

# Odonatological Abstract Service

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## 2012

**17999.** Brockhaus, T. (2012): Wie kam *Somatochlora alpestris* (Selys) in die zentraleuropäischen Gebirge? Der Lebensraumwechsel einer stenothermen transpaläarktisch verbreiteten Kaltzeitart am Beispiel des Erzgebirges (Sachsen) (Odonata, Anisoptera, Corduliidae). *Entomologische Nachrichten und Berichte* 56(1): 17-28. (in German, with English summary) ["How arrived *S. alpestris* in the mountains of Central Europe? The habitat change of a stenothermal ice-age species. The case of the Erzgebirge Mts. (Saxony) as an example. – *S. alpestris* is a cold-stenothermal species exhibiting recent transpalaeartic boreo-montane disjunction. The north of the area extends into the subarctic permafrost region of North Eurasia, while mountains in Eurasia were colonised into the Alpine regions. By comparing recent ecological conditions in the northern Permafrost regions of Scandinavia with the conditions during the coldest period of the Weichselian, 21.000 years BP. it is shown that *S. alpestris* may have inhabited an enormous transpalaeartic area during the last cold time. It included the periglacial areas of Central Europe between the northern ice core and the ice cores of the European mountains. At the end of the last cold time the species inhabited those boreal areas which became ice-free, or it withdrew into the Eurasian mountains, respectively. From pollen analyses much is known about the genesis of the bogs in the Erzgebirge. On the basis of this example it is outlined, how the habitat change from the periglacial cold-time tundra into the recent bogs took place during a time interval of approximately 14.000 years." (Author)] Address: Brockhaus, T., An der Morgensonne 5, 09387 Jahnsdorf, Germany. E-mail: T.Brockhaus@t-online.de

**18000.** Buczynski, P. (2012): Polish and dedicated to Poland odonatological papers. 10. The year 2011. *Odonatrix* 8(1): 27-30. (in Polish, with English summary) [The author presents a list of Polish and dedicated to Poland odonatological papers that were published in the year 2011. In the reported time period, 34 papers of various kind were published, and 1 Bach. thesis was written. Two papers published in the year 2010 are given too.] Address: Buczynski, P., Dept of

Zool., Maria Curie-Skłodowska University, Akademicka 19, 20-033 Lublin, Poland. E-mail: pawbucz@gmail.com

**18001.** Buczynski, P. (2012): Materials to the knowledge of dragonflies (Odonata) of Lublin region. Part IV. The collection of Yuri Mikhailovich Kolosov. *Odonatrix* 8(1): 23-27. (in Polish, with English summary) [The author discusses one of the oldest well preserved collection of dragonflies from Poland, collected in the years 1899–1915. Kolosov (1892–1943) was a Russian entomologist connected with the School of Agriculture and Forestry in Puławy. He published the description of migration of *Libellula quadrimaculata* through Puławy, mentioning incidentally 18 other species (Kolosov 1915). His collection is preserved in the Museum and Institute of Zoology of Polish Academy of Sciences. It consists of 102 specimens, belonging to 34 species. The collection is incomplete, as evidenced by the lack of many common species: the fauna of the studied area had at least over 40 species and the material was mainly collected in the valley of the central River Vistula in the vicinities of Puławy (51°25'N, 21°58'E). The collection of Kolosow is a unique record of the old composition of the valley of the River Vistula, with the great share of non-recorded contemporary tyrphophilous dragonflies as well as lacustrine species associated with moderately eutrophic oxbows (e.g. *Nehalennia speciosa*, *Aeshna juncea*, *Epitheca bimaculata*, *Leucorrhinia* spp.). The record of *Orthetrum albistylum* is also valuable – then it was the northernmost site in the whole range of this species.] Address: Buczynski, P., Dept of Zool., Maria Curie-Skłodowska University, Akademicka 19, PL-20-033 Lublin, Poland. E-mail: pawbucz@gmail.com

**18002.** Buczyński, P.; Dawidowicz, L.; Wagner, G.; Jarska, W. (2012): New locality of the Sedgling *Nehalennia speciosa* (Charpentier, 1840) (Odonata: Coenagrionidae) in the Suwalki Region. *Odonatrix* 8(1): 11-13. (in Polish, with English summary) ["The authors give a new site of *Nehalennia speciosa* in north-eastern Poland: a transitional peat bog in Błaskowizna village (54°15'22"N, 22°49'19"E). On July 4 and 7, 2011 about 10 individuals of the species were observed, with territorial males in it. They inhabited the flooded depression in the center of the peat bog grown with *Carex*

lasiocarpa swamp with addition of: *Utricularia minor*, *Aldrovanda vesiculosa*, *Menyanthes trifoliata* and *Dryopteris thelypteris*. *Aeshna juncea* during metamorphosis was also noted there. In other zones of the peat bog, in a buffering zone as well as beaver canals with open water, 12 dragonfly species were recorded, including 9 autochthonic ones (*Enallagma cyathigerum*, *Coenagrion puella*, *C. pulchellum*, *Aeshna grandis*, *A. juncea*, *A. subarctica*, *Cordulia aenea*, *Leucorrhinia pectoralis*, *L. rubicunda*). The discussed site is threatened by drainage and overgrowing by alder and reed (now at initial stage). It requires protective activities. The peat bog in B<sup>3</sup>askowizna is only the fifth site of *N. speciosa* known from the Suwa<sup>3</sup>ki Region. This results from the lack of adequately targeted research not the lack of the species itself. The similar diagnosis can be made for just 13 km distant south-western areas of Lithuania where only one site of this species has been discovered so far." (Authors)] Address: Buczynski, P., Dept of Zool., Maria Curie-Skłodowska Univ., Akademicka 19, 20-033 Lublin, Poland. E-mail: pawbucz@gmail.com

**18003.** Dossena, M.; Yvon-Durocher, G.; Grey, J.; Montoya, J.M.; Perkins, D.M.; Trimmer, M.; Woodward, G. (2012): Warming alters community size structure and ecosystem functioning. *Proc. R. Soc. B.* 279: 3011-3019. (in English) ["Global warming can affect all levels of biological complexity, though we currently understand least about its potential impact on communities and ecosystems. At the ecosystem level, warming has the capacity to alter the structure of communities and the rates of key ecosystem processes they mediate. Here we assessed the effects of a 48C rise in temperature on the size structure and taxonomic composition of benthic communities in aquatic mesocosms, and the rates of detrital decomposition they mediated. Warming had no effect on biodiversity, but altered community size structure in two ways. In spring, warmer systems exhibited steeper size spectra driven by declines in total community biomass and the proportion of large organisms. By contrast, in autumn, warmer systems had shallower size spectra driven by elevated total community biomass and a greater proportion of large organisms. Community-level shifts were mirrored by changes in decomposition rates. Temperature-corrected microbial and macrofaunal decomposition rates reflected the shifts in community structure and were strongly correlated with biomass across mesocosms. Our study demonstrates that the 4°C rise in temperature expected by the end of the century has the potential to alter the structure and functioning of aquatic ecosystems profoundly, as well as the intimate linkages between these levels of ecological organization." *Ischnura elegans*, *Libellula quadrimaculata*, *Orthetrum cancellatum* (Authors)] Address: Dossena, M., School of Biological and Chemical Sciences, Queen Mary University of London, London E1 4NS, UK

**18004.** Ishizawa, N. (2012): Observation of an annular solar eclipse. *Newsletter from Kunugiyama Forest* 18: 1-4. (in English) [rice paddies at Bodaigi, Tokorozawa City, Saitama Prefecture, Japan (35°46'14" N, 139°25'26" E). "*Orthetrum albistylum speciosum* were flying around at an extremely low light intensity at the partial solar eclipse (Ta ca. 22°C),

therefore, the reason why the delayed appearance of them seemed to be due to low Ta; the time when Ta exceeded 20°C was 8:20 a.m. The light intensity at the magnitude maximum of the former partial solar eclipse was 771 lx (Ta: 22.3°C), the perching posture of *O.a. speciosum* male was changed from the normal posture with its body axis parallel to the horizon (Photo 3A) to near the upright position (Photo 3B Ishizawa, 2011) e.g. the posture of sleeping. Such behaviours at the solar eclipse were also observed by Katatani (2010) at Nara Prefecture. It is assumed that dragonflies may adopt sleeping posture when the light intensity lowers ca. less than 1,000 lx. Even when the light intensity exceeds 2,000 lx like this time, dragonflies might not be active at lower Ta. The factor of Ta influenced on them more than the annular solar eclipse. *O. a. speciosum* and *O. japonica* are said to be the perchers and ectothermic insects that depend their thermoregulation on the solar power. At the annular solar eclipse the light intensity doesn't seem to influence on the behaviour of animals." (Author)] Address: Ishizawa, N., 1644-15, Yamaguchi, Tokorozawa City, Saitama Pref., Japan. E-mail: greffect708@htk.ne.jp

**18005.** Janeková, K.; David, S. (2012): The faunistic-ecological research of Odonata in the lower part of inundation area of the Orava river (NW Slovakia).. *Folia faunistica Slovaca* 17(2): 117-125. (in Slovak, with English summary) ["The area of Odonata exploration belongs to the Orava region, which is situated in NW Slovakia. The examined localities spread out in the lower part of inundation area of the Orava river, in surroundings of the town Dolný Kubín. The entire research of dragonflies was carried out in years 2008 – 2010 at 6 localities, which represent 6 types of biotopes – a gravel pit, an oxbow lake, an old river branch, a submontane river, an oxbow-lake and old flooded quarries and gravel-pit. 29 species of dragonflies have been found in the localities. The eudominant ones are *Coenagrion puella*, *Enallagma cyathigerum*, *Platycnemis pennipes* and *Erythromma najas* respectively. There are 10 endangered species e. g. *Sympetma fusca*, *Somatochlora meridionalis*, *Crocothemis erythraea* and *Sympetrum meridionale*. From the Odonata biodiversity point of view the most valuable locality is the above mentioned gravel-pit Pámica. We have found 23 Odonata species there." (Authors)] Address: Janeková, Katarína, Katedra ekológie a environmentalistiky FPV Univerzity Konštantína Filozofa v Nitre – spoločné pracovisko ÚKE SAV, pobočka Nitra s FPV UKF v Nitre, Tr. A. Hlinku 1, 949 74 Nitra, Slovakia. E-mail: katkajanejkova@gmail.com

**18006.** Klein, B.A. (2012): The curious connection between insects and dreams. *Insects* 2012, 3, 1-17; doi:10.3390/insects3010001: 17 pp. ["A majority of humans spend their waking hours surrounded by insects, so it should be no surprise that insects also appear in humans' dreams as we sleep. Dreaming about insects has a peculiar history, marked by our desire to explain a dream's significance and by the tactic of evoking emotions by injecting insects in dream-related works of art, film, music, and literature. I surveyed a scattered literature for examples of insects in dreams, first from the practices of dream interpretation, psychiatry, and

scientific study, then from fictional writings and popular culture, and finally in the etymology of entomology by highlighting insects with dream-inspired Latinate names. A wealth of insects in dreams, as documented clinically and culturally, attests to the perceived relevance of dreams and to the ubiquity of insects in our lives... One common contextual category for dream interpretation is the killing of annoying insects. To kill lice on your body signifies a release from anxiety and sorrow, and to clean lice from your body signifies hope for the release of evils [37]. For Europeans, to kill a wasp denotes the dreamer's ability to stand up fearlessly against opponents [34], and to eat a dragonfly means that you are consumed by passion at the risk of hurting others' feelings [35]. Interpretations exist for dreams about most of the insect orders, of which the parasitic, biting, and stinging insects are well represented." (Author)] Address: Klein, B.A., Dept of Neurobiology and Behavior, Cornell University, Ithaca, NY 14853, USA

**18007.** Lok, A.F.S.L.; Tang, H.B. (2012): Odonates: Damselflies and dragonflies. In: Alvin F. S. L. Lok, W. F. Ang, Hugh T. W. Tan, Richard T. Corlett and P. Y. Tan (eds.): The native fauna of the Native Garden @ HortPark: Birds, fishes, amphibians, reptiles, butterflies, moths, damselflies, and dragonflies. Raffles Museum of Biodiversity Research, National University of Singapore and Centre for Urban Greenery and Ecology, National Parks Board, Singapore, 2012: 113-147. (in English) [Singapore; a total of 25 odonates were recorded between 10 May to 9 December 2010.] Address: Lok, A.F.S.L., Blk 656D Jurong West St 61 #07-323, Singapore 643656. E-mail: alvinfrancislok@yahoo.com

**18008.** Michalczuk, W. (2012): New records of the Sedgling *Nehalennia speciosa* (Charpentier, 1840) in Roztocze and the Sandomierska Basin (Odonata: Coenagrionidae). *Odonatrix* 8(1): 14-18. (in Polish, with English summary) ["Four sites of *N. speciosa* have been known so far from Central and Eastern Roztocze as well as the Biłgorajska Plain (NE part of the Sandomierska Basin). In the years 2008–2011, next 7 sites were recorded. In contrary to the northern part of the occurrence of this species in Poland, here it occurs first of all in transitional peat bogs with small water bodies in the advanced stage of succession and highly hydrated peatmoss. The dominating habitat type is also different than in the national scale: these are *Sphagnum* sp. patches with bottle sedge. One of the sites refers to a fen." (Author)] Address: Michalczuk, W., Zamojskie Towarzystwo Przyrodnicze, ul. Partyzantów 74/59, 22-400 Zamosc, Poland. E-mail: wiack@wp.pl

**18009.** Mikołajczuk, P.; Milaczewska, E. (2012): New localities of the Sedgling *Nehalennia speciosa* (Charpentier, 1840) (Odonata: Coenagrionidae) in the eastern part of Masovia and in the northern part of the Lublin District. *Odonatrix* 8(1): 1-10. (in Polish, with English summary) ["The authors give 17 new sites of *N. speciosa* discovered in the years 2010–2011 in central–eastern Poland. This data is essential due to poor level of studying of this area and the species itself: stenotopic, under protection and very strongly

threatened in Poland (EN category on the Red list of dragonflies of Poland). Species co-occurring with Sedgling were also given, indicating autochthonous species (marked with \* symbol) and probably autochthonous (#). Among new sites 7 ones have situated in the eastern part of Masovia and 10 in the northern part of the Lublin District. They fill the gap between sites in northern Poland and the Łęczyńsko-Wódzkie Lake District and the areas of Koźienice. Therefore the state of maintenance of the species in the central-eastern part of the country is much better than it was suggested earlier (Bernard et al. 2009). Other discoveries in eastern Poland also confirm this fact ... The localities of Sedgling known before and new ones probably do not form the isolated range island but they belong to the extension of its compact main part situated in northern Poland. This is even more likely that at least in eastern Masovia there are numerous peat bogs located in forests similar to those described in this paper. This suggests the existence of a large number of yet unknown sites of *N. speciosa* which can form compact concentrations on which the analysis of satellite maps and geological maps of the Quaternary seem to indicate. In Poland *N. speciosa* inhabits: I. narrow zone of floating and waterlogged mats of vegetation on the boundary of open water table of lakes and small water bodies, and II. at least partially flooded parts of *Sphagnum* peat bogs and fens, usually at their small depression. Habitats of the first type are dominating (Bernard, Buczyński 2008). Among the localities we studied, we observed two types of environments, however, the rarer second type was more often (Bernard, Buczyński 2008). The preferences of imagines of *N. speciosa* towards *Carex* sp., *C. rostrata*, *C. lasiocarpa* and *Eriophorum vaginatum* were observed. New data shows that the number of localities in potential gaps of the range of *N. speciosa* can be large. Therefore taking a look for this species in other areas where such studies have not been conducted is needed." (Authors)] Address: Mikołajczuk, P., ul. Partyzantów 59c/26, 21-560 Międzyrzec Podlaski, Poland. E-mail: gugapm@wp.pl

**18010.** Pérez, I.S.; Palomares, G.M.; López Alabau, A. (2012): Odonatos del Parque Natural "Hoces del Cabriel" (Valencia, España) (Odonata). *Boletín de la S.E.A.* 50: 317-320. (in Spanish, with English summary) ["Data are provided on the odonate fauna of the Hoces del Cabriel Natural Park (Valencia, Spain) based on samples taken from Spring to Autumn in 2010 and 2011. Thirty-two species have been detected in the study area." (Authors)] Address: Pérez, I.S.. C/Camino 14, 2o, 3a. 46300 Utiel (Valencia), Spain. E-Mail: natxosendra@gmail.com

**18011.** Perkin, J.S.; Shattuck, Z.R.; Bonner, T.H. (2012): Life history aspects of a relict Ironcolor Shiner *Notropis chalybaeus* population in a novel spring environment. *The American Midland Naturalist* 167(1): 111-126. (in English) [*N. chalybaeus* (Cyprinidae) "is generally absent from groundwater-dominated systems throughout its range; however, a relict disjunct population occurs within the spring-fed upper reaches of the San Marcos River in central Texas. We conducted monthly seine collections within the restricted 2.2

km headwater range of the species to assess food habits and reproductive life history within a unique spring-run environment. Prey items were dominated by aquatic insects including Diptera (16% by weight), Ephemeroptera (13%), and Odonata (5%), as well as terrestrial insects (9%). The population consisted of four age groups with a maximum life span of 2.5 y. Reproductive ecology showed a protracted spawning season ranging Mar.–Dec. during which multiple clutches were produced. Reproductive maturity was reached at approximately 1 y (36 mm SL), mean mature oocyte diameter was 0.8 mm, and number of mature oocytes per clutch ranged 46–326. Comparisons between ironcolor shiner populations in the San Marcos River and thermally dynamic Marshalls Creek of Pennsylvania revealed mature female size was larger ( $T_{38} = 10.48$ ,  $P < 0.01$ ) and mature oocyte diameter smaller ( $T_{38} = 16.87$ ,  $P < 0.01$ ) in the upper San Marcos River. Literature accounts regarding ironcolor shiner reproductive ecology suggest a latitudinal trade-off between reproductive season length and oocyte size. Our findings provide further evidence for the roles of photoperiod and water temperature in structuring the reproductive seasonality of spring-dwelling fishes, specifically the lack or delay of terminating cues in stenothermal waters. In this manner, aquifer depletion and alteration of thermal regimes threaten spring-dwelling fishes by disrupting naturally occurring reproductive cues." (Authors)] Address: Perkin, J.S., Division of Biology, Kansas State Univ., 116 Ackert Hall, Manhattan 66506, USA. E-mail: jperkin@ksu.edu

**18012.** Pliuraite, V.; Kesminas, V. (2012): Ecological impact of Eurasian beaver (*Castor fiber*) activity on macroinvertebrate communities in Lithuanian trout streams. *Central European Journal of Biology* 7(1): 101-114. (in English) ["Our study found that beaver activity affects macroinvertebrate assemblages of both beaver ponds and downstream sites. The percentage composition of the invertebrate faunae of beaver ponds was strikingly different from the invertebrate faunae of upstream forested and downstream sites. The number of EPT (ephemeropteran, plecopteran, trichopteran) taxa in the upstream forested sites in all streams was higher than in beaver pond and downstream sites. Statistically significant differences were found in absolute and relative abundances of EPT and Chironomidae between different streams sites. The absolute and relative abundance of pollution-sensitive EPT was significantly higher in forested sites than in beaver pond and downstream sites in all measured streams. Beaver ponds had a significantly higher absolute and relative abundance of Chironomidae compared with upstream forested and downstream sites. We found that Plecoptera and Coleoptera were absent from beaver pond sites. The absolute abundance of Plecoptera was significantly higher in upstream forested sites than in downstream sites in all three streams. Gatherers were the dominant functional feeding group in relative abundance in all three habitat types. The percentage of gatherers was higher in beaver ponds than in forested and downstream sites." (Authors) *Calopteryx splendens* *Gomphus vulgatissimus*] Address: Pliuraite, Virginija, Nature Research Centre, 08412 Vilnius-21, Lithuania. E-mail: virga@eko.lt

**18013.** Thomsen, P.F.; Kielgast, J.; Iversen, L.; Wiuf, C.; Rasmussen, M.; Gilbert, M.T.P.; Orlando, L.; Willerslev, E. (2012): Monitoring endangered freshwater biodiversity using environmental DNA. *Molecular ecology* 21(11): 2565-2573. (in English) ["Freshwater ecosystems are among the most endangered habitats on Earth, with thousands of animal species known to be threatened or already extinct. Reliable monitoring of threatened organisms is crucial for data-driven conservation actions but remains a challenge owing to nonstandardized methods that depend on practical and taxonomic expertise, which is rapidly declining. Here, we show that a diversity of rare and threatened freshwater animals—representing amphibians, fish, mammals, insects and crustaceans—can be detected and quantified based on DNA obtained directly from small water samples of lakes, ponds and streams. We successfully validate our findings in a controlled mesocosm experiment and show that DNA becomes undetectable within 2 weeks after removal of animals, indicating that DNA traces are near contemporary with presence of the species. We further demonstrate that entire faunas of amphibians and fish can be detected by high-throughput sequencing of DNA extracted from pond water. Our findings underpin the ubiquitous nature of DNA traces in the environment and establish environmental DNA as a tool for monitoring rare and threatened species across a wide range of taxonomic groups. ... We specifically surveyed six animal species representing different taxonomic groups: the amphibians common spadefoot toad (*Pelobates fuscus*) and great crested newt (*Triturus cristatus*), the fish European weather loach (*Misgurnus fossilis*), the mammal Eurasian otter (*Lutra lutra*), the dragonfly large white-faced darter (*Leucorrhinia pectoralis*) and the crustacean tadpole shrimp (*Lepidurus apus*). ... The success rate of the DNA-based species detection by qPCR in ponds with known occurrence of the targeted species was 100% for the fish, 91–100% for the amphibian species, 82% for the dragonfly and 100% for the tadpole shrimp .... the system for *L. pectoralis* was tested negative for *L. dubia*, *L. rubicunda*, *Anax imperator* and *Cordulia aenea*." (Authors);] Address: Willerslev, E., Centre for GeoGenetics, Natural History Museum of Denmark, Univ. Copenhagen, Øster Voldgade 5-7, DK-1350 Copenhagen, Denmark. E-mail: ewillerslev@snm.ku.dk

## 2016

**18014.** Bomphrey, R.J.; Nakata, T.; Henningsson, P.; Lin, H.-T. (2016): Flight of the dragonflies and damselflies. *Phil. Trans. R. Soc. B* 371: 20150389. 15 pp. (in English) ["This work is a synthesis of our current understanding of the mechanics, aerodynamics and visually mediated control of dragonfly and damselfly flight, with the addition of new experimental and computational data in several key areas. These are: the diversity of dragonfly wing morphologies, the aerodynamics of gliding flight, force generation in flapping flight, aerodynamic efficiency, comparative flight performance and pursuit strategies during predatory and territorial flights. New data are set in context by brief reviews covering anatomy

at several scales, insect aerodynamics, neuromechanics and behaviour. We achieve a new perspective by means of a diverse range of techniques, including laser-line mapping of wing topographies, computational fluid dynamics simulations of finely detailed wing geometries, quantitative imaging using particle image velocimetry of on-wing and wake flow patterns, classical aerodynamic theory, photography in the field, infrared motion capture and multi-camera optical tracking of free flight trajectories in laboratory environments. Our comprehensive approach enables a novel synthesis of datasets and subfields that integrates many aspects of flight from the neurobiology of the compound eye, through the aeromechanical interface with the surrounding fluid, to flight performance under cruising and higher-energy behavioural modes." (Authors)] Address: Bompfrey, R.J., Structure and Motion Laboratory, Department of Comparative Biomedical Sciences, Royal Veterinary College, North Mymms, Hatfield AL9 7TA, UK. E-mail: rbompfrey@rvc.ac.uk

**18015.** Debecker, S.; Sanmartín-Villar, I.; Guinea-Luengo, M.; Cordero-Rivera, A.; Stoks, R. (2016): Integrating the pace-of-life syndrome across species, sexes and individuals: covariation of life history and personality under pesticide exposure. *Journal of Animal Ecology* 85(3): 726-738. (in English) ["(1.) The pace-of-life syndrome (POLS) hypothesis integrates covariation of life-history traits along a fast-slow continuum and covariation of behavioural traits along a proactive-reactive personality continuum. Few studies have investigated these predicted life-history/personality associations among species and between sexes. Furthermore, whether and how contaminants interfere with POLS patterns remains unexplored. (2.) We tested for covariation patterns in life history and in behaviour, and for life-history / personality covariation among species, among individuals within species and between sexes. Moreover, we investigated whether pesticide exposure affects covariation between life history and behaviour and whether species and sexes with a faster POLS strategy have a higher sensitivity to pesticides. (3.) We reared larvae of four species of *Ischnura* damselflies (*I. elegans*, *I. genei*, *I. graellsii* and *I. pumilio*) in a common garden experiment with an insecticide treatment (chlorpyrifos absent/present) in the final instar. We measured four life-history traits (larval growth rate during the pesticide treatment and development time; adult mass and lifespan) and two behavioural traits (larval feeding activity and boldness, each before and after the pesticide treatment). (4.) At the individual level, life-history traits and behavioural traits aligned along a fast-slow and a proactive-reactive continuum, respectively. Species-specific differences in life history, with fast-lived species having a faster larval growth and development, a lower mass at emergence and a shorter lifespan, suggested that time constraints in the larval stage were predictably driving life-history evolution both in the larval stage and across metamorphosis in the adult stage. Across species, females were consistently more slow-lived than males, reflecting that a large body size and a long lifespan are generally more important for females. In contrast to the POLS hypothesis, there was only little evidence for the expected positive coupling between life-history pace and proactivity.

Pesticide exposure decreased larval growth rate and affected life-history/personality covariation in the most fast-lived species. (5.) Our study supports the existence of life-history and behavioural continua with limited support for life-history/personality covariation. Variation in digestive physiology may explain this decoupling of life history and behaviour and provide valuable mechanistic insights to understand and predict the occurrence of life-history/personality covariation patterns." (Authors)] Address: Debecker, Sara, Laboratory of Aquatic Ecology, Evolution and Conservation, University of Leuven, Leuven, Belgium. E-mail: sara.debecker@bio.kuleuven.be

## 2017

**18016.** Agus, M.; Pujiastuti, Y.; Windusari, Y. (2017): The Diversity of the dragonfly (Odonata) as an indication of water quality. *Science & Technology Indonesia* 2(4): 80-84. (in English) ["Information on the diversity of dragonfly in the University area is still not much. Reduced areas that support the growth and development of dragonfly species are thought to have an impact on the decline of the population and the diversity of these species. The purpose of this study identified and analyzed the diversity of dragonfly species. Dragonfly are collected through direct capture and using sticky traps, then visual observations are made for identification. Environmental conditions in the area of Sriwijaya University Campus is still good, with the visibility of environmental parameters in the form of DO, BOD and COD still meet environmental quality standards so that dragonflies are still able to lay eggs to keep their generation. Sriwijaya University campus found 19 species of Odonata belonging to 5 families and 2 sub-ordo, with the value of species diversity index of 2.05 and moderate." (Authors)] Address: Agus, M., Environmental Management Dept, Graduate School of Sriwijaya Univ. E-mail: agusmuhammad@student.pps.unsri.ac.id

**18017.** Ajibade, A.O.; Ajani, E.K.; Omitoyin, B.O. (2017): The predatory behaviour of nymphs of dragonfly (*Africocypha varicolor*) on fry of African mud catfish (*Clarias gariepinus*) and control by skunk weed (*Petivera alliacea*) root-extract in aquaculture. *Fisheries and Aquaculture Journal* 8(3) • 1000219: 5 pp. (in English) ["The use of natural organic extract instead of synthetic chemicals in harvesting wild fish and eliminating unwanted aquatic biota is popular in Nigeria. This research, therefore, investigated the possibility of using the root extract of a common weed in southwestern Nigeria, named *P. alliacea*, in checkmating the predatory influence of nymphs of dragonfly which frequently attack fry of African mud catfish. Activity of extract was first assessed through a brine shrimp test in a 24 hr investigation before concentrations of 0.0 g/l, 0.22 g/l, 0.48 g/l, and 1.06 g/l were applied under laboratory conditions in plastic aquaria against the naiads. The 96 hr Lc50 was 0.47 g/l obtained using probit analysis. The regression equation for the probit curve was  $y=3.173+3.5$  ( $y$ =probit value,  $x$ =actual concentration and  $r=0.7$ =coefficient of correlation). An average of

six fry and one fry were consumed by one dragonfly nymph every 96 hr at two weeks and three weeks old, respectively." (Authors)] Address: Ajibade, A.O., Dept of Fisheries Technology, Oyo State College of Agriculture and Technology, P.M.B. 10, Igboora, Nigeria. E-mail: porkyprof@yahoo.ca

**18018.** Akshatha Rao, B.S: Anusha, T.N.; Karthik, M.K.; Lakshmi, K.S.; Pavan Kumar, K.S.; Shashwathi, H.S.; Vagdevi Rao, K.C.; Vishwajith, H.U.; Keshava Murthy, M.V. (2017): Odonate diversity in selected habitats of Sringeri Taluk, Chikmagalur district. *Journal of Environmental Science, Toxicology and Food Technology* 11(9): 56-59. (in English) ["Dragonflies and Damselflies, collectively called Odonates and are one of the most common insects flying over forests, fields, meadows, ponds and rivers. Few streams, ponds, marshes, swamps and hilly green areas with lesser disturbance of humans were selected for the present study. Transect method was employed for the present study. A line transect of 500m length was laid in ten selected study areas and the odonates observed along the transects were documented and photographed. The diversity and abundance of the documented species of dragonflies and damselflies were measured and the Shannon and Simpson's diversity indices were calculated using the standard formulae available. 52 species belonging to 28 genera and 10 families are documented in the present study. Out of these 29 are anisopterans and remaining 23 are zygopterans." (Authors)] Address: Murthy, M.V., Department of Zoology, Sri J C B M College Sringeri, India

**18019.** Al-Hashmi, A.H. (2017): External morphological study of the *Sympetrum fonscolombei* (Selys, 1840) (Odonata: Anisoptera: Libellulidae) in Baghdad. *Al-Mustansiriyah Journal of Science* 28(2): 11-15. (in English, with Arabian summary) ["The specimens were collected from different region in Baghdad / Iraq, by using air net during April 2016. In this study, a morphological characters of *Sympetrum fonscolombii* (Selys, 1840) is include three region of body (head, thorax and abdomen); in addition, male and female genitalia. Such characters were supported by Figures.] Address: Al-Hashmi, Asmaa, Department of Biology, College of Science, Mustansiriyah University, Iraq. E-mail: asmaa\_alhashmi80@yahoo.com

**18020.** Amaya-Vallejo, V., Novelo-Gutierrez, R.; Realpe, E. (2017): *Perigomphus basicornis* sp. nov. (Odonata: Gomphidae) from Anchicayá, Colombia. *Zootaxa* 4294(3): 395-400. (in English) ["The new species is described and illustrated based on adult males obtained from mature larvae collected in Anchicayá zone, Valle del Cauca, Colombia, and reared in Universidad de Los Andes laboratory, Bogotá, Colombia. The adult differs from the other described species of *Perigomphus* in the shape of the cerci and the size of the epiroct. Larvae are easy to collect in field but challenging to rear in the lab because of their habitat preferences. Adults are difficult to find in the field as they live high in the canopy. Holotype: reared male and exuviae, 22.xi.2016; deposited in Instituto de Ecología, A.C., Xalapa, Mexico." (Authors)] Address: Amaya-Vallejo, Vanessa, Univ. de los Andes, Lab.

de Zoología y Ecología Acuática LAZOE. Cra 1 N°18A-12, Lab J307 Bogotá, Colombia

**18021.** Angradi, T.R.; Bartsch, W.M.; Trebitz, A.S.; Brady, V.J.; Launspach, J.J. (2017): A depth-adjusted ambient distribution approach for setting numeric removal targets for a Great Lakes Area of Concern beneficial use impairment: Degraded benthos. *Journal of Great Lakes Research* 43(1): 108-120. (in English) ["We compiled macroinvertebrate data collected from 1995 to 2014 from the St. Louis River Area of Concern (AOC) of Lake Superior. Our objective was to define depth-adjusted cutoff values for benthos condition classes to provide an analytical tool for quantifying progress toward achieving removal targets for the degraded benthos beneficial use impairment. We used quantile regression to model the limiting effect of depth on selected benthos metrics, including taxa richness, percent non-oligochaete individuals, combined percent Ephemeroptera, Trichoptera, and Odonata individuals, and density of ephemeropterid mayfly nymphs (Hexagenia). We created a scaled trimetric index from the first three metrics. Metric values above the 75th percentile quantile regression model prediction were defined as being in relatively excellent condition in the context of the degraded beneficial use impairment for that depth. We set the cutoff between good and fair condition as the 50th percentile model prediction, and we set the cutoff between fair and poor condition as the 25th percentile model prediction. We examined sampler type, geographic zone, and substrate type for confounding effects. Based on these analyses we combined data across sampler types and created separate models for each of three geographic zones. We used the resulting condition-class cutoff values to determine the relative benthic condition for three adjacent habitat restoration project areas. The depth-limited pattern of ephemeropterid abundance we observed in the St. Louis River AOC also occurred elsewhere in the Great Lakes. We provide tabulated model predictions for application of our depth-adjusted condition class cutoff values to new sample data." (Authors)] Address: Angradi, T.R., United States Environmental Protection Agency, Office of Research & Development, National Health & Environmental Effects Research Laboratory, Mid-Continent Ecology Division, 6201 Congdon Blvd., Duluth, MN 55804, USA

**18022.** Ansari, N.A. (2017): Diversity of odonate fauna in Surajpur Lake: An urban wetland of Upper Gangetic Plain, Northern India. *Journal of Ecology and Environmental Sciences* 43(2): 73-79. (in English) ["Surajpur Lake is a prominent urban wetland site in Upper Gangetic Plain, Northern India known for its rich avifaunal and other aquatic biodiversity. Present study was carried out to assess the odonate diversity from March 2010 to February 2013 by applying standard survey techniques. During the study period, a total of 36 species belonging to 29 genera and 5 families of odonate fauna were recorded. Anisoptera were represented by 25 species and Zygoptera by 11 species. Libellulidae was the dominant family among the dragonflies and Coenagrionidae among the damselflies. The relative abundance of odonates includes 14 species as common, 11 as very common,

7 were occasional, 3 were rare and one was very rare out of 36 species. The diversity of odonate fauna discussed in the light of results hitherto unreported." (Authors)] Address: unknown

**18023.** Arambourou, H.; Sanmartín-Villar, I.; Stoks, R. (2017): Wing shape-mediated carry-over effects of a heat wave during the larval stage on post-metamorphic locomotor ability. *Oecologia* 184(1): 279-291. (in English) ["Two key insights to better assess the ecological impact of global warming have been poorly investigated to date: global warming effects on the integrated life cycle and effects of heat waves. We tested the effect of a simulated mild (25 °C) and severe (30 °C) heat wave experienced during the larval stage on the flight ability of the damselfly *Ischnura elegans*. To get a mechanistic understanding of how heat stress may translate into reduced post-metamorphic flight ability, we evaluated the hypothesized mediatory role of adult size-related traits, and also tested alternative pathways operating through changes in wing shape and two flight-related traits (both relative fat and flight muscle contents). Exposure to a heat wave, and particularly the severe one, shortened the larval stage, reduced adult size-related traits and modified the wing shape but did not significantly affect emergence success, relative fat content and relative flight muscle mass. Notably, the heat wave negatively affected all components of flight ability. Unexpectedly, the heat wave did not reduce flight ability through reducing size. Instead, we identified a novel size-independent mechanism bridging metamorphosis to link larval environment and adult flight ability in males: through affecting wing shape. The present study advances mechanistic insights in the still poorly understood coupling of life stages across metamorphosis. Additionally, our results underscore the need for integrative studies across life stages to understand the impact of global warming." (Authors)] Address: Arambourou, Hélène Irstea, Research Unit MAEP (Freshwater Systems, Ecology and Pollution), Villeurbanne Cedex, France

**18024.** Arjangay, A.; Darvizeh, A.; Tooski, M.Y.; Ansari, R. (2017): An experimental and numerical investigation on low velocity impact response of a composite structure inspired by dragonfly wing configuration. *Composite Structures* 184: 327-336. (in English) ["The low velocity impact response of a novel foam-based composite structure inspired by microstructural features of dragonfly wings is investigated through the use of FE model and experiments. A nonlinear progressive damage model of the composite skins is incorporated into the FE code by VUMAT subroutine. Inter-laminar damage is reproduced using interface cohesive elements and the foam core is modeled as a crushable foam material. The numerical results are compared with experimental data acquired by impact testing on bio-inspired structures consisting of E-glass/epoxy skins filled by polyurethane foam, where a good agreement is achieved. To assess the contribution of the sandwich vein on the impact behavior of the structure, a comparison is made between different veiny structures and monolithic laminates with the same materials under low velocity impact. It is concluded that the sandwich vein can limit the damage propagation and makes the rest

of the structure remain intact." (Authors)] Address: Arjangay, A., Dept Mechanical Engineering, Univ. of Guilan, P.O. Box 3756, Rasht, Iran. E-mail: azadeh.arjangpay@gmail.com

**18025.** Babošová, M.; Noskovic, J.; Ivanic Porhajašová, J. (2017): Dragonflies (Odonata) of the Nature Reserve Torozlín and water area Štrkáren gravel-pit in the southwestern part of the Slovak Republic. *Acta fytotechn zootech* 20(3): 49-53. (in English) ["Over the period of the years 2014 and 2015 in the locality of nature reserve Torozlín and water area Štrkáren gravel-pit being located at the village Komjatice, lying in the southwestern part of the Podunajská pahorkatina upland was evaluated the species of dragonflies. 179 individuals of dragonflies were collected during the monitoring period, of which 13 species were determined as belonging to eight families. On the locality of the Torozlín Nature Reserve, the dominant species were *Ischnura elegans* (37.50%), *Platycnemis pennipes* (28.85 %), *Sympetrum vulgatum* (10.58 %), *S. sanguineum* (5.76 %) and *Platycnemis pennipes* (54.67 % *Ischnura elegans* (37.33 %) and *Libellula depressa* (5.34 %). Based on the fact that the Torozlín site has a marshy character, the species composition was more varied. Protection and vulnerability were assessed by the Red List of IUCN, the European Red List of dragonflies and the Red List of dragonflies of the Slovak Republic. Evaluation of protection was carried out under the Decree of the Ministry of Environment of the Slovak Republic No. 492/2006 Collection of Laws. For individual species found also their dominance was calculated." (Authors)] Address: Babošová, Mária, Slovak Univ. of Agriculture in Nitra, Faculty of Agrobiological & Food Resources, Department of Environmental & Zoology, Tr. Anreja Hlinku 2, 949 76 Nitra, Slovakia. E-mail: Maria.Babosova@uniag.sk

**18026.** Babu, R. (2017): Diversity of Odonates (Insecta: Odonata) in Fish Farm, College of Veterinary and Animal Sciences, CSKHPKV, Palampur, Himachal Pradesh, India. *Rec. zool. Surv. India* 117(4): 367-375. (in English) ["Odonata diversity in fish farm of Department of Fisheries, CSKHPKV, Palampur, Kangra Valley, Himachal Pradesh were comprehensively studied and documented for the first time. A total of 27 species belonging to 19 genera and 7 families of two suborders are recorded. The suborder Zygoptera was represented by 13 species and 14 species represents Anisoptera. Among the families, Libellulidae was richest family with 13 species and followed by Coenagrionidae with 9 species. The wide range of habitats including foraging and nocturnal roosting habitat at Fish Farm, CSKHPKV leads to greatest species diversity." (Authors)] Address: Babu, R., Southern Regional Centre, Zoological Survey of India, Chennai - 600 028, Tamil Nadu, India

**18027.** Bakare, S.S.; Verma, P.R.; Andrew, R.J. (2017): Ultrastructure of spermatozoa of *Anax guttatus* (Odonata: Aeshnidae). *Odonatologica* 46(3/4): 241-254. (in English) ["In *A. guttatus* the mitochondria accumulate at the base of the nucleus to form a single nebenkern during spermiogenesis. An electron dense matrix 'centriole adjunct' is formed at the base of the nucleus surrounding the nebenkern. The acrosomal

vesicle migrates to the anterior end of the nucleus. The ultrastructure of the spermatozoa reveals that its elongated head lodges an apical inverted 'T' shaped, double-layered acrosome and a long, electron-dense nucleus, while the tail is composed of the axoneme, a pair of identical mitochondria derivatives, and the lateral/osmophilic bodies. The nucleus is displaced on one side by the axoneme. The axoneme consists of microtubules, and these are arranged into nine outer peripheral inter-singlets, nine peripheral doublets, and two central tubules (9+9+2 type). The mitochondrial derivatives and lateral bodies surround the axoneme at the tail region of the spermatozoon. A large number of cristae are evident in the longitudinal section of the derivatives. The spermatozoon of *A. guttatus* is therefore characterized by several unique features, such as the absence of a centriole, a spiked double layered acrosome, and a long nucleus with a sub-central axoneme running all along its length. The mitochondria derivative runs parallel to the axoneme, while a pair of lateral bodies is located parallel to the mitochondrial derivatives." (Authors)] Address: Andrew, R.J., P. G. Dept of Zoology & Higher Learning, Hislop College, Civil Lines, Nagpur, 440 001, (MS), India. E-mail: [rajuandrew@yahoo.com](mailto:rajuandrew@yahoo.com)

**18028.** Balazas, A. (2017): Dragonfly (Insecta: Odonata) assemblage of three types of habitats in the the south of Central Slovakia. *Mendel Net* 24: 304-309. (in English) ["Several field works between 2016 and 2017 were undertaken on the south of Central Slovakia. Three different types of biotopes based on their species richness and abundance (flooded quarry, fishpond and peat bog) were distinguished and compared in Cerova vrchovina Upland and Juhoslovenska kotlina Lowland. The most diverse locality was flooded quarry with 23 species, followed by fishpond with 13 species, while the lowest diversity had peat bog with 11 species. A total of 27 species were observed. Among them, 4 lepidoptera, 1 platycnemid, 8 coenagrionids, 3 aeshnids, 1 cordulid and 10 libellulids were presented. At 16 of them larval stage was recorded. According to the actualised Czech Republic's Red List of dragonflies 4 species belongs to Critically endangered, 2 to Endangered, 4 to Vulnerable and 6 to Near Threatened category. New additions to the Cerova vrchovina Upland's species list were added. *Le. Coenagrion pulchellum*, *Anaciaeschna isocetes*, *Aeshna grandis* and *Libellula fulva*. New locality of *Epitheca bimaculata* in the Special Protected Area Poiplie is given. The most significant result is record of *Sympetrum depressiusculum* after almost two decades in Slovakia." (Authors)] Address: Balazas, A., Dept Zool., Fisheries, Hydrobiology & Apiculture, Mendel Univ. in Brno, Zemedelska 1, 613 00 Brno, Czech Republic. E-mail: [balazsaeko@gma.il.com](mailto:balazsaeko@gma.il.com)

**18029.** Barbosa de Oliveira-Junior, J.M.; De Marco Junior, P.; Dias-Silva, K.; Leitão, R.P.; Leal, C.G.; Pompeu, P.S.; Gardner, T.A.; Hughes, R.M.; Juen, L. (2017): Effects of human disturbance and riparian conditions on Odonata (Insecta) assemblages in eastern Amazon basin streams. *Limnologia* 66: 31-39. (in English) ["Riparian vegetation is an important determinant of the physical, chemical, and biological condition of streams, and odonates are useful indicators of

riparian condition. To identify environmental factors that structure Odonata assemblages in tropical forest streams, we collected adult odonate specimens and habitat data from 50 stream sites located in the Brazilian municipality of Paragominas (Pará state). We collected 1769 specimens representing 11 families, 41 genera, and 97 species. Of these species, 56 were Zygoptera, and 41 were Anisoptera. Improved environmental condition was reflected in increased Zygoptera species richness and reduced Anisoptera species richness. Channel shading was strongly and positively related to Zygoptera richness, and negatively to Anisoptera richness. Zygoptera species richness, but not Anisoptera species richness, was related positively to bank angle, quantity of wood in the stream bed, electrical conductivity, and decreased water temperature. Altered riparian vegetation structure was the principal determinant of odonate assemblage structure. Our results indicate that maintaining intact riparian vegetation is fundamental for conserving or re-establishing aquatic odonate assemblage structure." (Authors)] Address: Barbosa de Oliveira-Junior, J.M. Programa de Pós-Graduação em Zoologia, Lab. de Ecologia e Conservação, Universidade Federal do Pará/Museu Paraense Emílio Goeldi, Rua Augusto Correia, N°. 1, Bairro Guamá, CEP: 66075-110, Belém, Pará, Brazil. E-mail: [josemaxoliveira@gmail.com](mailto:josemaxoliveira@gmail.com)

