Odonatological Abstract Service

published by the INTERNATIONAL DRAGONFLY FUND (IDF)

Editor:

Martin Schorr, Schulstr. 7B, D-54314 Zerf, Germany. Tel. ++49 (0)6587 1025; E-mail: oestlap@online.de

Published in Zerf, Germany

ISSN 1438-0269

2010

18877. Dow, R.A.; Reels, G.T. (2010): The Odonata of three National Parks in Sarawak. Agrion 14(1): 14-19. (in English) [Checklist of the regional from Kubah, Similajau and Lambir Hills National Parks are presented and discussed.] Address: Reels, G., 31 St Anne's Close, Winchester SO22 4LQ, UK. E-mail: gtreels@gmail.com

18878. GRETIA (2010): Synthèse des connaissances préalable à la déclinaison régionale du Plan national d'actions Odonates en Basse-Normandie. Rapport pour la DREAL Basse-Normandie: 148 pp. (in French) [http://odonates.pnaopie.fr/wp-content/uploads/2011/01/Synthesedesconnaissances_Odonates.pdf] Address: not stated

18879. Hord, K. (2010): Numerical investigation of the aerodynamic and structural characteristics of a corrugated wing. MSc. thesis, J.B. Speed School of Engineering, Department of Mechanical Engineering, University of Louisville: 78 pp. (in English) ["Previous experimental studies on static, bio-inspired corrugated wings have shown that they produce favourable aerodynamic properties such as delayed stall compared to streamlined wings and flat plates at high Reynolds numbers (Re = 4x104). The majority of studies have been carried out with scaled models of dragonfly forewings from the Aeshna cyanea [cf.] in either wind tunnels or water channels. In this thesis, the aerodynamics of a corrugated airfoil was studied using computational fluid dynamics methods at a low Reynolds number of 1000. Structural analysis was also performed using the commercial software SolidWorks 2009. The flow field is described by solving the incompressible Navier-Stokes equations on an overlapping grid using the pressure-Poisson method. The equations are discretized in space with second-order accurate central differences. Time integration is achieved through the second-order Crank-Nicolson implicit method. The complex vortex structures that form in the corrugated airfoil valleys and around the corrugated airfoil are studied in detail. Comparisons are made with experimental measurements from corrugated wings and also with simulations of a flat plate. Contrary to the studies at high Reynolds numbers, our study shows that at low Reynolds numbers the wing corrugation does not provide any aerodynamic benefit compared to a smoothed flat plate. Instead, the corrugated profile generates more pressure drag which is only partially offset by the reduction of friction drag, leading to more total drag than the flat plate. Structural analysis shows that the wing corrugation can increase the resistance to bending moments on the wing structure. A smoothed structure has to be three times thicker to provide the same stiffness. It was concluded the corrugated wing has the structural benefit to provide the same resistance to bending moments with a much reduced weight." (Author)] Address: not stated

18880. Schiel, H.-J.; Hunger, H. (2010): Libellen - Erfolgskontrollen an ausgewählten Gewässern im Projektgebiet. Naturschutz-Spectrum 98: 401-407. (in German) [The development of the dragonfly fauna is described for five water bodies (systems) where measures were carried out within the framework of the LIFE-Project Living Rhine Floodplains near Karlsruhe, Baden-Württemberg, Germany. All measures were extremely successful for the dragonfly fauna, whereby the rapid settlement and reproduction of Leucorrhinia caudalis at the newly created water body near Karlsruhe for the promotion of the species and the strong increase of Coenagrion mercuriale after the redesign of ditches in the nature reserve Oberbruchwiesen near Graben-Neudorf were the highlights. The results of the success control and possibilities of promoting dragonflies through special species protection measures are discussed.] Address: Schiel, F.-J., Inst. Naturschutz und Landschaftsanalyse, Turenenweg 9, D-77880 Sasbach, Germany. E-mail: Franz-Josef.Schiel@INULA.de

