within the Paleoptera, one of the evolutionary oldest groups of insects (Hexapoda). Their fossil record between the Upper Carboniferous and the Lower Permian comprises the ‘largest’ insects ever found, with wingspan up to 70 cm.

The Permian basin of Lodeve (Hérault department, south of France) has given a very rich palaeontomofauna in the Salagou Formation with particularly rich and peculiar Odonoptera (more than 60 specimens in six families). The most remarkable are specimens of the clade Meganisoptera or griffenflies; all belong to the subfamily Tupinae (family Meganeuridae) including large to very large adult specimens. They form a unique and diverse meganeurid fauna with nine taxa.

The Paleozoic odonopteran order Meganisoptera (griffenflies, so-called ‘Protodonata’) is currently considered as the stem group to true Odonata. They differ from Odonata by absence of discoidal cells, nodal structures and pterostigma in wing venation, as well as females having a well-developed ovipositor and males lacking secondary genitalia.

These taxa include the third largest Odonoptera ever discovered, an *Arctotypus* species, with 50-55 cm wingspan and the smallest meganeurid, *Nannotupus pumilio* Nel *et al.*, 2008 with 120 mm wingspan. Sizes of the specimens are commented with paleobiological considerations. All the specimens have been deposited in the Musée Fleury of Lodève (Lapeyrie collection).

The paleontological potential of the Salagou formation needs more investigation to find new fossils to reconstruct the palaeoecology of the period, especially with regards to meganeurids. The meganeurids are absent from the Triassic and became extinct during the end of the Permian, around 20 millions years after the Salagou Formation.

Population genetics of the Western-Palearctic rare dragonfly *Oxygastra curtisii*

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Oxygastra curtisii is an endemic species from the South West of Europe, with presence in the North of Morocco. This dragonfly is the only member of its genus and it has traditionally been considered a member of the Corduliidae, although some authors have proposed that it should be included in a separate family. Given its reduced geographical range, it is included in the Habitats Directive and categorized as Near Threatened in the European Red List of dragonflies of the IUCN, which makes this species focus of a growing research interest.

As a first approach to the evaluation of the status of *O. curtisii*, a total of 442 samples collected across the Iberian Peninsula (12 populations) and France (seven populations) were genotyped for ten microsatellite markers developed for this species. Two of these markers showed evidence for null alleles and deviations from Hardy-Weinberg equilibrium and were thus excluded from subsequent analyses. An analysis of population structure using STRUCTURE suggests three clusters as the most likely population structure for the species. The first of these clusters clearly separates two French populations (Dadou's and Saint Laurent D'Aigouze's) from the rest. The other two clusters separate the Iberian populations from the rest of the French populations, with the exception of the North westernmost population from Spain (Deza river's), which falls together with the French group, and a French population (Vére-Grésigne's), which falls slightly together with Dadou's and Saint Laurent D'Aigouze's. The F_{ST} value is 0.103, which does not suggest a strong genetic structure of the populations, but still yet is one of the highest values found for Anisoptera using microsatellites. The first cluster presents five exclusive alleles (four of them for the same locus). The second cluster has one exclusive allele present in only one specimen and the last cluster has 20 exclusive alleles (27 if the Deza's population is included in it), suggesting a higher variability in the Iberian Peninsula than in France. Here we discuss the implications of these results in relation to the history of the distribution of this species, as well as their relevance for its conservation.

Preliminary results of the *Lindenia tetraphylla* monitoring scheme in Croatia

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The main distribution range of *Lindenia tetraphylla* (Vander Linden, 1825) is the Middle East and the eastern Mediterranean, where it is a typical species of big coastal lakes. In Croatia, four stable populations of the species are present along the Adriatic Sea coast but the population size of each of these had never been assessed. Due to its ecological requirements and the anthropogenic impact on its habitats, *L. tetraphylla* is one of the endangered and protected dragonfly species in Europe. In order to adequately preserve the species and its habitats, additional protection measures are needed. With the aim of developing a monitoring scheme for the species, we have conducted a preliminary study to assess the population size at one of the localities in Croatia, where the species completes its life cycle: Velo Blato lake on the island of Pag. Adults are known to have a great dispersal potential and show a strong tendency to migrate. Therefore, exuviae are better than adults to assess local population size: exuviae are found near the water and are easy to count. The size of the population was estimated by counting the total number of exuviae in predefined areas of 30x30 m along the waterhabitat. Practically, each of the predefined areas was divided into six additional parts where substrate, vegetation, water depth, together with the number of exuviae, their distance from the water and gender were recorded. This study represents an important contribution to our knowledge of the species and some its emergence preferences, and may be useful in further long term preservation actions.

Balkan Odonatological Meeting 2013 realised in Croatia

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Regional biodiversity and distribution surveys are of a great importance for determining conservation status of species and in studying factors that influence diversity. Due to the very limited available data considering distribution of many dragonfly species, Balkan Peninsula is still one of the poorest investigated areas in Europe. With the aim of changing that point, Balkan Odonatologists meet once a year in one of the Balkan countries. The Balkan Odonatological Meeting (BOOM) combines field studies, lectures and workshops on dragonflies (Odonata). Organized by the Croatian Entomological Society and co-organized by the “Zrinska gora” Society and the Slovene Dragonfly Society, the third BOOM took place from August 1st to August 7th, 2013. Twenty five participants from nine different European countries had the opportunity to investigate the dragonfly fauna in two different regions in Croatia: Continental and Mediterranean. During the meeting, we visited 57 localities and recorded 44 dragonfly species which resulted in 372 faunistic data on the dragonfly species distribution. Fifteen of the recorded dragonfly species are of a certain conservation concern.

BOOM 2014 will take place in Bosnia and Herzegovina from August 1st to August 8th where participants will have the opportunity to investigate largely unexplored habitats of different regions. The main focus will be on the Posavina region, one of the least explored regions of the country characterised with rich and diverse freshwater habitats.

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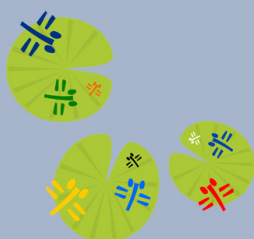


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ECOO 2014
3rd European Congress on Odonatology
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ECOO 2014 is organised by the French Odonatological Society (SfO), by the Office for the insects and their environnement (Opie) and by the Conservatory of natural sites of the Languedoc-Roussillon region, in the frame of the National action plan for Odonata