**18030.** Barden, P.; Ware, J.L. (2017): Relevant relicts: The impact of fossil distributions on biogeographic reconstruction?. *Insect Systematics and Diversity* 1(1): 73-80. (in English) ["Localized extinction can play a significant role in obscuring reconstructions of historical biogeography. Insects, one of the most diverse clades in the tree of life, have complex patterns of local endemism, patterns of relictual distributions, and clades which are rather widespread and cosmopolitan. At the same time, insects have a rich fossil record that can contribute to the inference of ancestral geographical distributions, in light of present ranges. Here, we review current and ancestral insect distributions to explore the impact of fossil ranges on ancestral area reconstruction. Known examples of relictual distributions within Phasmatodea and termites are discussed, while we test the impact of fossil inclusion on biogeographic reconstruction within ants and dragonflies. The inclusion of fossil distributions increases the breadth of ancestral ranges across several nodes in ant and dragonfly phylogenies, which has implications for biogeographically based interpretations of past evolutionary ecology for these groups. More broadly, the incorporation of fossil data into estimates of ancestral distributions will not only improve the accuracy of those estimates but also provide additional temporal context." (Authors)] Address: Barden, P., New Jersey Institute of Technology, Newark, NJ, USA. E-mail: [barden@njit.edu](mailto:barden@njit.edu)

**18031.** Barnard, A.A.; Fincke, O.M.; McPeck, M.A.; Masly, J.P. (2017): Mechanical and tactile incompatibilities cause reproductive isolation between two young damselfly species. *Evolution* 71(10): 2410-2427. (in English) ["External male reproductive structures have received considerable attention as a cause of reproductive isolation (RI), because the morphology of these structures often evolves rapidly



between populations. This rapid evolution presents the potential for mechanical incompatibilities with heterospecific female structures during mating and could thus prevent interbreeding between nascent species. Although such mechanical incompatibilities have received little empirical support as a common cause of RI, the potential for mismatch of reproductive structures to cause RI due to incompatible species-specific tactile cues has not been tested. We tested the importance of mechanical and tactile incompatibilities in RI between *Enallagma anna* and *E. carunculatum*, two damselfly species that diverged within the past ~250,000 years and currently hybridize in a sympatric region. We quantified 19 prezygotic and postzygotic RI barriers using both naturally occurring and lab-reared damselflies. We found incomplete mechanical isolation between the two pure species and between hybrid males and pure species females. Interestingly, in species pairs for which mechanical isolation was incomplete, females showed greater resistance and refusal to mate with hybrid or heterospecific males compared to conspecific males. This observation suggests that tactile incompatibilities involving male reproductive structures can influence female mating decisions and form a strong barrier to gene flow in early stages of speciation." (Authors)] Address: Barnard, Alexandra, Ecology & Evolutionary Biology Program, Dept of Biology, Univ. of Oklahoma, Norman, Oklahoma, USA. E-mail: alex.barnard@ou.edu

**18032.** Basallo, J.P.E- (2017): Control biológico de larvas de *Culex* sp. mediante el uso de náyades de Odonata en condiciones de laboratorio. M. Sc. Salud Pública, Universidad Distrital Francisco José de Caldas, Facultad de Medio Ambiente y recursos naturales, Tecnología en Saneamiento Ambiental, Bogotá D. C.: 63 pp. (in Spanish, with English summary) ["In the city of Bogotá *Culex quinquefasciatus* represent a problem for public health due to its sting can cause allergies and discomfort in humans and domestic animals. Therefore, its population control has been sought with different methods. Biological control with natural predators is one of the control mechanisms used, for which consumption was evaluated during the months of October to December of 2016 and the months of January and February of the 2017. The aim of this study was to evaluate the biological control of *Culex* sp. in their different stages (I, II, III and IV), by nymphs of the suborders Zygoptera and Anisoptera (Insecta: Odonata), commonly known as devil's horses and dragonflies. Taking into account related studies where it is shown that these can be an effective biological control, it was determined that the consumption is higher in Anisoptera than in Zygoptera and that the two suborders have a preference for stage II larvae." (Author)] Address: not stated

**18033.** Bastos dos Santos, T.; Cardoso Peixoto, P.E. (2017): Agonistic interactions in the dragonfly *Micrathyrina unguolata*: does male fighting investment come from an innate ability or an indomitable will? *Behavioral Ecology and Sociobiology* 71(7), Article number: 104: (in English) ["In fights between males for access to mating territories, the winner may be the rival with the highest fighting capacity or that places the highest value on the disputed site. However, it is also

possible that both factors simultaneously affect dispute settlement. Therefore, a better understanding of contest resolution rules may be achieved by simultaneously investigating how winning chances depend on individual motivation linked to resource value and on individual traits linked to fighting capacity. In this study, we used males of *Micrathyrina unguolata* to evaluate whether individual fighting ability, individual motivation, or the interaction between both factors determine the individual investment in territorial contests. For this, we simulated the approach of an intruder to trigger a territorial defense response by either resident (marked males present in the territory for at least 1 day before the experiment) or substitute males (marked males that occupied the territories after we removed the residents). Resident males fought longer against the potential intruder than their substitute counterparts. However, traits related to fighting ability had a marginal effect on the time invested in fights. These results indicate that resident males are more willing to invest in fights regardless of their physical or physiological attributes. Distinct motivational levels among individuals should increase the variation in mean contest duration among rival pairs. If this effect is widespread, it may have important implications for studies that investigate contest rules by relating fighting duration and individual traits. Significance statement: In many species, the winner of territorial fights is the individual with higher fighting ability or the one that values more the disputed resource and consequently is more motivated to fight. However, because these two factors may interact to determine the winner, investigations should benefit by simultaneously evaluating the effect of fighting ability and motivation on contest resolution. Here, we induced fights between focal males against artificially introduced rivals to test if male investment in fights is affected by an interaction between traits linked to fighting ability and motivational status. We showed that the prior occupation of a territory was the main determinant of the time spent fighting. We conclude that the previous occupation of a territory may increase individual motivation to fight due to higher valuation of the resource and eventually may surpass the effect of fighting ability to determine the winner." (Authors)] Address: Bastos dos Santos, Tamires, Programa de pós-graduação em Zoologia, Universidade Estadual de Feira de Santana, Feira de Santana, Brazil

**18034.** Beatty, C.D.; Sánchez Herrera, M.; Skevington, J.H.; Rashed, A.; Van Gossum, H.; Kelso, S.; Sherratt, T.N. (2017): Biogeography and systematics of endemic island damselflies: The Nesobasis and Melanesobasis (Odonata: Zygoptera) of Fiji. *Ecology & Evolution* 7(17): 7117-7129. (in English) ["The study of island fauna has greatly informed our understanding of the evolution of diversity. We here examine the phylogenetics, biogeography, and diversification of the damselfly genera *Nesobasis* and *Melanesobasis*, endemic to the Fiji Islands, to explore mechanisms of speciation in these highly speciose groups. Using mitochondrial (COI, 12S) and nuclear (ITS) replicons, we recovered Garli-part maximum likelihood and MrBayes Bayesian phylogenetic hypotheses for 26 species of *Nesobasis* and eight species/subspecies of *Melanesobasis*. Biogeographical patterns were

explored using Lagrange and Bayes-Lagrange and interpreted through beast relaxed clock dating analyses. We found that *Nesobasis* and *Melanesobasis* have radiated throughout Fiji, but are not sister groups. For *Nesobasis*, while the two largest islands of the archipelago—Viti Levu and Vanua Levu—currently host two distinct species assemblages, they do not represent phylogenetic clades; of the three major groupings each contains some Viti Levu and some Vanua Levu species, suggesting independent colonization events across the archipelago. Our Beast analysis suggests a high level of species diversification around 2–6 Ma. Our ancestral area reconstruction (Rasp-Lagrange) suggests that both dispersal and vicariance events contributed to the evolution of diversity. We thus conclude that the evolutionary history of *Nesobasis* and *Melanesobasis* is complex; while inter-island dispersal followed by speciation (i.e., peripatry) has contributed to diversity, speciation within islands appears to have taken place a number of times as well. This speciation has taken place relatively recently and appears to be driven more by reproductive isolation than by ecological differentiation: while species in *Nesobasis* are morphologically distinct from one another, they are ecologically very similar, and currently are found to exist sympatrically throughout the islands on which they are distributed. We consider the potential for allopatric speciation within islands, as well as the influence of parasitic endosymbionts, to explain the high rates of speciation in these damselflies." (Authors)] Address: Beatty, C.D., Dept Ecol. & Evol. Biol., Cornell Univ., Ithaca, NY, USA. Email: christopher.beatty@cornell.edu

**18035.** Bhusnar, A.R.; Sathe, T.V. (2017): Biology of a dragonfly *Crocothemis servilia servilia* Drury (Odonata: Libellulidae), a predator of paddy pests in Kolhapur. *IOSR Journal of Pharmacy and Biological Sciences* 12(3): 18-21. (in English) ["*C. servilia* is biocontrol agent of paddy pests in Kolhapur region of Maharashtra. It predate on paddy jassid *Nilaparvata* sp., Paddy borer *Chilo suppressalis* (Walker) and Jowar stem borer *Chilo partellus* (Swin). Therefore, biology of *C. servilia servilia* has been studied under laboratory conditions (24±°C, 70 - 75% RH and 12 hr Photo period). It completes its life cycle within 3 months, egg stage lasts for 18 days and nymphal period is 72 days. There are 12 instars, each has about 7 ;V 10 days duration. During nymphal period they feed on paramoecium, daphnia, redworms and mosquito larvae. Adult survives for 4 days without food. Mated female can lay about 140-150 eggs in water body/water trough. A single mated female, an average can produce 142 adults under laboratory conditions." (Authors)] Address: Bhusnar, A.R., Dept Zoology, Yashwantrao Chavan Warana Mahavidyalaya Warananagar, India

**18036.** Blades, D.C.A.; Copley, C.; Lee, K. (2017): An efficient storage system for adult Odonata specimens, with application for other museum collections. *Collection Forum* 31(1-2): 15-22. (in English) ["A new system of storing adult Odonata (damselfly and dragonfly) specimens is described and compared to existing storage systems. The major design innovation is the use of tongue and groove ("zipper lock") resealable polyethylene envelopes manufactured to fit the

standard index card and specimen arrangement currently used in major collections. Other design improvements include low-cost, adhesive-free specimen trays and glass-top drawers built to fit in standard-dimension Cornell insect cabinets. Comparisons of materials and designs with other available systems are presented and discussed. Finally, examples are presented of this new system's applicability to other collections such as Lepidoptera and Archeology." (Authors)] Address: Blades, D.C.A., Research Associate, Dept of Entomology, Natural History Section, Royal British Columbia Museum, Victoria, British Columbia, Canada V8W 9W2. E-mail: david.blades@gov.bc.ca

**18037.** Bota-Sierra, C.A.; Novelo-Gutiérrez, R. (2017): The genus *Heteragrion* (Odonata: Zygoptera) in Northwestern Colombia, with the description of *Heteragrion tatama* sp. nov. *Zootaxa* 4347(3): 553-571. (in English) ["The Neotropical forest specialist genus *Heteragrion* counts with 54 species and one subspecies described to date, eight of which have been recorded from Colombia. Here, information on *Heteragrion* species resulting from ten years of exploration of northwestern Colombia and examination of museum collections, including types and species from Central America, is presented. A new species endemic to the Tatamá National Park in the western Andes, *Heteragrion tatama* sp. nov. is described, as well as the female of *Heteragrion aequatoriale* Selys, 1886. *Heteragrion calendulum* Williamson, 1919 was rediscovered, a century after its first collection, which allowed us to compare it with *Heteragrion atrolineatum* Donnelly, 1992, and to conclude that the latter species is its junior synonym. We present pictures of female prothoracic intersternite, which offer valuable taxonomic information. The variation in coloration patterns for *H. aequatoriale* and *Heteragrion mitratum* Williamson, 1919 is discussed, and maps with new distributional data, a taxonomic key, natural history notes and photographs of the *Heteragrion* species distributed west of the Magdalena valley in Colombia, are also provided." (Authors)] Address: Bota-Sierra, C.A., Red de Biodiversidad y Sistemática, Instituto de Ecología, A.C., Xalapa, Veracruz, México. E-mail: comeliobota@gmail.com

**18038.** Bota-Sierra, C.A. (2017): Two new species of the family Philogeniidae (Odonata: Zygoptera) from the Western Colombian Andes. *International Journal of Odonatology* 20(3/4): 137-150. (in English) ["The family Philogeniidae was recently proposed as a monophyletic clade grouping the genera *Philogenia* and *Archaeopodagrion*. Here, two new species found during recent expeditions to the Western Colombian Andes are described, *Archaeopodagrion fernandoi* sp. nov. and *Philogenia martae* sp. nov. Also, *Philogenia zetekii* is recorded for the first time in Colombia. Natural history notes, a taxonomic key for *Archaeopodagrion*, a distributional map, illustrations, photographs, and notes on the morphology of Philogeniidae are provided." (Author)] Address: Bota-Sierra, C.A., Red de Biodiversidad y Sistemática, Instituto de Ecología, A.C. Xalapa, Mexico

**18039.** Bota-Sierra, C.A.; Sandoval-H, J. (2017): The female of *Oreialagma oreas* (Odonata: Coenagrionidae),

with notes on the species natural history. *International Journal of Odonatology* 20(3/4): 165-172. (in English) ["*Oreialagma oreas* (Ris, 1918) is a recently rediscovered Colombian Andean endemic species, for which the information available is very scarce. It was originally described from a single male. Since 2008, *O. oreas* has been recorded in new localities but its life history remained unknown. Here we describe and diagnose the species female for the first time and show evidence of female dichromatism in the genus. Also, we present photographs and illustrations of males and females, a distribution map, and information on this species biology, reporting that it breeds on bromeliads as other species in the genus." (Authors)] Address: Sandoval-H, Juliana, Departamento de Ciencias Biológicas, Facultad de Ciencias Naturales, Universidad ICESI, Calle 18 No. 122.135, Cali, Colombia. Email: julisando@gmail.com

**18040.** Bowler, D.E.; Hof, C.; Haase, P.; Kröncke, I.; Schweiger, O.; Adrian, R.; Baert, L.; Bauer, H.G.; Blick, T.; Brooker, R.W.; Dekoninck, W.; Domisch, S.; Eckmann, R.; Hendrickx, F.; Hickler, T.; Klotz, S.; Kraberg, A.; Kühn, I.; Matesanz, S.; Meschede, A.; Neumann, H.; O'Hara, R.; Russell, D.J.; Sell, A.F.; Sonnewald, M.; Stoll, S.; Sundermann, A.; Tackenberg, O.; Türkay, M.; Valladares, F.; van Herk, K.; van Klink, R.; Voigtländer, K.; Wagner, R.; Welk, E.; van Klink, R.; Vermeulen, R.; Wiemers, M.; Wiltshire, K.H.; Böhning-Gaese, K. (2017): Cross-realm assessment of climate change impacts on species' abundance trends. *Nature Ecology & Evolution* 1(67): (in English) ["Climate change, land-use change, pollution and exploitation are among the main drivers of species' population trends; however, their relative importance is much debated. We used a unique collection of over 1,000 local population time series in 22 communities across terrestrial, freshwater and marine realms within central Europe to compare the impacts of long-term temperature change and other environmental drivers from 1980 onwards. To disentangle different drivers, we related species' population trends to species- and driver-specific attributes, such as temperature and habitat preference or pollution tolerance. We found a consistent impact of temperature change on the local abundances of terrestrial species. Populations of warm-dwelling species increased more than those of cold-dwelling species. In contrast, impacts of temperature change on aquatic species' abundances were variable. Effects of temperature preference were more consistent in terrestrial communities than effects of habitat preference, suggesting that the impacts of temperature change have become widespread for recent changes in abundance within many terrestrial communities of central Europe." The data set includes Odonata. (Authors)] Address: Bowler, Diana, Senckenberg Biodiv. & Climate Res. Centre, 60325 Frankfurt/M., Germany. E-mail: diana.e.bowler@gmail.com

**18041.** Brasil, L.S.; Da Silva G., Nubia F.; Batista, J.D.; De Resende, B.O.; Cabette, H.; Soares, R. (2017): Aquatic insects in organic and inorganic habitats in the streams on the Central Brazilian savanna. *Revista Colombiana de Entomología* 43(2): 286-291. (in English, with Spanish summary) ["A major part of the mechanisms that affects species distribution is related to environmental conditions. Within a stream channel

the accumulation of substrates like litter, roots, stones, gravel and sand create habitats that act as shelter and/or food source to aquatic communities, in this way supporting, or not, the establishment of different species. Based on this fact we verified the structure of aquatic insect communities in organic and inorganic habitats within Cerrado streams. Tested for differences on genera richness (i), individual abundance (ii) and genera composition (iii), and also (iv) verified if there are any indicator genera, which are faithful and specific to organic or inorganic habitats. Sampled organic (litter) and inorganic (sand and gravel) substrates in five sections of three streams and collected individuals of the orders Ephemeroptera, Plecoptera, Trichoptera, Odonata and Heteroptera (EPTOH). Community composition differed between habitats, with organic ones having higher richness and abundance, besides being the only habitat that presented faithful and specific genera (six). It is argued that this difference may be caused due to shelter and food supply provided by organic substrates." (Authors)] Address: Brasil, L.S., Av. Perimetral, 1901/1907, Museu Paraense Emílio Goeldi, Campus de Pesquisa Coordenação de Zoologia - Terra Firme Belém, Pará, Brasil - CEP 66017-970, Caixa Postal 399. E-mail: brasil\_biologia@hotmail.

**18042.** Breviglieri, C.P.B.; Oliveira, P.S.; Romero, G.Q. (2017): Fear mediates trophic cascades: Nonconsumptive effects of predators drive aquatic ecosystem function. *The American Naturalist* 189(5): 490-500. (in English) ["Predators control prey populations and influence communities and the functioning of ecosystems through a combination of consumptive and nonconsumptive effects. These effects can be locally confined to one ecosystem but can also be extended to neighboring ecosystems. In this study, we investigated the nonconsumptive effects of terrestrial avian predators on the communities of aquatic invertebrates inhabiting bromeliads and on the functioning of these natural ecosystems. Bromeliads with stuffed birds placed nearby showed a decrease in aquatic damselfly larvae abundance and biomass, and we can infer that these changes were caused by antipredator responses. These larvae, which are top predators in bromeliad ecosystems, changed the composition of the entire aquatic invertebrate community. While total species richness, mesopredator richness, and shredder abundance increased in the presence of birds, scraper biomass decreased, possibly as a consequence of the increase in mesopredator richness. High scraper biomass in the absence of birds may have accelerated detrital decomposition, making more nutrients available for bromeliads, which grew more. These results show that nonconsumptive effects triggered by terrestrial predators can cascade down to lower trophic levels and dramatically affect the functioning of aquatic ecosystems, which can in turn alter nutrient provision to terrestrial ecosystems." (Authors)] Address: Breviglieri, C.P.B., Dept of Animal Biology, Inst. of Biology, State Univ. of Campinas (UNICAMP), Campinas, São Paulo 13083-970, Brazil. E-mail: crassopaulo@gmail.com

**18043.** Buczynski, P.; Szlauer-Lukaszewska, A.; Tonczyk, G.; Buczynska, E. (2017): Groyne: a factor modifying the

occurrence of dragonfly larvae (Odonata) on a large low-land river. *Marine and Freshwater Research* 68: 1653-1663. (in English) ["The regulation of rivers and their valleys has had a strong, negative influence on the maintenance of their original biota. Nevertheless, some hydro-engineering works conducted along already regulated rivers may be beneficial, creating habitats for endangered species and assemblages. Such works include the construction of groynes. We analysed this effect on the occurrence of dragonfly larvae along middle and lower stretches of the Oder, where groynes were built over a distance of 306 km, creating an area of uniform habitat. We demonstrated that the presence of groynes increased not only the abundance of dragonfly larvae, but also the species richness and diversity of these insects. Habitats were recreated for assemblages typical of a river with highly diverse habitat conditions, from typically riverine assemblages to those occurring in oxbow lakes, also endangered by regulations. The fauna along the stretches with groynes was richer and more valuable than that along the stretches without groynes, achieving values approaching those obtained from modelled unregulated rivers. This can be put down to greater habitat heterogeneity and groyne-reduced levels of waves produced by ships. The presence of groynes provides the key to the restoration or stabilisation of the populations of certain species and to renaturalisation processes." (Authors)] Address: Buczynski, P., Dept of Zool., Maria Curie-Skłodowska University, Akademicka 19, 20-033 Lublin, Poland. E-mail: pawbucz@gmail.com

**18044.** Büsse, S.; Bybee, S.M. (2017): Larva, nymph and naiad – a response to the replies to Bybee et al. (2015) and the results of a survey within the entomological community. *Systematic Entomology* 42: 11-14. (in English) ["Conclusions: The goal of this survey was not to seek an outcome based on the idea that 'winner takes all' or 'might is right'; the most prevalent opinion is not necessarily the most scientifically 'correct' one. However, we felt it was important to explore the current usage across the entomological community regarding the terminology for immature insects. Our goal is to foster the most complete understanding possible regarding the usage of these terms and the terminology of the immature stage of insects. It is important to be aware that there are different terminologies and opinions in order to make a conscious decision as to which terminology to choose, as specialized terminology is useful for facilitating efficient and accurate communication across discipline boundaries (as well as insect groups). The scientific world is fraught with different opinions and ideas. The way that we discuss, frame, test and refute these opinions and ideas is central to the scientific process. The need for efficient and accurate communication among scientists is paramount. Simply being aware of the opinions that exist regarding how terminology is applied, the history of that terminology and its actual usage is a step forward." (Authors)] Address: Büsse, S., Dept Funct. Morphology & Biomech., Inst. Zool., Kiel Univ., Am Botanischen Garten 9, 24118 Kiel, Germany. E-mail: sbuesse@zoologie.uni-kiel.de

**18045.** Buxton, V.L.; Sperry, J.H. (2017): Reproductive decisions in anurans: A review of how predation and competition affects the deposition of eggs and tadpoles. *BioScience*

667(1): 26-38. (in English) ["The selection of breeding habitat has broadscale implications for species distributions and community structure and smaller-scale ramifications for offspring survival and parental fitness. In anurans, offspring deposition is a decisionmaking process that involves the assessment of multiple factors at a breeding site, including the presence of predators and competitors. Evolutionary theory predicts that adult anurans should seek to minimize the risk of predation to offspring, reduce the pressure of competition, and maximize offspring survival. Many experimental studies have demonstrated the ability of anurans to assess deposition sites for predation and competition and to choose accordingly, but our understanding of the various ecological factors involved in site choice and the broader consequences of choice is still limited. Here, we review and synthesize the literature on the influence of predators [including Odonata] and competitors on anuran deposition behaviour. We highlight current gaps in our understanding of this topic and outline future avenues of research." (Authors)] Address: Buxton, Valerie, Dept of Natural Resources & Environmental Sciences, Univ. of Illinois, Urbana-Champaign, USA. E-mail: vbuxton2@illinois.edu

**18046.** Casanueva Gómez, P.; Carpintero, P.; Hernández Árbol, M.A.; Santamaría, T.; Sánchez-Bordona, F.C. (2017): Un análisis biométrico en exuvias de *Anax imperator* Leach, 1815 (Odonata, Aeshnidae) en lagunas de la provincia de Salamanca, España. *Boletín de la Asociación Española de Entomología* 41(1-2): 197-210. (in Spanish, with English summary) ["A biometric analysis of exuviae of *A. imperator* in lagoons of Salamanca province, Spain. Little is known about the biometry of the *A. imperator* exuviae in the Iberian Peninsula and their possible geographical variations. To find out, four nearby lagoons have been sampled, all within the province of Salamanca, central-western Iberian Peninsula. Several features of the 217 sampled exuviae were measured: prementum (maximum width, minimum and length), cephalic width and total length (including anal pyramid), and relation between the lateral spine length on the seventh segment and the length of the ninth abdominal segment. Except the minimum width, mean values of all other measurements vary significantly among lagoons. Focus is set on whether these variations are influenced by environmental characteristics (salinity of water, mainly)." (Authors)] Address: Casanueva Gómez, Patricia, Depto de Ciencias Experimentales, Univ. Europea Miguel de Cervantes, 47012 Valladolid, España. E-mail: pcasanueva@uemc.es

**18047.** Castaños, C.E.; Córdoba-Aguilar, A.; Munguía-Steeyer, R. (2017): Physiological condition and wing pigmentation expression in a damselfly with seasonal polyphenism. *Physiological Entomology* 42(4): 346-354. (in English) ["Secondary sexual traits can be indicators of individual condition that may present seasonal polyphenism as a result of the differential costs of expression along the season. Wing spots in male damselflies of the Calopterygidae family are secondary sexual traits associated with intrasexual competition and mate choice. *Hetaerina titia* Drury is a calopterygid damselfly where males show red and black wing spots, contrasting with other

species of the genus whose males only express a red wing spot. In the present study, we evaluate the seasonal variation of the expression of male's red and black wing spots and their allometric patterns. Additionally, we measure male condition in the form of proteins, lipids, soluble carbohydrates and glycogen in early and late seasons. Black wing spots present higher variation than red wing spots and males of the late season are more pigmented. Allometry is positive for wing red spot in the early season and for black spot in the late season. Males of the late season present a higher concentration of proteins, soluble carbohydrates and glycogen, although there is no variation in the lipid content. The results of the present study suggest that, in *H. titia* males, black pigmentation replaces the function of the red pigmentation to signal condition. Both traits, however, may be heavily affected by environmental situations (e.g. food availability)." (Authors)] Address: Córdoba-Aguilar, A., Depto Ecología Evol., Inst. de Ecología, Univ. Nacional Autónoma de México, Apdo. Postal 70-275, Ciudad Universitaria, 04510, México, D. F., México. E-mail: [acordoba@ecologia.unam.mx](mailto:acordoba@ecologia.unam.mx)

**18048.** Chari, L.D.; Moyo, S.; Richoux, N.B.; (2017): Trophic ecology of adult male Odonata. I. Dietary niche metrics by foraging guild, species, body size, and location. *Ecological Entomology* 43: 1-14. (in English) ["1. Information on the dietary niches of adult odonates is sparse, as they are highly mobile and evasive animals, which makes them difficult to observe in their natural habitat. Moreover, there is a lack of knowledge on how varying behavioural traits of odonates relate to phenomena like niche partitioning. 2. This study investigated niche partitioning amongst odonate species, foraging guilds and size classes in a riverine system in the Eastern Cape province of South Africa. A combination of stable isotope and fatty acid-based niches was used to infer odonate feeding. 3. Both fatty acid and stable isotope-based niches showed that there was niche separation amongst odonates that forage in flight (fliers) and those that forage from a perch (perchers), amongst odonates of different size classes (damselflies, medium- and large-sized dragonflies), and amongst species, although varying levels of niche overlap were observed in each case. 4. Niche sizes of odonates varied between an upstream and a downstream site. Generally greater niche overlap was recorded at the narrow upstream site (associated with low insect emergence rates) than the wider downstream site (associated with high insect emergence rates), indicating that a greater degree of resource sharing occurred at the upstream site where aquatic food was less abundant. 5. The findings of this study suggest that dietary niches of odonates can be influenced by foraging guild, body size, and/or environmental conditions, and additional study in a variety of regions is recommended to determine the greater applicability of these findings." (Authors)] Address: Chari, L.D., Dept of Zoology and Entomology, Rhodes University, Grahamstown, South Africa

**18049.** Chovanec, A.; Wildermuth, H. (2017): Ein seltener Fall unbewachter Eiablage bei *Coenagrion scitulum* (Odonata: Coenagrionidae). *Libellula* 36(3/4): 135-138. (in German, with English summary) ["Unguarded oviposition of *C. scitulum*

– A single ovipositing female *C. scitulum* was observed at a small water body in Lower Austria in July 2016. This is presumably the first documented case of unguarded oviposition without immediately preceded copulation in a Coenagrion species." (Authors)] Address: Chovanec, A., Krotenbachgasse 68, A-2345 Brunn am Gebirge, Austria. E-mail: [andreas.chovanec@bmlfuw.gv.at](mailto:andreas.chovanec@bmlfuw.gv.at)

**18050.** Chovanec, A. (2017): Sanierung morphologischer Defizite und Anlage flussbegleitender Kleingewässer – Erfolgskontrolle gewässerökologisch wirksamer Maßnahmen an der Pram (Oberösterreich) durch den Einsatz von Libellen (Odonata) als Bioindikatoren. *Beiträge zur Entomofaunistik* 18: 13-37. (in German, with English summary) ["The present study deals with the assessment of the morphological status of a three kilometres long rehabilitated river section of the river Pram from Riedau to Zell (Upper Austria) by calculating the Dragonfly Association Index (DAI). The DAI was developed to compare rivertype-specific reference conditions with the status quo; this procedure follows the requirements of the EU Water Framework Directive. Furthermore, the colonisation of two newly created small water bodies near the river Pram by dragonflies was investigated. A total of 27 species (25 autochthonous) were found at the river Pram and the standing waters, which correspond to 35 % of the Austrian species (78 species). A total of 14 autochthonous species were detected at the river itself. The DAI-based assessment procedure reveals a high ecological status for this river section. *Ophiogomphus cecilia* one of three gomphid species recorded at the Pram, is listed in the Appendices II and IV of the EU Fauna-Flora-Habitat-Directive." (Author)] Address: Chovanec, A., Krotenbachgasse 68, 2345 Brunn am Gebirge, Austria. E-Mail: [andreas.chovanec@bmlfuw.gv.at](mailto:andreas.chovanec@bmlfuw.gv.at)

**18051.** Chovanec, A. (2017): Spätsommeraspekt der Libellenfauna (Odonata) ausgewählter Standorte an Bodensee und Dornbirnerach (Vorarlberg). *inatura – Forschung online* 45: 10 pp. (in German, with English summary) ["This paper deals with the late summer aspect of the dragonfly fauna at selected sites of the Austrian shore of Lake Constance and at the Dornbirnerach. Investigations carried out by the end of July / beginning of August 2017 revealed a species inventory of 19 spp., 17 at the Lake Constance, 5 at the Dornbirnerach. Particular highlights are the records of the autochthonous population of *Sympetrum depressiusculum*, («critically endangered» according to the Austrian Red List and «vulnerable» according to the European Red List) and of *Somatochlora flavomaculata*, («endangered» according to the Austrian Red List). Both species were found at the Lake Constance. *Boyeria irene*, already sighted at the Constance Rhine (Suisse) and at the Lake Constance in Germany but not detected for Austria at all, was not found." (Author)] Address: Chovanec, A., Umweltbundesamt, Spittelauer Lände 5, 1090 Wien, Austria. E-Mail: [andreas.chovanec@bmlfuw.gv.at](mailto:andreas.chovanec@bmlfuw.gv.at)

**18052.** Chovanec, A. (2017): Auswirkungen von Restrukturierungsmaßnahmen am Rußbach (Niederösterreich, Weinviertel) auf die Libellenfauna (Insecta: Odonata). *Wiss. Mitt. Niederösterr. Landesmuseum* 27: 69-96. (in German, with

English summary) ["The ecological status (with a special focus on hydro-morphology) of two rehabilitated sections of the Rußbach in Lower Austria was assessed by an odonotological study. Dragonfly surveys were carried out in 2015, which was one year after the finishing of the hydraulic engineering at the section Unterolberndorf (UO) and about ten years after the creation of the near-natural retention area Schleinbach (SB). Key element of the assessment procedure, which is in compliance with the Austrian Water Act and the EU Water Framework Directive, is a comparison between the current situation and the river type-specific reference conditions. Due to the size of the catchment areas the two sections belong to different river types. This is the reason why different reference communities were used in the assessment procedure, which was carried out on the basis of the Dragonfly Association Index (DAI). The DAI has been developed in order to evaluate the ecological status of lowland rivers of the bioregion Eastern Ridges and Lowlands. A total of 23 dragonfly species was recorded, which nearly corresponds to 30 % of the Austrian inventory of Odonate species; twenty species were autochthonous at least at one of the two river sections. Twelve of the 23 species were found at both sections. Five species are "threatened" Red List species, one of them, *Coenagrion ornatum*, which was autochthonous at both sections, is listed in the Appendix II of the Fauna-Flora-Habitat Directive. At the section UO a total of 15 species were recorded, with 12 species of them being classified as autochthonous. At the section SB 20 species were found, with 17 of them being autochthonous. The abundances of most species at the section SB were remarkably low, owing to shadowing by riparian woods, encroachment of dense reed and drying out of the standing water body in the retention area. Both river sections were ranked as class II ("good ecological status"), therewith representing the second best class and quality target in the 5-tiered classification scheme. Management measures in order to save the status are proposed." (Author)] Address: Chovanec, A., Krotenbachgasse 68, 2345 Brunn am Gebirge, Austria. e-mail: andreas.chovanec@bmlfuw.gv.at

**18053.** Chumchal, M.M.; Drenner, R.W.; Greenhill, F.M.; Kennedy, J.H.; Courville, A.E.; Gober, C.A.A.; Lossau, L.O. (2017): Recovery of aquatic insect-mediated methylmercury flux from ponds following drying disturbance. *Environmental Toxicology and Chemistry* 36(8): 1986-1990. (in English) ["Small ponds exist across a permanence gradient and pond permanence is hypothesized to be a primary determinant of insect community structure and insect-mediated methylmercury (MeHg) flux from ponds to the surrounding terrestrial landscape. Here we present the first experiment examining the recovery of insect-mediated MeHg flux following a drying disturbance that converted permanent ponds with insectivorous fish to semi-permanent ponds without fish. We used floating emergence traps to collect emergent insects for 10 weeks in the spring and summer from five ponds with fish (permanent) and five ponds that were drained to remove fish, dried and refilled with water (semi-permanent). During the 73 day period after semi-permanent ponds were refilled, total MeHg flux from semi-permanent

ponds was not significantly different than total MeHg flux from permanent ponds, indicating that insect-mediated MeHg flux had rapidly recovered in semi-permanent ponds following the drying disturbance. Methylmercury fluxes from Anisoptera and phantom midges (Diptera: Chaoboridae) were significantly greater from newly refilled semi-permanent ponds than permanent ponds but the MeHg fluxes from other eight emergent insect taxa did not differ between treatments. The present study demonstrates the impact of drying disturbance and the effect of community structure on the cross-system transport of contaminants from aquatic to terrestrial ecosystems. This article is protected by copyright." (Authors)] Address: Chumchal, M.M., Department of Biology, Texas Christian University, Fort Worth, Texas, USA. E-mail: m.m.chumchal@tcu.edu

**18054.** Ciolan, E.; Cicort-Lucaciu, A.-S.; Sas-Kovács, I.; Ferenti, S.; Covaciu-Marcov, S.-D. (2017): Wooded area, forest road-killed animals: Intensity and seasonal differences of road mortality on a small, newly upgraded road in western Romania. *Transportation Research Part D: Transport and Environment* 55: 12-20. (in English) ["Highlights: •On a recently modernized road from Romania numerous invertebrates and vertebrates were killed. •Animals related with forests and watercourses had the highest road mortality. •The surrounding forests had existed before the road, which affects the native fauna of the region. •The seasonality of road mortality is due to the victims' life cycle and meteorological conditions. The roads are one of the most obvious expressions of modern society, being considered vital for economical growth. Nevertheless, roads have a very strong negative impact upon environment, manifested, among others, by road mortality. In Romania numerous minor roads are currently upgraded and asphalted. In the year 2016, on a road of this kind, in a wooded mountain area, we recorded 1628 road killed animals belonging to 48 taxons. The majority were forest and wet areas animals (earthworms, snails, amphibians, etc), characteristic for the road's vicinity. Flying or dry areas animals were fewer. The road crosses the forest and the wet areas animals' habitats. Now, they are certain victims on the road, because its recent upgrade had increased the cars' speed. Road mortality differed between periods and according to the road surroundings aspect. The highest road mortality intensity was registered at the end of the spring. It has dropped in the summer and then rose again in the autumn, but just moderately. The animals were affected according to their life cycle and ecological demands. On this minor road surrounded by relatively uniform wooded habitats, the road mortality differences were determined in the first place by the demandings and life cycle of the victims, which were affected by meteorological conditions. This studied road is a proof of how forest native animals are exposed once their habitat is crossed by a road." (Authors) The paper includes a reference to Odonata.] Address: Ciolan, E., "Ioan Ciordas" Tech. College Beius, Ioan Ciordas str, 5, Beius, Romania

**18055.** Clausnitzer, V.; Simaika, J.P.; Samways, M.J.; Daniel, B.A. (2017): Dragonflies as flagships for sustainable

use of water resources in environmental education. *Applied Environmental Education & Communication* 16(3): 196 - 209. (in English) ["Sustainable use of freshwater is globally important. Yet implementation of changes in water management is poor, especially in developing countries. This is an indication that, despite our dependence on freshwater, we lack awareness of the need to protect these systems. Here we promote dragonflies as an easy-to-learn tool in environmental education programs. Dragonflies have been employed successfully as indicators of ecosystem health in environmental impact assessments and monitoring programs globally. They can be used as environmental sentinels and as whistleblowers for freshwater health, providing an effective tool for environmental impact assessments and freshwater monitoring. We give detailed examples here of some successful projects from South Africa, Tanzania, and Japan. The approaches developed are models that pave the way for more water awareness projects elsewhere, especially in developing countries, where biodiversity and pressures on freshwater systems are high." (Authors)] Address: Clausnitzer, Viola, Senckenberg Museum Nat. History, Görlitz, Görlitz, Germany. E-mail: Viola.Clausnitzer@senckenberg.de

**18056.** Cook, P. (2017): Female color variation and male harassment in the polymorphic damselfly *Megalagrion calliphya*. MSc. thesis, Department of Biology, James Madison University: VI, 25 pp. (in English) ["Female dimorphism is commonly hypothesized to be a result of adaptations to male harassment. I tested whether polymorphic female coloration in the Hawaiian damselfly *M. calliphya* is under selection from male sexual harassment via two possible forms of negative frequency-dependent selection: the male mimicry and the learned mate recognition hypotheses. I measured male behavior toward tethered females at mating sites under naturally occurring conditions and found no evidence for either hypothesis. Harassment rates did not significantly differ between female morphs. One measure of morph frequency did predict harassment of all individuals, but this relationship was driven by a single population. I found no evidence that negative frequency-dependent selection contributes to the maintenance of polymorphism in this species. Future studies of female polymorphism should test other selective pressures which may act on polymorphism." (Author)] Address: not stated

**18057.** Cordero-Rivera, A. (2017): Sexual conflict and the evolution of genitalia: male damselflies remove more sperm when mating with a heterospecific female. *Sci Rep.* 2017 Aug 10;7(1):7844. doi: 10.1038/s41598-017-08390-3. (in English) ["In *Calopteryx* damselflies, males remove rivals' sperm stored by the female, thereby reducing sperm competition. This behaviour may create a sexual conflict, because females could lose the sperm stored in the spermatheca, used for long-term storage. Comparative evidence suggested antagonistic coevolution between sexes, which might prompt the evolution of narrow spermathecal ducts, or longer spermathecae, hindering sperm removal. *Calopteryx haemorrhoidalis* and *C. splendens* coexist and sometimes hybridize. Therefore, here I predicted that if females

coevolve with conspecific males, heterospecific males should have an advantage when interspecific matings occur because females will show less resistance to them than to conspecific males. By hand-pairing females to males of both species, I found that in intraspecific and interspecific matings, sperm was almost completely removed from the bursa (97-100%), but only partially from the spermathecae, with more spermathecal removal in interspecific (63-71%) than intraspecific matings (14-33%). This suggests that heterospecific males are more efficient in sperm removal as predicted by a sexually-antagonistic coevolutionary scenario. Furthermore, in most cases, only the left spermatheca was emptied, suggesting that the evolution of more than one spermatheca might also be a female counter-adaptation to regain control over fertilization." (Author)] Address: Cordero Rivera, A., Depnto de Ecología e Biología Animal, Universidade de Vigo, E.U.E.T. Forestal, Campus Univ., 36005 Pontevedra, Spain. E-mail: acordero@uvigo.es

**18058.** Cordero-Rivera, A. (2017): Phenotypic variability in *Hemiphlebia mirabilis* (Odonata: Hemiphlebiidae): insights into the origin of the discoidal cell in odonates. *Austral Entomology* 56(4): 433-438. (in English) ["This paper reports on the studies of two populations of the locally distributed damselfly *Hemiphlebia mirabilis* Selys in south-eastern Australia to determine the length of the maturation period, describe age-related changes in colouration, and quantify phenotypic variability in body size and wing venation. Modern odonates have a closed discoidal cell, which likely increases flight efficiency, but *H. mirabilis* was thought to always have an open discoidal cell in the fore wings. The study of 82 specimens documents variability in the discoidal cell character of wings as open or closed, with a minority of specimens showing all four discoidal cells closed, and others having one hind wing cell also open. Males are larger than females and body size decreases over the short flight season. Recapture histories of marked animals suggest that males emerge earlier than females and that sexual maturation takes 4-5 days. They become progressively darker, from metallic green to bronze, and their wings less flexible with age. The colour of pterostigma is sexually dimorphic. Male paraprocts and female anal valves are bright white, but in some specimens show a sky bluish tint when observed in direct daylight. Given that recent molecular studies suggest that *H. mirabilis* has evolved from an ancestral lineage, body colouration and wing venation may be plesiomorphic characters for this taxon." (Authors)] Address: Cordero-Rivera, A., ECOEVO Lab, University of Vigo, EUE Forestal, Campus Universitario, 36005 Pontevedra, Galiza, Spain. E-mail: adolfo.cordero@uvigo.es

**18059.** Cordero-Rivera, A. (2017): Behavioral diversity (Ethodiversity): A neglected level in the study of biodiversity. *Frontiers in Ecology and Evolution* 5(7): 8 pp. (in English) ["The concept of biodiversity embraces a multifaceted and hierarchical analysis of the complexity of life, with implications in many areas of science, philosophy, ethics, politics, and even religion. Three levels are included in the commonly accepted definitions: genetical, species, and ecosystem diversity,

going from the intraspecific level to the landscape. Here, I argue that a fourth level, never included in biodiversity studies, is of prominent relevance: ethological diversity or "ethodiversity." There is a growing number of studies describing alternative behaviors, behavioral plasticity, learning, and even personality, as characteristics of animal populations or individuals. Ethodiversity is also relevant in unraveling cryptic biodiversity, such as species that differ in their behavior but are otherwise undistinguishable. Maintaining ethodiversity is therefore essential in conservation, and cannot be achieved simply by focusing on genetic diversity. Behavior has profound ecological consequences, particularly in species interactions, and is a crucial element in the adaptability of animals to new environments. Ethodiversity is important at the intraspecific, inter-population, and species level and has practical relevance in several fields, like captive breeding, eco-novelty, and popular science. Finally, I expect ethodiversity to show a latitudinal cline, with more diverse and elaborate behaviors per species in the tropical regions, given the increase in interactions near the equator." (Author)] Address: Cordero Rivera, A., Depto de Ecología e Biología Animal, Universidade de Vigo, E.U.E.T. Forestal, Campus Universitario, 36005 Pontevedra, Spain. E-mail: a-cordero@uvigo.es