2012

18881. Baker, L.F.; Ciborowski, J.J.H.; MacKinnon,M.D. (2012): Petroleum coke and soft tailings sediment in constructed wetlands may contribute to the uptake of trace metals by algae and aquatic invertebrates. Science of the

Total Environment 414: 177-186. (in English) ["The fate of tracemetals in pore water collected from wetland sediments and organisms exposed to petroleum coke were evaluated within in situ aquatic microcosms. Oil sands operators of Fort McMurray, Alberta, Canada produced 60 million tonnes of petroleum coke by 2008, containing elevated concentrations of sulphur and several trace metals commonly seen in oil sands materials. This material may be included in the construction of reclaimed wetlands. Microcosms were filled with a surface layer of petroleum coke over mine-waste sediments and embedded in a constructed wetland for three years to determine how these materials would affect the metal concentrations in the sediment pore water, colonizing wetland plants and benthic invertebrates. Petroleum coke treatments produced significantly elevated levels of Ni. We also found unexpectedly higher concentrations of metals in “consolidated tailings” waste materials, potentially due to the use of oil sands-produced gypsum, and higher background concentration of elements in the sediment used in the controls. A trend of higher concentrations of V, Ni, La, and Y was present in the tissues of the colonizing macrophytic alga Chara spp. Aeshnid dragonflies may also be accumulating V. These results indicate that the trace metals present in some oil sands waste materials could be taken up by aquatic macroalgae and some wetland invertebrates if these materials are included in reclaimed wetlands." (Authors)] Address: Baker, Leanne, Dept Biological Sciences, Univ. of Windsor, 401 Sunset Ave., Windsor, Ontario, Canada N9B 3P4. Email: leannefbaker@hotmail.com

18882. Chovanec, A.; Wimmer, R. (2012): Beitrag zur Kenntnis der Verbreitung von Coenagrion ornatum (Selys, 1850) im Weinviertel, Niederösterreich (Odonata: Coenagrionidae). Beiträge zur Entomofaunistik 13: 108-112. (in German) [Note on the distribution of C. ornatum in the Weinviertel, Lower Austria including new records and habitat descriptions] Address: Wimmer, R., Lerchenfelderstr. 46/4/46, 1080 Wien, Austria

18883. Fiebrich, M. (2012): Die Libellen der Stillgewässer der Halbinsel Bodanrück - Ein Vergleich verschiedener Erfassungsmethoden. Diplomarbeit. Universität zu Trier: 165 pp. (in German) ["In the context of this diploma thesis, the dragonfly fauna of 17 stillwaters on the Bodanrück [Baden-Württemberg, Germany] peninsula was investigated. Different recording methods were used, which were compared with regard to their resulting species compositions. In the course of this study, 44 dragonfly species were recorded in 7 inspections, 28 of which are considered to be native on the basis of exuviae findings. The results were analysed for their similarity in terms of species composition, phenological differences and development trends over the last 25 years, in order to develop necessary management and protection measures at the end. The study showed that the recording methods are not equivalent and do not reflect the same species composition, which is why dragonfly mapping based on only one recording method is highly questionable. There is therefore no "best" method. This was also found by Raebel et al. (2010) and Giugliano et al. (2012) and supports this hypothesis. A survey of dragonfly species should accordingly be linked to the goal of mapping. Recording the imagines provides the most representative results with regard to the species diversity of a water body. In order to obtain information on the water quality, it is also advisable to search specifically for exuviae, even if this method is associated with a higher workload. Adult individuals, on the other hand, do not necessarily provide information on aquatic conditions (water quality, presence of predators, etc.). The recording of indicators of ground conditions should still be integrated, but this does not always provide a reliable indication of ground conditions. Standardised methods are indispensable for future surveys. For this purpose, the duration, period, area, etc. of surveys must be standardised in the future in order to make the results spatially and temporally comparable." (Author/DeepL)] Address: not stated