**18060.** Coughlan, N.E.; Stevens, A.L.; Kelly, T.C.; Dick, J.T.A.; Jansen, M.A.K. (2017): Zoochorous dispersal of freshwater bivalves: an overlooked vector in biological invasions? *Knowl. Manag. Aquat. Ecosyst.* 2017, 418, 42: 8 pp. (in English, with French summary) ["Vectors that underpin the natural dispersal of invasive alien species are frequently unknown. In particular, the passive dispersal (zoochory) of one organism (or propagule) by another, usually more mobile animal, remains poorly understood. Field observations of the adherence of invasive freshwater bivalves to other organisms have prompted us to assess the importance of zoochory in the spread of three prolific invaders: zebra mussel *Dreissena polymorpha*; quagga mussel *Dreissena bugensis*; and Asian clam *Corbicula fluminea*. An extensive, systematic search of the literature was conducted across multiple online scientific databases using various search terms and associated synonyms. In total, only five publications fully satisfied the search criteria. It appears that some fish species can internally transport viable adult *D. polymorpha* and *C. fluminea* specimens. Additionally, literature indicates that veligers and juvenile *D. polymorpha* can adhere to the external surfaces of waterbirds. Overall, literature suggests that zoochorous dispersal of invasive bivalves is possible, but likely a rare occurrence. However, even the establishment of a few individuals (or a single self-fertilising *C. fluminea* specimen) can, over-time, result in a substantial population. Here, we highlight knowledge gaps, identify realistic opportunities for data collection, and suggest management protocols to mitigate the spread of invasive alien species. ... Two adult zebra mussels *Dreissena polymorpha* attached to the dorsal carapace of an odonata nymph *Epicordulia* sp. (Corduliidae) larva. The nymph was collected on Lake Mendota, Madison, WI (43°04'38.800N 89°24'10.600W) on 24th October 2016 via a minnow trap in 2m of water"

(Authors)] Address: Coughlan, N.E., Institute for Global Food Security, School Biol. Sciences, Queen's Univ. Belfast, Medical Biology Centre, 97 Lisburn Rd, Belfast BT9 7BL, Northern Ireland. E-mail: neil.coughlan.zoology@gmail.com

**18061.** Cowan, E.M.; Cowan, P.J. (2017): The Odonata (Insecta) of northern and central Oman. *Journal of Threatened Taxa* 9(10): 10776-10791. ["Oman is largely a desert country with a mainly arid climate. We summarise published records of Odonata (Insecta) for northern and central Oman, present our photographic records of the same there for 50 sites and give an apparent-status statement for most species (the more afro-tropical Dhofar governorate is excluded). Highlights are photographed *Orthetrum ransonnetii*, *Macrodiplax cora* (ovipositing in tandem) and *Urothemis thomasi*. Of the 44 species for Oman, 36 have been recorded in northern and central Oman (eight zygopteran and 28 anisopteran species). All are Least Concern except *Arabineura khalidi* and *Urothemis thomasi*, both Endangered, and *Paragomphus sinaiticus*, Near Threatened." (Authors)] Address: Cowan, Elaine M., School of Education, University of Aberdeen, AB24 3FX, Scotland, UK. E-mail: desertlarksgirl@hotmail.com

**18062.** Cuevas-Yáñez, K.; Benítez, M.; Rocha, M.; Córdoba-Aguilar, A. (2017): Large-scale human environmental intervention is related to a richness reduction in Mexican odonates. *Revista Mexicana de Biodiversidad* 88: 664-673. (in English, with Spanish summary) ["It is unclear how land use change, reduction in tree cover and human footprint impact species occurrence and co-occurrence especially at a large regional scale. This is particularly prevalent for species with complex life cycles, for example odonates (dragonflies and damselflies). We evaluated richness of odonates in Mexico in terms of land use, tree cover and human footprint. We also analyzed how odonate species co-occur to interpret our richness analysis using a community perspective. We used odonate collecting records from year 2000 to 2014. Odonate geographical records were more abundant in forest and agricultural areas, and decreased in areas without vegetation. Although our results may suffer of incomplete samplings, there was a positive relationship between species richness and tree cover, and a quadratic relationship with human footprint was observed. These results indicate that some degree of forest disturbance may still sustain relatively high odonate richness levels. Finally, species tend to co-occur in particular ensembles with some species being key in their ecological communities. Further studies should detail the role these key species play in their environments to provide community stability." (Authors)] Address: Cuevas-Yáñez, Karina, Depto Ecología Evolutiva, Inst. de Ecología, Universidad Nacional Autónoma de México, Apartado postal 70-275, Ciudad Univ., 04510 Ciudad de México, Mexico

**18063.** de Souza, M.M.; Pires, E.P.; Brunismann, A.G.; Milani, L.R.; Pinto, A.P. (2017): Dragonflies and damselflies (Odonata) from the wetland of the Rio Pandeiros, northern region of Minas Gerais State, Brazil, with a description of the male of *Archaeogomphus vanbrinkii* Machado (Anisoptera: Gomphidae). *International Journal of Odonatology* 20(1):



13-26. (in English) ["The Odonata from the Refúgio Estadual da Vida Silvestre do Rio Pandeiros (RVSP), located in the Cerrado domain, Minas Gerais State, Brazil, were rapidly surveyed. Sampling efforts were undertaken along the Rio Pandeiros margins during four sampling periods between the rainy (spring–summer) and dry seasons (autumn–winter) from July 2014 to April 2015. We sampled 97 adult specimens of 48 species from seven families, and there were 21 species of Zygoptera, and 27 species of Anisoptera. The dry season yielded a greater species richness and abundance, with Libellulidae dominant along the overall sampling period. A comparison with other biotas in Minas Gerais bringing together a total list of 204 species is provided. RVSP represents an ecotone between the Cerrado and Caatinga domains at the São Francisco river basin and its assemblage exhibited higher similarity index with other Cerrado areas in that state. Our sampling included rare species, many hitherto known only from their type series, and seven new state records were detected for *Hetaerina proxima*, *Enallagma novaehispaniae*, *Oxyagrion fernandoi*, *Telebasis griffinii*, *Telebasis obsoleta*, and *Erythrodiplax leticia*. In addition, the first known male of *Archaeogomphus vanbrinki* is described and taxonomic notes presented. The nomenclature status of the specific name "vanbrinki" is revised, and as a consequence all subsequent spellings other than the original are considered unjustified emendations in light of the International Code of Zoological Nomenclature." (Authors)] Address: de Souza, M.M., Instituto Federal de Educação, Ciências e Tecnologia no Sul de Minas Gerais, Campus Inconfidentes, MG, Brazil

**18064.** Deacon, C.; Samways, M.J. (2017): Conservation planning for the extraordinary and Endangered *Spesbona damselfly*. *Journal of Insect Conservation* 21(1): 121-128. (in English) ["*S. angusta* is one of the world's rarest insects, is Red Listed as Endangered, and occurs today at only one known locality in the Cape Floristic Region (CFR), South Africa. It has some unusual characteristics, including rapid and reversible colour change in both sexes, and a larva with frilled lamellae that lives in a micro-habitat free of competitors and large anisopteran enemies. We define here the characteristics of its habitat and record some other unusual behavioural traits, including the adult male's ability to sail on the water surface, very strong site selection for oviposition, and female approach to males, all in the context of its conservation. We used satellite imagery to determine the location of habitats within its locality. We further used infrared imagery to identify warmer and cooler habitats within the area. Details of its occurrence were mapped, based on observational data acquired throughout the flight season. From this, we were able to establish that its population moves around its locality, and we also establish its environmental requirements for conservation. We also indicate its umbrella value for representing two other threatened odonate species, Endangered *Proischnura polychromatica* and Vulnerable *Syncordulia legator*, as well as some other CFR endemic odonates. Conservation of this species requires continual monitoring and removal of invasive alien trees as a priority. Translocation should also be considered as various risks to

this one locality are high. A potential site is identified." (Authors)] Address: Deacon, C., Department of Conservation Ecology and Entomology, Stellenbosch University, Matieland, South Africa. E-mail: charldeacon@sun.ac.za

**18065.** Delnat, V.; Debecker, S.; Stoks, R. (2017): Integrating trait multidimensionality, predation and autotomy to explain the maintenance of boldness. *Animal Behaviour* 130: 97-105. (in English) ["Highlights: •Mechanisms maintaining bolder animals within populations are not fully understood. •We scored boldness traits and linked these to autotomy and mortality by predation. •Boldness-related traits did not frequently covary, indicating multidimensionality. •Bold individuals were not killed more by predators. •Bold larvae relied more on autotomy to compensate increased risk-taking behaviour. There is an ongoing debate on how personality types are maintained within populations. We tested, for the first time, the potential of trait multidimensionality and trait compensation, where prey compensate for the costs of one trait by relying more on another one, in maintaining variation in boldness within a population. We studied how four boldness-related traits and swimming escape performance covary and shape the probability of survival and autotomy of *Ischnura pumilio* damselfly larvae in an experiment with predatory dragonfly larvae. Our results did not support the common belief that bold individuals are selected against in terms of survival selection by predation. Instead, we found survival selection favouring individuals combining being bold for two boldness-related traits. The four boldness-related traits did not covary frequently, supporting the multidimensionality of boldness. Moreover, animals bolder for one trait (activity in the presence of predator cues) were shyer for another trait (response to predator cues), which indicated trait compensation. However, the support for trait compensation was limited. The only other case of trait compensation was that bold larvae compensated for their increased risk-taking behaviour in the presence of a predator with a higher probability of autotomy. These patterns may contribute to maintaining variation in boldness in damselfly populations. Just as boldness-related traits are multidimensional, the mechanisms underlying their persistence in natural populations are also likely to be multifaceted." (Authors)] Address: Stoks, R., Lab. Aquatische Ecologie, K.U.Leuven, De Beriotstraat 32, 3000 Leuven, Belgium. E-mail: robby.stoks@bio.kuleuven.ac.be

**18066.** Dronzikova, M.V. (2017): Influence of river pollution on the biodiversity of dragonflies (Odonata) in the Tom' River Basin. *Bulletin of Kemerovo State University. Series: Biological, Engineering and Earth Sciences* 3 (2017): 4-10. (in Russian, with English summary) ["Some species are so sensitive to environmental changes that may serve as indicators, which defines their significance for a complex evaluation of ecosystem condition on the territory under study. The current research shows that separate species of dragon-flies (and the reophile species in particular) are very sensitive to pollution and can serve as the indicators of environment. The research was conducted mainly in the area around the cities of Novokuznetsk, Mezhdurechensk, Osynniky, Kiselevsk,

Prokopyevsk and Tashtagol, where the Tom-river is contaminated with pollutants from industrial sewage. The authors made an attempt to analyze the odonatocomplexes of the water sources of the Tom' River basin (the Tom, the Kondoma, the Aba, The Mrass-su) and register the chemical structure of the water. The results showed that the general odonatocomplex of the Tom' River basin consists of 6 kinds of rheophils. However, downstream from large industrial centers, there is a sharp decline in the number of species, almost to the point of complete disappearance at some rivers, which clearly correlates with the degree of water pollution." (Author)] Address: Dronzikova, Marina, Kemerovo State University (Novokuznetsk branch), 23, Tsiolkovsky St., Novokuznetsk, Russia, 654041. E-mail: m\_dronzikova@mail.ru

**18067.** Dubcova, D. (2017): Reprodukční chování samcu páskovce kroužkovaného (*Cordulegaster boltonii*). Diplomová práce. Univerzita Karlova, Přírodovědecká fakulta, Katedra ekologie, Raha: 65 pp. (in Czech, with English summary) [Communication among animals often relies on visible signals and the ability to compatibly perceive them. Correct signal perception is especially important for animals with male sexual selection. In my master's thesis, I am addressing the issue of how does a male golden-ringed dragonfly (*C. boltonii*) recognize a female of the same kind and therefore, what is the main trigger of copulation behavior. Dragonflies display a wide variety of colors and possess very big eyes. These characteristics already suggest that they are very liable on color vision (Futahashi, 2015). Their sight is perfectly developed within the insect class and plays the most important role in the imagines in comparison to other senses. The ability to orient themselves using sight is not just important for orientation in space, nonetheless it is important for reproduction. Since golden-ringed dragonflies do not demonstrate visible color dimorphism, previous as well as my research suggests that the key role for female reconnaissance is primarily their typical movement above water surface during oviposition. In my research, I presented variable types of lure - females to male *C. boltonii* and I observed what is the foremost trigger of reproduction behavior in the males. Besides the above mentioned female movement I achieved to demonstrate that the males perceive also the markings respectively the black striping of their counterpart. Moreover, I confirmed my hypotheses that if a male performs the same movements as a female, the other males do consider him a female. *C. boltonii* do not display color sexual dimorphism therefore the movement is the key signal which allows the male to recognize the sex of another dragonfly. I further examined if the males would react positively to an artificial substitute and how much would their reactions differ from the reactions to a proper female dragonfly. Since recently several studies addressed also the ability of ultraviolet light perception within sexually dimorphic kinds of dragonflies, I at-tempted to determine if golden-ringed dragonflies possess and perceive UV markings as well. It turned out that *C. boltonii* reflect UV markings among each other and even with more significantly stronger stimuli by which a male recognizes a female, the absence of UV markings significantly lowers their reactivity." (Author)] Address: not stated

**18068.** Dwivedi, Y.D.; Ho, W.H.; Donepudi Jagadish; Rao, P.M.V. (2017): Spanwise flow analysis of gliding bio-inspired corrugated wing. *Jour. of Adv. Research in Dynamical & Control Systems*, 12-Special Issue: 313-322. (in English) ["Most of the artificially flying machines have profiled smooth wing section, however the natural low Reynolds number flyers like insects specifically the dragonfly, do not have such types of profiled wings instead have corrugated wings with well-defined pattern. This paper presents an experimental flow visualisation and boundary layers measurements of a bio-inspired corrugated wing and compared with a flat plate at low to moderate chord Reynolds numbers ranging from  $1.5 \times 10^5$  to  $3.75 \times 10^5$  by varying the angle of attack from 00 to + 120 by using low speed subsonic open wind tunnel. The boundary layer measurements were done at a fixed chord location ( $0.7 x/c$ ) and different semispan locations (30%, 60% and 90% of the wing's semispan) from the longitudinal axis of the wing. Flow visualisation was done by using coloured tufts, placed in different span locations. The flow reversal was observed at particular Reynolds numbers and angles of attack only. The boundary layer measurements showed that there is a clear distinction on the velocity gradient profile in all the three tested semispan locations on both the types of the wings. The corrugated wing showed delayed stall and flow separation compared with the flat plate. The visualization of flow in both wings showed that there exists a spanwise flow moving from wing tip to root, indicating that there exist a three dimensional fluid flows." (Authors)] Address: Dwivedi, Y.D., School of Mechanical Engineering, VFSTR University, Vadlamudi, Guntur, Andhra Pradesh, India

**18069.** Eda, S. (2017): Unusual connections in copulation, and oviposition behaviour in dragonflies. *Tombo* 59: 29-45. (in Japanese, with English summary) ["Unusual connections and oviposition behaviour, including abnormal patterns, of Odonata are reviewed. Unusual connections are divided into male-male tandem in the same and different species, male-female tandem in the different species with and without copulation or oviposition, and triple connections of the same and different species. The triple connections are classified into A, B, AB, O, MMM types (cf. Fig. 2) and Y and X types are newly proposed. The quartets were also observed in 4 cases. Oviposition (ovi.) behaviour can be divided into the following 9 types (cf. Fig. 3). A: Sitting ovi. into plant, B: sitting ovi. into mud, C: Sitting ovi. into water, D: Flying ovi. into mud, E: Flying ovi. into water, F: Sitting ovi. onto plant surface, G: Flying ovi. onto plant surface, H: Sitting ovi. above water, I: Flying ovi. above water. Among Japanese species, F and H types are unusual." (Author)] Address: Eda, S., 3-4-25 Sawamura, Matsumoto, Nagano 390-0877, Japan. E-mail: SND02767@nifty.com

**18070.** Fan, X.-L.; Lin, Z.-H. (2017): Vulnerability and behavioral responses of South Chinese anuran tadpoles to native dragonfly (*Pantala flavescens*) naiads and introduced western mosquitofish (*Gambusia affinis*). *Journal of Freshwater Ecology* 32(1): 529-539. (in English) ["Anti-predator behavior is an important fitness component in most animals. Alien predator species are a serious threat to amphibian populations. We studied the vulnerability and behavioral defenses

of tadpoles of six Chinese anurans in response to the introduced, active foraging predator *Gambusia affinis* (western mosquitofish) and compared them with the responses to the native ambush predator *Pantala flavescens* (naiad stage) in laboratory experiments. The tadpoles were *Bufo gargarizans*, *Duttaphrynus* (formerly *Bufo*) *melanostictus*, *Rana zhenhaiensis*, *Fejervarya multistriata*, *Microhyla onata*, and *Hoplobatrachus chinensis* from Lishui, Zhejiang, South China. Our data showed that both native *P. flavescens* and introduced *G. affinis* could prey on the six tadpole species to different degrees and that the two toad tadpoles (*B. gargarizans* and *D. melanostictus*) were significantly less vulnerable to predation than the frog ones. The reduced vulnerability of toad tadpoles to predation may be attributed to their unpalatability and their continuous swimming ability, traits that are adaptive in more permanent habitats. Compared with the ambush predator *P. flavescens*, tadpoles reduced their activity level and used spatial avoidance measures when encountering *G. affinis*. Overall, our results suggest that some of the tadpoles in the study area are likely to recognize and respond to the predation threats of *G. affinis*." (Authors)] Address: Lin, Z.-H., Dept Ecol. & Biol. Res., College of Ecol., Lishui Univ., Zhejiang, P. R. China. E-mail: zhlin1015@126.com

**18071.** Fonseca, N.; Soares, A.; Félix, R.M.; Leitão, D. (2017): First evidence of breeding of *Zygonyx torridus* (Odonata: Libellulidae) in Portugal. *Notulae odonatologicae* 8(9): 326-331. (in English) ["*Exuviae* of *Z. torridus* collected in July 2015 at Ribeira da Boina stream, Algarve, represent the first evidence of this species breeding in Portugal. The status and current knowledge of *Z. torridus* in the country is summarized and notes on the habitat of the species are provided." (Authors)] Address: Fonseca, N., Rua da Fábrica 37-1.º Fte, 8500-590 Portimão, Portugal. E-mail: nelfonseca@gmail.com

**18072.** Futahashi, R. (2017): Molecular mechanisms underlying color vision and color formation in dragonflies. In: Toshio Sekimura & H. Frederik Nijhout (editors): *Diversity and evolution of butterfly wing patterns. An integrative approach.* Springer Nature. ISBN 978-981-10-4955-2: 303-320. (in English) ["Dragonflies are colorful diurnal insects with large compound eyes. Because they visually recognize conspecific and heterospecific individuals, their body color plays essential roles in ecology and reproductive biology. Here I introduce the recent topics of molecular mechanisms underlying color vision and color formation in dragonflies. Complex wing color polymorphism is recognized among the two closely related Japanese *Mnais* species, presumably due to stepwise character displacement to avoid interspecific mating. We discovered an extraordinary large number of visual opsin genes by RNA sequencing of 12 dragonfly species. Manual correction after de novo assembly was crucial for determining the exact number and sequence of opsin genes. Each opsin gene was differentially expressed between the adult and larva, as well as between dorsal and ventral regions of adult compound eyes, highlighting the behavior, ecology, and adaptation of aquatic larva to terrestrial adult. The repertoire of opsin genes differed among dragonfly species, plausibly involved in the diversity of the habitat and

behavior of each species. We also found that sex-specific yellow-red color transition in red dragonflies is regulated by redox changes in ommochrome pigments, which unveils a previously unknown molecular mechanism underlying body color change in animals. Establishment of the methods of gene functional analyses in dragonflies is desired for future studies." (Author)] Address: Futahashi, R., Bioproduction Research Institute, National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Japan

**18073.** Gabel, F.; Lorenz, S.; Stoll, S. (2017): Effects of ship-induced waves on aquatic ecosystems. *Science of the Total Environment* 601–602: 926-939. (in English) ["Highlights: • Effects of ship-induced waves are reviewed. • Abiotic: increase of erosion, resuspension of sediments and chemicals and turbidity. • Biotic: effects on dislocation, growth, reproduction and diversity on all trophic levels. • Effects on ecosystem services and management options are discussed. Most larger water bodies worldwide are used for navigation, and the intensity of commercial and recreational navigation is expected to further increase. Navigation profoundly affects aquatic ecosystems. To facilitate navigation, rivers are trained and developed, and the direct effects of navigation include chemical and biological impacts (e.g., inputs of toxic substances and dispersal of non-native species, respectively). Furthermore, propagating ships create hydrodynamic alterations, often simply summarized as waves. Although ship-induced waves are recognized as influential stressors, knowledge on their effects is poorly synthesized. We present here a review on the effects of ship-induced waves on the structure, function and services of aquatic ecosystems based on more than 200 peer reviewed publications and technical reports. Ship-induced waves act at multiple organizational levels and different spatial and temporal scales. All the abiotic and biotic components of aquatic ecosystems are affected, from the sediment and nutrient budget to the planktonic, benthic and fish communities. We highlight how the effects of ship-induced waves cascade through ecosystems and how different effects interact and feed back into the ecosystem finally leading to altered ecosystem services and human health effects. Based on this synthesis of wave effects, we discuss strategies for mitigation. This may help to develop scientifically based and target-oriented management plans for navigational waters that optimize abiotic and biotic integrity and their ecosystem services and uses." (Authors)] Address: Gabel, Friederike, Institute of Landscape Ecology, University of Münster, Heisenbergstr, 2, 48149 Münster, Germany

**18074.** Gabryszuk, M. (2017): Photogrammetric reconstruction of tandem-wing kinematics for free-flying dragonflies undergoing a range of flight maneuvers. M.Sc. Thesis, Faculty of the Graduate School of the University of Maryland, College Park: VIII, 111pp. (in English) ["Photogrammetric methods are used to reconstruct the body and wing kinematics of free-flying dragonflies. A novel experimental setup was designed and constructed to allow for repeated untethered flights in a constrained flight arena. Kinematic data are presented for twelve individual flights and a total of 23 complete

wing strokes, including unaccelerating, accelerating, climbing, and turning flight. High variability is observed in the wing motions employed by individual dragonflies, particularly in terms of stroke amplitude, pitch angle, and wingbeat frequency. Forewing and hindwing flapping is found to be neither in phase nor fully out of phase across all cases, with the forewings lagging the hindwings by an average of 90 degrees. Downstroke durations are observed to be shorter than upstroke durations except in highly accelerating flights. Migratory dragonflies are found to exhibit notably different wing kinematics than non-migratory species." *Erythemis simplicicollis*, *Pachydiplax longipennis*, *Pantala hymenaea* (Author)] Address: not stated

**18075.** Gainzarain, J.A.; Lasa, J.M. (2017): Presencia de *Brachytron pratense* (Müller, 1764) (Odonata, Aeshnidae) en una localidad montana de la provincia de Álava (norte de España). *Boletín de la Sociedad Entomológica Aragonesa* 61: 231-232. (in Spanish, with English summary) ["Presence of *B. pratense* at a montane locality in the province of Álava (northern Spain). "The Iberian distribution of the species appears to be very limited by altitude, and is restricted to coastal or very altitude, and is restricted to coastal localities or those very close to the coast. the coast, so the discovery of a population in Álava at 1000 m a.s.l. is noteworthy. of a population in Álava at 1000 m a.s.l. is noteworthy. On 26 June 2016 two males were observed at the Iturbaz reservoir, in the Entzia mountain range (30TWN56). Entzia (30TWN5640), one of which was photographed (Fig. 1). Two males were found again on 4 July at the same place, where, as on the same date where, as on the previous date, they flew constantly over a very specific area at over the water in a very specific area of the banks. In 2017, repeated visits to this repeated visits to this locality, and the species was observed again on three occasions on three occasions: 25 May (two, maybe three, ♂), 2 June (two ♂), 2 June (two ♂), 2 June (two ♂), 2 June (two ♂) and 2 June (two ♂). June (two ♂), and 7 June (one ♂), in all cases showing the same behaviour as in 2016. showing the same behaviour as in 2016. On subsequent visits, on 13 and 21 June no individuals were detected. As no juveniles or females have been observed, but the continued presence of males in two consecutive of males in two consecutive years in a locality very distant from other far away from other sites occupied by the species clearly points to the existence of an established to the existence of an established population in this pond." (Authors) Translated with [www.DeepL.com/Translator](http://www.DeepL.com/Translator) (free version)] Address: Gainzarain, J.A., Instituto Alavés de la Naturaleza. Apdo. de correos 2092 01080 Vitoria-Gasteiz, Spain. E-mail: [j.gainzarain@gmail.com](mailto:j.gainzarain@gmail.com)

**18076.** García-García, P.L.; Vázquez, G.; Novelo-Gutiérrez, R.; Favila, M.E. (2017): Effects of land use on larval Odonata assemblages in cloud forest streams in central Veracruz, Mexico. *Hydrobiologia* 785: 19-33. (in English) ["This study analyzes the effect of stream water quality and its relationship with habitat characteristics on larval Odonata assemblages in streams found in tropical montane cloud forests, pastures, and coffee plantations in the upper La Antigua River

watershed. The main factors that influenced larval Odonata assemblages in forest streams were low temperatures and high oxygen levels in water, coupled with a high diversity of the substrate and riparian vegetation; in pasture streams and coffee plantation streams, sedimentation strongly affected the composition of larval Odonata assemblages. In all the streams, species richness (0 D) was higher during the dry season. The highest Shannon a diversity (1 D) values were found in forest streams during the rainy season; however, in pasture and coffee plantation streams, 1 D values were higher during the dry season. The low species turnover in forest streams suggests that these streams provide highly stable conditions for Odonata assemblages; however, in pasture and coffee plantation streams, the higher turnover was related to the more variable water and habitat conditions. Thus, the persistence of Odonata assemblages in the upper La Antigua River watershed is closely related to the conservation status of the tropical montane cloud forests." (Authors)] Address: García-García, P.L., Red de Ecología Funcional, Instituto de Ecología, A. C., Carretera Antigua a Coatepec 351, Congregación El Haya, 91070 Xalapa, Veracruz, Mexico. E-mail: [gabriela.vazquez@inecol.mx](mailto:gabriela.vazquez@inecol.mx)

**18077.** Gerner, N.V.; Kone, M.; Ross, M.S.; Pereira, A., Ulrich, A.C.; Martin, J.W.; Liess, M. (2017): Stream invertebrate community structure at Canadian oil sands development is linked to concentration of bitumen-derived contaminants. *Science of the Total Environment* 575: 1005-1013. (in English) ["Highlight: • Aquatic exposure and effects were examined in Northern Alberta (Canada). • Effects on invertebrate community structure were monitored. • Effects at concentrations 100 times below the acute sensitivity of *Daphnia magna* • A biological indicator system, SPEARoil, was designed. • SPEARoil is applicable for future routine monitoring of oil sands related effects. In Canada, the Athabasca oil sands deposits are a source of bitumen-derived contaminants, reaching the aquatic environment via various natural and anthropogenic pathways. The ecological effects of these contaminants are under debate. To quantify the effects of bitumen-derived contaminants we monitored the aquatic exposure of polycyclic aromatic hydrocarbons (PAHs), metals, and naphthenic acids as well as the invertebrate community in the Athabasca River and its tributaries. PAH concentrations over 3 consecutive years were related to discharge and were highest in the year with high autumn rainfall. In the year with the highest PAH concentrations, these were linked with adverse effects on the aquatic invertebrate communities. We observed relative effects of the composition and concentration of contaminants on the invertebrate fauna. This is reflected by the composition and abundance of invertebrate species via the use of the species' traits "physiological sensitivity" and "generation time". Applying the SPEAR approach we observed alterations of community structure in terms of an increased physiological sensitivity and a decrease of generation time for the average species. These effects were apparent at concentrations 100 times below the acute sensitivity of the standard test organism *Daphnia magna*. To rapidly identify oil sands related effects in the field we designed a biological indicator system, SPEARoil,

applicable for future routine monitoring.] Address: Gerner, Nadine, UFZ, Helmholtz Centre for Environmental Research, Department System-Ecotoxicology, Permoserstr. 15, 04318 Leipzig, Germany

**18078.** Giuliano, D. (2017): L'entomofauna del S.I.C. IT1110033 "Stazioni di *Myricaria germanica*" (Insecta: Odonata; Orthoptera; Lepidoptera: Rhopalocera). *Rivista piemontese di Storia naturale* 38: 207-224. (in Italian, with English summary) ["This paper presents the results of a one-year monitoring project on insect fauna carried out in the SCI IT1110033 "Stazioni di *Myricaria germanica*". Dragonflies, grasshoppers and butterflies were chosen as target taxa in this research, providing an overview of the diversity status of these groups in the study area. Overall, 15 dragonfly, 30 grasshopper and 51 butterfly species were found, enhancing and updating the information about the presence and the distribution of these insects in the SCI. While dragonflies are strictly relied on small wetlands and ditches within the Pellice's river ecosystem, grasshopper and butterfly diversity depends mainly on habitat heterogeneity. The relatively high quality of the river ecosystem, together with the extensive management of meadows, produce a number of habitats (e.g. dry grasslands, gravel beds, bushes, hay meadows, etc.) essential for hosting species with a wide range of ecological requirements. Therefore, the conservation of the river ecosystem quality and the maintenance of an extensive meadows management are critical measures to preserve the entomological diversity in the SCI." (Author)] Address: Giuliano, D., via G. Matteotti 2 - 10066 Torre Pellice (TO), Italy. E-mail: [davide.giuliano@alice.it](mailto:davide.giuliano@alice.it)

**18079.** Gleason, J.E.; Rooney, R.C. (2017): Aquatic macroinvertebrates are poor indicators of agricultural activity in northern prairie pothole wetlands. *Ecological Indicators* 81: 333-339. (in English) ["The Northern Prairie Pothole Region (NPPR) of Alberta, Canada, contains numerous shallow marshes that serve as important habitat for wildlife and provide essential ecosystem services. Many of these wetlands have been destroyed or degraded by human activity and the majority of remaining wetlands occur in landscapes affected by crop and cattle production. Alberta has implemented a conservation policy which requires the creation of wetland assessment tools. Aquatic macroinvertebrates are frequently used as indicators of environmental condition in rivers, but their effectiveness as indicators in prairie pothole wetlands is not clear. To evaluate the capacity of aquatic macroinvertebrates identified to family-level resolution to serve as regional bioindicators of agricultural disturbance in NPPR wetlands, we sampled macroinvertebrates at 64 fishless wetlands. The wetlands spanned a gradient in the extent of agriculture from 0 to 100% cover within a 500 m buffer around each wetland. We discovered that, contrary to our predictions, macroinvertebrate family richness and community composition could not predict agricultural disturbance (cropping or cattle grazing). We conclude that efforts to develop bioindicators for NPPR wetlands should be redirected to other taxa that are less costly to identify to species and that exhibit sensitivity to agricultural disturbance. ... We were particularly

optimistic about chironomids and odonates, but we could discern no relationship between these taxa and land use. For Odonata, these results are contrary to both our predictions and previous research from Alberta's NPPR (e.g., Hornung and Rice, 2003; Silver and Vamosi, 2012). One explanation for this discrepancy may be that these studies identified larval odonates to genus, but as mentioned this was beyond the scope of our limited study." (Authors)] Address: Gleason, Jennifer, Dept of Biology, Univ. of Waterloo, Waterloo, ON, N2L 3G1, Room 251 Biology 2 Building, Canada

**18080.** Golab, M.J.; Golab, P.A.; Contreras-Garduño, J.; Zajac, T.; Sniegula, S. (2017): The effects of habitat deterioration and social status on patrolling behavior in the territorial damselfly *Calopteryx splendens*. *Polish Journal of Ecology* 65(1): 122-131. (in English) ["Patrolling behaviour plays an important role in resource defense and in shaping social interactions in territorial species. However, it is not clear whether and how resource deterioration affects patrolling and interactions between territorial males. We addressed this issue by studying the territorial patrolling of *C. splendens* males, which use riverine vegetation patches composed of floating rafts of *Potamogeton natans* as territories. Males can hold single territories established on one vegetation patch (solitary residents) or hold adjacent territories established on shared vegetation patch (contiguous residents). The study predicted that solitary males engage more in patrolling than contiguous residents and that patrolling intensity is proportional to patch quality. Two types of semi-natural vegetation patches were sunk: of high and low quality measured on the basis of the patch size (range 2–5 m<sup>2</sup>) and its attractiveness to damselflies (measured as number of residents, non-territorial males and contests observed at a given patch). Changes in number of patrolling flights were monitored for solitary and two contiguous residents: first which hold territory situated closer to the patch centre and secondary holding territory nearer to the edge of a patch. Results indicated that solitary residents patrolled more often than either of the two contiguous residents. Habitat deterioration significantly reduced the patrolling intensity of both single and first contiguous resident, however, their patrolling activity was not resumed at the same intensity after the original patch had been restored. The secondary resident of a contiguous pair did not respond to habitat deterioration, but increased its patrolling activity following restoration. Patch quality was found to have no impact on patrolling, which implies that social context can be more important in predicting changes in patrolling behaviour in response to resource deterioration." (Authors)] Address: Golab, Maria, Inst. of Nature Conservation, Polish Academy of Sciences, Mickiewicza 33, 31-120 Krakow, Poland. E-mail: [marysiagolab@gmail.com](mailto:marysiagolab@gmail.com)

**18081.** Gómez-Anaya, J.A.; Novelo-Gutiérrez, R. Astudillo-Aldana, M.R. (2017): Efecto de las descargas domésticas y de beneficio de café sobre la calidad del agua y la diversidad de larvas de Odonata (Insecta) en un arroyo de bosque mesófilo de montaña en Veracruz, México. *Revista Mexicana de Biodiversidad* 88: 372-380. (in Spanish, with English summary) ["Effect of domestic and coffee mill discharges on the

water quality and the Odonata larval diversity in a mountain cloud forest stream in Veracruz, Mexico: Two contrasting sites along Huehueyapan River (Veracruz, Mexico), one relatively conserved and the other one impacted by domestic and coffee mill discharges, were compared based on water quality data, and the structure of the Odonata larval assemblages. Riparian vegetation of both sites was differentially modified or replaced. Physical and chemical parameters and Odonata larvae were gathered from January to November 2001. A Hotelling-T test was used to compare the physico-chemical parameters while rank/abundance graphs and Renyi diversity profiles were constructed using Odonata larvae data. A total of 2,212 larvae of 13 species in 7 genera were collected. The sites were very similar in number of species and Odonata larval assemblage structure, however, some of the most abundant species at both sites showed significant differences in abundance. The observed differences between the 2 sites are mainly explained by differences in the structure of riparian vegetation and the availability of substrates for odonates and, secondarily, by physical and chemical changes in the water. An abundance ratio was established based on the most abundant species for monitoring future impairment or recovery changes." (Authors)] Address: Gomez-Anaya, J.A., Red de Biodiv. y Sistemática, Inst. de Ecología A.C., Carretera antigua a Coatepec Num. 351, El Haya, 91070 Xalapa, Veracruz, Mexico

**18082.** Grof-Tisza, P.; LoPresti, E.; Heath, S.K.; Karban, R. (2017): Plant structural complexity and mechanical defenses mediate predator-prey interactions in an odonate-bird system. *Ecology and Evolution* 7(5): 1650-1659. (in English) ["Habitat-forming species provide refuges for a variety of associating species; these refuges may mediate interactions between species differently depending on the functional traits of the habitat-forming species. We investigated refuge provisioning by plants with different functional traits for Odonata nymphs emerging from water bodies to molt into their adult stage. During this period, nymphs experience high levels of predation by birds. On the shores of a small pond, plants with mechanical defenses (e.g., thorns and prickles) and high structural complexity had higher abundances of odonate exuviae than nearby plants which lacked mechanical defenses and exhibited low structural complexity. To disentangle the relative effects of these two potentially important functional traits on nymph emergence-site preference and survival, we conducted two fully crossed factorial field experiments using artificial plants. Nymphs showed a strong preference for artificial plants with high structural complexity and to a lesser extent, mechanical defenses. Both functional traits increased nymph survival but through different mechanisms. We suggest that future investigations attempt to experimentally separate the elements contributing to structural complexity to elucidate the mechanistic underpinnings of refuge provisioning." (Authors)] Address: Grof-Tisza, P., Department of Entomology & Nematology, University of California, Davis, CA, USA. Email: pgroftisza@ucdavis.edu

**18083.** Groover, R.S. (2017): Temporal and Spatial Aspects of the Colonization and Re-Colonization of Dragonflies in

Lentic Habitats. Dissertation, George Mason University, Fairfax, VA: xii, 147 pp. (in English) ["This dissertation describes dragonfly species of Hanover County, Virginia, which species are most likely to be first colonizers of a new or reconstructed impoundment, which species are never found as first colonizers, and which species are the dominant species three years after the impoundment fills with water. In this Piedmont region of Virginia, *Erythemis simplicicollis*, *Libellula incesta*, *Libellula luctuosa*, and *Perithemis tenera* were the first to colonize all sites researched. *Celithemis eponina* and *Pachydiplax longipennis* did appear as first colonizers, but not at all sites. Proximity to a source site appears to be a determinate for these six species, not any size or behavioral characteristics. Seventeen species, no matter what the proximity of a source site, never were first colonizer species for a new impoundment. During this research three species not previously noted on published species lists from government or organizations for this county were collected: *Anax junius*; *Libellula pulchella*; and *Pantala hymenaea*. Seven species found during this study are new additions for the Commonwealth of Virginia official species list for Hanover County: *A. junius*; *A. longipes*; *Celithemis eponina*; *C. fasciata*; *Libellula vibrans*; *Pantala flavescens*; and *Tramea lacerata*. Investigations regarding dominance after three years indicated that dominance did not change; whatever species arrived first, maintained dominance. Additional community structure in the lentic habitat was observed. This dissertation investigated the impact of wind on dispersal direction. In a manipulated mark and observation experiment, findings indicate that wind velocity in excess of 5 km/hr. resulted in the dragonfly's dispersal downwind. Less than 5 km/hr. results in varied direction of flight. Wind direction and velocity may impact direction of dispersal for adult dragonflies. Larval dragonflies were reared in an outdoor vivarium, the first of its kind, with documented survival of 74%, or greater, of the tenebrals." (Author)] Address: not stated

**18084.** Gwiazda, R.; Ledwon, M.; Neubauer, G. (2017): Sex-specific foraging behaviour of adult Whiskered Terns *Chlidonias hybrida* in response to body mass and offspring age. *Acta Ornithologica* 52(1): 81-92. (in English) ["Understanding foraging strategies remains a central question in behavioural ecology, but studies investigating how foraging of sexes is affected by other individual characteristics, like body size, are still scarce. We investigated how foraging behaviour during chick rearing varies in males and females with brood size, offspring age and individual body mass of parents, in a sexually size-dimorphic waterbird, the Whiskered Tern *Chlidonias hybrida*. Our study took place at the carp fish ponds in southern Poland, where both invertebrates (dragonflies, a typical prey of females — caught by picking) and small vertebrates (fish, tadpoles, frogs, males typical prey — caught by plunge-diving) are plentiful and available for both sexes during chick-rearing period. In total, 1680 attacks of 29 uniquely marked birds (16 males and 13 females) were observed during chick-rearing period. Foraging techniques were affected by sex of the parent and offspring age, interacting with body mass, and brood size. Males foraged mainly by plunge diving, but avoided this foraging technique

if their broods were small and when offspring were young, probably because the chicks were too small to consume vertebrate prey caught by diving. In contrast, females foraged mostly by picking prey from the air, water surface or floating leaves, for most of chick-rearing period, but increased frequency of plunge diving as offspring age increased. A significant interaction between body mass and offspring age suggests that birds differing in body mass foraged differently as their offspring grew. We conclude that despite sex-specific differences in foraging behaviour (and prey type delivered to the chicks), both sexes in the Whiskered Tern alter foraging behaviour in response to both brood and individual birds' attributes." (Authors)] Address: Gwiazda, R., Inst. Nature Conservation, Polish Acad. Sciences, Adama Mickiewicza 33, 31-120 Kraków, Poland. E-mail: gwiazda@iop.krakow.pl

**18085.** Gyeltshen, T.; Kalkman, V.; Orr, A. (2017): Field guide to the common Dragonflies and Damselflies of Bhutan. National Biodiversity Centre, Bhutan: 74 pp. (in English) ["This field guide is designed to enable identification, generally to species level, of mature male dragonflies and damselflies known to occur in Bhutan. At present over 110 species are known from Bhutan of which 49 are depicted in this guide. Although the guide does not include all species known from Bhutan it does include all common species and we therefore hope that with its help the great majority of specimens encountered in the field can be identified. Females cannot generally be identified with this guide, but many closely resemble the males in pattern and even when they are very different, in the field they are often recognisable by the males with which they associate, especially when observed mating." (Authors)] Address: Gyeltshen, T., Ugyen Wangchuk Institute for Conservation of Environment and Research, Bumthang, Bhutan. E-mail: thinleytshen@gmail.com

**18086.** Gyeltshen, T. (2017): A survey of Odonata from eastern Bhutan, with nine new national records. *Notulae odonatologicae* 8(9): 354-364. (in English) ["Odonates were collected in five districts (Tashigang, Samdrupjongkhar, Lhuntse, Pemagatshel and Zhemgang) in the eastern half of Bhutan between 13-iv- and 30-v-2016 and in Lhuntse district and Kanglung region in June 2016. A total of 16 localities were visited and 42 species were found, nine of which are new to Bhutan. These are *Philoganga montana*, *Anisogomphus occipitalis*, *Gomphidae* sp., *Davidius zallorensis*, *Stylogomphus inglisi*, *Chlorogomphus preciosus*, *Lyriothemis bivittata*, *Potamarcha congener* and *Zygonyx iris*, increasing the number of Odonata species known from Bhutan to 104." (Author)] Address: Gyeltshen, T., Dept Zool., School of Environmental & Life Sciences, Sherubtse College, Kanglung, Bhutan. E-mail: thinleytshen@gmail.com

**18087.** Hartika, W.; Diba, F.; Wahdina (2017): Keanekaragaman jenis capung (Odonata) pada ruang terbuka hijau kota Pontianak. *Jurnal Hutan Lestari* 5(2): 156-163. (in English) ["Dragonflies are spread throughout the world; the number is very abundant, especially in a wide variety of habitats. This study aims to determine the type of dragonfly in the area of Sylva UNTAN Arboretum Forest City, Forest City

Hall of Governors, the football field UNTAN Jogging Track and Field UNTAN as part of a green open space in the city of Pontianak. The second objective was to determine the existence of the diversity of the types of dragonflies in the area of green open space, as well as to determine the species diversity index, the percentage of relative abundance, evenness index and species richness index. The study was conducted in April-May 2016, with the methods time search. Results of the study found 12 species of dragonflies. 8 species belonging to the suborder Anisoptera Libellulidae families and 4 types belong to the suborder Zygoptera which includes family Coenagrionidae and Platycnemididae." (Authors) ] Address: Hartika, W., Fakultas Kehutanan, Universitas Tanjungpura Jalan Imam Bonjol Pontianak 78124, Indonesia. Email : widyazulharzi@gmail.com

**18088.** Hashim, N.A.; Aziz, M.A.; Basari, N.; Saad, K.; Jasmi, A.H.; Hamid, S.A. (2017): Diversity and guild structure of insects during rice flowering stage at a selected rice field in Penang, Malaysia. *Malays. Appl. Biol.* 46(3): 161-169. (in English) ["A study on diversity of insects in rice field was conducted at Kg Terus, Guar Perahu in Penang. This study aims to determine the diurnality and guild structure of insect in rice field specifically during the flowering stage of rice. Insects were collected using sweep net method and light trap method. Overall, a total of 1936 insect specimens representing 28 species, 19 families and seven orders were collected. Twenty five species from 19 families were caught during day time while 17 species from 13 families were trapped at night. Coleopterans were the dominant insect captured during day time sampling with *Micraspis crocea* from family Coccinellidae captured in highest number (223). In contrast, Hemipterans was dominant during night time with *Nilaparvata lugens* from family Delphacidae found in highest number (258). The Odonata recorded the highest diversity index ( $H' = 1.2587$ ) while Coleoptera recorded the highest richness index ( $Imargalef = 5.8390$ ) values for diurnal insect. For nocturnal insect, Hemiptera recorded the highest values for both diversity index ( $H' = 1.2655$ ) and richness index ( $Imargalef = 5.8390$ ). In term of guild structure, the rice pest was the most dominant insect found in rice field for both diurnal and nocturnal group. This followed by predator, others (visitor/pollinator) and parasitoid groups. Result of this study will identify the classification of insect present during the flowering stage of rice allowing farmers to forecast pest population build up to assist in the pesticides selection that will be generally applied at the end of flowering stage. This consequently will help to conserve beneficial insects and lower the pest management cost." (Authors)] Address: Hashim, N.A., School of Food Science & Technology, Univ. Malaysia Terengganu, 21030 Kuala Nerus, Terengganu, Malaysia. E-mail: aida.hashim@umt.edu.my

**18089.** Henarejos González, J.M. (2017): Revisión de las especies de odonatos presentes en la Región de Murcia. Máster en Tecnología, Administración y Gestión del Agua. Facultad de Biología. Curso 2014-2016: 48 pp. (in Spanish, with English summary) ["This paper is based on the compilation of quotes from Odonata species to have a global view

of their status in the Region of Murcia. The quotations come from volunteer naturalists, mostly, and references. Odonata current populations with a previous job done by Andreu-Rubio (1953) is compared. After analyzing the data, changes are detected in the populations of certain species, including notes that populations have changed a lot, absence and appearance of new species." (Author)] Address: not stated

**18090.** Higashikawa, W.; Yoshimura, M.; Yagi, T.; Maeto, K. (2017): Short and flat grass preferred by adults of the endangered dragonfly *Sympetrum pedemontanum elatum* (Odonata: Libellulidae). *Applied Entomology and Zoology* 52: 605-613. (in English) ["*S. pedemontanum* (Müller in Allioni) is widely distributed across the Eurasian continent and its neighboring islands. However, the populations of its subspecies *S. pedemontanum elatum* (Selys) in Japan have been rapidly decreasing with the loss of habitats in rural and suburban areas since the 1970s. For the conservation of this subspecies, which is now listed as endangered in many prefectures, it is important to understand the habitat preferences of the adults. Previous studies indicate that adult males of this species tend to fly on the flat surface of rice paddy fields. Thus, we hypothesized that they preferred short and flat grass. Field experiments in the Sakasegawa River, Hyogo Prefecture, Japan, showed that adult *S. p. elatum* significantly preferred the trimmed grass of *Phragmites japonicus* to untreated shaggy grass, regardless of sex. Our results indicate the importance of grass management for the conservation of this species, not only in and around paddy fields but also in fluvial habitats, which are abundant in Japan." (Authors)] Address: Higashikawa, W., Research Evaluation Division, Research Planning & Coordination Dept, Forestry & Forest Products Res. Inst., Tsukuba, Ibaraki, Japan

**18091.** Hill, M.J.; Biggs, J.; Thornhill, I.; Briers, R.A.; Gledhill, D.G.; White, J.C.; Wood, P.J.; Hassall, C. (2017): Urban ponds as an aquatic biodiversity resource in modified landscapes. *Global Change Biology* 23: 986-999. (in English) ["Urbanization is a global process contributing to the loss and fragmentation of natural habitats. Many studies have focused on the biological response of terrestrial taxa and habitats to urbanization. However, little is known regarding the consequences of urbanization on freshwater habitats, especially small lentic systems. In this study, we examined aquatic macro-invertebrate diversity (family and species level) and variation in community composition between 240 urban and 782 nonurban ponds distributed across the United Kingdom. Contrary to predictions, urban ponds supported similar numbers of invertebrate species and families compared to nonurban ponds. Similar gamma diversity was found between the two groups at both family and species taxonomic levels. The biological communities of urban ponds were markedly different to those of nonurban ponds, and the variability in urban pond community composition was greater than that in nonurban ponds, contrary to previous work showing homogenization of communities in urban areas. Positive spatial autocorrelation was recorded for urban and nonurban ponds at 0–50 km (distance between pond study sites) and negative spatial autocorrelation was observed at

100–150 km and was stronger in urban ponds in both cases. Ponds do not follow the same ecological patterns as terrestrial and lotic habitats (reduced taxonomic richness) in urban environments; in contrast, they support high taxonomic richness and contribute significantly to regional faunal diversity. Individual cities are complex structural mosaics which evolve over long periods of time and are managed in diverse ways. This facilitates the development of a wide range of environmental conditions and habitat niches in urban ponds which can promote greater heterogeneity between pond communities at larger scales. Ponds provide an opportunity for managers and environmental regulators to conserve and enhance freshwater biodiversity in urbanized landscapes whilst also facilitating key ecosystem services including storm water storage and water treatment." (Authors)] Address: Hassall, C., School of Biology, Univ. of Leeds, Woodhouse Lane, LS2 9JT, Leeds, UK. E-mail: c.hassall@leeds.ac.uk

**18092.** Hoeymans, B. (2017): The dragonfly fauna of the Merkske valley. *Brachytron* 19(2): 55-70. (in Dutch, with English summary) ["A total of 50 species of damselflies and dragonflies has been observed in the Merkske valley. Thirty-eight of them have populations in the study area and probably three more species are also reproducing. Seven species are only known to occur erratically. Most of these have rather a Mediterranean or southeastern origin. Colonisation of the area by *Gomphus vulgatissimus* is expected in the near future. Two species, *Aeshna subarctica* and *Sympetrum flaveolum* no longer occur in the area. The impressive list of species illustrates the regional importance of Het Merkske for the dragonfly population." (Author)] Address: Hoeymans, B.: E-mail: bart.hoeymans@vlaanderen.be

**18093.** Holzweber, H.; Waringer, J.; Chovanec, A. (2017): Ökologie von Hochmoorlibellen (Insecta: Odonata) im Freiwald und Weinsbergerwald (Ober- und Niederösterreich). *Acta ZooBot Austria* 154: 75-88. (in German, with English summary) ["The ecological status of mires is mostly evaluated by vegetation; however, dragonflies (Odonata) are reliable and valuable indicators for the hydrological and morphological status of mires. Based on the occurrence of autochthonic Odonata, the Dragonfly Association Index (DAI) thereby gives information about the ecological situation of mires. For this investigation the ecology of dragonflies in mires was observed between April and September 2015. Study sites were situated in seven bogs in the Freiwald and Weinsbergerwald area in the Austrian Bohemian Massif, with 27 sampling sites in total. Overall, 14 different dragonfly species were found, and 11 species are autochthonic. *Coenagrion hastulatum*, *Aeshna juncea*, *Leucorrhinia dubia*, *Somatochlora alpestris* and *Somatochlora arctica* are autochthonic dragonflies which are dependent on mires. Additionally, the sampling sites were divided into different quality classes, based on vegetation, and were assessed via a DAI developed specifically for this region, which is also applicable to other limnological ecosystems. For the development of this DAI, 53 potentially occurring dragonfly species were classified by their ecological requirements via cluster analysis. As a result, we defined nine associations which correlate with mire-specific



characteristics. In the mires of this region three fundamental associations were extracted: association in mires with open water, association in mires without open water and association in marshy waters with emerged vegetation. The results show that three sampling sites are in a very good condition, three are in a good and 21 sampling sites are in a bad condition. Most of the mires in this region are anthropogenically affected, and the reproduction sites for specific dragonflies depending on mires continually decrease. Via individual preservation and renaturation these sites could persist, recover and even increase, thereby providing habitats for rare mire plants and animals." (Authors)] Address: Holzweber, Helene, Oberrosenauerwald I 38, A-3920 Groß Gerungs, Austria. E-Mail: helene.holzweber@chello.at

**18094.** Horgan, F.G.; Ramal, A.F.; Villegas, J.M.; Jamoralin, A.; Bernal, C.C.; Perez, M.O.; Pasang, J.M.; Naredo, A.I.; Almazan, M.L.P. (2017): Effects of bund crops and insecticide treatments on arthropod diversity and herbivore regulation in tropical rice fields. *Journal of Applied Entomology* 141(8): 587-599. (in English) ["Ecological engineering using vegetable or flower strips is promoted as a potential pest management strategy in irrigated rice. Farmers in the Philippines often plant rice levees (bunds) with vegetables, particularly string beans (*Vigna unguiculata* [L.] Walpers) to supplement income, but without considering the potential for pest management. This study examines the effects of planted bunds on rice herbivores and their natural enemies. We compared arthropods in (a) rice fields that had string beans planted on bunds, (b) fields without string beans and without any insecticide applications and (c) fields without string beans but with insecticide treatments (standard practice). Rice yield was similar across all treatments; however, the vegetation strips produced an extra 3.6 kg of fresh string bean pods per metre of bund. There were no apparent increases in major natural enemy groups in fields with string beans compared to fields with conventional bunds. Fields with insecticide treatments had higher damage from leafhoppers (Lepidoptera: Pyralidae). The sprayed fields also had lower parasitism of planthopper eggs and fewer predatory Odonata. Furthermore, the mortality of planthopper (Delphacidae: Hemiptera) and stemborer (Pyralidae) eggs by parasitoids and predators was density dependent only in the unsprayed fields (with and without string beans). Our results demonstrate that planting string beans on rice bunds improves the productivity of rice farms, but our ecological engineering system did not appreciably affect natural enemy or herbivore abundance; however, chemical insecticides adversely affected pest regulatory ecosystem functions leading to higher pest damage." (Authors)] Address: Horgan, F.G., Centre for Compassionate Conservation, Univ. of Tech. Sydney, 15 Broadway, Ultimo, Sydney NSW 2007, Australia. E-mail: f.g.horgan@gmail.com

**18095.** Huang, D.; Cai, C.; Nel, A. (2017): A new Burmese amber hawker dragonfly helps to redefine the position of the aeshnopteran family Burmaeshnidae (Odonata: Anisoptera: Aeshnoidea). *Cretaceous Research* 79: 153-158.. (in English) ["The new genus and species *Angustaeshna magnifica* of Burmaeshnidae is described on the basis of a new

fossil from Burmese amber. The genus *Cretaeshna* from the same amber is transferred from the Telephlebiidae into the Burmaeshnidae. We redefine this last family, no longer considered as the sister group of the Late Cretaceous Enigmaeshnidae, but as putative sister group of the Telephlebiidae in the Aeshnoidea. No known fossil belongs to the Telephlebiidae." (Authors)] Address: Huang, D., State Key Lab. of Palaeobiology and Stratigraphy, Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, Nanjing 210008, People's Republic of China. E-mail: dyhuang@nigpas.ac.cn

**18096.** Ichikawa, Y.; Yokoi, T.; Watanabe, M. (2017): Thermal factors affecting egg development in the wandering glider dragonfly, *Pantala flavescens* (Odonata: Libellulidae). *Applied Entomology and Zoology* 52(1): 89-95. (in English) ["*P. flavescens* arrives in Japan from tropical regions every spring. The offspring colonize areas throughout Japan, with rapid increases in populations in the autumn, but all individuals die in the winter, suggesting low tolerance to low temperatures. However, few quantitative data on egg development and water temperature have been reported for this species. Females at the reproductive stage were collected from fields throughout the flying season and their eggs released using an artificial oviposition technique. Almost all of the eggs were fertilized. Egg size was stable throughout the seasons. Most eggs hatched within a period of 5 days at high water temperatures (35 and 30 °C), which were recorded in the shallow ponds and rice paddy fields from summer to early autumn. However, the egg-stage duration increased with declining water temperature. All eggs in water at 15 °C had failed to hatch by 90 days. The calculated critical temperature of water was determined to be approximately 14.3 °C; the total effective temperature for the egg stage was about 80 degree-days. Thus, low water temperatures in winter may prevent *P. flavescens* overwintering in Japan." (Authors)] Address: Yokoi, T., Graduate School of Life and Environmental Sciences, University of Tsukuba. Tsukuba, Ibaraki 305-8572, Japan. E-mail: tomoyoko@envr.tsukuba.ac.jp

**18097.** Itoh, S. (2017): The impacts of the big tsunami with the 2011 of the Pacific coast of Tohoku Earthquake to the populations of *Sympetrum striolatum imitoides* inhabit coastal area of Iwate Prefecture, north-eastern Honshu, Japan. *Tombo* 59: 6-10. (in Japanese, with English summary) ["The population of *S. striolatum imitoides* at Iwate Prefecture is limited in the middle to southern coastalline of the prefectural area. 11 March 2011, the big tsunami with the 2011 off the Pacific Coast of Tohoku Earthquake hit this area and many plants and animals were damaged. The author researched *S. striolatum imitoides* of this area in the flight season and confirmed the survived the adult insect 6/7 localities until 2012 flight season." (Author)] Address: Itoh, S., Kinoshita 4-9-7-102, Wakabayashi-ku, Sendai-shi, Miyagi, 984-0047 Japan

**18098.** Ivanova, E.P.; Song Ha Nguyen, S.H.; Guo, Y.; Baulin, V.A.; Webb, H.K.; Truong, V.K.; Wandiyanto, J.V.; Garvey, C.J.; Mahon, P.J.; Mainwaring, D.E.; Crawford, R.J. (2017): Bactericidal activity of self-assembled palmitic and

stearic fatty acid crystals on highly ordered pyrolytic graphite. *Acta Biomaterialia* 59: 148-157. (in English) ["The wings of insects such as cicadas and dragonflies have been found to possess nanostructure arrays that are assembled from fatty acids. These arrays can physically interact with the bacterial cell membranes, leading to the death of the cell. Such mechanobactericidal surfaces are of significant interest, as they can kill bacteria without the need for anti-bacterial chemicals. Here, we report on the bactericidal effect of two of the main lipid components of the insect wing epicuticle, palmitic (C<sup>16</sup>) and stearic (C<sup>18</sup>) fatty acids. Films of these fatty acids were re-crystallised on the surface of highly ordered pyrolytic graphite. It appeared that the presence of two additional CH<sub>2</sub> groups in the alkyl chain resulted in the formation of different surface structures. Scanning electron microscopy and atomic force microscopy showed that the palmitic acid microcrystallites were more asymmetric than those of the stearic acid, where the palmitic acid microcrystallites were observed to be an angular abutment in the scanning electron micrographs. The principal differences between the two types of long-chain saturated fatty acid crystallites were the larger density of peaks in the upper contact plane of the palmitic acid crystallites, as well as their greater proportion of asymmetrical shapes, in comparison to that of the stearic acid film. These two parameters might contribute to higher bactericidal activity on surfaces derived from palmitic acid. Both the palmitic and stearic acid crystallite surfaces displayed activity against Gram-negative, rod-shaped *Pseudomonas aeruginosa* and Gram-positive, spherical *Staphylococcus aureus* cells. These microcrystallite interfaces might be a useful tool in the fabrication of effective bactericidal nanocoatings. Statement of Significance: Nanostructured cicada and dragonfly wing surfaces have been discovered to be able physically kill bacterial cells. Here, we report on the successful fabrication of bactericidal three-dimensional structures of two main lipid components of the epicuticle of insect wings, palmitic (C<sup>16</sup>) and stearic (C<sup>18</sup>) acids. After crystallisation onto highly ordered pyrolytic graphite, both the palmitic and stearic acid films displayed bactericidal activity against both Gram-negative *Pseudomonas aeruginosa* and Gram-positive *Staphylococcus aureus* cells. The simplicity of the production of these microcrystallite interfaces suggests that a fabrication technique, based on solution deposition, could be an effective technique for the application of bactericidal nanocoatings." (Authors)] Address: Ivanova, Elena, School of Science, Faculty of Science, Engineering and Technology, Swinburne University of Technology, Hawthorn, VIC 3122, Australia

**18099.** Iwai, N.; Akasaka, M.; Kadoya, T.; Ishida, S.; Aoki, T.; Higuchi, S.; Takamura, N. (2017): Examination of the link between life stages uncovered the mechanisms by which habitat characteristics affect odonates. *Ecosphere* 8(9): e01930. 10.1002/ecs2.1930: 7 pp. (in English) ["The larval and adult stages of amphibious animals are affected by both aquatic and terrestrial habitat characteristics, and each stage also affects the other. However, this link between life stages has been largely overlooked in previous studies. We examined the effect of aquatic and terrestrial habitat characteristics on

the diversity of larval and adult odonates, taking into account the link between the two life stages. Species diversity of adult and larval odonates and aquatic plants, as well as patterns of land use, was investigated in 63 irrigation ponds. We created structural equation models, with paths from land use and aquatic plants characteristics to larval and adult stages of odonates, as well as between the two stages, and chose the best model based on the lowest Akaike information criterion. Adult odonates, but not larvae, were affected by aquatic and terrestrial habitat characteristics, suggesting that the former is the key stage for odonate communities. We observed a positive relationship between the diversity of aquatic plants and larval odonates, but this was in fact due to the effects of aquatic plants on adults, which carried over to the larval stage. Our study showed that a consideration of the link between life stages is crucial for a complete understanding of the relationship between habitat characteristics and amphibious animal populations." (Authors)] Address: Iwai, N., The Institute of Agriculture, Tokyo University of Agriculture and Technology, 3-5-8 Saiwai-cho, Fuchu, Tokyo 183-8509 Japan. E-mail: iwain@cc.tuat.ac.jp

**18100.** Jacquot, P., Mora, F., Ruffoni, A. (2017): L'atlas des libellules de Bourgogne-Franche-Comté: des approches différentes, un objectif conjoint. *Revue scientifique Bourgogne-Nature* 25: 216-232. (in French, with English summary) ["In connection with the administrative fusion of the former regions Bourgogne and Franche-Comté, contacts were established between observers' networks to put the bases of a future common atlas dealing with the group of dragonflies. Forts of a first fruitful partnership which became a reality in 2013 by the publication of a collective work on the day butterflies (ESSAYAN et al., 2013), it is indeed seemed more than ever convenient to pursue this collaboration which, besides mutualizing skills and experiences, will allow a more effective evaluation of the status of the species of dragonflies of our parts of the country. The authors suggest raising a brief history of the evolution of the knowledge, presenting the current local contexts, and putting some methodological bases." (Authors)] Address: Jacquot, Perrine, Conservatoire botanique national de Franche-Comté - Observatoire régional des Invertébrés, France. E-mail: perrine.jacquot.ori@cbnfc.org

**18101.** Janssens, L.; Stokks, R. (2017): Stronger effects of Roundup than its active ingredient glyphosate in damselfly larvae. *Aquatic Toxicology* 193: 210-216. (in English) ["Highlights: •Commercial pesticide formulations can be more toxic than their active ingredient. •We compared the effects of Roundup and its active ingredient glyphosate. •Roundup was more toxic than glyphosate in terms of survival, behaviour and physiology. •Glyphosate itself reduced growth rate, escape swimming speed and fat content. •Sublethal effects matter when comparing commercial products and active ingredients. Abstract: Pesticides are causing strong decreases in aquatic biodiversity at concentrations assumed safe by legislation. One reason for the failing risk assessment may be strong differences in the toxicity of the active ingredient of pesticides and their commercial formulations. Sublethal effects, especially those on behaviour, have been

largely ignored in this context, yet can be equally important as lethal effects at the population and ecosystem levels. Here, we compared the toxicity of the herbicide Roundup and its active ingredient glyphosate on survival, but also on ecologically relevant sublethal traits (life history, behaviour and physiology) in damselfly larvae. Roundup was more toxic than glyphosate with negative effects on survival, behaviour and most of the physiological traits being present at lower concentrations (food intake, escape swimming speed) or even only present (survival, sugar and total energy content and muscle mass) following Roundup exposure. This confirms the toxicity of the surfactant POEA. Notably, also glyphosate was not harmless: a realistic concentration of 2 mg/l resulted in reduced growth rate, escape swimming speed and fat content. Our results therefore indicate that the toxicity of Roundup cannot be fully attributed to its surfactant, thereby suggesting that also the new generation of glyphosate-based herbicides with other mixtures of surfactants likely will have adverse effects on non-target aquatic organisms. Ecotoxicological studies comparing the toxicity of active ingredients and their commercial formulations typically ignore behaviour while the here observed differential effects on behaviour likely will negatively impact damselfly populations. Our data highlight that risk assessment of pesticides ignoring sublethal effects may contribute to the negative effects of pesticides on aquatic biodiversity." (Authors)] Address: Janssens, Lizanne, Evolutionary Stress Ecology and Ecotoxicology, University of Leuven, Deberiotstraat 32, B-3000 Leuven, Belgium

**18102.** Jiang, Y.; He, Z.; Zhao, M.; Wang, C.; Sun, L.; Feng, Y. (2017): Oil content and fatty acid composition of six kinds of common edible dragonfly naiads. *China Oils and Fats* 42(3): 135-139. (in Chinese, with English summary) ["In order to evaluate the nutritional value of common edible dragonfly naiads in Yunnan and Guizhou provinces, the oil content and fatty acid composition of *Epophthalmia elegans*, *Anax parthenope julius*, *Ictinogomphus rapax*, *Partiala flavescens*, *Sinictinogomphus clavatus* and *Orthetrum pruinum neglectum* were analyzed by Soxhlet extraction method and GC-MS. The results showed that the oil contents of six kinds of dragonfly naiads were 5.72% -11.90%. The oil contents of *Sinictinogomphus clavatus* and *Orthetrum pruinum neglectum* were the highest and the lowest respectively. 18-29 kinds of fatty acids were identified, including odd-number carbon fatty acids, EPA and DHA, which had special functions. The unsaturated fatty acids (UFA) accounted for 61.50% -65.22% of total fatty acids and the polyunsaturated fatty acids (PUFA) accounted for 29.57% -50.00% of total UFA. The contents of hexadecanoic acid were the highest, which were 17.57% -24.61%. The ratios of n-6 PUFA to n-3 PUFA were 0.68 -1.30, which were similar to the freshwater fish oils. The ratios of saturated fatty acid to monounsaturated fatty acid to PUFA in *Pantala flavescens* and *Orthetrum pruinum neglectum* were 1.17:1.2:1 and 1.3:1.18:1, which were close to the ratios recommended by the North Atlantic Treaty Organization and the American Heart Association (1:1.5:1 and (0.8 - 1) :1.5:1)." (Authors)] Address: Jiang, Y., Research Institute of Resources Insects, Chinese Academy of Forestry, Kunming 650224, Yunnan, China

**18103.** Jiang, Y.; Zhao, M.; Me, Z.; Wang, C.; Sun, L.; Feng, Y. (2017): Nutrition composition and evaluation of six edible dragonfly naiads. *Biotic Resources* 39(5): 352-359. (in Chinese, with English summary) ["To utilize the resource of edible dragonflies scientifically, we analyzed and valued the nutritional composition of six common edible dragonfly naiads collected in Yunnan and Guizhou provinces of China. The contents of protein, oil, carbohydrate, moisture, ash, amino acid, mineral element and fat soluble vitamin were analyzed by Kjeldahl method, Soxhlet extraction method, anthrone colorimetry method, auto analysis of free amino acid method, atomic absorption method, inductively coupled plasma mass spectrometry method (ICP-MS) and high performance liquid chromatography (HPLC). The results showed that the average content of moisture of six common edible dragonfly naiads were 81.17%, the average contents of protein, oil, carbohydrate and ash were 65.62%, 9.80%, 3.01% and 5.47% respectively from dry basis. Their amino acid composition fits the ideal protein pattern established by WHO/FAO, and the limiting amino acids were Met + Cys and Trp. The closeness degrees of protein of six common edible dragonfly naiads to egg protein were 0.59~0.66. They were rich in mineral elements, especially Calcium and Selenium, and as high as 0.252~3.859 mg · kg<sup>-1</sup> or tocopherol was detected in six specimens. Edible dragonflies have prospects of development and utilization, but it should be noted that some heavy metal elements in some species exceed the standard." (Authors)] Address: Jiang, Y., Research Institute of Resources Insects, Chinese Academy of Forestry, Kunming 650224, Yunnan, China

**18104.** Joest, R. (2017): Neue Daten zum Vorkommen der Grünen Flussjungfer (*Ophiogomphus cecilia*) an der Lippe im Kreis Soest. *ABU info* 39-40: 22-26. (in German) [50 records of the middle section of River Lippe (Landkreis Soest, Nordrhein-Westfalen [NRW], Germany) between Lippstadt and western border near the town of Hamm are documented. "*O. cecilia* is considered an indicator of near-natural flowing waters. For some time now, the already extinct species has re-established itself in NRW. It has been recorded on the river Lippe in the district of Soest since 2009. The number of records, the regular occurrence and the first exuviae indicate that this species is native to the area. The records originate from the river Lippe below Lippstadt to below Lippborg. The largest number of records was found in renaturalised sections between Lippstadt and Eickelborn. These sections are characterised by shallower and fast-flowing areas as well as sand deposits and deadwood and do not have a continuous woody fringe due to grazing on the banks. Besides the improvement of water quality and climatic changes, renaturation measures can be seen as a cause for the settlement of *O. cecilia* on the Lippe." ] Address: Joest, R., Arbeitsgemeinschaft Biologischer Umweltschutz – Biologische Station Soest, Bad Sassendorf-Lohne. E-mail: r.joest@abu-naturschutz.de

**18105.** Johansson, F.; Halvarsson, P.; Mikolajewski, D.J.; Höglund, J. (2017): Phylogeography and larval spine length of the dragonfly *Leucorrhinia dubia* in Europe. *PLoS ONE*

12(9): e0184596. <https://doi.org/10.1371/journal.pone.0184596>: 9 pp. (in English) ["Presence or absence of predators selects for different kind of morphologies. Hence, we expect variation in traits that protect against predators to vary over geographical areas where predators vary in past and present abundance. Abdominal larval spines in dragonfly larvae provide protection against fish predators. We studied geographical variation in larval spine length of the dragonfly *Leucorrhinia dubia* across Western Europe using a phylogenetic approach. Larvae were raised in a common garden laboratory experiment in the absence of fish predators. Results show that larvae from northern Europe (Sweden and Finland) had significantly longer larval spines compared to larvae from western and central Europe. A phylogeny based on SNP data suggests that short larval spines is the ancestral stage in the localities sampled in this study, and that long spines have evolved in the Fenno-Scandian clade. The role of predators in shaping the morphological differences among the sampled localities is discussed." (Authors)] Address: Johansson, F., Dept of Ecology & Genetics, Uppsala Univ., Uppsala, Sweden. E-mail: frank.johansson@ebc.uu.se

**18106.** Jones, D.K.; Hintz, W.D.; Schuler, M.S.; Yates, E.K.; Mattes, B.M.; Relyea, R.A. (2017): Inducible tolerance to agrochemicals was paved by evolutionary responses to predators. *Environ. Sci. Technol.* 51(23): 13913-13919. (in English) ["Recent research has reported increased tolerance to agrochemicals in target and nontarget organisms following acute physiological changes induced through phenotypic plasticity. Moreover, the most inducible populations are those from more pristine locations, far from agrochemical use. We asked why do populations with no known history of pesticide exposure have the ability to induce adaptive responses to novel agrochemicals? We hypothesized that increased pesticide tolerance results from a generalized stressor response in organisms, and would be induced following sublethal exposure to natural and anthropogenic stressors. We exposed larval wood frogs (*Lithobates sylvaticus*) to one of seven natural or anthropogenic stressors (predator cue (*Anax* spp.), 0.5 or 1.0 mg carbaryl/L, road salt (200 or 1000 mg Cl<sup>-</sup>/L), ethanol-vehicle control, or no-stressor control) and subsequently tested their tolerance to a lethal carbaryl concentration using time-to-death assays. We observed induced carbaryl tolerance in tadpoles exposed to 0.5 mg/L carbaryl and also in tadpoles exposed to predator cues. Our results suggest that the ability to induce pesticide tolerance likely arose through evolved antipredator responses. Given that antipredator responses are widespread among species, many animals might possess inducible pesticide tolerance, buffering them from agrochemical exposure." (Authors)] Address: Jones, D.K., Darrin Fresh Water Institute, Dept of Biological Sciences, Rensselaer Polytechnic Inst., Troy, New York 12180, United States

**18107.** Joshi, S.; Kunte, K. (2017): Two new dragonfly species (Odonata: Anisoptera: Aeshnidae) from north-eastern India. *Zootaxa* 4300(2): 259-268. (in English) ["*Cephalaeschna acanthifrons* sp. nov. collected from Eaglenest Wildlife Sanctuary, West Kameng District, Arunachal Pradesh,

India, and *Planaeschna poumai* sp. nov. collected from two localities in Senapati District, Manipur, India, are described and compared with congeneric species. These records also represent the first reports of these obscure genera from India in the past 30 years." (Authors)] Address: Joshi, S., National Centre for Biological Sciences, GKVK Campus, Bellary Rd, Bengaluru, Karnataka 560065, India. E-mail: shantanu@ifoundbutterflies.org

**18108.** Joshi, S.; Veino, J.; Veino, D.; Veino, L.; Veino, R.; Kunte, K. (2017): Additions to the Indian dragonfly fauna, and new records of two enigmatic damselflies (Insecta: Odonata) from northeastern India. *Journal of Threatened Taxa* 9(7): 10433-10444. (in English) ["*Pseudothemis zonata* and *Burmagomphus divaricatus* are reported for the first time from northeastern India—hitherto not reported from the west of Thailand. The female of *Anisopleura vallei*, is described for the first time, with new records of this species from four localities in Kohima District, Nagaland, India. Previously, the only known record of this species was the type series collected by St. Quentin in 1935. We also provide new records of *Schmidtiphaea chittaranjani* which was previously known only from the holotype." (Authors)] Address: Joshi, S., National Center for Biological Sciences (NCBS), GKVK, Bellary Road, Bengaluru, Karnataka 560065, India. E-mail: shantanu@ifoundbutterflies.org

**18109.** Jung, S.W.; Cho, Y.C.; Lee, H.-G. (2017): Community characteristics and biological quality assessment on benthic macroinvertebrates of Bongseonsa stream in Gwangneung Forest, South Korea. *Korean J. Environ. Ecol.* 31(6): 508-519. (in Korean, with English summary) ["There have been many studies on monitoring of biodiversity changes and preservation of Gwangneung Forest Biosphere Reserve (GFBR) in South Korea in recognition of the rare ecosystem that has been preserved for a long period. However, there are few studies on diversity and community characteristics of benthic macroinvertebrates as an indicator of stream health of GFBR. The purpose of this study was to assess the water quality of Bongseonsa Stream that penetrated through Gwangneung Forest and the nearby torrents by analyzing the benthic macroinvertebrates community during April to September 2016. The investigation collected a total of 114 species of benthic macroinvertebrates belonging to 56 families, 17 orders, 8 classes, and 5 phyla from the Bongseonsa Stream and Kwangneung Stream. Ephemeroptera and Trichoptera were the largest groups in species diversity with 30 species (32.3%) and 16 species (17.2%), respectively, and Tubificidae sp., *Baetis fuscatus*, *Antocha* KUa, and *Cheumatopsyche brevilineata*, which usually habit in contaminated streams, appeared frequently. Among the feeding function groups, the gatherers and hunters appeared relatively frequently, and the shredders and scrapers appeared frequently in the torrents. Among the habitat oriented groups, the clingers and burrower appeared more frequently and represented the microhabitats in the shallow areas. The result of the analysis of benthic macroinvertebrates community showed that the dominant index was 0.48±0.10 in average while it was lowest with 0.33 in GS 8 of the Gwangneung Forest torrent

and highest in BS 1 of Bongseonsa Stream. The diversity and richness indices were inversely proportional to the dominant index and were 2.53 and 4.22, respectively, in GS 8 where the dominant index was low. The result of the analysis of community stability showed that area I, which had high resistance and restoration, was high in Bongseonsa Stream while the area III, which had low resistance and restoration, was high in Gwangneung Forest, indicating that the water system in Gwangneung Forest had a wider distribution of species sensitive to agitation. The biological water quality assessment showed ESB of  $50.88 \pm 17.69$ , KSI of  $1.11 \pm 0.57$ , and BMI of  $78.55 \pm 11.05$  GS 8 of Gwangneung Forest torrent was judged to be the highest priority protective water area with the best water environment and I class water quality with ESB of 63, KSI of 0.55, and BMI of 89.9. On the contrary, BS 1 of Bongseonsa Stream was judged to be the high priority improvement area that had the lowest water quality rating of III with ESB of 25, KSI of 2.13, and BMI of 62.7. Although the diversity of water beetle was higher in the water system of nearby Bongseonsa Stream than the water system inside the Gwangneung Forest, the annual community structure appeared to have distinct differences." Lamelligomphus ringens (Authors)] Address: Lee, H.-G., Department of Biological Science, Sangji University, Wonju 26339, Korea. E-mail: momingdew@sangji.ac.kr

**18110.** Kalnins, M. (2017): *Argiolestes spungisi* sp. nov. (Odonata: Argiolestidae) from New Guinea. Telnov, D. et al. (eds) 2017: Biodiversity, Biogeography and Nature Conservation in Wallacea and New Guinea, III: 357-362, plates 52-55. (in English) ["A new species of *Argiolestes* is described: *Argiolestes spungisi* sp. nov. (type locality: Indonesia, West New Guinea, Doberai Peninsula, Ayamaru village 23 km SE, Aqafu springs, deposited LINC). Ecological notes on habitat (forest brooks) of type locality are given." (Author)] Address: Kalnins, M., The Entomological Society of Latvia, Dzervenu iela 9-12, LV-2150, Sigulda, Latvia. E-mail: martins.kalnins@biology.lv

**18111.** Karlsson, E. (2017): Temperature acclimation in dragonfly larvae: which species are more vulnerable to global warming? M.Sc. thesis, Biology Education Centre and Department of ecology and genetics/Animal ecology, Uppsala University: 33pp. (in English) ["Climate change is affecting all known habitats on earth. Increased temperatures in aquatic habitats will not only heat the waters but will also cause larger variation in temperature fluctuation. Many animals in aquatic systems are adapted to specific habitats in these waters and may face disadvantages if temperatures changes too much. In my project, I have used larvae of dragonflies and damselflies to examine how they might be affected by changes in water temperature caused by climate change. I sampled damselfly and dragonfly larvae in three lakes around Uppsala at two water depths, in order to examine whether these species differed in their depth distribution. Larvae exposed to thermal fluctuations should be better at adapting to the increase in temperature from global warming. In a laboratory experiment I tested the ability to acclimate to three temperatures (18, 21 and 24 °C) in three

species of damselfly larvae (*Ischnura elegans*, *Coenagrion pulchellum*, and *Erythromma najas*), over four different time intervals (1, 2, 12 and 24 hours) for *E. najas* and two time intervals for *I. elegans* and *C. pulchellum*. To measure acclimation, I introduced prey items in a laboratory experiment, and counted how many strikes and captures the larvae managed to do during a 10 min interval after being acclimated to the four different time intervals. The results of the field sampling in the lakes showed species specific depth distribution differences in dragonfly and damselfly larvae, with the majority of species preferring the surface over the bottom. The results from the temperature acclimation experiments showed that species changed their strikes and capture success on prey over the different time intervals, and especially *E. najas* showed a clear trend that suggest adaptation to temperate changes. Species differed in prey capture behaviour, with *E. najas* having the highest and *C. pulchellum* the lowest number of strikes and capture success. Results also suggested that *E. najas* is able to acclimate to the temperatures over the time period tested. This species also had a wide depth distribution in the lakes, which might explain its faster acclimation, even though a similar depth distribution was found in the non acclimating *C. pulchellum*. The other two species (besides *E. najas*) showed less clear patterns with regard to acclimation and it was difficult to tell if they were able to acclimate to the tested temperatures. My results suggest that damselfly larvae species are able to acclimate in prey capture behaviour over relatively short time periods in response to temperature fluctuations, and they might therefore be able to adapt to increasing temperature fluctuations in the future." (Author)] Address: Karlsson, E., Biology Education Centre & Department of ecology and genetics/Animal ecology, Uppsala University

**18112.** Kaunisto, K.M.; Roslin, T.; Sääksjärvi, I.E.; Vesterinen, E.J. (2017): Pellets of proof: First glimpse of the dietary composition of adult odonates as revealed by metabarcoding of feces. *Ecology and Evolution*. 2017;7. <https://doi.org/10.1002/ece3.3404>: 8588-8598. (in English) ["Recent advances in molecular techniques allow us to resolve the diet of unstudied taxa. Odonates are potentially important top-down regulators of many insects. Yet, to date, our knowledge of odonate prey use is based mainly on limited observations of odonates catching or eating their prey. In this study, we examine the potential use of metabarcoding in establishing the diet of three adult odonate species (*Lestes sponsa*, *Enallagma cyathigerum*, and *Sympetrum danae*) at a site in southwestern Finland. To this purpose, we compared three different methods for extracting DNA from fecal samples: the Mache-rey-Nagel Nucleospin XS kit, a traditional salt extraction, and the Zymo Research Fecal Microprep kit. From these extracts, we amplified group-specific mitochondrial markers (COI and 16S rRNA) from altogether 72 odonate individuals, and compared them to comprehensive reference libraries. The three odonate species show major overlap in diet, with no significant differences between individuals of different size and/or gender, reflecting opportunistic foraging of adult odonates. Of a total of 41 different prey species detected, the most frequently consumed ones were Diptera, with additional records of six other orders. Based on our data, the best DNA

extraction method is the traditional salt extraction, as it provides the most information on prey content while also being the most economical. To our knowledge, this is the first study to resolve the species-level diet of adult odonates. Armed with the appropriate methodological caveats, we are ready to examine the ecological role of odonates in both terrestrial and aquatic food webs, and in transferring subsidies between these two realms." (Authors)] Address: Kaunisto, K.M., Zoological Museum, Biodiv. Unit, Univ. Turku, Turku, Finland. E-mail: kkauni@utu.fi

**18113.** Kever, D.; Schott, O. (2017): Les effect positifs du Life Hautes Fagnes sur les libellules. Une synthèse des résultats après cinq ans de suivi standardisé (2013-2017). *Miscellanea Faniae* 33: 2-6. (in French) ["Initiated in 2013 following the large-scale restorations carried out by the LIFE Nature project 'Restoration of the moors and peat bogs of the High Fens Plateau', the monitoring of odonates quickly showed encouraging results (Kever 2014, Kever et al. 2014). We propose here to present a summary of the main highlights after five years of post-LIFE monitoring (2013-2017)."] (Authors)] Address: Kever, D., SPW/DGO3/DEMNA/DNE, Station scientifique des Hautes-Fagnes, Mont-Rigi, Route de Botrange, 137 - B-4950 Robertville, Belgium. E-mail: david.kever@spw.wallonie.be

**18114.** Khandakera, M.S.K.; Dudek, D.M.; Beers, E.P.; Dillard, D.A. (2017): Expression, crosslinking, and developing modulus master curves of recombinant resilin. *Journal of the Mechanical Behavior of Biomedical Materials* 69: 385-394. (in English) ["Highlights: • Recombinant resilin comprising exons 1 & 2 crosslinked for mechanical testing. • DMA tests conducted as function of temperature, frequency, & ethanol concentration. • Storage modulus increases observed spanning three orders of magnitude. • Glass transition, H-bonding, or structural reorganization likely responsible for effect. • Properties of recombinant resilin are in fair agreement with actual insect resilin. Abstract: Resilin is a disordered elastomeric protein found in specialized regions of insect cuticles, where low stiffness and high resilience are required. Having a wide range of functions that vary among insect species, resilin operates across a wide frequency range, from 5 Hz for locomotion to 13 kHz for sound production. We synthesize and crosslink a recombinant resilin from clone-1 (exon-1 + exon-2) of the gene, and determine the water content (approximately 80 wt%) and dynamic mechanical properties, along with estimating surface energies relevant for adhesion. Dynamic moduli master curves have been developed, by applying the time-temperature superposition principle (TTSP) and time-temperature concentration superposition principle (TTCSP), and compared with reported master curves for natural resilin from locusts, dragonflies, and cockroaches. To our knowledge, this is the first time dynamic moduli master curves have been developed to explore the dynamic mechanical properties of recombinant resilin and compare with resilin behavior. The resulting master curves show that the synthetic resilin undergoes a pronounced transition with increasing ethanol concentrations, with the storage modulus increasing by approximately three orders of magnitude. Although possibly a glass transition, alternate

explanations include the formation of intramolecular hydrogen bonds or that the chitin binding domain (ChBD) in exon-2 might change the secondary structure of the normally disordered exon-1 into more ordered conformations that limit deformation." (Authors)] Address: Khandakera, M.S.K., Dept Biomedical Engineering & Mechanics, Virginia Tech, Blacksburg, VA 24061, USA. E-mail: mkkhanda@vt.edu.

**18115.** Khelifa, R. (2017): Spatiotemporal pattern of phenology across geographic gradients in insects. 2017. University of Zürich, Faculty of Science: 141 pp. (in English, with German summary) ["Phenology – the timing of recurrent biological events – influences nearly all aspects of ecology and evolution. Phenological shifts have been recorded in a wide range of animals and plants worldwide during the past few decades. Although the phenological responses differ between taxa, they may also vary geographically, especially along gradients such as latitude or elevation. Since changes in phenology have been shown to affect ecology, evolution, human health and the economy, understanding phenological shifts has become a priority. Although phenological shifts have been associated with changes in temperature, there is still little comprehension of the phenology-temperature relationship, particularly the mechanisms influencing its strength and the extent to which it varies geographically. Such questions would ideally be addressed by combining controlled laboratory experiments on thermal response with long-term observational datasets and historical temperature records. Here, I used odonates (dragonflies and damselflies) and Sepsid scavenger flies to unravel how temperature affects development and phenology at different latitudes and elevations. The main purpose of this thesis is to provide essential knowledge on the factors driving the spatiotemporal phenological dynamics by (1) investigating how phenology changed in time and space across latitude and elevation in northcentral Europe during the past three decades, (2) assessing potential temporal changes in thermal sensitivity of phenology and (3) describing the geographic pattern and usefulness of thermal performance curves in predicting natural responses. Additionally, this thesis presents (4) a new behavior in odonates and (5) a commemoration of the 100th anniversary of a noteworthy book in odonatology. In Chapter I, the phenological shift of adult odonates across latitude and elevation was examined with long-term observation data of 54 species in six European countries, historical temperature records and experimental studies on species-specific thermal performance curves. Geographic variation in phenological shifts is expected since the magnitude of recent climate warming varies across both space (latitude and elevation) and time (seasons). However, little information exists on whether the average temperature, fluctuation of temperature or physiological response to such temperature fluctuations is the best predictor of phenology. First, phenology has shifted across both latitude and elevation, but to a different extent (magnitude), increasing with latitude and decreasing with elevation. Although average temperature explained some of the variation in spatiotemporal pattern of phenology, the physiological response (development) to temperature fluctuations provi-

ded better predictions. These results indicate that while researchers rely mostly on temperature data to explain phenological shifts, understanding the non-linear relationship between temperature and development would permit more robust predictions. Chapter II investigates the temporal changes in sensitivity of phenology to temperature (ST) using the same data as chapter one. Here, I tested the hypothesis that the phenology of species has become less sensitive to temperature over time, and that this pattern may vary geographically. There was an overall decline in ST between 1980 and 2013, but geographically this decline was observed along latitudinal but not elevational gradients. To explain this geographic pattern of ST, I tested three non-mutually exclusive hypotheses: (1) the position of the environmental temperature within the thermal performance curve determines the strength of the response of species to warming, (2) photoperiod has declined after phenological advancements and caused the decline in the thermal response of species, and (3) reduced chilling by winter warming has affected the response of species to spring temperature. I found the strongest support for hypotheses 2 (photoperiod limitation) and 3 (winter warming). These findings reveal that interactions between environmental cues may change the response of species to warming, thereby rendering long-term predictions very challenging. Chapter III focuses on the use of the thermal performance curve (TPC) for predicting larval development under laboratory and field conditions. Although the average temperature has been used extensively to assess the effect of warming, recent studies have highlighted the relevance of temperature fluctuations in shaping thermal responses. More importantly, there is missing knowledge on the usefulness of TPC in predicting development under natural conditions. I therefore combined laboratory and field experiments in five species of Sepsis flies (Diptera: Sepsidae), using distant populations from the temperate region (Europe, Africa and North America), to compare observed development data with theoretical estimates derived from TPC. The predictability of development under fluctuating temperature was better in the laboratory than in the field. Interestingly, accounting for temperatures that fall below a critical minimum improves the predictability of development such that flies not encountering cold conditions show predictable development times whereas flies encountering cold conditions tend to emerge earlier than expected. This study reveals the importance of cold temperatures in shaping thermal reaction norms, thus providing new insights to improve predictions of the responses of ectotherms to future climate change. Chapter IV provides the first description of sexual death feigning in a dragonfly species. Death feigning (playing dead) is a widespread behavior in animals, being recorded in mammals, birds, fish, reptiles, amphibians and insects. However, sexual death feigning, with one sex playing dead to avoid the opposite sex, is particularly rare. To date, the only four cases recorded include a species of spider, two species of robber flies and a species of mantis. Although death feigning has been documented in odonates, this thesis is the first record of sexual death feigning in *Aeshna juncea*. I suggest that sexual conflict has been the primary driver of the evolution of this behavior due to high levels of male harassment in this species.