18884. Geneste, G. (2012): Suivi d’un site d’émergence d’Oxygastra curtisii sur la Seine à Nogent-sur-Seine (Aube). http://www.odonates-champagne-ardenne.fr/: 6 pp. (in French) ["On 20 June 2010, during a Sunday odonatological survey on the banks of the Seine, in the commune of Nogent-sur-Seine, I discovered a high density of exuviae of the Thin-bodied Cordulia Oxygastra curtisii. Carefully identified afterwards, 105 exuviae were collected over a distance of approximately 7 metres from the river bank. I suspect that such a large number of exuviae in such a small area is linked to the fact that the exuviae collected represent an accumulation of the current year's and the previous year's emergence. After carefully checking for the presence of exuviae later in the summer, I decide to monitor this site frequently and rigorously the following year. Translated with www.DeepL.com/Translator (free version)] Address: Geneste, G. E-mail: guillaumegeneste@yahoo.fr

18885. Karlsson, T.; Gezelius, L. (2012): Tåkerns trollsländor. Vingspegeln 31: 76-82. (in Swedish) ["During 2008-2012, the Entomological Society of Östergötland has run an inventory project, Trollsländor i Östergötland, with the aim of mapping the county's dragonfly fauna. This past season was the last of the project, and in 2013 the results of the inventory are planned to be compiled in a book of the type landscape fauna, together with previous finding data. This article presents the results of the inventory, as well as older data, for Lake Tåkern. The data on which the article is based are observations of dragonflies reported to Artportalen and literature data on dragonflies at Tåkern." (Author/DeepL)] Address: Karlsson, T., Opphemsgatan 2, S-58237 Linköping, Sweden. E-mail: tommy.karlsson@e.lst.se

18886. Schmidlin, S.; Schmera, D.; Baur, B. (2012): Alien molluscs affect the composition and diversity of native macroinvertebrates in a sandy flat of Lake Neuchâtel, Switzerland. Hydrobiologia 679(1): 233-249. (in English) ["The spread of alien molluscs is a serious threat to native biodiversity in fresh waters. Alien freshwater molluscs may deplete the resources of native species and alter the physical structure of the habitat through their shell mass. These changes might have both positive and negative effects on

native community members. We investigated the native macroinvertebrate community in relation to the densities of four alien mollusc species (Corbicula fluminea, Dreissena polymorpha, Potamopyrgus antipodarum and Lithoglyphus naticoides) in a sandy flat of Lake Neuchâtel, Switzerland. The habitat examined was dominated by these alien mollusc species. The abundance of the alien molluscs did not directly impact the native community assembly. However, C. fluminea and D. polymorpha influenced the composition and diversity of native macroinvertebrates by transforming the sandy substratum into a partly hard substratum habitat. Substantial differences in community composition between shallow (<3.5 m) and (=5 m) deep sites were recorded. At shallow sites, the abundance of D. polymorpha was significantly reduced as a result of depth-selective feeding of ducks. A controlled shell decay study revealed that shells of alien molluscs (C. fluminea, D. polymorpha) persist for a longer period in the sediment than those of native molluscs. Consequently, shells of alien molluscs have a long-lasting impact by modifying the sandy habitat. This form of ecosystem engineering favours the occurrence of several native taxa, but is disadvantageous for other taxa with specific habitat requirements, and thus can be regarded as an indirect impact of competition." (Authors) The list of macrozoobenthos includes "Ischnura sp.".] Address: Schmidlin, Stephanie, Section of Conservation Biology, Dept of Environmental Sciences, University of Basel, St. Johanns-Vorstadt 10, 4056, Basel, Switzerland