Since the moorland hawkler is widespread in Europe where dragonflies have been studied extensively, it is likely that other cases of sexual death feigning remain undiscovered. Chapter V presents a commemoration of an important book in odonatology – *The Biology of Dragonflies* by Tillyard (1917) – and discusses the influence of this book on the field of odonatology, the contributions of the author to the understanding of dragonfly biology and systematics and the scientific advances over the last century. Tillyard has set the foundation for the study of the biology of dragonflies by providing the basic knowledge on their morphology, anatomy and embryology that is still in use today. I divide the history of odonatology into four major periods: Selys era, Tillyard era, Corbet era and the blossoming era (contemporary odonatology). This thesis, as well as many other studies on dragonflies, would not have seen the light of day without Tillyard's (1917) '*The Biology of Dragonflies*'; I therefore dedicate a chapter of my thesis to its 100th anniversary. The results shown in this thesis are particularly important because, unlike plants, ectotherms (cold-blooded animals) have received very little attention in the study of geographic and temporal patterns of phenology. Even though this group of animals encompasses most of the global biodiversity, its members share similar thermal adaptations (thermal performance curve). Consequently, understanding the mechanisms affecting their spatiotemporal pattern of phenology would help us predict their future response and adjust management plans accordingly." (Author)] Address: Khelifa, R., Zool. Dept, Univ. British Columbia, Vancouver, BC V6T 1Z4, Canada. E-mail: rassimkhelifa@gmail.com

**18116.** Kietzka, G.J.; Pryke, J.S.; Samways, M.J. (2017): Aerial adult dragonflies are highly sensitive to in-water conditions across an ancient landscape. *Diversity and Distributions* 23(1): 14-26. (in English) ["Aim: Adult dragonflies are renowned for being good bioindicators of anthropogenic change, but their response to the heterogeneity of undisturbed river systems has received little investigation. The Cape Floristic Region (CFR) has had a long lineage of natural selection which has honed life stages to the fine grain of the river systems. This leads to the intriguing question: How sensitive are the aerial adults to the in-water conditions? Location: Rivers of the CFR, in the Western Cape Province, South Africa, are naturally heterogeneous and complex ecosystems running across a geologically ancient landscape. The CFR is a significant centre of local endemism for many taxa, including dragonflies. Methods: We investigated dragonfly assemblages and 20 environmental variables along untransformed reaches of three CFR rivers. Results: We found that each river has its own particular 'signature' dragonfly assemblage. We also found that certain in-water parameters were the most important factors driving adult dragonfly assemblages, and not variables associated with substrate or riparian vegetation under these historic, natural conditions. This responsiveness to a heterogeneous range of in-water variables was similar from one river to the next, and also was independent of species turnover among the different dragonfly assemblages. Main conclusions: From a conservation perspective, the natural variation in certain water parameters, particularly in-water conditions, is essential for supporting

the full suite of adult dragonfly species. Challenging but important for conservation planning is that each river has its own biotic merit. Addressing this challenge also means that maintenance and restoration of historic, heterogeneous, in-water conditions in addition to the removal of alien invasive trees which are already known to be highly detrimental to this largely irreplaceable dragonfly fauna. Prioritizing which rivers to conserve can be achieved through using indices involving dragonflies." (Authors)] Address: Kietzka, Gabriella, Department of Conservation Ecology and Entomology, Stellenbosch University, Private Bag X1, Matieland 7602, South Africa. E-mail: gabikietzka@gmail.com

**18117.** Kobashi, K.; Harada, T.; Adachi, Y.; Mori, M.; Ihara, M.; Hayasaka, D. (2017): Comparative ecotoxicity of imidacloprid and dinotefuran to aquatic insects in rice mesocosms. *Ecotoxicology and Environmental Safety* 138: 122-129. (in English) ["Highlights: • Effects of imidacloprid and dinotefuran on paddy aquatic invertebrates were compared. • While applied at the same dose, residues of imidacloprid in both water and soil were higher than those of dinotefuran. • The number of species affected by imidacloprid exposures was higher than dinotefuran. • Dragonflies and chironomids are susceptible to neonicotinoids. • Mesocosms are key tools for assessing ecological risks of pesticides. Abstract: There are growing concerns about the impacts of neonicotinoid insecticides on ecosystems worldwide, and yet ecotoxicity of many of these chemicals at community or ecosystem levels have not been evaluated under realistic conditions. In this study, effects of two neonicotinoid insecticides, imidacloprid and dinotefuran, on aquatic insect assemblages were evaluated in experimental rice mesocosms. During the 5-month period of the rice-growing season, residual concentrations of imidacloprid were 5–10 times higher than those of dinotefuran in both soil and water. Imidacloprid treatment (10 kg/ha) reduced significantly the populations of, *Crocothemis servilia mariannae* and *Lyriothemis pachygastra* nymphs, whereas those of *Orthetrum albistylum speciosum* increased slightly throughout the experimental period. However, *Notonecta triguttata*, which numbers were high from the start, later declined, indicating possible delayed chronic toxicity, while *Guignotus japonicus* disappeared. In contrast, dinotefuran (10 kg/ha) did not decrease the populations of any species, but rather increased the abundance of some insects, particularly Chironominae spp. larvae and *C. servilia mariannae* nymphs, with the latter being 1.7x higher than those of controls. This was an indirect effect resulting from increased prey (e.g., chironomid larvae) and lack of competition with other dragonfly species. The susceptibilities of dragonfly nymphs to neonicotinoids, particularly imidacloprid, were consistent with those reported elsewhere. In general, imidacloprid had higher impacts on aquatic insects compared to dinotefuran." (Authors)] Address: Hayasaka, D., Graduate School of Agriculture, KINDAI University, 3327-204 Nakamachi, Nara 631-8505, Japan. E-mail: hayasaka@nara.kindai.ac.jp

**18118.** Kobayashi, T.; Ralph, T.J.; Lobb, J.; Miller, J.; Theischinger, G.; Hunter, S.J.; Jacobs, S.J. (2017): Dunphy Lake in Warrumbungle National Park, NSW: aquatic animal community after

the Wambelong fire in 2013. *Australian Zoologist* 39(3): 469-479. (in English) ["Fires are a common occurrence in Australian terrestrial ecosystems. A large fire occurred in January 2013 within and adjacent to the Warrumbungle National Park, near Coonabarabran in NSW, burning over 560 km<sup>2</sup> of the park and surrounding region (the Wambelong fire). The Wambelong fire affected Dunphy Lake, the only lake in the park. In this study, we assessed the post-fire aquatic animal community of the lake in March and September 2014. At the times of sampling the lake was largely dry and had only small isolated pools. We found 53 invertebrate taxa including the larvae of *Austrogynacantha heterogena* and one vertebrate species (larvae of the frog *Litoria rubella*) in the pool-water samples. Artificial inundation of the lake sediment samples under laboratory conditions led to the emergence of 31 taxa, totalling 62 taxa in the lake overall. Most taxa found in the lake are opportunistic and characteristic of those in still-water bodies. Dunphy Lake seems to be highly resilient in sustaining diverse aquatic animals. We highlight the importance of complementary pre- and post-fire data for improved assessments and interpretations of fire impacts to guide monitoring of post-fire recovery." (Authors)] Address: Kobayashi, T., Science Division, Office of Environment & Heritage NSW, PO Box A290 Sydney South NSW 1232, Australia. E-mail: Yoshi-Kobayashi@environment.nsw.gov.au

**18119.** Koprivnikar, J.; Urichuk, T.M.Y.; Szuroczi, D. (2017): Influences of habitat and arthropod density on parasitism in two co-occurring host taxa. *Canadian Journal of Zoology* 95(8): 589-597. (in English) ["Habitat attributes are known to influence infectious diseases such as those caused by parasites, but most studies have only considered single host and/or parasite taxa, making it difficult to assess which features may be of general importance and to predict how alterations could affect disease dynamics. We examined infection with trematode (flatworm) parasites in two commonly co-occurring host taxa, larval amphibians and larval odonates to investigate links with landscape-level features, including agricultural activity. We also assessed pond community composition with respect to the abundance and richness of aquatic arthropods known to prey upon tadpoles and/or free-swimming trematode infectious stages. Larval amphibians from agricultural sites were most likely to be parasitized but had lower infection intensities, and infected hosts were positively associated with increasing distance to the nearest forest habitat, but negatively with road distance. The opposite was observed for larval odonate infection status; however, probability and intensity of parasitism in both host taxa was negatively associated with greater predatory arthropod abundance, consistent with the "dilution effect" of biodiversity on infectious diseases. Our approach demonstrates the importance of considering multiple host taxa when studying habitat links to diseases, and future studies incorporating even greater diversity will be needed." (Authors)] Address: Koprivnikar, J., Dept of Chemistry & Biology, Ryerson Univ., 350 Victoria Street, Toronto, ON M5B 2K3, Canada. E-mail: jkoprivn@ryerson.ca

**18120.** Koroiva, R.; Pepinelli, M.; Rodrigues, M.E.; Roque,



F.; Lorenz-Lemke, A.P.; Kvist, S. (2017): DNA barcoding of odonates from the Upper Plata basin: Database creation and genetic diversity estimation. *PLoS ONE* 12(8): e0182283.: 14 pp. (in English) ["We present a DNA barcoding study of Neotropical odonates from the Upper Plata basin, Brazil. A total of 38 species were collected in a transition region of "Cerrado" and Atlantic Forest, both regarded as biological hotspots, and 130 cytochrome c oxidase subunit I (COI) barcodes were generated for the collected specimens. The distinct gap between intraspecific (0–2%) and interspecific variation (15% and above) in COI, and resulting separation of Barcode Index Numbers (BIN), allowed for successful identification of specimens in 94% of cases. The 6% fail rate was due to a shared BIN between two separate nominal species. DNA barcoding, based on COI, thus seems to be a reliable and efficient tool for identifying Neotropical odonate specimens down to the species level. These results underscore the utility of DNA barcoding to aid specimen identification in diverse biological hotspots, areas that require urgent action regarding taxonomic surveys and biodiversity conservation." (Authors)] Address: Koroiva, R., Ecology & Conservation Graduate Program, Universidade Federal de Mato Grosso do Sul, Campo Grande, Mato Grosso do Sul, Brazil. E-mail: ricardo.koroiva@gmail.com

**18121.** Koroiva, R.; Rodrigues, M.E.; Valente-Neto, F.; Roque, F. (2017): Odonates from Bodoquena Plateau: checklist and information about endangered species. *Biota Neotropica* 17(3), e20160310: 8 pp. (in English, with Portuguese summary) ["Here we provide an updated checklist of the odonates from Bodoquena Plateau, Mato Grosso do Sul state, Brazil. We registered 111 species from the region. The families with the highest number of species were Libellulidae (50 species), Coenagrionidae (43 species) and Gomphidae (12 species). 35 species are registered in the IUCN Red List species, four being Data Deficient, 29 of Least Concern and two species being in the threatened category. *Phyllogomphoides suspectus* Belle, 1994 (Odonata: Gomphidae) was registered for the first time in the state." (Authors)] Address: Koroiva, R., Universidade Federal do Mato Grosso do Sul, Instituto de Bociências, Cidade Universitária, 79070-900, Campo Grande, MS, Brazil

**18122.** Kosterin, O.E.; Chartier, G. (2017): Update of 2014 and 2016 to Odonata found at the marshy coast of SW Cambodia including three species added for the country. *International Dragonfly Fund - Report 101*: 1-26. (in English) ["The Odonata fauna of flat marshy areas of the Gulf of Siam coast in Koh Kong Province of Cambodia, containing 55 species, is considered. The published data of 2010- 2013 and new data of 2014 and 2016 on the surroundings of Koh Kong town are compiled and the first data on the area of large swampy Melaleuca forests at Andoung Tuek village are presented as well as some occasional photographic records. *Gynacantha bayadera*, *Lyriothemis mortoni* and *Pomothemis serrata* were for the first time recorded for Cambodia. *Mortonagrion falcatum* was found unexpectedly abundant at Andoung Tuek." (Authors)] Address: Kosterin, O.E., Institute of Cytology & Genetics SB RAS, Acad. Lavrentyev Ave.

10, Novosibirsk, 630090, Russia; Novosibirsk State University, 2 Pirogova St, Novosibirsk, 630090, Russia. E-mail: kosterin@bionet.nsc.ru

**18123.** Kumara, H.I.G.C.; Samarawikrama, V.A.M.P.K. (2017): Diversity of dragonfly species in the Hakkinda Islands of Mahaweli River in the Gatabe area. Project Report. A Research Grant in the Faculty of Humanities and Social Sciences University of Ruhuna: 19 pp. (in English) ["Hakkinda Islands surrounded by the Mahaweli River, close to the Kandy-Gatambe area is a bio-geographical hotspot in Sri Lanka, however, bio-geographical importance of these islands has been overlooked during the last few decades as a result of development projects and varied human activities. Considering that, the President of Sri Lanka has made an order declaring the Waratenna-Hakkinda area as a protected environmental area. According to the rudimentary survey, this protected area can be identified a special habitat to dragonfly species... Since the knowledge about diversity of dragonfly species is limited, this research's main objective is to bridge that gap in prevalent knowledge. This research is guided by Quantitative-Deductive research methodology. Under this methodology, line transects and quadrat sampling methods have been used in primary data collection process. According to research findings, a total of 16 dragonfly species from 8 families are identified and both riverine forest and river islands have rich diversity compared with home gardens in the area. Among the available species, 37.5% are identified to be endemic to the country. *Neurobasis chinensis*, *Vestalis apicalis* and *Libellago finalis* are identified to be vulnerable species. This research concludes that even if there are a high diversity of dragonfly species in the river islands and riverine forest areas, human activities and their irresponsible behaviour have directly / indirectly negatively influenced on dragonfly habitats and their breeding colonies. The research, thus, identifies an immediate requirement for a mechanism and regulations to protect a biologically important breeding colony of dragonfly species and their habitats to protect their diversity." (Authors)] Address: Kumara, H.I.G.C., Department of Geography, Faculty of Humanities & Social Sciences. University of Ruhuna

**18124.** Lambret, P.; Boudot, J.-P.; Chelmick, D.; De Knijf, G.; Durand, E.; Judas, J.; Stoquet, A. (2017): Odonata surveys 2010–2016 in the United Arab Emirates and the Sultanate of Oman, with emphasis on some regional heritage species. *Odonatologica* 46(3/4): 153-205. (in English) [oas 55: "Six field trips were carried out in the United Arab Emirates (UAE) and the Sultanate of Oman in autumn 2010, late winter 2013, spring 2014, autumn 2014, spring 2015 and spring 2016. We recorded 37 species at 87 localities, including new localities for some species of regional interest. Information on all observed Odonata species was recorded including their life stage, behaviour, habitat and water characteristics. Exuviae were also systematically collected. *Urothemis thomasi* was discovered at several new sites in the Hajar Mountains, the Dhofar and the Al Wusta regions, filling in the gap between the Dhofar and the Muscat area. In addition, new localities for two Arabian endemics:

*Arabicnemis caerulea* and *Arabineura khalidi* were found, with their occurrence in the Dhofar region extending their known area and demonstrating that *A. khalidi* cannot be regarded as a strict Hajar endemic. Important differences were noticed in the species composition of formerly surveyed localities, which may be ascribed to habitat degradation through management directed towards human recreation. Lastly, the well-known and diverse zoogeographical influences of Omani and the Emirati odonatofauna are confirmed with a large set of species of African origin in the Dhofar and a smaller set of species of Indomalayan origin visiting both the Dhofar and the northeast of the region during migrations and establishing, at least temporary, reproductive localities." (Authors)] Address: Lambret, P., Tour du Valat, Research Institute for the Conservation of Mediterranean Wetlands, Le Sambuc, 13200 Arles, France. [lambret@tourduvalat.org](mailto:lambret@tourduvalat.org)

**18125.** Lambret, P.; Hilaire, S.; Stoks, R. (2017): Egg hatching phenology and success of *Lestes macrostigma* in two temporary brackish ponds. *International Journal of Odonatology* 20(1): 1-12. (in English) ["Although a full life cycle approach is optimally needed to make conservation decisions, the egg stage is often neglected for insect species of special conservation interest. Water management and related abiotic factors are relevant factors to consider in aquatic species. *Lestes macrostigma* is a threatened damselfly restricted to temporary brackish waters. Here we provide detailed information on its hatching success and phenology in two natural field populations. Shoots containing fresh egg clutches of *L. macrostigma* were sampled in late June, just after the oviposition period. In the fall, shoots were separately placed in plastic boxes in two ponds in southern France. Examination of eggs indicated *L. macrostigma* overwinters at an early embryonic stage. The following spring we monitored hatching in detail. Hatching began on 15 March in both ponds and ended on 27 April. Hatching was synchronized, with half of the eggs hatching within five days in the first pond and 14 days in the second pond. Lower water temperatures decreased hatching success and likely also delayed hatching. Embedment of shoots in ice increased egg mortality. Based on our data, wildlife managers are encouraged to maintain water levels high during winter to reduce the risk of freezing of *L. macrostigma* eggs." (Authors)] Address: Lambret, P., Tour du Valat, Research Institute for the Conservation of Mediterranean Wetlands, Le Sambuc, 13200 Arles, France. E-mail: [lambret@tourduvalat.org](mailto:lambret@tourduvalat.org)

**18126.** Lamelas-López, L.; Florencio, M.; Borges, P.A.V.; Cordero-Rivera, A. (2017): Larval development and growth ratios of Odonata of the Azores. *Limnology* 18(1): 71-83. (in English) ["To fully understand odonate life cycles, it is vital to analyse the patterns of larval growth, which are tightly associated with variations in environmental factors. However, the identification of larval instars is often difficult, especially for early development stages. We hypothesise that pond hydroperiod influences odonate larval growth, and test this idea with novel information about the environmental characteristics of 12 study ponds in Terceira Island (Azores). This study, which represents the first analysis of larval

development of Odonata in the Azores, involved determining the instars of development and growth ratios. We measured the morphological characteristics of 898 Odonata larvae, and found that they significantly differed between temporary and permanent ponds. To estimate the larval instars, we used two methods: frequency distribution methods and correlation diagrams between body characteristics. The first method was the most effective, allowing the estimation of 17 instars for *Anax imperator*, 13 for *Sympetrum fonscolombii* and 10 for *Ischnura hastata*, as well as growth ratios between instars for head width, total length, abdomen length, wings and antenna length. Our results also suggest that a combination of the two methods is the most appropriate strategy for estimating the number of instars and growth ratios during larval development." (Author)] Address: Lamelas-López, L., CE3C, Centre for Ecology, Evolution & Environmental Changes/Azorean Biodiversity Group & Universidade dos Açores - Depto de Ciências e Engenharia do Ambiente, Rua Capitão João d'Ávila s/n, 9700-042 Angra do Heroísmo, Açores, Portugal. E-mail: [lucaslamelaslopez@gmail.com](mailto:lucaslamelaslopez@gmail.com)

**18127.** Lancaster, L.T.; Dudaniec, R.Y.; Hansson, B.; Svensson, E.I. (2017): Do group dynamics affect colour morph clines during a range shift? *Journal of Evolutionary Biology* 30(4): 728-737. (in English) ["Species exhibiting colour-polymorphism are thought to have an ecological advantage at the landscape scale, because spatial segregation of alternatively-adapted ecotypes into diverse habitats can increase the total species' niche breadth and thus confer greater geographic range size. However, morph frequencies are also influenced by intra-populational processes such as frequency- or density-dependent social interactions. To identify how social feedback may affect clinal variation in morph frequencies, we investigated reciprocal interactions between morph-specific thermal tolerance, local climatic conditions, and social environments, in the context of a colour-morph frequency cline associated with a recent range expansion in *Ischnura elegans* in Sweden. Cold tolerances of gynochromes (female-like female morph) were positively correlated with local gynochrome frequencies, suggesting a positive frequency-dependent fitness benefit of being common. In contrast, androchrome (male-mimic female morph) cold tolerances were improved following recent exposure to cold weather, suggesting a beneficial environmental acclimation effect. Thus according to an environment-matching hypothesis for clinal variation, androchrome frequencies should therefore increase towards the (cooler) range limit. In contrast to this prediction, gynochrome frequencies increased at the expanding range limit, consistent with a positive frequency-dependent social feedback when invading novel climates. Our results suggest that when phenotypes or fitnesses are affected by interactions with conspecifics, beneficial social effects on environmental tolerances may i) facilitate range shifts and ii) reverse or counteract typical patterns of intraspecific interactions and environment-matching clines observed in stable populations observed over broader geographic scales." (Authors)] Address: Lancaster, Lesley, Univ. of Aberdeen, Zoology Building, Tillydrone Ave., Aberdeen AB24 2TZ, UK. E-mail: [lesleylancaster@abdn.ac.uk](mailto:lesleylancaster@abdn.ac.uk)

**18128.** Lancaster, L.T.; Morrison, G.; Fitt, R.N. (2017): Life history trade-offs, the intensity of competition, and coexistence in novel and evolving communities under climate change. *Phil. Trans. R. Soc. B* 372: 20160046: 10 pp. (in English) ["The consequences of climate change for local biodiversity are little understood in process or mechanism, but these changes are likely to reflect both changing regional species pools and changing competitive interactions. Previous empirical work largely supports the idea that competition will intensify under climate change, promoting competitive exclusions and local extinctions, while theory and conceptual work indicate that relaxed competition may in fact buffer communities from biodiversity losses that are typically witnessed at broader spatial scales. In this review, we apply life history theory to understand the conditions under which these alternative scenarios may play out in the context of a range-shifting biota undergoing rapid evolutionary and environmental change, and at both leading- edge and trailing-edge communities. We conclude that, in general, warming temperatures are likely to reduce life history variation among competitors, intensifying competition in both established and novel communities. However, longer growing seasons, severe environmental stress and increased climatic variability associated with climate change may buffer these communities against intensified competition. The role of life history plasticity and evolution has been previously underappreciated in community ecology, but may hold the key to understanding changing species interactions and local biodiversity under changing climates. This article is part of the themed issue 'Human influences on evolution, and the ecological and societal consequences'." The paper includes many references to Odonata. (Authors)] Address: Lancaster, Lesley, Institute of Biological & Environmental Sciences, University of Aberdeen, Aberdeen AB24 2TZ, UK

**18129.** Le Gall, M.; Chaput-Bardy, A.; Husté, A. (2017): Context-dependent local movements of the blue-tailed damselfly, *Ischnura elegans*: effects of pond characteristics and the landscape matrix. *Journal of Insect Conservation* 21(2): 243-256. (in English) ["The loss of ponds and the fragmentation of their surrounding landscape negatively impacts the biodiversity of wetlands, such as damselflies. They are short-distance dispersers and can be influenced by the quality of suitable habitats and the landscape matrix. The aim of this study was to test the effect of the environmental context (i.e. pond characteristics and the surrounding landscape) on movements and survival probability in a damselfly species, *Ischnura elegans*. Three approaches (i.e. capture-mark-recapture, individual tracking and translocation studies) were performed in Northwestern France. The characteristics of ponds did not influence damselfly survival. However, the landscape context affected movements within ponds, and between ponds. Individuals from open-field ponds moved over longer distances than individuals from urban ponds. Moreover, in cases of disturbances, such as a pond drying up, movements from one pond to another were observed only in the open-field context. The ecological quality of the pond did not appear to affect survival of individuals, probably because *I. elegans* has a high tolerance to changes in ecological factors. However, higher local movements depend on the degree of openness of the

landscape. Landscape context is hence a key issue in damselfly conservation planning and in maintaining ecological continuities, such as along greenways and blueways, and specifically the degree of landscape openness during pond creation." (Authors)] Address: Husté, Aurelié, Normandie University, UNIROUEN, IRSTEA, ECODIV, 76000 Rouen, France. E-mail: aurelie.huste@univ.rouen.fr

**18130.** Leandro, C.; Jay-Robert, P.; Vergnes, A. (2017): Bias and perspectives in insect conservation: A European scale analysis. *Biological Conservation* 215: 213-224. (in English) ["Insects are among the most diverse and abundant organisms on Earth, and they play a major role in ecosystem functioning. To protect them from decline, some conservation measures have been put in place, based primarily on threatened species lists. This is the case in Europe, where 123 of the 105,000 known European insect species are currently protected. Yet how were these few species selected? Are those species representative of the European entomofauna? Is it possible for a conservation policy based on the protection of only 0.12% of described species to be effective? In this study, we aimed to measure bias in the selection of species for conservation by comparing protected and unprotected species in Europe. To this end, we considered 15 characteristics divided into five main categories: 'Taxonomy', 'Morphology', 'Diet', 'Knowledge' and 'Distribution'. We investigated bias in species selection and found that protected species were significantly larger, better known, more widespread and more multicoloured than a randomly selected set of unprotected species. Moreover, butterflies, dragonflies and grasshoppers were overrepresented, as were nectarivorous and saproxylophagous species. In contrast, Hymenoptera and Diptera, together representing >40% of European entomofauna, do not appear on the current list of protected species. To address this bias, we propose recommendations to improve the protection of insects at the European scale, including making lists more 'dynamic', introducing new criteria, and a paradigm shift towards conserving assemblages and ecological function. Existing technical and societal means could be used to achieve an integrative conservation approach for insects." (Authors)] Address: Leandro, Camilla, Univ. Paul Valéry Montpellier 3, Univ Montpellier, EPHE, CNRS, IRD, CEFE UMR 5175, F-34000, Montpellier, France. E-mail: camilla.leandro@cefe.cnrs.fr

**18131.** Lencioni, F.A.A. (2017): *Leptagrion lencionineto* sp. nov. from the Serra da Mantiqueira of south-eastern Brazil (Odonata: Coenagrionidae). *Odonatologica* 46(3/4): 255-264. (in English) ["*Leptagrion lencionineto* sp. nov. is described from two males, the holotype and a paratype, collected in Brazil: São Paulo, Campos do Jordão, Condomínio Paradise, alt. 1 796m a.s.l., 16-x-2005, F. Lencioni Neto leg., both deposited in the author's collection. The new species differs from all congeners by the elevated and bifurcated hind lobe of prothorax." (Authors)] Address: Lencioni, F.A.A., Rua Aníbal, 216 – Jardim Coleginho – BR-12310-780, Jacareí, S.P., Brazil. E-mail: odonata@zygoptera.bio.br

**18132.** Lesch, V.; Bouwman, H.; Kinoshita, A.; Shibata, Y. (2017): First report of perfluoroalkyl substances in South African Odonata. *Chemosphere* 175: 153-160. (in English) ["Highlights: • Dragonfly samples collected in South Africa analysed at NIES for PFASs. • PFOS was quantifiable in all individuals. • Quantifiable concentrations differ between southern and northern sites. • Agricultural areas in the northern sites had low concentrations. • Industrial areas in the southern sites had significantly higher concentrations. Abstract: Perfluorinated substances are global and ubiquitous pollutants. However, very little is known about these substances in invertebrates, and even less in terrestrial invertebrates in particular. We analysed adult male dragonflies from six sites in South Africa for perfluoroalkyl substances (PFASs), including perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluorononanoic acid (PFNA), perfluorodecanoic acid (PFDA), perfluoro-*n*-undecanoic acid (PFUnA), perfluoro-*n*-dodecanoic acid (PFDoA), perfluorohexanoic acid (PFHxA), and perfluorohexane sulfonic acid (PFHxS). PFOS was detected in all individuals, with less quantifiable occurrences of the other substances. The dragonflies from the three northern sites located in farming areas had significantly lower SPFAAs concentrations than the southern sites located closer to industrial areas (median SPFAAs of 0.32 ng/g wm (wet mass) for North, and 9.3 ng/g wm for South). All substances except PFOS occurred at similar concentrations at all six sites when quantifiable, but PFOS dominated in the Southern sites. The highest median concentration was from Bloemhof Dam (SPFAAs = 21 ng/g wm), which is known to be polluted by PFOS. Perfluorinated substances are not known to be manufactured in South Africa, therefore the residues detected are likely to have been derived from imported products. Odonata play a significant role in freshwater ecology. Any impacts on these aquatic and aerial predators are likely to have effects on aquatic and associated ecosystems. Further studies are required over a much larger geographic region and to investigate sources." (Authors)] Address: Lesch, Velesia, Research Unit for Environmental Sciences and Management, North-West University, Potchefstroom, South Africa. E-mail: velesialesch1@gmail.com

**18133.** López, J. A. (2017): Diversidad de libélulas (Insecta: Odonata) en los humedales de montaña de San Cristóbal de Las Casas, Chiapas, México. Tesis, Instituto de Ciencias Biológicas, Universidad de Ciencias y Artes de Chiapas: IV, 91 pp. (in Spanish) ["The aim of this study was to assess the diversity of the order Odonata (Insecta) in the mountain wetlands of San Cristóbal de Las Casas. Four sampling sites were chosen according to their accessibility and permissibility, corresponding to three lentic and one lotic environment. All sites were characterised and a Wetland Conservation Status Index (WCSI) was constructed. Systematic monthly sampling was carried out at each site during the period July 2014-June 2015. A one-kilometre transect close to the water bodies was walked and the sampling effort consisted of six hours of collecting adult odonates with an aerial entomological net/person. The type of sampling was with and without replacement. As a result, 14 odonate species were obtained, distributed in five families and 10 genera. *Ichnura*

*denticollis* and *Enallagma rua* were the most dominant species. The quality of the sampling was reliable and representative. Although the Kruskal-Wallis analysis of variance did not determine significant differences between odonate richness, Las Cañadas obtained the highest number of species due to its high heterogeneity of microhabitats as a lotic environment. On the other hand, the ANOVA test did elucidate significant differences between the abundance of odonates in the different sampling sites, largely due to the anthropogenic impact on aquatic macrophytes in Las Cañadas and Cinco de Marzo, which in turn allowed these wetlands to be the most diverse, unlike María Eugenia and La Kisst, which maintain a better state of conservation of this type of vegetation. These results are in line with the intermediate disturbance hypothesis, and therefore, Hutcheson's paired analysis determined significant differences between the diversity of most of the wetlands. On the other hand, nested assemblages were found in all wetlands, which could indicate local colonisation and extinction of species. Likewise, Jaccard's coefficient estimated the highest species similarity among the lentic wetlands, while the highest complementarity was between Las Cañadas and La Kisst. Because of these characteristics, the similarity dendrogram separated the odonatofauna by type of environment (lentic-lotic) and by the conservation status found in the wetlands. Finally, the frequency of occurrence of odonates in relation to mean monthly temperature and precipitation determined a clear difference between the seasonality and voltinism of the different odonate species in San Cristóbal." (Author) Translated with [www.DeepL.com/Translator](http://www.DeepL.com/Translator) (free version)] Address: not stated

**18134.** Lu, Y.-H.; Jin, L.-P.; Kong, L.-C.; Zhang, Y.-L. (2017): Phytotoxic, antifungal and immunosuppressive metabolites from *Aspergillus terreus* QT122 isolated from the gut of dragonfly. *Current Microbiology* 74(1): 84-89. (in English) ["Insect gut microbes have been considered as a resource for bioactive metabolites. The aim of this study was to characterize the compounds of a fungus *Aspergillus terreus* QT122 associated with the gut of dragonfly. Five main phytotoxic, antifungal, and immunosuppressive substances were isolated from the fungus QT122. The structures of such compounds were identified as emodin (1), 1-methyl emodin (2), terrein (3), methyl 6-acetyl-4-methoxy-7,8-dihydroxynaphthalene-2-carboxylate (4), and dihydrogeodin (5) on the basis of spectroscopic analysis and by comparison of the corresponding data to those reported in the literature previously. The compound 3 exhibited the best phytotoxic activity against the radicle growth of *A. retroflexus* L. and *E. crusgalli* L. with their IC<sub>50</sub> values of 11.2 and 3.1 µg/mL, which were comparable to that of the positive control of 2,4-dichlorophenoxyacetic acid (2,4-D) with the IC<sub>50</sub> values of 8.1 and 1.6 µg/mL, respectively. The compounds 2-3 showed potent antifungal activity in the growth of *Alternaria solani* with the IC<sub>50</sub> value of less than 0.1 µg/mL and the compound 2 also had great inhibitory effect against the growth of *Fusarium oxysporum* f. sp. *cucumerinum* (IC<sub>50</sub> < 0.1 µg/mL), which was comparable to that of referenced cycloheximide with IC<sub>50</sub> value of below 0.1 µg/mL. The compounds 3-5 exhibited strong immunosuppressive activities against the T cell viability with the inhibition rates

of more than 99%, which were comparable to positive cyclosporin A under the concentration of 20 µM. These results suggest that the compounds 2–5 have the potential to be used as bio-control agents in agriculture or immunosuppressive agents." (Authors)] Address: Zhang, Y.-L., College of Chemistry and Life Sciences, Zhejiang Normal University, Jinhua, People's Republic of China. E-mail: ylzhang@zjnu.cn

**18135.** Luke, S.H.; Dow, R.A.; Butler, S.; Khen, C.V.; Aldridge, D.C.; Foster, W.A., Turner, E.C. (2017): The impacts of habitat disturbance on adult and larval dragonflies (Odonata) in rainforest streams in Sabah, Malaysian Borneo. *Freshwater Biology* 62: 491-506. (in English) ["1. Dragonfly assemblages ... in Southeast Asian rainforests are extremely diverse but increasingly threatened by habitat disturbance, including logging and conversion of forest to oil palm plantations. 2. Land-use change can affect dragonfly larval stages by altering within-stream environmental conditions, and adults by loss of perches, shade and hunting habitat. However, the extent to which dragonflies are affected by land-use change is not well known, and strategies for conservation are poorly developed. 3. We surveyed dragonfly adults and larvae, forest quality and stream environmental conditions across 16 streams in Sabah, Malaysia. Habitat surrounding the streams included pristine forest, selectively logged forest, oil palm with forested riparian buffer strips and oil palm without buffers. 4. Overall abundance and species richness of adult dragonflies stayed constant with habitat disturbance, but larval abundance and richness decreased with higher habitat disturbance, and larvae were largely absent from oil palm streams. There was also a clear shift in community composition of both adult and larval dragonflies. Anisoptera adults were more species rich and abundant, but Zygoptera adults were less species rich in more disturbed sites. 5. The presence of riparian buffers in oil palm plantations offered some protection for forest-associated dragonfly species, and streams with wider riparian buffers supported adult assemblages more similar to those found in logged forest. However, oil palm streams with riparian buffers still contained a depauperate larval assemblage compared to logged forest areas, and dragonfly assemblages in narrow riparian buffer streams were similar to those found in streams surrounded by continuous oil palm. 6. Our results provide clear evidence of the effect of land-use change on dragonflies. Conservation efforts to conserve forest communities should target the preservation of existing forest areas, but management within oil palm plantation landscapes to preserve riparian buffers can still have a marked beneficial effect on dragonfly communities." (Authors)] Address: Luke, Sarah, Department of Zoology, University of Cambridge, Cambridge, U.K.

**18136.** Macadam, C.R.; Stockan, J.A. (2017): The diversity of aquatic insects used as human food. *Journal of Insects as Food and Feed* 3(3): 1-8. (in English) ["This paper assesses the diversity of aquatic insects and insects with aquatic larvae used as human food. Over 250 species have been used as food in 48 countries around the world. Coleoptera comprises the largest number of species utilised, followed by Odonata and Hemiptera. All life stages are eaten but primarily

larvae and adults. Currently, economic valuation is largely limited to Southeast Asia, although there is considerable potential to expand this. A few species including *Lethocerus indicus* (Lepeletier and Serville, 1825) have been negatively impacted due to exploitation as a food item coupled with other environmental pressures." (Authors)] Address: Macadam, C. R., Buglife – The Invertebrate Conservation Trust, Balallan House, 24 Allan Park, Stirling FK8 2QG, UK. E-mail: craig.macadam@buglife.org.uk

**18137.** Machado, A.B.M. (2017): *Hetaerina dutati* sp. nov. from Brazil with notes on *H. amazonica* Sjöstedt, 1918 (Odonata: Calopterygidae). *Odonatologica* 46(3/4): 265-273. (in English) ["*Hetaerina dutati* sp. nov. is described and illustrated based on specimens collected in forest streams in the state of Para in Brazil. The new species is close to *Hetaerina amazonica* Sjöstedt, 1918 differing from it mainly by the structure of male appendages and female epiproct. Some notes are made on topotypes of *H. amazonica*." (Author)] Address: Machado, A.B.M., Depto Zool., Univ. Federal de Minas Gerais, Caixa Postal 486, 31270-901 – Belo Horizonte, Minas Gerais, Brazil. E-mail: angelo@icb.ufmg.br

**18138.** Mahmood, T.; Adil, A. (2017): Diet composition of small Indian mongoose (*Herpestes javanicus*) varies seasonally in its native range. *Animal Biology* 67(1): 69-80. (in English) ["Feeding habits of mammals are very important to investigate in any ecosystem and are a central topic in ecology and population biology. The current study aimed at investigating diet composition of *H. javanicus* in an agro-ecosystem of Sialkot District using a faecal analysis method. Results revealed a diverse diet of the species, comprising both animal and plant matter. Animals were consumed more heavily (58%) than plants (8%). The predominant prey species were insects, while rodents, birds, seeds and plant leaves comprised a smaller portion of the diet. The insects prey species belonged to five different orders: Odonata, Orthoptera, Coleoptera (ground beetles), Dermaptera and Hymenoptera (family Formicidae; ants). The consumption of insects was higher during the summer season. Mammalian prey included five different rodent species: *Bendicota bengalensis* (lesser bandicoot rat), *Nesokia indica* (short-tailed mole rat), *Suncus murinus* (Asian musk shrew), *Tatera indica* (Indian gerbil) and *Mus musculus* (house mouse). Prey species richness was higher in the summer as was the diversity index, while the evenness index showed slightly higher values in spring and autumn compared to summer and winter. We conclude that small mammals are important prey species of the mongoose while insects are eaten regularly and in reasonably large numbers in its native range." (Authors)] Address: Mahmood, T., Dept of Wildlife Management, PMAS-Arid Agriculture University, Rawalpindi 46300, Pakistan. E-mail: tariqjanjua75@uuar.edu.pk

**18139.** Makepeace, H.S.; Lewis, J.H.; Sabine, D.L.; McAlpine, D.F.; Brunelle, P.M. (2017): First occurrences of the *Celithemis eponina* (Halloween Pennant) in Maritime Canada (Odonata: Libellulidae) and *Ischnura hastata* (Citrine Forktail) (Odonata: Coenagrionidae) in New Brunswick. *J.*

Acad. Entomol. Soc. 13: 46-48. (in English) ["During the late evening of 21 August 2013, HSM captured an adult female *C. eponina* at Tennants Cove, Kings County, New Brunswick (45.5857° -65.9864°). This specimen is now deposited in the insect collection of the New Brunswick Museum (NBM 52802). The capture site was an old field dominated by Poaceae, Cyperaceae, and Solidago spp. (Asteraceae) adjacent to a marshy inlet in the Saint John River. Single *C. eponina* were subsequently also observed, but not captured, on the 13 August 2016 by HSM at Fidele Lake, Charlotte County, New Brunswick (45.2117° -66.6309°) and on 19 August 2016 by HSM and DLS at Woodard Lake, Charlotte County, 8.5 km southwest (45.1483° -66.6930°. On 16 September 2015, JHL encountered a single adult male of *Ischnura hastata* on roadside vegetation at Black Beach, Saint John County, New Brunswick (45.1445° -66.2365°). The specimen was captured and is now deposited in the New Brunswick Museum insect collection (NBM 47709). The site is typical Maritime coastal old-field habitat, dominated by *Symphotrichum* spp. (Asteraceae) and *Solidago* spp., and is adjacent to the Bay of Fundy." (Authors)] Address: McAlpine, D.F., NB Museum, 277 Douglas Avenue, Saint John, NB, Canada, E2K 1E5. E-mail: Donald.McAlpine@nbm-mnb.ca

**18140.** Manenti, R.; Zanetti, N.; Pennati, R.; Scari, G. (2017): Factors driving semi-aquatic predator occurrence in traditional cattle drinking. *J. Limnol.* 76(1): 34-40. (in English) ["In several cases, human impact on water bodies and on their freshwater communities is detrimental, but in some cases the human activity may favour and enhance the biodiversity of small water bodies, as traditional cattle drinking pools. Despite their small size, small water bodies may constitute hot spot of biodiversity often representing the only lentic aquatic biotope in landscapes where superficial water lacks or flows in lotic environments like creeks and streams. Predators are good indicators of biodiversity in ponds and give information of food chain web complexity. In particular, semi-aquatic predators like amphibians and dragonflies may account for a substantial percentage of energy flow between aquatic and terrestrial ecosystems. In this study, we evaluated the conservation value of traditional cattle drinking pools building by assessing the factors determining the occurrence and distribution of the semiaquatic predators. From April to August 2015, we investigated 30 distinct pools recording several abiotic and biotic environmental variables. We detected 4 semi-aquatic predators: *Salamandra salamandra* larvae, *Triturus carnifex*, *Aeshna* sp. larvae and *Libellula* sp. larvae. Abiotic features played a major role in shaping the predator community that resulted linked to stable, with no dryness period, and large drinking pools. Invertebrate prey biomass was not particularly important, while vegetation cover and occurrence of unpalatable tadpoles were the most important biotic features of the pools. Our study provides novel evidence on the importance of cattle drinking pools management to preserve biodiversity especially in areas where traditional pastoral activity is disappearing." (Authors)] Address: Manenti, R., Dipartimento di Bioscienze, Università degli Studi di Milano, Via Celoria 26, 20133 Milano, Italy. E-mail: raulmanenti@gmail.com

**18141.** Manger, R.; Moorlag, H.A. (2017): An emerging Blue hawker (*Aeshna cyanea*) at the end of October in the Netherlands. *Brachytron* 19(2): 114-116. (in Dutch, with English summary) ["On the 24th of October 2017, a male *A. cyanea* emerged at a garden pond in Hoogeveen and flew away two days later. For the time being, this is the latest observation of an emerged *A. cyanea* in the Netherlands. The place of emergence was near a rather shallow garden pond in a sheltered garden. The year 2017 was one of the warmest years in the Netherlands since meteorological data were first recorded. It is suspected that the dragonfly had a one-year larval development, and therefore could emerge so late in the season." (Authors)] Address: Manger, R., Stoepveldsingel 55, 9403 SM Assen. The Netherlands. E-mail: rene@mangereco.nl

**18142.** Marques, T.S.; Brito, E.S.; Lara, N.R.F.; Beloto, L.M.; Valadao, R.M.; de Camargo, P.B.; Verdade, L.M. (2017): The trophic niche of *Mesoclemmys vanderhaegei* (Testudines: Chelidae): evidence from stable isotopes. *Zoologia* 34: e19985: 6 pp. (in English) ["Ecological niche is the multidimensional space comprising the resources used by an organism. Intraspecific variation in resource exploitation is common in reptile populations to maximize coexistence of individuals. The use of stable isotope analysis is an effective tool when there are variations in resource exploitation, since it can provide quantitative information about food consumption and habitat use. *M. vanderhaegei* (Bour, 1973) is a medium-sized turtle with a limited distribution in south central Brazil and Paraguay. In spite of that, little is known about its ecology. In this study we used stable isotope analysis to understand the intraspecific trophic niche variation in *M. vanderhaegei* at Serra das Araras Ecological Station, state of Mato Grosso, Brazil. The isotopic ratios of  $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$  were determined in claw samples collected from 14 males and 14 females. Isotopic niche width values were not statistically different between the sexes, there was a high degree of overlap between sexual niches and there were no relationships between isotopic compositions and body size. These results suggest that individuals of both sexes and throughout their ontogenetic development exploit food resources with the same isotopic baseline." The paper includes a reference to Odonata. (Authors)] Address: Marques, T.S., Nucleo de Estudos Ambientais, Univ. de Sorocaba. Rodovia Raposo Tavares km 92,5, 18023-000 Sorocaba, SP, Brazil. E-mail: thiagomq@yahoo.com.br

**18143.** Martin, J.M.; Saaristo, M.; Bertram, M.G.; Lewis, P.J.; Coggan, T.L.; Bradley O. Clarke, B.O.; Wong, B.B.M. (2017): The psychoactive pollutant fluoxetine compromises antipredator behaviour in fish. *Environmental Pollution* 222: 592-599. (in English) ["Highlights: •Mosquitofish (*G. holbrooki*) exposed to fluoxetine (FLX) at two realistic levels. •FLX at the lower level increased activity in the presence or absence of a predator. •FLX at both levels reduced latency to enter predator strike zone. •FLX caused sex-dependent reduction in 'freezing' after a simulated predator strike. •Exposure to FLX can have detrimental sub-lethal impacts on antipredator behaviour. Abstract: Pharmaceuticals are increasingly being detected in aquatic ecosystems worldwide. Particularly concerning are pharmaceutical pollutants

that can adversely impact exposed wildlife, even at extremely low concentrations. One such contaminant is the widely prescribed antidepressant fluoxetine, which can disrupt neurotransmission and behavioural pathways in wildlife. Despite this, relatively limited research has addressed the behavioural impacts of fluoxetine at ecologically realistic exposure concentrations. Here, we show that 28-day fluoxetine exposure at two ecologically relevant dosages—one representing low surface water concentrations and another representing high effluent flow concentrations—alters antipredator behaviour in Eastern mosquitofish (*Gambusia holbrooki*). We found that fluoxetine exposure at the lower dosage resulted in increased activity levels irrespective of the presence or absence of a predatory dragonfly nymph (*Hemianax papuensis*). Additionally, irrespective of exposure concentration, fluoxetine-exposed fish entered the predator 'strike zone' more rapidly. In a separate experiment, fluoxetine exposure reduced mosquitofish freezing behaviour—a common antipredator strategy—following a simulated predator strike, although, in females, this reduction in behaviour was seen only at the lower dosage. Together, our findings suggest that fluoxetine can cause both non-monotonic and sex-dependent shifts in behaviour. Further, they demonstrate that exposure to fluoxetine at environmentally realistic concentrations can alter antipredator behaviour, with important repercussions for organismal fitness." (Authors)] Address: Martin, J.M., School of Biological Sciences, Monash University, Victoria, Australia. E-mail: jake.martin@monash.edu

**18144.** Martínez-López, J.I.; Villeda-Callejas, M.; Barrera-Escorcia, H.; Domínguez-Rocha, G.; Lara-Vázquez, J.A.; Guedea-Fernández, G.E.D. (2017): Histologic description of the compound eyes of *Orthemis ferruginea* (Fabricius) (Anisoptera: Libellulidae) and *Enallagma civile* (Hagen) (Zygoptera: Coenagrionidae). *Entomología mexicana* 4: 726-731. (in Spanish, with English summary) ["Odonates are large airborne predators, this ability is directly related to the size of their photoreceptors. The main objectives of this work were to describe the structure of the compound eyes in adult odonates and the selection of staining techniques and better exposure times to the dye. Histological technique were done in the compound eyes of *E. civile* and *O. ferruginea* staining with Hematoxylin-eosin and Argentic Impregnation, separately and using phase contrast microscope observation blue and green filters. At the level of histological arrangement, it was shown that the compound eyes in *O. ferruginea* and *E. civile* presented the same cellular components but with some variations: well-defined corneogenic cells were located, the crystalline cones have a heterogeneous arrangement, being of different sizes in *O. ferruginea*, the measurements of the rdbom were 540 im and 251 im, respectively. The use of the blue filter in phase contrast microscopy highlights better staining with Hematoxylin and Eosin; while the green filter does the same but with the silver stain." (Authors)] Address: Villeda-Callejas, María del Pilar, Laboratorio de Zoología, Facultad de Estudios Superiores Iztacala, Universidad Nacional Autónoma de México, Avenida de Los Barrios Número 1, Los Reyes Iztacala, C. P. 54090, Tlalnepantla, Estado de México. E-mail: mapili\_villeda@yahoo.com.mx

**18145.** Martins, R.T.; Couceiro, S.R.M.; Melo, A.S.; Moreira, M.P.; Hamada, N. (2017): Effects of urbanization on stream benthic invertebrate communities in Central Amazon. *Ecological Indicators* 73: 480-491. (in English) ["Urbanization and its physical and chemical effects on aquatic environments influence invertebrate communities negatively. Yet, it is not clear how urbanization affects inter-annual variation of invertebrate assemblages in streams. We 1) evaluated urbanization effects on the ecological conditions (biotic and abiotic) of streams in Manaus and 2) analyzed invertebrate community variation over time (between 2003 and 2010). Data on abiotic variables and invertebrates from 2003 were obtained from a previous study. In 2010 we sampled abiotic variables and invertebrate communities in the same low-order urban streams sampled in 2003 (n = 40). We recorded high values of total nitrogen, total phosphorous, deforestation, total impervious area (TIA), water temperature, pH, and electrical conductivity in the most urbanized streams, as compared to the least-impacted ones. In contrast, the least-impacted streams had high dissolved oxygen concentrations. Water quality was poorer in 2010 than in 2003: oxygen concentration was lower and total nitrogen, total phosphorous, deforestation, and TIA significantly higher in 2010. We recorded higher inter-annual variation of abiotic variables in the most-impacted streams as compared to the least-impacted streams. EPT (% of Ephemeroptera, Plecoptera, and Trichoptera) and richness metrics decreased with urbanization. On the other hand, % OP (percent of Oligochaeta and Psychodidae) increased with urbanization. Observed and EPT richness and % OP increased between 2003 and 2010. On the other hand, rarefied richness decreased between years. Increases of observed and EPT richness between 2003 and 2010 were related to low inter-annual variability in streams conditions; however, differences of % OP and rarefied richness were not related to inter-annual variability in environmental conditions. The degree of urbanization did not explain the magnitude of the within-stream difference of invertebrate communities between 2003 and 2010. The increased effects of urbanization represented by the abiotic variables sampled and the reduction of invertebrate richness and increased dominance of tolerant taxa indicate that public policy is not enough to protect or mitigate human impacts on the urban water systems under study." (Authors)] Address: Martins, R.T., Programa de Pós-Graduação em Entomologia, Coordenação de Biodiversidade, Instituto Nacional de Pesquisas da Amazonia . INPA, Av. Andre Araujo, 2936, CP 478, CEP 69067-375, Manaus, AM, Brazil

**18146.** Masahiro, S.; Hirai, N.; Ishii, M. (2017): Early community assembly of aquatic insects in experimental ponds established across the forest margin of a Satoyama coppice. *Jpn. J. Environ. Entomol. Zool.* 28(3): 133-142. (in English, with Japanese summary) ["We investigated early community assembly of aquatic insects across the forest margin in Satoyama, the traditional rural landscape in Japan. In April 2011, we established six experimental ponds using plastic tanks (220 L, 20 cm in depth) filled with tap water, with two each outside (Plot A), at the margin (Plot B) and inside (Plot C) a Satoyama coppice in Osaka Prefecture. We surveyed aquatic

insects twice monthly between May and December and canopy openness as the indicator of environmental factors related to coppice forest seasonally. A total of 72,324 individuals belonging to 25 insect taxa were recorded in this study with 14,076, 5,699, 4,098, 14,079, 19,935 and 14,437 individuals from 17, 5, 10, 12, 13 and 12 taxa recorded at Ponds A1, A2, B1, B2, C1 and C2, respectively. In all ponds, taxa richness gradually increased until July or August and thereafter gradually decreased or remained constant. Abundance of each abundant family except Libellulidae differed significantly among the three plots or in time–plot interactions. The most dominant taxa changed from Chironomidae to Notonectidae (*Notonecta triguttata*) and then to Baetidae (*Cloeon* spp.) in Ponds A1 and A2, from Chironomidae to Libellulidae (*Orthetrum melania*) and again to Chironomidae in Pond B1 and from Chironomidae to Baetidae in Pond B2. Only Chironomidae was dominant in Ponds C1 and C2. Non-metric multidimensional scaling showed that community assembly differed among plot locations across the forest margin, although canopy openness was similar at Plots B and C. Our results show that aquatic insect communities developed rapidly in newly created habitats in Satoyama and the environmental gradient across the forest margin generated taxonomic diversity. With regard to the functional characteristics of aquatic insects, predatory plankton, herbivorous neuston and detritivores colonized abundantly inside the forest, and predatory divers and herbivorous benthos colonized abundantly outside the forest. Our results demonstrate that creation of aquatic habitats across a forest margin would be effective for conserving taxonomic and functional diversity of aquatic insect communities in Satoyama, one of the biodiversity hotspot habitats in Japan." (Authors)] Address: Masahiro, S., Graduate School of Life & Environmental Sciences, Osaka Prefecture Univ., Nakaku Gakuen-cho 1-1, Sakai, Osaka 599-8531, Japan

**18147.** Mason, N.A. (2017): Effects of wind, ambient temperature and sun position on damselfly flight activity and perch orientation. *Animal Behaviour* 124: 175-181. (in English) ["Highlights: •I examined effects of abiotic factors on damselfly flight and perching behaviour. •Activity increased at low wind speeds but was uncorrelated with ambient temperature. •Perched damselflies tended to face the wind (showed rheotaxis) during high winds. •Sun position was uncorrelated with perching orientation. •At higher temperatures, however, resting damselflies tended to face the sun. Many animals rely on movement for survival and reproduction. Directed movements incur metabolic costs, however, and animals adjust their behaviour to optimize energy expenditures in different abiotic conditions. Physical flows and solar radiation vary over time and space and influence animal behaviour at multiple spatiotemporal scales. Here, I quantify the effects of wind speed, wind direction, ambient temperature and sun position on the fine-scale movement ecology and perch orientation of a widespread damselfly, *Enallagma doubledayi*. Through field observations, I found that damselflies fly, forage and engage competitors in territorial interactions more often in calm rather than windy conditions. Furthermore, perched damselflies exhibit rheotaxis, in which individuals typically face into the wind,

presumably to minimize biomechanical costs associated with drag and possibly to detect inbound prey on the water surface and in the air column. In contrast, ambient temperature and the position of the sun were largely unassociated with activity levels and damselfly orientation. At higher ambient temperatures, however, perched odonates faced the sun with increasing consistency, perhaps to thermoregulate by minimizing exposure to solar radiation. Taken together, these findings suggest that damselflies preferentially fly when the ratio of animal speed to wind speed is high and adjust their perch orientation to minimize energy loss. These findings strengthen conceptual links between activity budgets and perch orientation strategies among animals in variable abiotic conditions." (Author)] Address: Mason, N.A., Dept of Ecology and Evolutionary Biology, Cornell University, Ithaca, NY 14853, USA. E-mail: nicholas.albert.mason@gmail.com.

**18148.** May, M.L.; Gregoire, J.A.; Gregoire, S.M.; Lubertazzi, M.A.; Matthews, J.H. (2017): Emergence phenology, uncertainty, and the evolution of migratory behavior in *Anax junius* (Odonata: Aeshnidae). *PLoS ONE* 12(9): e0183508. <https://doi.org/10.1371/journal.pone.0183508>: 27 pp. (in English) ["Mass migrations by Odonata, although less studied than those of Monarch butterflies and plague locusts, have provoked comment and study for many years. Relatively recently, increasing interest in dragonflies, supported by new technologies, has resulted in more detailed knowledge of the species involved, behavioral mechanisms, and geographic extent. In this paper we examine, in four independent but complementary studies, how larval habitat and emergence phenology interact with climate to shape the evolution of migratory strategy in *Anax junius*, a common species throughout much of the eastern United States and southern Canada. In brief, we argue that fish predation on larvae, coupled with the need for ample emergent vegetation for oviposition and adult eclosion, dictates that larval development and survival is optimal in ponds that are neither permanent nor extremely ephemeral. Coupled with annual variation in regional weather and winters in much of their range too cold for adult survival, conditions facing newly emerged *A. junius* may unpredictably favor either local reproduction or long-distance movement to more favorable areas. Both temperature and hydroperiod tend to favor local reproduction early in the adult activity period and migration later, so late emerging adults are more likely to migrate. No single pond is always predictably suitable or unsuitable, however, so ovipositing females also may spread the risk to their offspring by ovipositing at multiple sites that, for migrants, may be distributed over very long distances." (Authors)] Address: May, M.L., Department of Entomology, Rutgers University, New Brunswick, NJ, United States of America. E-mail: may@aesop.rutgers.edu

**18149.** May, M.L. (2017): Body temperature regulation in the dragonfly, *Arigomphus villosipes* (Odonata: Anisoptera: Gomphidae). *International Journal of Odonatology* 20(3/4): 151-163. (in English) ["Regulation of thoracic muscle temperature has been investigated in a number of dragonfly species but is poorly known in the large and diverse family, Gomphidae. Moreover, temperatures of other body regions



have been recorded in very few ectothermic insects. In addition, correlations among multiple components of thermoregulatory behavior have rarely been examined quantitatively. Here I examine thermoregulation in *Arigomphus villosipes*, a medium-sized gomphid common at the shores of lakes and ponds in the northeastern USA. Measurements of the temperatures of the thorax (Tth), head (Th) and abdomen (Tab), using standard "grab and jab" techniques, indicate that both Tth and Th are relatively independent of air temperature (Ta). It is not clear whether Tth and Th are independently regulated, although some data suggest that they might be. *Arigomphus villosipes* can warm its thoracic musculature endothermally to maintain high Tth during cool Ta in conditions of low solar radiation intensity. However, regulation is principally behavioral, involving variation in body and wing postures and perhaps in perch substrate choice. Certain of these behaviors are closely associated to form suites of behavior that together are adapted to enhance or inhibit heating, while others are constrained by trade-offs with other functional demands. The former have a significant demonstrable effect on Tth. These combinations of behaviors results in a well-developed capacity for thermoregulation, allowing the insects to expand their activity periods and choice of perches, and probably improving male performance during competitive chases of females prior to mating." (Author)] Address: May, M.L., Department of Entomology, Rutgers University, New Brunswick, NJ, USA. E-mail: may@aesop.rutgers.edu

**18150.** Maynou X.; Martín, R.; Aranda, D. (2017): The role of small secondary biotopes in a highly fragmented landscape as habitat and connectivity providers for dragonflies (Insecta: Odonata). *Journal of Insect Conservation* 21: 517-530. (in English) ["Habitat loss and degradation are considered major threats to freshwater biodiversity and to invertebrates in particular. These often irreversible processes may lead to local and regional extinctions of species, most notably of stenotopic taxa. In spite of this, a number of studies have shown that small habitat patches can sustain rich and abundant communities. The present work assesses the relevance of a group of four small man-made (secondary) wildlife ponds to Odonata species diversity and abundance. Results obtained on pond recruiting capacity, species richness, abundance and habitat use by means of exuviae collection and monitoring of adults using a capture-mark-recapture (CMR) method indicate the potential suitability of these small aquatic biotopes and the surrounding landscape as habitat providers and stepping stone connectors in the Vallès lowlands (Catalonia, Spain). This region, close to the metropolitan area of Barcelona, has severely degraded natural habitats and high landscape fragmentation due to infrastructure, urban and industrial expansion. A comparison among a greater number of sites (ponds and sections of streams and rivers) distributed across the region showed that adequately managed small waterbodies harbour richer Odonata communities than others that are unmanaged or managed specifically for other types of fauna or uses. Appropriate care of these small biotopes avoids disturbance and keeps them free from vertebrates like fish and waterfowl which, under certain conditions, may have a strong influence on the invertebrate communities because,

apart from feeding on larvae, they may have a negative impact on macrophyte development and water quality. While rivers and streams, the only natural aquatic habitats in the area, may be both expensive and technically challenging to restore and manage successfully, the creation and/or restoration of small ponds and short river sections in suitable locations can be a cost-effective method for enhancing freshwater vegetation and invertebrate diversity in this impacted landscape. ... Adults of a total of 24 species were recorded between 2015 and 2016 in the Vallès lowlands. Of these, 15 were anisopteran. In and around the Gallecs study ponds the number of taxa recorded was 18, 12 of them belonging to Anisoptera. Six taxa, *Lestes virens virens*, *Ischnura pumilio*, *Pyrrosoma nymphula*, *Platynemis latipes*, *Onychogomphus forcipatus unguiculatus* and *Sympetrum meridionale*, were considered accidentals. Excluding them, the number of species per sampling site in the region ranged from 1 to 13 (Online Resource 2). The average species richness was 7.58 ( $\pm$  SE = 0.68) with 12 sites (50%) hosting 7–9 species. The most widespread taxon was *Ischnura graellsii* (present at 22 sites), followed by *Anax imperator* Leach, 1815 and *Orthetrum cancellatum* (18) and *Crocothemis erythraea* and *Sympetrum fonscolombii* (17). Other fairly well distributed taxa were *Chalcolestes viridis*, *Anax parthenope* and *Sympetrum striolatum* (13) and *Aeshna mixta* and *Trithemis annulata* (11). The rest had a more restricted distribution (1–7 sites)" (Authors)] Address: Maynou X., Catalan Odonata Study Group, Institució Catalana d'Història Natural, Barcelona, Spain

**18151.** McMullen, L.E.; De Leenheer, P.; Tonkin, J.D.; Lytle, D.A. (2017): High mortality and enhanced recovery: modelling the countervailing effects of disturbance on population dynamics. *Ecology Letters* 20(12): 1566-1575. (in English) ["Disturbances cause high mortality in populations while simultaneously enhancing population growth by improving habitats. These countervailing effects make it difficult to predict population dynamics following disturbance events. To address this challenge, we derived a novel form of the logistic growth equation that permits time-varying carrying capacity and growth rate. We combined this equation with concepts drawn from disturbance ecology to create a general model for population dynamics in disturbance-prone systems. A river flooding example using three insect species (a fast life-cycle mayfly, a slow life-cycle dragonfly and an ostracod) found optimal tradeoffs between disturbance frequency vs. magnitude and a close fit to empirical data in 62% of cases. A savanna fire analysis identified fire frequencies of 3–4 years that maximised population size of a perennial grass. The model shows promise for predicting population dynamics after multiple disturbance events and for management of river flows and fire regimes." (Authors)] Address: Lytle, D.A., Dept Integrative Biology, Oregon State Univ., Corvallis, OR, USA, E-mail: lytle@oregonstate.edu

**18152.** Meadows, A.J.; Owen, J.P.; Snyder, W.E. (2017): Keystone nonconsumptive effects within a diverse predator community. *Ecology and Evolution* 7(23):10315- 10315 (in English) ["The number of prey killed by diverse predator communities is determined by complementarity and interference

among predators, and by traits of particular predator species. However, it is less clear how predators' nonconsumptive effects (NCEs) scale with increasing predator biodiversity. We examined NCEs exerted on *Culex* mosquitoes by a diverse community of aquatic predators. In the field, mosquito larvae co-occurred with differing densities and species compositions of mesopredator insects; top predator dragonfly naiads were present in roughly half of surveyed water bodies. We reproduced these predator community features in artificial ponds, exposing mosquito larvae to predator cues and measuring resulting effects on mosquito traits throughout development. Nonconsumptive effects of various combinations of mesopredator species reduced the survival of mosquito larvae to pupation, and reduced the size and longevity of adult mosquitoes that later emerged from the water. Intriguingly, adding single dragonfly naiads to ponds restored survivorship of larval mosquitoes to levels seen in the absence of predators, and further decreased adult mosquito longevity compared with mosquitoes emerging from mesopredator treatments. Behavioral observations revealed that mosquito larvae regularly deployed "diving" escape behavior in the presence of the mesopredators, but not when a dragonfly naiad was also present. This suggests that dragonflies may have relaxed NCEs of the mesopredators by causing mosquitoes to abandon energetically costly diving. Our study demonstrates that adding one individual of a functionally unique species can substantially alter community-wide NCEs of predators on prey. For pathogen vectors like mosquitoes, this could in turn influence disease dynamics." (Authors)] Address: Meadows, Amanda, Entomology, Washington State Univ., Pullman, WA, USA. E-mail: amanda.meadows@wsu.edu

**18153.** Mekhlif, A.F.; Khadair, G.T.; Alzakabe, L.A. (2017): Influence of the damselfly, *Ischnura evansi* (Odonata: Coenagrionidae) on the immature stage of *Culex pipiens molestus* (Diptera: Culicidae) as biological control.. Journal of Babylon University/Pure and Applied Sciences/ No.(2)/ Vol.(25): 446-454. (in English, with Arabian summary) ["The mosquitoes *Culex pipiens* are annoying pests and obligate vectors of many vertebrate pathogens. Their immature stages are common in fauna of a wide range quality of water bodies. Most of the alternative biocontrol strategies focus on mosquito immature stages. Predators play a major role in mosquito control programs. The naiads of the damselfly, *Ischnura evansi* (Coenagrionidae) naturally inhabitate with the mosquito, *C. pipiens molestus* immature stages, the large naiads with average size  $1.5 \pm 0.5$  cm more than daily predated 12.1 larvae of 1st and 2nd instars, with 0.63 clearance rate, the naiads strongly preferred mosquito larvae over the chironomids *C. ninavah* larvae of the density 20/liter. The starved naiad tends to ingest the egg rafts. But not more than 3 rafts/day. The presence of the predator with 5 individuals/liter extended the life cycle from 13.0 in control to 20.8 days with high significant effect on 3rd and the instars and pupa stage." (Authors)] Address: Mekhlif, Atalla, Department of Biology Directorate of Ninvah collage of science, Collage of education Ministry of education for women, Moussel Univ. Babylon Univ., Irak. E-mail: atalla@yahoo.com

**18154.** Mendes, F.; Kiffer Jr., W.P.; Moretti, M.S. (2017): Structural and functional composition of invertebrate communities associated with leaf patches in forest streams: a comparison between mesohabitats and catchments. *Hydrobiologia* 800: 115-127. (in English) ["We evaluated the influence of mesohabitats and catchments on the structural and functional composition of invertebrate communities [including 'Odonata'] associated with leaf patches in Atlantic Forest streams. We hypothesized that invertebrate communities would be more influenced by inter-habitat than inter-catchment variation, i.e., invertebrate taxonomic and trophic composition would differ more between pools and riffles than among catchments. Invertebrate richness differed among catchments only, while values of total abundance and biomass were higher in pools. The influence of mesohabitats on the structure of invertebrate communities was high, and most taxa had specificities with one mesohabitat. Among insect shredders, Grypoptergidae (Plecoptera) and Blattodea occurred more in riffles; Phylloicus, Nectopsyche, and Triplectides (Trichoptera) occurred more in pools. The biomass of omnivorous macroconsumers (*Trichodactylus fluviatilis* and *Macrobrachium potiuna*) was higher in pools and also differed among catchments. Except gathering-collectors, the taxonomic composition of functional feeding groups differed between pools and riffles. The obtained results corroborated the hypothesis that the structural and functional composition of invertebrate communities is more influenced by inter-habitat than by inter-catchment variation, and reinforced the importance of maintaining the biological and geomorphological characteristics of streams to allow the accumulation of leaves in different mesohabitats and preserve the aquatic biodiversity." (Authors)] Address: Mendes, F., Laboratory of Aquatic Insect Ecology, University of Vila Velha, Av. Comissário José Dantas de Melo 21, 29.102-920 Vila Velha, Brazil. E-mail: marcelo.moretti@uvv.br

**18155.** Miguel, T.B.; Calvão, L.B.; Carneiro Vital, M.V.; Juen, L. (2017): A scientometric study of the order Odonata with special attention to Brazil. *International Journal of Odonatology* 20(1): 27-42. (in English) ["The insects of the order Odonata have an aquatic larval stage and land-dwelling adults. These insects play an important role in aquatic ecosystems and are excellent bioindicators. The present study was based on a scientometric analysis of the research available on the Odonata, which aimed to identify the principal trends and gaps in the database on these organisms, compiled online from databases of the Institute for Scientific Information – ISI, Scielo and journals *Odonatologica* and *International Journal of Odonatology*. A total of 2317 papers were analyzed, permitting the detection of the following tendencies: a gradual increase in the number of papers occurred over time, most of the papers had an ecological perspective, most focused primarily on the adult stage and species level, and 49 studies focused on bio-indication by examining variation in the composition of the community, fluctuating asymmetry, bioaccumulation, species richness and abundance, and odonate habitat index (OHI). The increase in the ecological studies of odonates may reflect the dynamic characteristics of this order, and its relatively well-defined systematics,

principally in the case of the adults. Despite the increase in the number of publications, there are still many gaps, such as biogeography, parasitism, competition within and among species, evolutionary and phylogenetic relationships, as well as studies of the larval stages of these organisms. Given the sensitivity of the members of this order to environmental variables, they may be used for the evaluation of aquatic systems, given their roles as detectors, exploiters or accumulators, depending on the type of response to environmental modifications." (Authors)] Address: Miguel, T.B., Programa de Pós-Graduação em Ecologia e Conservação, Univ. do Estado de Mato Grosso, Br 158, Km 148, CEP: 78690-000, Nova Xavantina, MT, Brazil. E-mail: thiagobmiguel@hotmail.com

**18156.** Mikl, L.; Adámek, Z.; Všeticková, L.; Janác, M.; Roche, K.; Šlapanský, L.; Jurajda, P. (2017): Response of benthic macroinvertebrate assemblages to round (*Neogobius melanostomus*, Pallas 1814) and tubenose (*Proterorhinus semilunaris*, Heckel 1837) goby predation pressure. *Hydrobiologia* 785: 219-232. (in English) ["One of the main assumed impacts of invasive gobies is predation on benthic macroinvertebrates. Despite numerous dietary studies, however, quantitative evaluations of impact in European river systems are scarce. Here, we investigate the impact of tubenose (*Proterorhinus semilunaris*, Heckel 1837) and round (*Neogobius melanostomus*, Pallas 1814) gobies on macroinvertebrates in a lowland river (River Dyje, Czech Republic) by allowing and preventing gobiid access to rip-rap substrate naturally colonised by invertebrates at two sites (Site 1—tubenose goby only, Site 2—tubenose and round gobies). Gobies had a negative impact on invertebrates at both sites, with overall invertebrate density reduced by 15% (ca. 17.9 g m<sup>-2</sup> per year) at Site 1 and 36% (ca. 23.6 g m<sup>-2</sup> per year) at Site 2. Both species showed increased impact in summer and ingested larger invertebrates preferentially, resulting in an overall reduction in invertebrate body size. Tubenose gobies had a significant impact on Annelida, Gastropoda, Crustacea and Ephemeroptera nymphs, while tubenose and round goby together impacted Anoptera nymphs, Odonata nymphs and Chironomidae larvae. Our results confirm that round and tubenose gobies can have a significant negative impact on aquatic invertebrate density and community composition." (Authors)] Address: Mikl, L., Inst. Vertebrate Biology, Acad. Sciences Republic, Kvetná 8, 603 65 Brno, Czech Republic. E-mail: libor.mikl@seznam.cz

**18157.** Mitamura, T. (2017): The impacts of the Great East Japan Earthquake and tsunami to individual number of Odonata on coastal area of Fukushima Prefecture, north eastern Honshu, Japan. *Tombo* 59: 23-28. (in Japanese, with English summary) ["On 11-III-2011, the coastal area of Fukushima prefecture was inundated by the Great East Japan Earthquake and tsunami. The disaster damaged many human lives and biodiversity. Since the habitat of organism was exposed to radiation by the accident of Fukushima No.1 nuclear power plant, investigation of natural environment is not progressing in the coastline area of Fukushima Prefecture. The number of Odonata decreased after the tsunami. *Mortonagrion hirosei* and *Platycnemis foliacea sasakii* have disappeared in Fukusnima pref. The number of Aeshnidae species

decreased to 7 from 12 in Matsukawa-ura, Soma." (Authors)] Address: Mitamura, T., 7-4 Sekiai, Koori-mächi, Date-gun, Fukushima pre f., 969-16, Japan

**18158.** Mozhui, L.; Kakati, L.N.; Changkija, S. (2017): A study on the use of insects as food in seven tribal communities in Nagaland, Northeast India. *Journal of Human Ecology* 60(1): 42-53. (in English) ["This paper documents the use of insect as food among seven tribal communities of Nagaland. Information was obtained through personal field interviews with 240 informants with the help of semi-structured questionnaires. It was found that 82 species of insects belonging to 9 orders (Odonata, Orthoptera, Mantodea, Isoptera, Hemiptera, Coleoptera, Hymenoptera, Lepidoptera and Diptera) are an important traditional food item principally consumed by the tribal people. Insects are preferred as eggs, larvae, nymphs, pupa or adult which are cooked, roasted or consumed raw. Documentation was done by calculating the "use value" (UV) of each species. It is evident from the study that insects can enhance nutritional deficiencies and can also improve the livelihood of the rural poor in the region. Hence, an inventory of food insects covering as many tribes is necessary so as to get benefit from their natural diversity before the existing traditional information is lost." (Authors)] Address: Mozhui, L., Research Fellow, Ecology Lab., Dept of Zoology, Nagaland University, Lumami 798 627, Nagaland, India. E-mail: Lobenommozhui@gmail.com

**18159.** Nagahata, Y.; Kawashima, I. (2017): Odonata larvae collected at the tidal wave sites in a year of the Great East Japan Earthquake. *Tombo* 59: 15-22. (in Japanese, with English summary) ["At the sites attacked by the tsunami wave caused by the 2011 off the Pacific coast of Tohoku Earthquake on March 11, 2011, Odonata larvae were investigated on November, 2011, 8 months after the disaster. Many of the water areas have occurred on the places which were once rice paddies or farmlands before the tsunami. Most of them came newly into existence after the tsunami, but a few ponds and marshes continued existing from the past. Around 10 species of the three families of Odonata larvae were examined during the survey. Among them, *Ischnura* sp. (*I. asiatica* or/and *I. senegalensis*) and *Anax parthenope* were discovered from wider range, which are supposed to expand the distributions after the tsunami. On the other hand, the populations of *Aeschnophlebia anisoptera* and *Polychanthagyna melanictera*, which were locally distributed even before the tsunami, have continued to exist, overcoming the disaster." (Authors)] Address: Nagahata, Y., Zao Hango 91, Yamagata, Yamagata, 990-2305, Japan E-mail: rosalia@muse.ocn.ne.jp

**18160.** Nangoy, M.J.; Koneri, R. (2017): Dragonfly in Bogani Nani Wartabone National Park north Sulawesi. *Asian Journal of Biodiversity* 8(1): 47-61. (in English) [oas 55;" As a group of freshwater invertebrates, dragonflies (Odonata) are commonly used as ecological indicators of freshwater ecosystems. This study analyzes the diversity of Odonata in various types of habitat at Bogani Nani Wartabone National Park, North Sulawesi, Indonesia: Sampling was conducted over three months in three habitat types, viz (primary

forest, secondary forest, and agricultural land). Samples were taken along the transect line using a sweep net. Samples were collected from 9:00 am to 03:00 pm during the periods that odonates are most active. Identification was based on external morphological characteristics using the relevant guide. In total, 1235 specimens of Odonata were obtained belonging to 19 species, 17 genera, and 7 families. Abundance, and richness of dragonfly species positively correlated with air temperature, but negatively correlated with humidity and vegetation cover. Based on the results of this study, ... *Nososticta flavipennis*, *Rhinocypha frontalis*, and *Teinobasis* sp are found only in primary forests and are not found in other habitats. They can be used as indicators of forest health. The highest abundance, richness, diversity, and evenness of dragonfly species are found on agricultural land, while the lowest were found in secondary forests." (Authors)] Address: Nangoy, M.J., Animal Science, Faculty, Sam Ratulangi University, Kampus Bahu Street, Manado 95115, Indonesia. E-mail: mnangoy@unsrat.ac.id

**18161.** Nasirian, H.; Irvine, K.N. (2017): Odonata larvae as a bioindicator of metal contamination in aquatic environments: application to ecologically important wetlands in Iran. *Environmental Monitoring and Assessment* 189(9) 436: 18 pp. (in English) ["The objectives of this study were twofold: (i) assess the bioaccumulation characteristics of a suite of metals associated with several different species of Odonata and (ii) examine Odonata species richness as a reflection of ecosystem health in two ecologically important wetlands of southwestern Iran, the Shadegan and Hawr Al Azim wetlands. Levels of arsenic (As), cadmium (Cd), cobalt (Co), chromium (Cr), copper (Cu), iron (Fe), mercury (Hg), manganese (Mn), lead (Pb), and zinc (Zn) were determined using inductively coupled plasma optical emission spectrometry (ICP-OES) in nine different Odonata larva species. Based on these data, biota-sediment accumulation factors (BSAFs) were calculated and generally, it was found that Cr, Cu, Mn, and Zn were being taken up by the Odonata (BSAFs >1). Because of its prevalence in the wetland and its observed ability to take up metals, it is suggested that *Ischnura ramburii* is an appropriate indicator of ecosystem health for these wetlands with respect to metal contamination. Odonata species richness across all sites was 49, while for the individual sites, the greatest species richness was 26 and the lowest species richness was 13. The species richness value across all sites is quite healthy, given the arid climate of the region." (Authors)] Address: Nasirian, H., Dept of Medical Entomology & Vector Control, School of Public Health, Tehran Univ. of Medical Sciences, Tehran, Iran. E-mail: hanasirian@yahoo.com

**18162.** Nel, A.; Weis, R. (2017): A new Early Jurassic damselfly from the Grand Duchy of Luxembourg (Odonata: Campterophlebiidae). *Alcheringa* 41(3): 1-5. (in English) ["*Gallodorsettia kronzi* gen. et sp. nov., the first representative of the damselfly family Campterophlebiidae from the Toarcian of Grand Duchy of Luxembourg, is described herein. Its closest relative is the genus *Dorsettia*, known from the early Lower Jurassic of UK and China. The Campterophlebiidae seem to be rare in the Early Jurassic of Western Europe,

despite being one of the most diverse odonatan families at that time, especially in Asia." (Authors)] Address: Weis, R., Musée national d'histoire naturelle, Luxembourg, Section Paléontologie, 25, rue Münster L-2160 Luxembourg, Grand-Duché de Luxembourg. E-mail: rweis@mnhn.lu

**18163.** Ngiam, R.W.J.; Lim, W.L.; Collins, C.M. (2017): A balancing act in urban social-ecology: human appreciation, ponds and dragonflies. *Urban Ecosystems* 20(4): 743-758. (in English) ["Green spaces in cities provide cultural ecosystem services (CES) such as nature connection, wildlife interaction and aesthetic appreciation which can improve aspects of human well-being. Recognising these benefits, researchers are now examining the complex relationship between humans and nature in urban social-ecology. Most studies investigate people's appreciation and valuation of different green space features and their contribution to urban biodiversity. Recommendations arising from such studies are best practices to achieve a balance between landscape aesthetic and ecological objectives, but many knowledge gaps still exist. In a social-ecological project in Greater London, appreciation of ponds and dragonflies in urban green spaces, and the environmental factors determining dragonfly diversity were investigated. We found ponds and their appearance were valued by people as enhancing their green space experience. The preference for wild-looking ponds was moderate. Dragonflies were enjoyed for their colour and high visibility, especially by those who had basic dragonfly knowledge. Species richness of dragonflies was positively associated with habitat heterogeneity in and around a pond. However, people were unable to relate a heterogeneous pond to more dragonfly species. For the first time, some factors that influence the human appreciation-ponds-dragonflies (HPD) relationship in an urban context are revealed. To fully realise the CES potential of ponds and dragonflies in Greater London, a HPD framework is proposed. The framework underpins strategies that foster cultural sustainability for ponds and dragonfly conservation." (Authors)] Address: Ngiam, R.W.J., Conservation Division, National Parks Board, Singapore Botanic Gardens, Singapore, Singapore

**18164.** Nilsson-Örtman, V.; Johansson, F. (2017): The rate of seasonal changes in temperature alters acclimation of performance under climate change. *The American Naturalist* 190 (6): 743-761. (in English) ["How the ability to acclimate will impact individual performance and ecological interactions under climate change remains poorly understood. Theory predicts that the benefit an organism can gain from acclimating depends on the rate at which temperatures change relative to the time it takes to induce beneficial acclimation. Here, we present a conceptual model showing how slower seasonal changes under climate change can alter species' relative performance when they differ in acclimation rate and magnitude. To test predictions from theory, we performed a microcosm experiment where we reared a mid- and a high-latitude damselfly species alone or together under the rapid seasonality currently experienced at 62°N and the slower seasonality predicted for this latitude under climate change and measured larval growth and survival. To separate acclimation

effects from fixed thermal responses, we simulated growth trajectories based on species' growth rates at constant temperatures and quantified how much and how fast species needed to acclimate to match the observed growth trajectories. Consistent with our predictions, the results showed that the midlatitude species had a greater capacity for acclimation than the high-latitude species. Furthermore, since acclimation occurred at a slower rate than seasonal temperature changes, the midlatitude species had a small growth advantage over the high-latitude species under the current seasonality but a greater growth advantage under the slower seasonality predicted for this latitude under climate change. In addition, the two species did not differ in survival under the current seasonality, but the midlatitude species had higher survival under the predicted climate change scenario, possibly because rates of cannibalism were lower when smaller heterospecifics were present. These findings highlight the need to incorporate acclimation rates in ecological models." Coenagrion armatum, C. pulchellum (Authors)] Address: Nilsson-Örtman, V., Dept of Ecology and Evolutionary Biology, University of Toronto, 25 Willcocks Street, Toronto, Ontario M5S 3B2, Canada. E-mail: viktor.j.nilsson@gmail.com

**18165.** Nixon, M.R.; Orr, O.G.; Vukusic, P. (2017): Covert linear polarization signatures from brilliant white two-dimensional disordered wing structures of the phoenix damselfly. *J. R. Soc. Interface* 2017 14 20170036: 8 pp. (in English) ["*Pseudolestes mirabilis* reflects brilliant white on the ventral side of its hindwings and a copper-gold colour on the dorsal side. Unlike many previous investigations of odonate wings, in which colour appearances arise either from multilayer interference or from wing-membrane pigmentation, the whiteness on the wings of *P. mirabilis* results from light scattered by a specialized arrangement of flattened waxy fibres and the copper-gold colour is produced by pigment-based filtering of this light scatter. The waxy fibres responsible for this optical signature effectively form a structure that is disordered in two dimensions and this also gives rise to distinct optical linear polarization. It is a structure that provides a mechanism enabling *P. mirabilis* to display its bright wing colours efficiently for territorial signalling, both passively while perched, in which the sunlit copper-gold upperside is presented against a highly contrasting background of foliage, and actively in territorial contests in which the white underside is also presented. It also offers a template for biomimetic high-intensity broadband reflectors that have a pronounced polarization signature." (Authors)] Address: Nixon, M.R., School of Physics, University of Exeter, Exeter EX4 4QL, UK. E-mail: m.r.nixon@exeter.ac.uk

**18166.** Okude, G.; Futahashi, R.; Kawahara-Miki, R.; Yoshitake, K.; Yajima, S.; Fuka, T. (2017): Electroporation-mediated RNA interference reveals a role of the multicopper oxidase 2 gene in dragonfly cuticular pigmentation. *Applied Entomology and Zoology* 52(3): 379-387. (in English) ["Dragonflies are colorful insects, and recent RNA sequencing studies have identified a number of candidate genes potentially involved in their color pattern formation and color vision. However, functional aspects of such genes have not

been assessed due to the lack of molecular genetic tools applicable to dragonflies. We established an electroporation-mediated RNA interference (RNAi) procedure using the tiny dragonfly *Nannophya pygmaea* Rambur, 1842 that targets the multicopper oxidase 2 gene (MCO2; also known as lacase2 gene) responsible for cuticular pigmentation in many insects. RNA sequencing of *N. pygmaea* and genomic survey of the dragonfly *Ladona fulva* identified four multicopper oxidase family genes: MCO1, MCO2, MCO3 and multicopper oxidase-related protein gene (MCORP). In *N. pygmaea*, MCO2 was specifically expressed around the cuticular pigmentation period, whereas MCO1 was constantly expressed. MCORP was expressed at adult stages, and MCO3 was scarcely expressed. When we applied *in vivo* electroporation, final instar larvae injected with MCO2 small interfering RNA became adults with patchy unpigmented regions. RNAi without *in vivo* electroporation did not affect cuticular pigmentation, suggesting that dragonflies do not show a systemic RNAi response. These results indicate that MCO2 is required for cuticular pigmentation across diverse insects, and highlight the usefulness of the electroporation-mediated RNAi method in dragonflies." (Authors)] Address: Futahashi, R., Bioproduction Res. Inst., National Inst. of Advanced Industrial Science & Technology (AIST), Central 6, Tsukuba, Ibaraki, 305-8566, Japan

**18167.** Olbrich, M.; Seifert, M. (2017): Erstnachweis der Zierlichen Moosjungfer *Leucorrhinia caudalis* (Charpentier, 1840) (Insecta: Odonata) in Thüringen und Anmerkungen zur Libellenfauna des Naturschutzgebietes „Phönix Nord“ (Altenburger Land, Thüringen). *Mauritiana* 32: 346-359. (in German, with English summary) ["In the mining landscape of the nature reserve "Phönix Nord" *L. caudalis* was observed on 27-V-2017. This is the first observation for Thuringia. The examiner discuss the current distribution, behaviors and habitat requirements for the species in this article. Also current observations of *Gomphus pulchellus*, *Sympetrum fonscolombii* and other remarkable dragonfly species of this very diverse stretch of waters get described." (Authors)] Address: Olbrich, M., Hempelstr. 5, 04177 Leipzig, Germany. E-Mail: maximilian.olbrich@gmail.com

**18168.** Oliveira-Junior, J.M.B.; Ligeiro, R.; Juen, L. (2017): Odonata (Insecta) as a tool for the biomonitoring of environmental quality. *Ecological Indicators* 81: 555-566. (in English) ["Highlights: •Different assemblage characteristics can potentially be used to assess loss of environmental integrity. •Species composition was the characteristic that best evaluated ecological integrity. •Taxonomic diversity and taxonomic distinction also achieved good results. •Species richness and abundance/biomass relationships did not provide good responses. •Deconstructing Odonata assemblages and choosing the right indicators are mandatory for efficient ecological assessments. Abstract: Despite the fundamental dependence of human populations on water resources, a range of anthropogenic impacts, in particular the removal of riparian vegetation, threaten freshwater environments. One of the most effective means of evaluating the effects of anthropogenic disturbance in aquatic ecosystems is the use of bioindicators, and the insects of the order Odonata are

among the most efficient indicators, due to their enormous sensitivity to environmental changes. In this context, the present study aimed to verify which parameters of the odonate community (species richness, abundance/biomass, composition, taxonomic diversity and taxonomic/phylogenetic distinctness) are most effective for the evaluation of the loss of environmental integrity. The study focused on 50 streams in the northeast of the Brazilian state of Pará. The streams were sampled during the dry season, between June and August 2011. The physical characteristics of each stream were evaluated using a Habitat Integrity Index (HII). The species composition provided the best parameter for the evaluation of ecological integrity, providing a relatively accurate assessment at a lower mean research cost than other parameters. Taxonomic diversity and distinctness also provided relatively reliable results, contributed additional information on the evolutionary relationships among the odonate taxa, and also provided a low-cost approach. Deconstructing communities is necessary to detect impacts, considering the considerable variation in the environmental requirements of the different species. Overall, the parameter that best responded to gradients of disturbance was species composition, followed by diversity and taxonomic distinctness. Given these findings, odonate-based biomonitoring should focus on these parameters to guarantee the optimal detection and evaluation of habitat alterations." (Authors)] Address: Miguel, T.B., Programa de Pós-Graduação em Ecologia e Conservação, Univ. do Estado de Mato Grosso, Br 158, Km 148, CEP: 78690-000, Nova Xavantina, MT, Brazil. E-mail: thiagobmiguel@hotmail.com

**18169.** Ott, J.; Munzinger, S. (2017): Aussagekraft von Datenkennwerten aus Citizen-Science-Beobachtungsdaten. Ableitung Roter Listen am Beispiel der Libellen. *Naturschutz und Landschaftsplanung* 49(10): 325-333. (in German, with English summary) ["Significance of data parameters from citizen science monitoring data. Derivation of Red Lists – the example of dragonflies Using the example of dragonflies the paper demonstrates the establishment of practicable Red Lists for different federal states and for the German Federal Republic based on a relatively small database from naturgucker.de. This data collection only comprises 1/19 compared to the German Atlas of the GdO (Society of German-speaking odonatologists), which underlies the current federal Red List. The study shows that a nearly identical Red List can be produced with the help of a specially developed "mAI-value" (mAI = multi-dimensional index of the frequency of species). This value consists of three components. The method appears to be a quick and cost-effective alternative to the otherwise elaborate and time-consuming development, at least for the group of the dragonflies. Processing the data from the "Artenfinder Rheinland-Pfalz" the application provided similarly positive results." (Authors)] Address: Ott, J., Friedhofstr. 28, D-67705 Trippstadt, Germany. E-mail: ott@lupogmbh.de

**18170.** Ottonello, D.; D'Angelo, S.; Oneto, F.; Malavasi, S.; Zuffi, M.A.L. (2017): Feeding ecology of the Sicilian pond turtle *Emys trinacris* (Testudines, Emydidae) influenced by seasons and invasive aliens species. *Ecological Research* 32(1): 71-80. (in English) ["Feeding ecology of a species is

the result of its evolutionary history, biology, physiology and local constraints, such as prey availability, intra- and inter-specific interactions and environmental characteristics. In this study we investigated the still unknown diet of the Sicilian pond turtle, with special emphasis to the relationships with recently introduced alien species in the "Lake Preola and Gorghi Tondi" Nature Reserve (Sicily, Italy). A total of 83 faecal samples were collected in three different periods. *E. trinacris* seems an opportunistic and generalist species. The main prey taxa were aquatic invertebrates [including Odonata], including the invasive *Procambarus clarkii*, while non-aquatic preys are found sporadically. Plant matter, mainly leaves and roots of aquatic forms, was also found in high frequency with a high occurrence of fruits and seeds in spring. We did not find a significant difference in diet composition within sex and age, while an evident divergence was found between periods and sites. In particular, we noticed a decrease in prey abundance and in food-niche breadth from pre-reproductive period to post-reproductive period. Moreover a very clear difference was found between a site with allochthonous fishes and a site fish-free, with a more abundant and wide diet spectrum in the last one, as a result of the increased availability of prey. We highlighted the importance to take any possible actions to avoid the spread of fishes in other basins and to study the indirect impact of *Procambarus clarkii*, as possible vector of harmful trace element." (Authors)] Address: Ottonello, D., Dept Environmental Sciences, Informatics & Statistics, Ca` Foscari Univ.of Venice, Via Torino 155, 30172 Venezia Mestre, Italy. E-mail: dario.ottonello@unive.it

**18171.** Pal, A. (2017): Dragonflies and damselflies of University of North Bengal campus, West Bengal, India with new distribution record of *Agriocnemis kalinga* Nair & Subramanian, 2014. *Journal of Threatened Taxa* 9(12): 11067-11073. (in English) ["A study was made to determine the present status of the diversity of Odonata from University of North Bengal campus and its surroundings. The study shows the presence of total 69 species of odonates belonging to 41 genera and nine families from the area. *A. kalinga* is recorded for the first time from northern Bengal." (Authors)] Address: Pal, A., Dept of Botany, University of North Bengal, Rajarammohunpur, Darjeeling, West Bengal 734013, India. E-mail: aaratrikp05@gmail.com

**18172.** Palomo, M.; Quirce, C.; Galante, E. (2017): La Estación Biológica de Torretes (Ibi, Alicante): un espacio para la conservación de odonatos. *Cuadernos de Biodiversidad* 53: 52-60. (in Spanish, with English summary) ["Odonates are biological indicators of the aquatic environments quality, because them require, in most cases, clean and well oxygenated waters to develop their larval stages. Many species have been included in the Red List of threatened species for their vulnerability to contaminated environments. A study of Odonata fauna was carried out in several permanent water points in the Biological Station - Botanical Garden of Torretes (Ibi, Alicante), a Mediterranean forest space of 53 hectares, managed by the Research Institute CIBIO of the

University of Alicante. This center aims to investigate and disseminate the value of biodiversity and conservation. In the biological station was collected 16 species Odonates of the 28 reported in natural environments for the Alicante province, which highlight the importance of this natural space in the conservation and biodiversity of these insects." (Authors)] Address: Galante, E., Centro Iberoamericano de la Biodiversidad. Universidad de Alicante, Spain. E-mail: galante@ua.es

**18173.** Parkinson, D.; Goffart, P.; Kever, D.; Motte, G.; Schott, O. (2017): Réponse des odonates à la restauration des tourbières ardennaises. *Forêt.Nature* 142: 48-55. (in French) ["In view of the many new water bodies created, a positive effect on odonates of the hydrological restoration work carried out in the framework of the recent LIFE "peatland" projects in the peaty environments of Haute-Ardenne was to be expected. This study, targeting more particularly the species specialised in peat bogs, effectively shows a positive evolution of the populations concerned of these species, as a result of the restoration work: increase in specific diversity and abundance, extension of the distribution area of the populations on a local and regional scale. Based on the analysis of a dataset collected in the Hautes-Fagnes according to a specific methodology, preliminary results are also presented concerning the influence of different environmental factors results show the interest in carrying out restoration work on a regional scale and the very good short-term reactivity of odonates to these interventions. The future capitalisation of the benefits already observed from these projects for Walloon biodiversity will depend on the monitoring of the future management of the restored sites, through the implementation of the management plans drawn up in the wake of the restoration projects." (Authors) Translated with www.DeepL.com/Translator (free version) ] Address: Goffart, P., Direction de la nature et de l'eau (SPW, DGO3, DEMNA) Avenue Maréchal Juin 23, B-5030 Gembloux, Belgium. E-mail: p.goffart@mrv.wallonie.be

**18174.** Parr, A. (2017): A male *Coenagrion puella* resembling *C. pulchellum* (Odonata: Coenagrionidae). *Libellula* 36 (1/2): 59-65. (in English, with German summary) ["On 22-V-2016, a male *Coenagrion* sp. damselfly was observed in the county of Norfolk, Great Britain, which was finally assigned to *C. puella* despite its general visual appearance being very similar to *C. pulchellum*. This individual is placed on record, and potential causes for the aberration – including the possibility of hybridization – are discussed." (Author)] Address: Parr, A., 10 Orchard Way, Barrow, Bury St Edmunds, Suffolk IP29 5BX, UK. E-mail: adrian.parr@btinternet.com

**18175.** Payra, A.; Bhutia, N.G. (2017): Some new records of Odonata (Insecta) fauna from Sikkim Himalaya, India. *Ambient Science* 4(2); Online DOI:10.21276/ambi.2017.04.2.nn01: 2 pp. (in English) ["The topography of the Sikkim state is kind of varied and also the elevation ranges from 200 to 8598m. The climate of the state divided into the tropical, temperate and alpine Zones. The State is endowed with rich floral and faunal diversity. However, Odonata fauna of Sikkim has been far less explored. With the addition of the new records

of *Caliphaea confusa*, *Zygonyx iris* and validation of the occurrence of *Rhinocypha unimaculata* for the State Sikkim, Odonata diversity counts now 77. However, further surveys will identify more species of Odonates from Sikkim.] Address: Payra, A., Dept of Wildlife and Biodiversity Conservation, North Orissa University, Odisha - 757003, India

**18176.** Pestic, V.; Gligorovic, B.; Savic, A.; Buczyński, P. (2017): Ecological patterns of Odonata assemblages in karst springs in central Montenegro. *Knowl. Manag. Aquat. Ecosyst.* 2017, 418, 3: 20 pp. (in English, with French summary) ["Karstic springs are important habitats for maintaining freshwater biodiversity. However, little is known about Odonata larvae assemblages in karstic springs, and studies about the ecological factors that determine species distribution in these habitats are still lacking. In this study the composition of Odonata larvae communities from 91 springs located in the central part of Montenegro was investigated. The richest fauna was found in sublacustrine springs, followed by limnocrenes, while that of the rheocrenes was less rich. The results obtained confirm the main research hypothesis that Odonata larvae assemblages in the karstic springs in the central part of Montenegro were comparably influenced by the environmental parameters acting on the level of individual springs as well as the factors acting at the landscape level. Odonata larvae assemblages divided springs into four groups. On the other hand, the springs could be divided into three groups based on habitat and landscape characteristics. CCA indicates that disturbance factors such as the permanence and directness of human influence on springs for use as drinking water sources are foremost in determining Odonata assemblages at the level of individual springs. The habitat scale considered several factors that influence Odonate assemblages, including altitude and riparian vegetation. This study proves that further odonatological studies in springs should include both types of factors and their interactions." (Authors)] Address: Pešić, V., Dept of Biology, University of Montenegro, Cetinjski put b.b., 81000 Podgorica, Montenegro. E-mail: vladopesic@gmail.com

**18177.** Phillips, I.D.; Prestie, K.S. (2017): Evidence for substrate influence on artificial substrate invertebrate communities. *Environmental Entomology* 46(4): 926-930. (in English) ["Cobble baskets are frequently used as a tool to measure differences in benthic macroinvertebrate communities between waterbodies; however, underlying differences in substrate type may influence the resultant colonization of baskets, misrepresenting communities. This study tests the hypothesis that cobble basket placement influences the resulting benthic macroinvertebrate community. Cobble basket arrays (n = 4) were deployed in Dog Lake, Saskatchewan, in 2011 (97 d) and 2012 (95 d) on cobble habitats and soft or sandy substrates ~100 m apart. Baskets placed on cobble substrate had significantly higher Shannon–Weaver diversity relative to those placed on soft substrate in both years, and higher % EPT (Ephemeroptera Plecoptera Trichoptera) in 2011, but total density was not significantly different. Non-metric multidimensional scaling revealed that the community was different between both treatments, characterized

by higher densities of *Gammarus lacustris* Sars in baskets placed on soft sediment in both years, higher densities of *Aeshna* sp. and *Mystacides* sp. on cobble substrate in 2011, and higher densities of *Helobdella stagnalis* (L.) and *Glossophinia complanata* (L.) on cobble substrate in 2012. The results were consistent with the hypothesis that baskets placed on cobble substrate versus soft substrate will result in differing community colonization. The resulting recommendation for monitoring and assessment using cobble baskets in lakes is that baskets be placed on comparable substrate type when comparing between lakes, and that cobble beds be chosen as a more appropriate substrate for deployment, as the added habitat complexity of baskets on soft sediment may act as an attractant and not reflect the true community composition of that habitat." (Authors)] Address: Phillips, I.D., Water Quality & Habitat Assessment Services, Water Security Agency, 101-108 Research Dr., Saskatoon, Saskatchewan, S7N 3R3, Canada. E-mail: iain.phillips@wsask.ca

**18178.** Phillips, N.; Knowles, K.; Bomphrey, R.J. (2017): Petiolate wings: effects on the leading-edge vortex in flapping flight. *Interface Focus* 7: 20160084: 13 pp. (in English) ["The wings of many insect species including crane flies and damselflies are petiolate (on stalks), with the wing planform beginning some distance away from the wing hinge, rather than at the hinge. The aerodynamic impact of flapping petiolate wings is relatively unknown, particularly on the formation of the lift-augmenting leading-edge vortex (LEV): a key flow structure exploited by many insects, birds and bats to enhance their lift coefficient. We investigated the aerodynamic implications of petiolation  $P$  using particle image velocimetry flow field measurements on an array of rectangular wings of aspect ratio 3 and petiolation values of  $P \frac{1}{4}$  1–3. The wings were driven using a mechanical device, the 'Flapperatus', to produce highly repeatable insect-like kinematics. The wings maintained a constant Reynolds number of 1400 and dimensionless stroke amplitude  $L^*$  (number of chords traversed by the wingtip) of 6.5 across all test cases. Our results showed that for more petiolate wings the LEV is generally larger, stronger in circulation, and covers a greater area of the wing surface, particularly at the mid-span and inboard locations early in the wing stroke cycle. In each case, the LEV was initially arch-like in form with its outboard end terminating in a focus-sink on the wing surface, before transitioning to become continuous with the tip vortex thereafter. In the second half of the wing stroke, more petiolate wings exhibit a more detached LEV, with detachment initiating at approximately 70% and 50% span for  $P \frac{1}{4}$  1 and 3, respectively. As a consequence, lift coefficients based on the LEV are higher in the first half of the wing stroke for petiolate wings, but more comparable in the second half. Time-averaged LEV lift coefficients show a general rise with petiolation over the range tested." (Authors)] Address: Bomphrey, R.J.; E-mail: rbomphrey@rvc.ac.uk

**18179.** Piano, E.; Isaia, M.; Falasco, E.; La Morgia, V.; Soldato, G.; Bona, F. (2017): Local versus landscape spatial influence on biodiversity: a case study across five European

industrialized areas. *Environmental Monitoring and Assessment* 189:126: 12 pp. (in English) ["Land use change — mostly habitat loss and fragmentation — has been recognized as one of the major drivers of biodiversity loss worldwide. According to the habitat amount hypothesis, these phenomena are mostly driven by the habitat area effect. As a result, species richness is a function of both the extent of suitable habitats and their availability in the surrounding landscape, irrespective of the dimension and isolation of patches of suitable habitat. In this context, we tested how the extent of natural areas, selected as proxies of suitable habitats for biodiversity, influences species richness in highly anthropogenic landscapes. We defined five circular sampling areas of 5 km radius, including both natural reserves and anthropogenic land uses, centred in five major industrial sites in France, Italy and Germany. We monitored different biodiversity indicators for both terrestrial and aquatic ecosystems, including breeding birds, diurnal butterflies, grassland vegetation, Odonata, amphibians, aquatic plants and benthic diatoms. We studied the response of the different indicators to the extent of natural land uses in the sampling area (local effect) and in the surrounding landscape (landscape effect), identified as a peripheral ring encircling the sampling area. Results showed a positive response of five out of seven biodiversity indicators, with aquatic plants and Odonata responding positively to the local effect, while birds, vegetation and diatoms showed a positive response to the landscape effect. Diatoms also showed a significant combined response to both effects. We conclude that surrounding landscapes act as important biodiversity sources, increasing the local biodiversity in highly anthropogenic contexts." (Authors)] Address: Isaia, M., Dept of Life Sciences & Systems Biology, Univ. of Turin, Turin, Italy

**18180.** Pires, M.M.; Stenert, C.; Maltchik, L. (2017): Partitioning beta-diversity through different pond hydroperiod lengths reveals predominance of nestedness in assemblages of immature odonates. *Entomological Science* 20(1): 318-326. (in English) ["Patterns of freshwater invertebrate assemblage structure in the transition from permanent to non-permanent lentic habitats are well described in the literature. However, the effects of small changes in the hydroperiod of non-permanent ponds on invertebrate assemblage structure remain less studied, especially on  $\beta$ -diversity. Thus, we tested the effects of different pond hydroperiod lengths on the assemblage structure of immature odonates, in terms of both  $\alpha$ - and  $\beta$ -diversity. Small high-altitude ponds with different hydroperiod lengths (assigned to 'short', 'medium' and 'long' hydroperiods) were sampled in southern Brazil between 2013 and 2014. Based on the hypothesis that shorter hydroperiods filter constituents of lentic fauna, i.e. that long-living species cannot inhabit shorter-hydroperiod ponds, we expected to find higher  $\alpha$ - and  $\beta$ -diversity in longer hydroperiods, as well as predominance of the nestedness component in  $\beta$ -diversity. Restricted occurrence of some genera and higher  $\alpha$ -diversity of immature odonate assemblages was detected in long-hydroperiod ponds. Within-hydroperiod  $\beta$ -diversity values did not vary among hydroperiods, because the occasional occurrence of some genera with high dispersal  $\alpha$ -



bility of adults in short-hydroperiod ponds yielded similar values of the  $\beta$ -diversity among hydroperiods. Partitioning of  $\beta$ -diversity among hydroperiods revealed a significant higher contribution of the nestedness component rather than turnover. This pattern is explained by the occurrence of some generalist genera across the whole gradient of hydroperiod, as a subset of fauna in longer-hydroperiod ponds. Thus, our results suggest that reduction in hydroperiod length, if occurring in the future climate change, would favour habitat-generalist taxa in lentic ecosystems." (Authors)] Address: Pires, M.M., Unisinos Avenue, 950, Postal Code 93.022-750, São Leopoldo, RS, Brazil. E-mail: marquespiresm@gmail.com

**18181.** Popova, O.N.; Haritonov, A.Y.; Sushchik, N.N.; Makhutova, O.N.; Kalachova, G.S.; Kolmakova, A.A.; Gladyshev, M.I. (2017): Export of aquatic productivity, including highly unsaturated fatty acids, to terrestrial ecosystems via Odonata. *Science of The Total Environment* 581–582: 40-48. (in English) ["Highlights: •We measured abundance and emergence of odonates in forest-steppe during 31 years. •Odonates bring organic carbon to the land, which is equal to land insect production. •Highly unsaturated fatty acids (HUFA) were measured in biomass of odonates. •Odonates subsidize essential HUFAs in land as many as all other amphibiotic insects. Abstract: Based on 31-year field study of the abundance and biomass of 18 species of odonates in the Barabinsk Forest–Steppe (Western Siberia, Russia), we quantified the contribution of odonates to the export of aquatic productivity to surrounding terrestrial landscape. Emergence varied from 0.8 to 4.9 g of wet biomass per m<sup>2</sup> of land area per year. Average export of organic carbon was estimated to be 0.30 g·m<sup>-2</sup>·year<sup>-1</sup>, which is comparable with the average production of herbivorous terrestrial insects in temperate grasslands. Moreover, in contrast to terrestrial insects, emerging odonates contained high quantities of highly unsaturated fatty acids (HUFA), namely eicosapentaenoic acid (20:5n<sup>-3</sup>, EPA), and docosahexaenoic acid (22:6n-3, DHA), which are known to be essential for many terrestrial animals, especially for birds. The export of EPA + DHA by odonates was found to be 1.92–11.76 mg·m<sup>-2</sup>·year<sup>-1</sup>, which is equal to an average general estimation of the export of HUFA by emerging aquatic insects. Therefore, odonates appeared to be a quantitatively and qualitatively important conduit of aquatic productivity to forest-steppe ecosystem." (Authors)] Address: Gladyshev, M.I., Siberian Federal University, Svobodny av. 79, Krasnoyarsk 660041, Russia. E-mail: glad@ibp.ru

**18182.** Preston, T.M.; Ray, A.M. (2017): Effects of energy development on wetland plants and macroinvertebrate communities in Prairie Pothole Region wetlands. *Journal of Freshwater Ecology* 32(1): 29-34. (in English) ["Energy production in the Williston Basin, USA, results in the coproduction of highly saline, sodium chloride-dominated water (brine). The Prairie Pothole Region (PPR) overlies the northeastern portion of the Williston Basin. Although PPR wetlands span a range of salinity, the dominant salt is sodium sulfate, and salinities are much lower than brine. Introduction of brine to wetlands can result in pronounced water-quality changes; however, the ecological effects of such contamination are

poorly understood. We examined the effects of brine contamination on primary productivity, emergent macrophyte tissue chemistry, and invertebrate communities [including Odonata] from 10 wetlands in the PPR. Based on a recognized Contamination Index (CI) used to identify brine contamination in the PPR water-quality samples indicated that six wetlands were uncontaminated while four were contaminated. Across this gradient, we observed a significant decrease in above-ground biomass and a significant increase in tissue chloride concentrations of hardstem bulrush (*Schoenoplectus acutus*) with increased CI values. Additionally, a significant decrease in macroinvertebrate taxonomic richness with increased CI values was observed. These findings provide needed insight on the biological effects of brine contamination on PPR wetlands." (Authors)] Address: Preston, T.M., U.S. Geological Survey, Northern Rocky Mountain Science, USA. E-mail: tmpreston@usgs.gov

**18183.** Pujiastuti, Y.; Windusari, Y.; Agus, M. (2017): The distribution and composition of Odonata (Dragonfly and Damselfly) in Sriwijaya University, Inderalaya Campus South Sumatera. *Journal of Biological Researches* 23(1): 1-5. (in English) ["The information about distribution and composition of Odonata in Sriwijaya University campus area is still not much. The decrease areas supporting the growth of Odonata influence distribution and composition of these species. The objective of research was to analyze the distribution and composition of Odonata in Sriwijaya University, Inderalaya Campus. This research had been conducted from December 2016 until February 2017 and continued in April 2017 by using visual observation, direct capture, and sticky traps. The sampling locations were determined by five points of observation station by using purposive sampling method. The result revealed Odonata living in Sriwijaya University, Inderalaya Campus is was aggregated and consisted of 22 species belonged to five families. The highest composition of species was found in Libellulidae (77.65%) followed by Coenagrionidae (17.86%)." (Authors)] Address: Pujiastuti, Yulia, Department of Plant Protection, Faculty of Agriculture, Sriwijaya University

**18184.** Pujol-Buxó, E.; García-Guerrero, C.; Llorente, G.A. (2017): Alien versus predators: effective induced defenses of an invasive frog in response to native predators. *Journal of Zoology* 301(3): 227-234. (in English) ["Inducible defenses enhance fitness of prey living in environments with unpredictable predation risk, but these plastic reactions depend on the detection of the threat by the prey. To anuran larvae confronted with unknown predators, only prey-borne cues are noticeable, generally triggering either an incomplete set of reactions or no response at all. Thus, we should expect a certain disadvantage for establishing invasive anurans if tadpoles are unable to recognize local predators. Here, we test the presence and effectiveness of inducible defenses in tadpoles of the invasive frog *Discoglossus pictus* confronting two native predators. Using both lab and mesocosm experiments, we also evaluate the effects these predators may exert on the invasive frog populations. Interestingly, although *D. pictus* has been introduced from another continent,

its native (African) and invasive (European) ranges are included in the same ecoregion (Mediterranean Basin), sharing several genera and species of aquatic predators. In both experiments and using both invertebrates, tadpoles responded to the native predators, and our results match those usually reported in similar predator-prey systems using combinations of native species. Moreover, these reactions seem clearly effective in reducing mortality and injury rates of *D. pictus* tadpoles. We believe that the introduced frog is highly benefiting from a previous knowledge of populations of these or similar predator species. Therefore, even though native and invasive ranges of *D. pictus* are in different continents, the similarity of predator communities of both areas may be advantageous for its establishment and expansion." (Authors)] Address: Pujol-Buxó, E., Dept de Biologia Evolutiva, Ecologia i Ciències Ambientals, Universitat de Barcelona, Barcelona, Spain. Email: epujolbuxo@ub.edu

**18185.** Quintana, A.T.; Tur, B.R. (2017): Emergence patterns of Odonata (Insecta) from a lotic habitat in Eastern Cuba. *Revista de Biología Tropical/International Journal of Tropical Biology and Conservation* 65(2): 807-818. (in Spanish, with English summary) ["The emergence patterns of tropical odonates (dragonflies and damselflies) are scarcely known. We studied the emergence patterns of odonates in a freshwater lotic system in Giro, Northern Santiago de Cuba, between January and December 2008. We visited the locality between 09:00 and 14:00, on a weekly basis, and collected exuviae from a fixed section (8 x 1 m<sup>2</sup>) offshore, along the riparian vegetation. We collected data on species composition and, for each species, abundance, relative biomass and emergence pattern. We collected 443 exuviae belonging to 22 species: seven Zygoptera and 15 Anisoptera. Half of the annual Odonata emergence took place in the dry season (December to March) with the highest value in February (25 %). For species for which we found seven or more exuviae per month, *Enallagma coecum* and *Macrothemis celeno* tended to be a synchronal emergence. We also found temporal segregation of the emergence pattern between *M. celeno* and *Protoneura capillaris*, *Neoneura maria*, *Progomphus integer* and *Scapania frontalis*. These differences were probably related to the highest annual fluctuations of temperature, relative humidity and number of rainy days per month. We concluded that there is an asynchrony and heterogeneity in Odonata emergence times in the studied freshwater lotic system." (Authors)] Address: Trapero-Quintana, A., Departamento de Biología, Universidad de Oriente. Ave. Patricio Lumumba s/n. Santiago de Cuba 90500, Cuba. E-mail: trapero76@gmail.com

**18186.** Rajabi, H.; Schroeter, V.; Eshghi, S.; Gorb, S.N. (2017): The probability of the wing damage in the dragonfly *Sympetrum vulgatum* (Anisoptera: Libellulidae): a field study. *Biology Open* 6(9): 1290-1293. (in English) ["Dragonfly wings resist millions of cycles of dynamic loading in their lifespan. During their operation, the wings are subjected to relatively high mechanical stresses. They further experience accidental collisions which result from the insects' daily activities, such as foraging, mating and fighting with other individuals. All these factors may lead to irreversible wing damage.

Here, for the first time, we collected qualitative and quantitative data to systematically investigate the occurrence of damage in dragonfly wings in nature. The results obtained from the analysis of 119 wings of more than 30 individuals of *S. vulgatum*, collected at the second half of their flight period, indicate a high risk of damage in both fore- and hindwings. Statistical analyses show no significant difference between the extents of damage neither in fore- and hindwings nor in male and female dragonflies. However, we observe a considerable difference in the probability of damage in different wing regions. The wing damage is found to be mainly due to two failure modes: wear and fracture." (Authors)] Address: Rajabi, H., Institute of Zoology, Functional Morphology and Biomechanics, Kiel University, D-24118 Kiel, Germany. E-mail: hrajabi@zoologie.uni-kiel.de

**18187.** Ramos-Merchante, A.; Prenda, J. (2017): Macroinvertebrate taxa richness uncertainty and kick sampling in the establishment of Mediterranean rivers ecological status. *Ecological Indicators* 72: 1-12. (in English) ["Freshwater macroinvertebrates have been extensively used as environmental indicators and are the most prevalent biological group used in aquatic bioassessment in the European Water Framework Directive (WFD 2000/60/EEC), usually through several popular indices, as the Biological Monitoring Working Party (BMWP). Many of these indices are based on taxa richness, i.e. the number of taxa present in a given area, as the simplest and most common measure of biodiversity. Given the importance to the WFD of the ecological status assessment by macroinvertebrates and the consequences thereof, sampling requires careful consideration and evaluation of the associated uncertainty. In this work, carried out in a Mediterranean river, we show that after 20 sample "kicks" it was possible to estimate the true taxa richness using Clench nonlinear asymptotic models (CM). However, cumulative curves of taxa extracted with kick sampling underestimated the true number of theoretical taxa (A). In order to achieve an acceptable error a very large sample size was required, always >20 kicks. According to these criteria, sampling was clearly inefficient in most localities. The minimum effort required to achieve a significant and acceptable level of taxa richness, for 90% of A, should be between 25 and 71 kicks and for 95% of A, 52–150 kicks. Both satisfactory percentages represent a mean difference of 2 (range 0–6) and 3 (range 1–8) taxa actually not being captured from the total predicted for each locality, for 90 and 95% of the CM asymptote, respectively. This study shows that by using the 20 kicks methodology it is possible to achieve reliable true macroinvertebrate richness estimates, but the establishment of the community composition, i.e. the full taxa making up any index score, will be inaccurate to an unknown degree." Odonata are treated at the family level (Authors)] Address: Prenda, J., Dept Integrated Sciences, Univ. of Huelva, Campus Universitario El Carmen, Avda, Andalucía s/n, 21071, Huelva, Spain. E-mail: jprenda@uhu.es

**18188.** Rana, J.S.; Semalty, B.; Singh, P.; Swami, N.; Dewan, S.; Singh, J.; Gusain, M.P.; Gusain, O.P. (2017): Checklist of benthic macroinvertebrate taxa along different riparian land use types in Alaknanda River catchment of the Central

Himalaya, Uttarakhand (India). Proceedings of the Zoological Society 72(2): 130-153. (in English) ["A checklist of benthic macroinvertebrates recorded at 08 different riparian land use (RLU) types in Alaknanda river catchment (ARC) in the Central Himalaya (India) is provided here. Among 77 taxa recorded, 73 insect genera belonged to 9 orders and 52 families at different RLU types. Majorities were nymphs and larvae of Ephemeroptera, Plecoptera, Trichoptera, Coleoptera, Lepidoptera, Odonata [including obviously wrong identifications], Hemiptera, Megaloptera and Diptera. The highest number of insect taxa (50) was recorded from Dense Mixed Forest; whereas, the lowest (27) was recorded from barren site i.e., Montane Barren. Also, the forested site had most number of common taxa (25). Benthic macroinvertebrates at Chir Pine Forest serves as a link between Dense Mixed Forest and Open Mixed Forest. Agricultural sites had 36 taxa in common. Interestingly the agricultural sites share 24 taxa with the forested sites. Overall 13 benthic insect taxa were ubiquitous in ARC, while 15 were rare, confined to a single site." (Authors)] Address: Rana, J.S., Freshwater Biology Unit, Dept Zoology & Biotechnology, Hemvati Nandan Bahuguna Garhwal Univ., Srinagar (Garhwal), India

**18189.** Rapacciuolo, G.; Ball-Damerow, J.E.; Zeilinger, A.R.; Resh, V.H. (2017): Detecting long-term occupancy changes in Californian odonates from natural history and citizen science records. *Biodiversity and Conservation* 26(12): 2933-2949. (in English) ["In a world of rapid environmental change, effective biodiversity conservation and management relies on our ability to detect changes in species occurrence. While long-term, standardized monitoring is ideal for detecting change, such monitoring is costly and rare. An alternative approach is to use historical records from natural history collections as a baseline to compare with recent observations. Here, we combine natural history collection data with citizen science observations within a hierarchical Bayesian occupancy modeling framework to identify changes in the occupancy of Californian Odonata over the past century. We model changes in the probability of occupancy of 34 odonate species across years and as a function of climate, after correcting for likely variation in detection probability using proxies for recorder effort and seasonal variation. We then examine whether biological traits can help explain variation in temporal trends. Models built using only opportunistic records identify significant changes in occupancy across years for 14 species, with eight of those showing significant declines and six showing significant increases in occupancy in the period 1900–2013. These changes are consistent with estimates obtained using more standardized resurvey data, regardless of whether resurvey data are used individually or in conjunction with the opportunistic dataset. We find that species increasing in occupancy over time are also those whose occupancy tends to increase with higher minimum temperatures, which suggests that these species may be benefiting from increasing temperatures across California. Furthermore, these species are also mostly habitat generalists, whilst a number of habitat specialists display some of the largest declines in occupancy across years. Our approach enables more ro-

bust estimates of temporal trends from opportunistic specimen and observation data, thus facilitating the use of these data in biodiversity conservation and management." (Authors)] Address: Rapacciuolo, G., Dept of Ecology and Evolution, Stony Brook University, Stony Brook, USA. E-mail: giorapac@gmail.com

**18190.** Renner, S.; Périco, E.; Ely, G.; Sahlén, G. (2017): Preliminary dragonfly (Odonata) species list from the Pampa biome in Rio Grande do Sul, Brazil, with ecological notes for 19 new records for the State. *Biota Neotropica* 17(4) e20170374: 8 pp. (in English) ["An inventory of Odonata was carried out in the southern half of the state of Rio Grande do Sul, Brazil, in the Pampa biome. Originally, this biogeographical region was covered mostly by open fields and grassland, with sections of higher vegetation surrounding water bodies and rocky hills. Today the landscape is fragmented due to agricultural activities, mainly cattle farming, rice crops and forest plantations. Our survey was conducted in three municipalities from this region, between March 2015 and April 2016. Aiming at a general overview of the species composition, our sampling sites were selected on a wide basis, including lakes, bogs, temporary water bodies, small streams and river sections. 82 species of Odonata were collected comprising 40 genera and seven families. The dominant families were Libellulidae (56,1%), Coenagrionidae (24,5%) and Aeshnidae (7,3%). We found a diverse odonate assemblage, adding 19 new species records for the state of Rio Grande do Sul." (Authors)] The following species are detailed: *Mnesarete lencionii* Garrison, 2006, *Argia lilacina* Selys, 1865, *Minagrion waltheri* Selys, 1876, *Oxyagrion rubidum* (Rambur, 1842), *Archaeogomphus densus* Belle, 1982, *Brechmorhoga nubecula* Rambur, 1842, *Dasythemis venosa* Burmeister, 1839, *Diastatops obscura* (Fabricius, 1775), *Dythemis nigra* Martin, 1897, *Erythemis vesiculosa* Fabricius, 1775, *Erythrodiplax lygaea* Ris, 1911, *Gynothemis venipunctata* Calvert, 1909, *Idiataphe longipes* Hagen, 1861, *Macrothemis heteronycha* Calvert in Ris, 1909, *Macrothemis lutea* Calvert, 1909, *Micrathyria spuria* Selys, 1900, *Orthemis aequilibris* Calvert, 1909, *Orthemis attenuata* Erichson, 1848, *Tholymis citrina* Hagen, 1867] Address: Renner, S., Universidade do Vale do Taquari, Laboratório de Ecologia e Evolução, Rua Avelino Talini, 171, Bairro Universitário, 95900-000 Lajeado, RS, Brazil

**18191.** Roberts, D. (2017): Mosquito larvae can detect water vibration patterns from a nearby predator. *Bulletin of Entomological Research* 107(4): 499-505. (in English) ["Mosquito larvae have been shown to respond to water-borne kairomones from nearby predators by reducing their activity, and thus visibility. If they can identify the predator, they can then alter their response depending upon the associated predation risk. No studies have shown that mosquito larva may also detect water-borne vibrations from the predator. Final instar larvae of three mosquitoes: *Culiseta longiareolata*, *Culex perexiguus* and *C. quinquefasciatus*, were exposed to recorded vibrations from feeding dragonfly nymphs, to dragonfly kairomones and the combined effect of both. Predator vibrations caused *C. longiareolata* to significantly re-

duce bottom feeding and instead increased the more passive surface filter feeding. The larvae also significantly increased escape swimming activity. These behavioural changes were not significantly different from the effect of dragonfly kairomones, and there was no synergistic or additional effect of the two. *C. perexiguus* gave a smaller (but still significant) response to both dragonfly vibrations and to kairomones, probably due to a different feeding behaviour: when lying on the bottom, it was an inactive filter feeder. *C. quinquefasciatus* did not respond to either vibrations or kairomones and during these experiments was entirely an inactive surface filter feeder. Both *C. longiareolata* and *C. perexiguus* were thus able to detect and identify vibrations from feeding dragonfly nymphs as an anti-predator strategy. The lack of response in *C. quinquefasciatus* is probably a result of living in water that is highly polluted with organic material, where few predators can survive." (Author)] Address: Roberts, D., Biol. Dept, Sultan Qaboos Univ., Oman

**18192.** Roque, F.O.; Corrêa, E.C.; Valente-Neto, F.; Stefan, G.; Schulz, G.; Barbosa Souza, P.R.; Motta, C.M.; Bavutti, L.L.O.; Colzani, E.; Demétrio, M.F.; Escarpinati, S.C.; Silvestre, R.; Vaz-de-Mello, F.Z.; Siqueira, T.; Ochoa Quintero, J.M. (2017): Idiosyncratic responses of aquatic and terrestrial insects to different levels of environmental integrity in riparian zones in a karst tropical dry forest region. *Austral Entomology* 556(4): 459-465. (in English) ["Decisions about biodiversity conservation depend on how different taxonomic groups respond to human-influenced environmental change. Here, we ask whether richness and composition of terrestrial (frugivorous butterflies and dung beetles) and aquatic insects (Plecoptera, Trichoptera, Ephemeroptera, Odonata and Coleoptera) change in a congruent manner across a gradient of riparian habitat degradation in a karst tropical dry forest region of Brazil, the Bodoquena Plateau. Our results showed incongruent ordination patterns based on the different taxa analysed. We found no correlation between richness and composition of the groups and environmental integrity. Incongruent responses among the taxonomic groups may be a consequence of high variability in ecological requirements among different taxa. Additionally, the effect of human disturbance on these taxonomic groups can be masked by the predominant presence of generalist species in tropical dry forests and by historical factors related to the adaptability of several species to changing ecosystems." (Authors)] Address: Roque, F.O., Center for Tropical Environmental and Sustainability Science (TESS), James Cook University, Cairns, QLD 4878, Australia. E-mail: roque.eco@gmail.com

**18193.** Sahito, H.A.; Bhutto, S.R.; Kousar, T.; Jatoti F.A.; Mangrio, W.M.; Ghumro, B.D.; Shah, Z.H. (2017): Morphotaxonomic characteristics of dragonfly, Lesser Emperor, *Anax parthenope* (Selys, 1839) (Odonata: Aeshnidae) at region Sukkur, Sindh. *J. of Advanced Botany and Zoology* 5(2): 1-6. (in English) ["Odonates are ecologically important as both predators and prey. Their larvae constitute a natural biological control over mosquito larvae and thus help to control several epidemic diseases like malaria, dengue, filaria etc. *A. parthenope* has been identified for the first time at region

Sukkur, Sindh - Pakistan. The study was mainly emphasized on morphological differences between male and female specimen. Both male and female specimens were having some same but mostly different characteristics. Like both male and female had large green compound eyes touching dorsally, head was found hypognathous, thorax dark green with visible thoracic segments, male had slightly larger than female wings, bigger in size and more colorful. Which was very rare in insects, fore and hind wings were not similar, forewing narrow and elongated whereas; the hind wings were broad basally, distal part of the wing was yellowish, abdomen was black dorsally and ventrally but found greenish from lateral side. It was concluded that there was a lot of potential to explore Odonata fauna of this region. The climate and topography of this area along with lot of natural pastures and aquatic bodies support dragonflies' life and biology. However, due to rapid increase in urbanization, suitable habitats of Odonata were disappearing at an alarming rate. Thus, only single specie was found. Further surveys and necessary conservation measures were also adopted, therefore, suggested as need of the day to utilize it, in right direction after knowing its species complex." (Authors)] Address: Sahito, H.A., Dept of Zoology, Fac. of Nat. Sci., Shah Abdul Latif Univ., Khairpur, Sindh, Pakistan. E-mail: hakim.sahito@salu.edu.pk

**18194.** Sakai, S.; Eda, S. (2017): A case of unusual oviposition by *Sympetrum frequens* while in tandem. *Tombo* 59: 96. (in English, with Japanese summary) ["The female or a tandem pair of *S. frequens*, continued to oviposit for about 20 seconds striking eggs into the water while the male rested on grasses at Nyukasa highland in Ina city, Nagano prefecture on September 9, 2016." (Authors)] Address: Eda, S., 3-4-25 Sawamura, Matsumoto, Nagano 390-0877, Japan. E-mail: SND 02767@nifty.com

**18195.** Sakai, S.; Eda, S. (2017): Interspecific copulation and oviposition between male *Sympetrum croceolum* and female *S. speciosum*, whose flying oviposition behaviors belong to different types. *Tombo* 59: 97-99. (in Japanese, with English summary) ["On 15-X-2016, a case of interspecific tandem copulation and oviposition between a male *S. croceolum* and a female *S. speciosum* was observed and photographed at Kasahara, Ina city, Nagano prefecture. The oviposition behavior of this interspecific pair correlated with that of *S. croceolum* in which the abdominal tip of the female is plunged into the water but the eggs are released while the abdominal tip is in the air, though no eggs were observed on this occasion. This result would suggest that the initiative is taken by the male rather than the female when they perform flying oviposition in tandem." (Authors)] Address: Eda, S., 3-4-25 Sawamura, Matsumoto, Nagano 390-0877, Japan. E-mail: SND 02767@nifty.com

**18196.** Satpathi, C.R. (2017): A treatise on dragonflies (Order: Odonata, Class: Insecta) of rice ecosystems in eastern India. *World Scientific News* 86(2): 67-133. (in English) ["This study highlights the 75 species of dragonfly fauna associated with rice ecosystems in eastern India out of which 15 species were regular and rest were sporadic. From the general

taxonomic point of view all the species were grouped under 5 families of under order Odonata. Comparing different body parts the double branching keys were prepared for easy identification of 15 common dragonfly species recorded in rice ecosystems of West Bengal. Each key begins with a couplet (a pair of alternative) and each of which leads to another couplet. Finally the reader reaches the specific identity of species. Free hand drawing of wings of the 50 dragonflies were also used for separate identification of these insect species. In addition to this, different studies were made on courtship and mating, egg laying habitats, nymphal development, longevity, flight capacity of dragonfly to make the study more interesting to the reader. The population build up of dragonfly, favors to certain altitude as well as availability of water which is reverse to the other group of insects. Three different localities were selected at 9.75 m (Chakdaha), 200 m (Cooch Behar) and 1250 m (Kalimpong) of which former two represent an unique physiographic ecological system in Eastern India characterized by extreme diversities of dragonfly inhabiting there. The studies on natural enemies of dragonfly along with their major threats indicated that about 2, 4 and 4 species were critically endangered, endangered and vulnerable in rice ecosystem of West Bengal. Dragonflies are very sensitive to changes in landscape and are reliable indicators of wetland health. Therefore the effective conservation of dragonfly depends entirely on conservation of their habitats. Different studies were made to estimate the role of dragonfly in integrated pest management of rice crop in West Bengal. An investigation was also carried out to find out the crop stage wise diversification of individual predator and found that dragonfly was more diverse during flowering to ripening stages of crop respectively. The values Simpson and Shanon diversity index showed that dragonflies are specific flowering to ripening stage of crop. Subsequently the value of Margalef index and Menhinick index also indicated that the aforesaid predators were more diverse in flowering stage of crop whereas it was least in vegetative stage of crop. From the Hill's diversity the number of abundant and most abundant species was calculated where maximum and minimum were obtained from dragonfly and staphylinid respectively. The studies on colonization and succession of major dragonfly taxa in the rice field indicated that it followed a uniform pattern in relation to growth stages as well different phases in the rice field. The studies on relative abundance of dragonfly in different ecosystems reflected that their population in fields could be conserved and enhanced through maintenance of rice weed flora on bund or allowing ratoon rice after the rice crop during fallow period. The fallow land has limited effect on incidence of insect predator in rice crop. The relative ranking chart of 50 important predators in rice ecosystem of West Bengal indicates that the insect belonging to Coleopteran (17) were top of the list whereas dragonfly was third (10). The validity of chart may increase over time and they will need to be updated periodically." (Author)] Address: Satpathi, C.R., Dept of Agri. Entomology, Fac. Agriculture, Bidhan Chandra Krishi Viswavidyalaya, P.O. Krishi Viswavidyalaya, Mohanpur, District Nadia, West Bengal, 741252, India. E-mail: csatpathi2003@yahoo.co.in

**18197.** Siepielski, A.M.; Beaulieu, J.M. (2017): Adaptive

evolution to novel predators facilitates the evolution of damselfly species range shifts. *Evolution* 71(4): 974-984. (in English) ["Most species have evolved adaptations to reduce the chances of predation. In many cases adaptations to coexist with one predator generate tradeoffs in the ability to live with other predators. Consequently, the ability to live with one predator may limit the geographic distributions of species, such that adaptive evolution to coexist with novel predators may facilitate range shifts. In a case study with *Enallagma* damselflies, we used a comparative phylogenetic approach to test the hypothesis that adaptive evolution to live with a novel predator facilitates range size shifts. Our results suggest that the evolution of *Enallagma* shifting from living in ancestral lakes with fish as top predators, to living in lakes with dragonflies as predators, may have facilitated an increase in their range sizes. This increased range size likely arose because lakes with dragonflies were widespread, but unavailable as a habitat throughout much of the evolutionary history of *Enallagma* because they were historically maladapted to coexist with dragonfly predators. Additionally, the traits that have evolved as defenses against dragonflies also likely enhanced damselfly dispersal abilities. While many factors underlie the evolutionary history of species ranges, these results suggest a role for the evolution of predator-prey interactions." (Authors)] Address: Siepielski, A.M., Dept of Biological Sciences, University of Arkansas, Fayetteville AR 72701, USA. Email: amsiepie@uark.edu

**18198.** Simon, S.; Sagasser, S.; Saccenti, E.; Brugler, M.R.; Schranz, M.E.; Hadrys, H.; Amato, G.; DeSalle, R. (2017): Comparative transcriptomics reveal developmental turning points during embryogenesis of a hemimetabolous insect, the damselfly *Ischnura elegans*. *Sci Rep.* 2017 Oct 19;7(1):13547. doi: 10.1038/s41598-017-13176-8.: 14 pp. (in English) ["Identifying transcriptional changes during embryogenesis is of crucial importance for unravelling evolutionary, molecular and cellular mechanisms that underpin patterning and morphogenesis. However, comparative studies focusing on early/embryonic stages during insect development are limited to a few taxa. *Drosophila melanogaster* is the paradigm for insect development, whereas comparative transcriptomic studies of embryonic stages of hemimetabolous insects are completely lacking. We reconstructed the first comparative transcriptome covering the daily embryonic developmental progression of *I. elegans*, an ancient hemimetabolous representative. We identified a "core" set of 6,794 transcripts - shared by all embryonic stages - which are mainly involved in anatomical structure development and cellular nitrogen compound metabolic processes. We further used weighted gene co-expression network analysis to identify transcriptional changes during Odonata embryogenesis. Based on these analyses distinct clusters of transcriptional active sequences could be revealed, indicating that embryos at different development stages have their own transcriptomic profile according to the developmental events and leading to sequential reprogramming of metabolic and developmental genes. Interestingly, a major change in transcriptionally active sequences is correlated with katabolism (revolution) during mid-embryogenesis, a 180° rotation of the embryo within the

egg and specific to hemimetabolous insects." (Authors)] Address: Simon, Sabrina., Biosystematics Group, Wageningen Univ. & Research, Droevendaalsesteeg 1, 6708 PB, Wageningen, The Netherlands. E-mail: sabrina.simon@wur.nl.

**18199.** Singh, D.; Singh, B.; Hermans, J.T. (2017): Dragonflies and damselflies (Odonata: Insecta) of Keoladeo National Park, Rajasthan, India. *Journal of Threatened Taxa* 9(7): 10445-10452. (in English) ["The present study was undertaken to examine the diversity, occurrence and distribution pattern of damselflies and dragonflies (Odonata) in Keoladeo National Park from 2010–2015. A combination of direct search, observation and opportunistic sighting methods were used to record 37 different species of Odonata (9 damselflies and 28 dragonflies). Among the Odonata recorded, the most diverse families are Libellulidae presented by 22 species and Coenagrionidae was present with eight species. According to the list presented by Palot & Soniya (2000) 21 species could be added; of the species presented here five are recorded for the first time from Rajasthan." (Authors)] Address: Singh, D., Nahchani (village+post), Tehsil- Kiraoli, Agra District, Uttar Pradesh 283122, India. E-mail: dhirendrasingh711@gmail.com

**18200.** Smirnov, N.A. (2017): Addition to the fauna of Dragonflies and Damselflies (Odonata) of Chernivtsi Region (Ukraine). *Ukrainska Entomofaunistyka* 8(2): 27-32. (in Ukrainian, with English and Russian summaries) ["According to the results of author's field studies and the material deposited at the Natural Museum of Yuriy Fedkovych Chernivtsi National University new data on nine species of dragonflies and damselflies from Chernivtsi Region are provided." (Author) *Chalcolestes viridis*, *Anaciaeschna isocoles*, *Anax ephippiger*, *Anax parthenope*, *Epithea bimaculata*, *Libellula fulva*, *Sympetrum fonscolombii*, *Leucorrhinia pectoralis*, *Erythromma viridulum*] Address: Smirnov, N.A.: E-mail: nazarsm@ukr.net

**18201.** Sniegula, S.; Janssens, L.; Stoks, R. (2017): Integrating multiple stressors across life stages and latitudes: Combined and delayed effects of an egg heat wave and larval pesticide exposure in a damselfly. *Aquatic Toxicology* 186: 113-122. (in English) ["Highlights: •Exposure of eggs to an heat wave was followed by exposure of larvae to a pesticide. •Heat exposure of the eggs had delayed costs in adult damselflies. •Larval pesticide exposure reduced fitness traits in larval and adult stage. •Both stressors were mainly additive and never synergistic. •Multistressor studies should integrate across life stages to capture total costs. Abstract: To understand the effects of pollutants in a changing world we need multistressor studies that combine pollutants with other stressors associated with global change such as heat waves. We tested for the delayed and combined impact of a heat wave during the egg stage and subsequent sublethal exposure to the pesticide esfenvalerate during the larval stage on life history and physiology in the larval and adult stage of the damselfly *Lestes sponsa*. We studied this in a common garden experiment with replicated central- and high latitude po-

pulations to explore potential effects of local thermal adaptation and differences in life history shaping the multistressor responses. Exposure of eggs to the heat wave had no effect on larval traits, yet had delayed costs (lower fat and flight muscle mass) in the adult stage thereby crossing two life history transitions. These delayed costs were only present in central-latitude populations potentially indicating their lower heat tolerance. Exposure of larvae to the pesticide reduced larval growth rate and prolonged development time, and across metamorphosis reduced the adult fat content and the flight muscle mass, yet did not affect the adult heat tolerance. The pesticide-induced delayed emergence was only present in the slower growing central-latitude larvae, possibly reflecting stronger selection to keep development fast in the more time-constrained high-latitude populations. We observed no synergistic interactions between the egg heat wave and the larval pesticide exposure. Instead the pesticide-induced reduction in fat content was only present in animals that were not exposed to the egg heat wave. Our results based on laboratory conditions highlight that multistressor studies should integrate across life stages to fully capture cumulative effects of pollutants with other stressors related to global change." (Authors)] Address: Sniegula, S., Institute of Nature Conservation, Polish Academy of Sciences, Al. Mickiewicza 33, 31-120 Krakow, Poland

**18202.** Sniegula, S.; Golab, M.J.; Johansson, F. (2017): Cannibalism and activity rate in larval damselflies increase along a latitudinal gradient as a consequence of time constraints. *BMC Evolutionary Biology* 17, Article number: 167: 9 pp. (in English) ["Background: Predation is ubiquitous in nature. One form of predation is cannibalism, which is affected by many factors such as size structure and resource density. However, cannibalism may also be influenced by abiotic factors such as seasonal time constraints. Since time constraints are greater at high latitudes, cannibalism could be stronger at such latitudes, but we know next to nothing about latitudinal variation in cannibalism. In this study, we examined cannibalism and activity in larvae of the damselfly *Lestes sponsa* along a latitudinal gradient across Europe. We did this by raising larvae from the egg stage at different temperatures and photoperiods corresponding to different latitudes. Results: We found that the more seasonally time-constrained populations in northern latitudes and individuals subjected to greater seasonal time constraints exhibited a higher level of cannibalism. We also found that activity was higher at north latitude conditions, and thus correlated with cannibalism, suggesting that this behaviour mediates higher levels of cannibalism in time-constrained animals. Conclusions: Our results go counter to the classical latitude-predation pattern which predicts higher predation at lower latitudes, since we found that predation was stronger at higher latitudes. The differences in cannibalism might have implications for population dynamics along the latitudinal gradients, but further experiments are needed to explore this." (Authors)] Address: Johansson, F., Dept of Ecology & Genetics, Uppsala Univ., 751 05 Uppsala, Sweden. E-mail: frank.johansson@ebc.uu.se

**18203.** Sniegula, S.; Prus, M.A.; Golab, M.J.; Outomuro, D.

(2017): Do males with higher mating success invest more in armaments? An across-populations study in damselflies. *Ecological Entomology* 42(4): 526-530. (in English) ["1. Males with higher mating success would be expected to invest more in traits that facilitate mating, leading to steeper allometry of those traits with respect to body size. Across-population studies following latitudinal variation in male mating success are an excellent study system to address this question. 2. Males of the damselfly *Lestes sponsa* were used to investigate whether the allometric patterns of the length and width of the anal appendages, used for grasping the female prior to mating, corresponded to male mating success. Across a large latitudinal gradient, it was hypothesised that there is a larger investment in the grasping apparatus, i.e. a steeper allometric slope, following higher mating success. 3. Behavioural observations in field enclosures showed the highest mating success at high latitude, while there were no significant differences in mating success between the central and low latitudes. Positive allometry was found for the length of the anal appendages in high-latitude males, while central- and low-latitude males showed no significant regressions of the traits on body size. 4. These results partially support the hypothesis, as high-latitude, more successful males invested more in the length (but not the width) of the grasping apparatus than did central- and low-latitude males. Therefore, higher mating success might be facilitated by larger investment in armaments. Intraspecific studies on allometric patterns of traits that participate in mating success might offer new insights into the role of those traits in the reproductive behaviour of a species." (Authors)] Address: Sniegula, S., Dept of Ecosystem Conservation, Institute of Nature Conservation, Polish Academy of Sciences, al. Mickiewicza 33, 31-120 Krakow, Poland E-mail: szymon.sniegula@gmail.com

**18204.** Start, D.; Gilbert, B. (2017): Predator personality structures prey communities and trophic cascades. *Ecology Letters* 20(3): 366-374. (in English) ["Intraspecific variation is central to our understanding of evolution and population ecology, yet its consequences for community ecology are poorly understood. Animal personality – consistent individual differences in suites of behaviours – may be particularly important for trophic dynamics, where predator personality can determine activity rates and patterns of attack. We used mesocosms with aquatic food webs in which the top predator (dragonfly nymphs) varied in activity and subsequent attack rates on zooplankton, and tested the effects of predator personality. We found support for four hypotheses: (1) active predators disproportionately reduce the abundance of prey, (2) active predators select for predator-resistant prey species, (3) active predators strengthen trophic cascades (increase phytoplankton abundance) and (4) active predators are more likely to cannibalise one another, weakening all other trends when at high densities. These results suggest that intraspecific variation in predator personality is an important determinant of prey abundance, community composition and trophic cascades." (Authors)] Address: Start, D., Dept of Ecology & Evolutionary Biology, Univ. of Toronto, Toronto, ON, Canada M5S 3B3. E-mail: denon.start@mail.utoronto.ca

**18205.** Suhling, F.; Martens, A.; Suhling, I. (2017): Long-distance dispersal in Odonata: Examples from arid Namibia. *Austral Ecology* 42(5): 544-552. (in English) ["We report cases of long-distance dispersal in Odonata, some of which were directly observed by identifying single individuals of riverine species in unsuitable habitat, mostly desert, far distant from reproduction habitats. The shortest possible linear distances of the observation points to reproduction habitats were measured. Furthermore, established populations of riverine species were recorded in artificial lakes in central and southern Namibia far distant from the next regular reproduction sites. Our records demonstrate that single individuals of riverine species were probably covering distances of several hundred kilometres over arid landscape without any intervening possible reproduction habitat. Although it is likely that only small numbers of individuals of the river populations may disperse long distances, relatively recent colonizations of artificial habitats suggest that a few, or even single, dispersing individuals may lead to large-scale-range expansions." (Authors)] Address: Suhling, F., Institute of Geoecology, Landscape Ecology and Environmental Systems Analysis, Technische Universität Braunschweig, Langer Kamp 19c, 38106 Braunschweig, Germany. E-mail: f.suhling@tu-bs.de

**18206.** Sushchik, N.N.; Popova, O.N.; Makhutov, O.N.; Gladyshev, M.I. (2017): Composition of fatty acids in the eye of a dragonfly. *Doklady Biochemistry and Biophysics* 475: 1-3. (in English) [We have studied the fatty acid composition of eyes of amphibiotic insects, namely, the odonate *Sympetrum flaveolum*. The main polyunsaturated fatty acid of odonate's eyes has been found to be 20:5n-3 (eicosapentaenoic fatty acid, EPA) rather than 18:2n-6 and 18:3n-3, which usually dominate in eyes of terrestrial insects, or 22:6n-3, which dominates in eyes of vertebrates. The prevalence of EPA in odonate's eyes probably provides a more effective transmission of light signal in this animal compared to terrestrial insects. It is important for odonates because vision plays a decisive role in finding and catching prey." (Authors)] Address: Sushchik, N.N., Institute of Biophysics of the Federal Research Center "Krasnoyarsk Scientific Center of the Siberian Branch of the Russian Academy of Sciences", Russia

**18207.** Swaegers, J.; Strobbe, F.; McPeck, M.A.; Stoks, R. (2017): Selection on escape performance during ecological speciation driven by predation. *Animal Behaviour* 124: 153-159. (in English) ["Highlights: •We reconstructed selection on escape traits during habitat shifts in damselflies. •Fish predation selected for decreased swimming propensity but did not affect speed. •Dragonfly predation selected for increased speed but did not affect propensity. •Quantitative genetic rearing showed both escape traits to be heritable. •Phenotypic evolution of antipredator traits may occur at an ecological timescale. Despite the many study systems in which predation has played a major role in phenotypic diversification and speciation, the underlying selective regimes imposed by different predator assemblages have rarely been quantified. We did so for the damselfly genus *Enallagma* which strongly diverged in antipredator traits when the ancestral species occupying lakes containing fish (hereafter fish lakes) repeatedly

invaded fishless lakes with dragonfly larvae as top predators (hereafter dragonfly lakes). In two selection experiments in field enclosures we quantified the selection on two key escape traits of two fish-lake *Enallagma* species associated with survival selection by fish in the ancestral fish lakes and by dragonfly predators in the invaded fishless, dragonfly lakes. In accordance with the different hunting modes, fish imposed selection for a decreased swimming propensity while dragonfly larvae imposed selection for increased swimming speed in one of the two species. In two complementary quantitative genetic rearing experiments, we found relatively low but significant broad-sense heritabilities for both escape traits. Integrating these estimates for the selection coefficients and the heritabilities suggests that the evolutionary increase in swimming speed associated with the habitat shift may have occurred rapidly. Our study suggests that the phenotypic evolution of ecologically important traits related to habitat shifts may occur at an ecological timescale." (Authors)] Address: Swaegers, J., Dept Biology, Lab. Aquatic Ecol., Evolution & Conservation, Univ. of Leuven, Leuven, Belgium

**18208.** Tamm J. (2017): Zur Beeinträchtigung und Gefährdung von *Cordulegaster bidentata* unter Berücksichtigung von Kartierungen der Imagines in einigen deutschen Mittelgebirgen (Odonata: Cordulegastridae). *Libellula* 36(1/2): 1-21. (in German, with English summary) ["On impairment and endangering of *C. bidentata* in consideration of mapping imagines in central German highlands – *C. bidentata* (imagines) has been mapped in several highland forests of Central Germany in the years 2008 to 2016. It was found at 89 of 726 spring sites mapped. On this basis, knowledge could be gained about the structures of both populated and unpopulated habitats and moreover about important human impact. The latter mainly was evident in the form of large-scale coniferous forests, ponds close to the springs, crossing spring areas by heavy forest harvesters and by forest roads and in the form of massive deposits of branch wood wastes on the springs and streams. The threat situation of the species resulting from these impairments is analysed. Future developments are estimated. *C. bidentata* is classified as "endangered" in Germany and in some regions even "critically endangered" in its present situation." (Author)] Address: Tamm, J., Elgershäuser Str. 12, 34131 Kassel, Germany. E-mail: jochen.tamm@t-online.de

**18209.** Theischinger, G.; Richards, S.J.; Toko, P.S. (2017): *Bironides ypsilon* sp. nov. and *Nannophlebia ballerina* sp. nov., two new stream-dwelling dragonflies from southern Papua New Guinea (Odonata: Libellulidae). *Odonatologica* 46(3/4): 331-349. (in English) ["Two new species of stream-dwelling libellulid dragonflies are described from Gulf Province, Papua New Guinea. *Bironides ypsilon* sp. nov. and *Nannophlebia ballerina* sp. nov. are both small black and yellowish green dragonflies that appear to be confined to the vicinity of clear forest streams where adults were found perched on low vegetation. Characters of both sexes are illustrated, and the affinities of the new species are discussed." (Authors)] Address: Toko, P.S., New Guinea Binatang Research Center, Madang, Papua New Guinea. E-mail: pagi.sione@gmail.com

**18210.** Theischinger, G.; Richards, S.J. (2017): Insular odonates in Melanesia: a new species of damselfly from Manus Island, Papua New Guinea (Zygoptera: Platystictidae) and comments on *Nososticta manuscola* Theischinger et Richards. In: Telnov, D. et al. (eds) 2017: Biodiversity, Biogeography and Nature Conservation in Wallacea and New Guinea, III: 495-499, plates 101-103. (in English) ["*Drepanosticta gazelle* sp. nov., is described from Manus Island, Papua New Guinea. The new species is most similar to *D. antilope* Theischinger et Richards, 2005, another insular species known only from New Britain Island to the south-east of Manus. The female of *Nososticta manuscola* Theischinger et Richards, 2015, a species previously known from a single male, is described for the first time and data on variation in male morphology are provided." (Authors)] Address: Theischinger, G., 2A Hammerley Road, Grays Point, NSW 2232, Australia. E-mail: Gunther.Theischinger@environment.nsw.gov.au

**18211.** Tiple, A.D.; Talmale, S.S.; Padwad, S.V. (2017): A comparative description between new record of dragonfly *Burmagomphus pyramidalis* Laidlaw from central India and earlier available record. *Ambient Science* 4(2): 4 pp. (in English) ["*B. pyramidalis* Laidlaw, 1922 was reported so far from south to southwest India. Present report of the species from Tropical Forest Research Institute (TFRI) Jabalpur and Pachmarhi Biosphere Reserve (Hoshangabad Dist.), Madhya Pradesh is for the first time from the central parts of India. The study provides here variations in collected specimens in antehumeral marking on the thorax and the 9 abdominal segment. In specimen two upper antehumeral portion narrow, broaden at middle, again somewhat narrow and broaden at extreme humeral portion touches to the base of 2 pair of legs, also interrupted at the middle at humeral region as against upper antehumeral portion broad, narrow at middle, and broaden at extreme humeral portion, however, a conspicuous transverse citron yellow band dorsally seen on hind margin. In specimen one 9 abdominal segment with two big yellow triangular marks dorsally present on hind margin. Variations between collected two specimens of and available description by Fraser (1926 & 1934) are discussed." (Authors)] Address: Tiple, A.D., Department of Zoology, Vidyabharti College, Seloo, Wardha-442104, Maharashtra, India

**18212.** Tol, J. van (2017): Mission Report: Entomological fieldwork Bhutan May-June 2017. Internal report of Naturalis Biodiversity Center, Leiden, The Netherlands, December 2017: 60 pp. (in English) ["Three years ago, the National Biodiversity Centre (Bhutan) and Naturalis Biodiversity Center signed a Memorandum of Understanding for scientific cooperation. An important partner for the scientific and outreach activities was the Bhutan Trust Fund for Environmental Conservation (Thimphu), which provided a grant of USD 150,000 for the period 2014-2016. Although the grant ended by the end of 2016, but it was decided that further entomological fieldwork was needed, for instance to prepare for the next phase which will focus on applied entomology and water quality assessment. Costs of the Bhutanese counterparts for this fieldwork were covered by a grant of Naturalis." (Author)] Address: Tol, J. van, National Museum of Natural History, P.O. Box 9517,



**18213.** Torres-Pachon, M.; Novelo-Gutierrez, R. (2017): *Phyllogomphoides enriquei* (Odonata: Gomphidae) a new species from Mexico. *Zootaxa* 4312(3): 595-600. (in English, with Spanish summary) ["*Phyllogomphoides Belle*, 1970, is the second most diverse genus with 46 species within neotropical Gomphidae, after *Progomphus* Selys, 1854 with 69 species. Most of the Mexican species are very similar in color pattern, however, the male accessory genitalia, cerci and epiproct allow to identify and separate species. Here, *Phyllogomphoides enriquei* sp. nov. (holotype ♂: Mexico, Michoacan, Municipality of Tepalcatepec, Rio Pinolapa, 19°00.524 N; 103°01.456 W, elevation 616m, 04 July 2005, R. Novelo & J.A. Gomez leg.; to be deposited in Coleccion Entomologica del Instituto de Ecologia, A.C., Xalapa) is described and illustrated, being characterized by the anterior hamuli bilobed, tumid anteriorly, ending in a strong spine posteriorly, followed by a wide, deep cleft between anterior and posterior lobes. It appears to be closely related to *Phyllogomphoides luisi* Gonzalez-Soriano & Novelo-Gutierrez, 1990. A distributional map of *Phyllogomphoides* species from Michoacan State is provided. With this discovery, the number of species of *Phyllogomphoides* for Mexico rises to 13." (Authors)] Address: Torres-Pachon, Mónica, Instituto de Ecología, A.C. Red de Biodiversidad y Sistemática. Carretera antigua a Coatepec 351, El Haya, 91070, Xalapa, Veracruz, Mexico. E-mail: monica.torres@posgrado.ecologia.edu.mx

**18214.** Tüzün, N.; Op de Beeck, L.; Stoks, R. (2017): Sexual selection reinforces a higher flight endurance in urban damselflies. *Evolutionary Applications* 10(7): 694-703. (in English) ["Urbanisation is among the most important and globally rapidly increasing anthropogenic processes, and is known to drive rapid evolution. Habitats in urbanised areas typically consist of small, fragmented and isolated patches, which is expected to select for a better locomotor performance, along with its underlying morphological traits. This, in turn, is expected to cause differentiation in selection regimes, as populations with different frequency distributions for a given trait will span different parts of the species' fitness function. Yet, very few studies considered differentiation in phenotypic traits associated with patterns in habitat fragmentation and isolation along urbanisation gradients, and none considered differentiation in sexual selection regimes. We investigated differentiation in flight performance and flight-related traits, and sexual selection on these traits across replicated urban and rural populations of *Coenagrion puella*. To disentangle direct and indirect paths going from phenotypic traits over performance to mating success, we applied a path analysis approach. We report for the first time direct evidence for the expected better locomotor performance in urban compared to rural populations. This matches a scenario of spatial sorting, whereby only the individuals with the best locomotor abilities colonise the isolated urban populations. The covariation patterns and causal relationships among the phenotypic traits, performance and mating success strongly depended on the urbanisation level. Notably, we detected sexual selection for a higher flight endurance only in urban populations, indicating that the higher flight performance of

urban males was reinforced by sexual selection. Taken together, our results provide a unique proof of the interplay between sexual selection and adaptation to human-altered environments." (Authors)] Address: Tüzün, N., Lab. Aquatic Ecol., Evolution & Conservation, Univ. of Leuven, Charles Deberiotstraat 32, 3000 Leuven, Belgium. E-mail: nedim.tuzun@kuleuven.be

**18215.** Turiault, M. (2017): The type material of *Isostictidae*, *Dicteriadidae*, *Argiolestidae* and *Megapodagrionidae* in the Museum für Naturkunde in Berlin (Odonata). *Odonatologica* 46(3/4): 351-358. (in English) ["A catalogue listing all species-group names associated with type specimens of the families *Isostictidae*, *Dicteriadidae*, *Argiolestidae* and *Megapodagrionidae* (Odonata) currently housed in the entomological collection of the Museum für Naturkunde - Leibniz Institute for Evolution and Biodiversity Science in Berlin (Germany) – includes current status of the species-group names, transcriptions of data labels and references to the original descriptions." (Authors)] Address: Turiault, Mélanie, Uhlenhorster Str. 23, 12555 Berlin, Germany. E-mail: melanieturiault@msn.com

**18216.** Uiterwaal, S.F.; Mares, C.; DeLong J.P. (2017): Body size, body size ratio, and prey type influence the functional response of damselfly nymphs. *Oecologia* 185(3): 339-346. (in English) ["Predator-prey interactions play a crucial role in structuring food webs, and the functional response is one way to measure the strength of this interaction. Here, we examine how predator and prey body size affects the functional response of a generalist predator—damselfly [mostly *Ischnura verticalis* and *Enallagma civile*] nymphs—feeding on three prey types: copepods, *Daphnia*, and *Chydorus*. Our results suggest that consumption of copepods is independent of predator body size, while increased predator body size is associated with an increased space clearance rate for *Daphnia* and a reduced space clearance rate for *Chydorus*. When considered together, foraging rates on *Daphnia* and *Chydorus* (both cladocerans) are consistent with a hump-shaped functional response, with peak foraging rates occurring at an intermediate predator-prey size ratio. Thus, although most food web theory assumes allometric predator-prey links or peaked functional responses at intermediate predator-prey size ratios, our results suggest that both relationships may occur in food webs, in addition to size-independent functional responses." (Authors)] Address: Uiterwaal, Stella, School of Biological Sciences, University of Nebraska-Lincoln, Lincoln, USA

**18217.** Usio, N.; Nakagawa, M.; Aoki, T.; Higuchi, S.; Kadono, Y.; Akasaka, M.; Takamura, N. (2017): Effects of land use on trophic states and multi-taxonomic diversity in Japanese farm ponds. *Agriculture, Ecosystems & Environment* 247(1): 205-215. (in English) ["Highlights: •Farm ponds are among the most biodiverse anthropogenic freshwater habitats. •Land use and fish abundance were among the significant factors affecting the trophic states of ponds. •Multi-taxonomic richness patterns changed along the gradient of trophic states. •A clear-water state was associated with diverse aquatic plants, macroinvertebrates, and adult Odonata. •A turbid

state was associated with diverse phytoplankton and fish. Abstract: Farm ponds are among the most biodiverse anthropogenic freshwater habitats because of their small size, shallow water depth, and aquatic vegetation. Land-use changes, such as converting riparian vegetation to human use or changing the management practices of farm ponds, are assumed to be major factors that change such ecosystems from a clear-water state to a turbid state, leading to deterioration of water quality and biodiversity in such ponds. Using the database of a large-scale pond survey, we evaluated the effects of surrounding land use (landscape factors and modern pond management practices), fish abundance, and other environmental variables on total phosphorus concentration and taxonomic richness patterns of six biological indicators associated with changes in the trophic state. Local- and landscape-level vegetation structure associated with land use and total fish abundance were among the factors influencing the total phosphorus concentration of farm ponds, a main driver of trophic state changes. In addition, a transition from a clear-water state to a turbid state was associated with lower taxonomic richness of aquatic plants, macroinvertebrates, and adult Odonata, and a higher taxonomic richness of phytoplankton and fish. Based on these results, we discuss potential land-use and pond management strategies for conserving and/or restoring the water quality and biodiversity of farm ponds through maintenance of a clear-water state." (Authors)] Address: Usio, N., Institute of Nature and Environmental Technology, Kanazawa University, Kanazawa 920-1192, Japan. E-mail: sio@se.kanazawa-u.ac.jp

**18218.** Van Allen, B.G.; Rasmussen, C.J.; Dibble, C.J.; Clay, P.A.; Rudolf, V.H.W. (2017): Top predators determine how biodiversity is partitioned across time and space. *Ecology letters* 20: 1004-1013. (in English) ["Natural ecosystems are shaped along two fundamental axes, space and time, but how biodiversity is partitioned along both axes is not well understood. Here, we show that the relationship between temporal and spatial biodiversity patterns can vary predictably according to habitat characteristics. By quantifying seasonal and annual changes in larval dragonfly communities across a natural predation gradient we demonstrate that variation in the identity of top predator species is associated with systematic differences in spatio-temporal  $\beta$ -diversity patterns, leading to consistent differences in relative partitioning of biodiversity between time and space across habitats. As the size of top predators increased (from invertebrates to fish) habitats showed lower species turnover across sites and years, but relatively larger seasonal turnover within a site, which ultimately shifted the relative partitioning of biodiversity across time and space. These results extend community assembly theory by identifying common mechanisms that link spatial and temporal patterns of  $\beta$ -diversity." (Authors)] Address: Rudolf, V.H.W., BioSciences, Rice University, Houston, TX, USA. E-mail: volker.rudolf@rice.edu

**18219.** Van Dievel, M.; Stoks, R.; Janssens, L. (2017): Beneficial effects of a heat wave: higher growth and immune components driven by a higher food intake. *Journal of Experimental Biology* 220: 3908-3915. (in English) ["While heat

waves will become more frequent and intense under global warming, the ability of species to deal with extreme weather events is poorly understood. We investigated how a heat wave influenced growth rate and investment in two immune components (phenoloxidase activity and melanin content) in larvae of *Ischnura elegans* and *Enallagma cyathigerum*. Late instar larvae were kept at 18°C (i.e. their average natural water temperatures) or at a simulated long heat wave at 30°C. To explain the heat wave effects, we quantified traits related to energy uptake (food intake and growth efficiency), energy expenditure (metabolic rate measured as activity of the electron transport system, ETS) and investment in energy storage (fat content). The two species differed in life strategy with *I. elegans* having a higher growth rate, growth efficiency, ETS activity, and fat content. In line with its preference for cooler water bodies, the heat wave was only lethal for *E. cyathigerum*. Yet, both species benefited from the heat wave by increasing growth rate, which can be explained by the higher increase in food intake than metabolic rate. This may also have contributed to the increased investments in energy storage and immune components under the heat wave. This mediatory role of food intake indicates the critical role of food availability and behaviour in shaping the impact of heat waves. Our results highlight the importance of including behavioural and physiological variables to unravel and predict the impact of extreme climate events on organisms." (Authors)] Address: Van Dievel, Marie, Evolutionary Stress Ecology & Ecotoxicology, Univ. of Leuven, Charles Deberiotstr. 32, 3000 Leuven, Belgium. E-mail: Marie.VanDievel@kuleuven.be

**18220.** Vermeulen, T. (2017): Dragonflies (Odonata) of the Moervaart depression. *Brachytron* 19(2): 90-103. (in Dutch, with English summary) ["The area of the Moervaart depression (East Flanders, Belgium), a historic landscape formed between 20 000 and 11 000 years ago as a relic of a glacial lake, represents a dragonfly hotspot. A five-year (2012-2016) monitoring project shows the area has become attractive to several species of dragonflies. In response to recent restoration efforts and improved management of nature reserves new species have quickly colonized the area. These include *Aeshna isocetes*, *Brachytron pratense* and *Lestes virens*. The area Boudelo Foundation (Sinaai) is especially species-rich. The microclimate of some water habitats in the Moervaart depression also attracts some scarce southern species, including *Anax parthenope* and *Aeshna affinis*. The diversity of dragonflies is related to variation in suitable habitats." (Author)] Address: Vermeulen, T.; E-mail: tommy.vermeulen@skynet.be

**18221.** Verspui, K. (2017): Nineteenth century water-colours of dragonflies and damselflies with a connection to the Netherlands. *Brachytron* 19(1): 3-15. (in Dutch, with English summary) ["The rediscovered damselfly and dragonfly watercolour collection of Edmond de Selys Longchamps is brought to the attention by discussing those watercolours that have a connection with the Netherlands. The watercolours of *Heterargia optata* (currently *Palaiargia optata*), *Calicnemis erythromelas* (currently *Calicnemis erythromelas*), *Vestalis*

elongata, Hagenius albarda (currently Sieboldius albarda), Epophthalmia vittata and Aeschna rufescens (currently Aeschna isocles) are presented as examples. The diversity, value and accessibility of this nineteenth-century collection of odonate watercolours are discussed." (Authors)] Address: Verspui, Karin: E-mail: karin.verspui@gmail.com

**18222.** Verspui, K.; Wasscher, M.T. (2017): The damselfly and dragonfly watercolour collection of Edmond de Selys Longchamps: II Calopterygines, Cordulines, Gomphines and Aeschnines. International Journal of Odonatology 20(2): 79-112. (in English) ["In the nineteenth century Edmond de Selys Longchamps added watercolours, drawings and notes to his extensive collection of dragonfly and damselfly specimens. The majority of illustrations were executed by Selys and Guillaume Severin. The watercolour collection is currently part of the collection of the Royal Belgian Institute for Natural Sciences in Brussels. This previously unpublished material has now been scanned and is accessible on the website of this institute. This article presents the part of the collection concerning the following sous-familles according to Selys: Calopterygines (currently superfamilies Calopterygoidea and Epiophlebioidea), Cordulines (currently superfamily Libelluloidea), Gomphines (currently superfamily Petaluroidea, Gomphoidea, Cordulegastroidea and Aeshnoidea) and Aeschnines (currently superfamily Aeshnoidea). This part consists of 750 watercolours, 64 drawings and 285 text sheets. Characteristics and subject matter of the sheets with illustrations and text are presented. The majority (92%) of all sheets with illustrations have been associated with current species names (Calopterygines 268, Cordulines 109, Gomphines 268 and Aeschnines 111). We hope the digital images and documentation stress the value of the watercolour collection of Selys and promote it as a source for odonate research." (Authors)] Address: Verspui, Karin, Lingedijk 104, Tricht, the Netherlands. Email: karin.verspui@gmail.com

**18223.** Villalobos Jiménez, G. (2017): The impacts of urbanisation on the ecology and evolution of dragonflies and damselflies (Insecta: Odonata). Ph.D. thesis, The University of Leeds School of Biology: XV, 234 pp. (in English) ["Urbanisation is one of the main drivers of ecosystem change. The impacts of urban land use on biodiversity have been investigated, but other aspects of ecology have been overlooked, as well as the effects of urban stressors. Understanding the effects of specific urban stressors is crucial in order to appropriately manage urban areas and conserve their biodiversity. Odonata are a suitable taxon for evaluating the impacts of urbanisation on both terrestrial and aquatic ecosystems. Here, using a combination of field and laboratory data, I study the ecological impacts of urban stressors on odonates. I found that the urban heat island has negligible impacts on the phenology of odonates compared to climate change. Moreover, noise disturbance reduces significantly the feeding rate of the damselfly *Ischnura elegans*, although anthropogenic noise has no significant impact. Regarding the impacts of polarised light pollution (PLP), the strength of polarotaxis increased significantly with age in laboratory-reared specimens, but there was no significant differentiation between

urban and rural populations. However, field-caught urban specimens showed less preference to polarised light compared to rural populations, suggesting strong selective pressures are acting upon urban populations, but no adaptation has occurred. Flight-related traits showed no significant differentiation among urban and rural populations of *I. elegans*. Lastly, biodiversity patterns did not differ among urban and rural areas, although aquatic vegetation and presence of fish were the main drivers of community composition. These results show odonates can tolerate a wide range of urban stressors, notably *I. elegans*. However, PLP, fish, and absence of aquatic vegetation in urban ponds can have a negative impact on odonate biodiversity, which has important implications on conservation and management of urban areas. Urban ecosystems are complex, thus an integrative approach is necessary in order to understand in depth the impacts of urbanisation on biodiversity." (Author)] Address: Villalobos Jiménez, Giovanna, School of Biology, Univ. of Leeds, Woodhouse Lane, Leeds LS2 9JT, UK. E-mail: bsgdjv@leeds.ac.uk

**18224.** Vinko, D.; Kulijer, D.; Dinova, D.; Rimeeska, B.; Brauner, O.; Olias, M. (2017): Faunistic results from the 5th Balkan odonatological meeting - BOOM 2015, Republic of Macedonia. Acta Entomologica Slovenica 25(1): 89-114. (in English, with Slovenian summary) ["Dragonfly research in the West Balkans experienced significant boost in recent years, also due to the establishment of the Balkan Odonatological Meetings (BOOM) in 2011. The main goal of BOOM is to contribute to research and protection of dragonflies of the Balkan Peninsula. This paper presents the faunistic results of the 5th BOOM, held in Republic of Macedonia. Between 7 and 15 August 2015, 46 sites were surveyed and 41 dragonfly species found. This represents more than half of the hitherto recorded dragonfly species for the country. This paper includes data for localities and habitats from central and southern part of R. Macedonia, which was less investigated in the past. Significant results include the first documented report of *Selysiothemis nigra* for the country. New data on several species with a comparably low number of previously published records for R. Macedonia, i.e. *Chalcolestes parvidens*, *Calliaeschna microstigma*, *Lindenia tetraphylla*, *Cordulegaster heros*, *C. bidentata*, *C. insignis*, *Somatochlora meridionalis*, *S. flavomaculata*, *Sympetrum vulgatum* and *S. flaveolum*, are also presented and brief discussion is provided." (Authors)] Address: Vinko, D., Slovene Dragonfly Society, Verovškova 56, SI-1000 Ljubljana, Slovenia. E-mail: damjan.vinko@gmail.com

**18225.** Vivas-Santeliz, J.; De Marmels, J. (2017): Current knowledge of Odonata in Venezuela: diversity and distribution of endemic taxa. Odonatologica 46(1/2): 35-54. (in English) ["So far, 525 species and 14 subspecies of odonates are known to occur in Venezuela. These are distributed in 124 genera and 13 families, with an undescribed species of the genus *Ypirangathemis* and *Paracordulia*. Despite Venezuela being one of the countries of Latin America with a very high diversity of described species, research on odonates is stagnant, mainly due to the small number of odonatologists and even more because of the political, economic and

social situation in this country, rendering field trips to collect odonates almost impossible. The country harbours a significant number of endemics, including six endemic genera and a total of 78 endemic species. The Pantepui region, as well as the Andean and Coastal Cordilleras all have high levels of endemism. A majority of endemic species is found within protected areas. However, threats to their survival have increased over the years, since there are no conservation plans for them or their habitats. Just seven species have so far been evaluated and catalogued in the Red Data Book of Venezuelan fauna, among them *Phyllogomphoides brunneus*, which is the only species of Odonata included in this Red Data Book that is not endemic to the country. The present paper aims to identify the distributions and diversity of endemic species in Venezuela, which can be used as a base to others investigations, including conservation studies in which they are assessed for inclusion in the Red List." (Authors)] Address: Vivas-Santeliz, J., Museo del Instituto de Zoología Agrícola Francisco Fernández Yépez, Fac. de Agronomía, Univ. Central de Venezuela, Maracay, Estado Aragua, Venezuela. E-mail: jonjvs1@gmail.com

**18226.** Walia, G.K.; Katnoria, N. (2017): Linear characterization of chromosomes in two species of family Euphaeidae (Odonata: Zygoptera). *International Journal of Entomology Research* 2(4): 75-78. (in English) ["Chromosome complement and meiotic behavior of chromosomes in two species of family Euphaeidae have been described by conventional staining, C- banding, silver nitrate staining and sequence specific staining. *Anisopleura lestoides* reveals two complements n=12 (without m chromosomes) and n=13 (with m chromosome), while *Bayadera indica* possess n=13m. In *Anisopleura lestoides* all the autosomal bivalents including m bivalent are showing terminal C-bands and NOR bands. Whereas in *Bayadera indica*, terminal C-bands on both ends in 9 autosomal bivalents and C-bands on one side in 3 bivalents, whereas terminal NOR bands are present in 10 autosomal bivalents, 1 NOR band on one side in 1 bivalent, m bivalent is C-negative and NOR-negative. X chromosome is C-positive and NOR rich in both the species. In the sequence specific staining, two autosomal bivalents show both CMA3 and DAPI bright signals and remaining bivalents including m bivalent and X chromosome possess CMA3 bright and DAPI dull regions in *Anisopleura lestoides*, while all the chromosomes show both DAPI and CMA3 bright signals in *Bayadera indica*." (Authors)] Address: Walia, Gurinder Kaur, Dept of Zoology and Environmental Sciences, Punjabi University, Patiala 147002, Punjab, India

**18227.** Waller, J.T.; Svensson, E.I. (2017): Body size evolution in an old insect order: No evidence for Cope's Rule in spite of fitness benefits of large size. *Evolution* 71(9): 2178-2193. (in English) ["We integrate field data and phylogenetic comparative analyses to investigate causes of body size evolution and stasis in an old insect order: odonates ("dragonflies and damselflies"). Fossil evidence for "Cope's Rule" in odonates is weak or non-existent since the last major extinction event 65 million years ago, yet selection studies show consistent positive selection for increased body

size among adults. In particular, we find that large males in natural populations of the banded demoiselle (*Calopteryx splendens*) over several generations have consistent fitness benefits both in terms of survival and mating success. Additionally, there was no evidence for stabilizing or conflicting selection between fitness components within the adult life-stage. This lack of stabilizing selection during the adult life-stage was independently supported by a literature survey on different male and female fitness components from several odonate species. We did detect several significant body size shifts among extant taxa using comparative methods and a large new molecular phylogeny for odonates. We suggest that the lack of Cope's rule in odonates results from conflicting selection between fitness advantages of large adult size and costs of long larval development. We also discuss competing explanations for body size stasis in this insect group." (Authors)] Address: Waller, J.T., Evolutionary Ecology Unit, Department of Biology, Lund University, SE-223 62 Lund, Sweden. E-mail: john.waller@biol.lu.se

**18228.** Wang, A.R.; Kim, M.J.; Kim, S.S.; Kim, I. (2017): Additional mitochondrial DNA sequences from the dragonfly, *Nannophya pygmaea* (Odonata: Libellulidae), which is endangered in South Korea. *International Journal of Industrial Entomology* 35(1): 51-57. (in English) ["The tiny dragonfly, *Nannophya pygmaea* (Odonata: Libellulidae), is an endangered insect in South Korea. Previously, a partial mitochondrial DNA sequence that corresponded to a DNA barcoding region has been used to infer genetic diversity and gene flow. In this study, we additionally sequenced the barcoding region from *N. pygmaea* that had been collected from three previously sampled populations (40 individuals) and these sequences were combined with the preexisting data. We also selected and sequenced an additional mitochondrial gene (ND5) to find further variable gene regions in the mitochondrial genome. DNA barcoding sequences of 108 individuals from five South Korean localities showed that genetic diversity was highest in Gangjin, Jeollanam-do Province. Muuido, which was previously occupied by a single haplotype, was also found to have an identical haplotype, which confirmed the low genetic diversity on this islet. Gene flow among populations is highly limited, and no clear distance- or region-based geographic partitioning was observed. Phylogenetic relationships among haplotypes showed that there were no discernable haplotypes in South Korea. ND5 provided slightly more haplotypes compared to the barcoding region in 40 individuals (14 vs. 10 haplotypes in the COI gene). It also had a slightly higher within-locality diversity estimate, which suggested that ND5 had potential as mitochondrial DNA-based marker for population genetic analysis." (Authors)] Address: Kim, I., Department of Applied Biology, College of Agriculture & Life Sciences, Chonnam National University, Gwangju 61186, Republic of Korea. E-mail: ikkim81@chonnam.ac.kr