2014

18887. Dayaram, A (2014): Discovery of novel circular replication-associated protein encoding single-stranded DNA viruses in ecosystems using viral metagenomic approaches. PhD. thesis, School of Biological Sciences, University of Canterbury: 293 pp. (in English) ["The introduction of next-generation sequencing (NGS) technologies has dramatically changed the field of virology, with many significant discoveries of novel circular replication-associated protein (Rep) encoding single-stranded (CRESS) DNA viruses. Traditionally, most research into CRESS DNA viruses has often focused on investigating plant and animal pathogens that are of significant economic importance. This research has led to the discovery and establishment of three different CRESS DNA families including Geminiviridae, Nanoviridae and Circoviridae, which infect eukaryotes. CRESS DNA viruses can have single or multicomponent genomes, with the latter requiring all components for infection. CRESS DNA viruses have circular single-stranded DNA (ssDNA) genomes with at least one protein encoding a Rep which is responsible for viral replication. It has been shown that CRESS DNA viruses are able to evolve rapidly with nucleotide substitution rates that are similar to those observed in RNA viruses. The Rep gene has conserved regions known as motifs which are often used to determine relatedness between CRESS DNA virus. NGS has expanded our knowledge on the diversity of novel CRESS DNA viruses. Viral genomes are now routinely recovered from different sample types without any prior knowledge of the viral sequence. This has led to the development of the field of viral ecology. This field places an emphasis on viruses being one of the most abundant organisms on earth, and are therefore likely to play a major role in ecosystems. Environmental metagenomic studies have isolated CRESS DNA viruses from sea water, freshwater, faecal matter from various animals, soil, the atmosphere, sediments and sewage; dramatically increasing the known CRESS DNA viral genomes in the public domain. These studies are shedding light on the distribution of CRESS DNA viruses, as well as providing baseline data for future studies to examine virus-host interactions, community structure and ultimately viral evolution. Vector enable metagenomics (VEM) is another novel approach utilising NGS techniques for discovering CRESS DNA viruses. As many plant-infecting CRESS DNA viruses such as geminiviruses and nanoviruses are vectored by insects, this approach exploits this mechanism by using insect vectors as a surveillance tool to monitor and survey these viruses circulating in ecosystems. Recent studies have used these methods to identify known viral plant pathogens as well as novel viruses circulating in insect vectors such as whiteflies and other higher order insects such a mosquitoes and dragonflies. These approaches successfully demonstrated that VEM can be used as a unique method, with the first mastrevirus discovered in the new world being recovered from dragonfly species Erythrodiplax fusca using this approach. The research in this thesis uses metagenomics to survey CRESS DNA viral diversity in different organisms and environments. Two hundred and sixty eight novel CRESS DNA viruses were recovered and verified in this study from a range of sample types (adult Odonata, Odonata larvae, Mollusca, benthic sediment, water, Oligochaeta and Chironomidae) collected in the United States of America, Australia and New Zealand. All viral genomes isolated had two major proteins encoding for a putative Rep and coat protein (CP), with major Rep motifs identified in most Reps. Phylogenetic analysis of the Reps encoded by the viral genomes highlighted that most were extremely diverse falling outside of the previously described ssDNA viral families. A top-down approach was implemented to recover CRESS DNA viruses and possible viral pathogens from Odonata and their larvae. Thirty six viral genomes were recovered from terrestrial adult dragonflies as well as the twenty four from aquatic larvae. Dragonfly cycloviruses were isolated from the some adult Odonata species which were closely related to the isolates previously described by Rosario et al. (2012). The viruses isolated in the aquatic and terrestrial ecosystems differed substantially indicating that different CRESS DNA viromes exist in both land and water. The diversity of CRESS DNA viruses in seven different mollusc species (Amphibola crenata, Austrolvenus stutchburyi, Paphies subtriangulata, Musculium novazelandiae, Potamopyrgus antipodarum, Physella acuta and Echyridella menziesi) from Lake Sarah and the Avon-Heathcote estuary both in New Zealand, were also investigated. One hundred and forty nine novel viral genomes were recovered. Two CRESS DNA genomes were recovered from molluscs which have Rep-like sequences most closely

related to those found in some bacterial genomes. Sclerotinia sclerotiorum hypovirulence-associated DNA virus 1 (SsHADV-1) was originally isolated from fungal species Sclerotinia sclerotiorum in china and was later found in benthic sediments in New Zealand. As part of this study, SsHADV-1 was recovered from dragonflies (Erythemis simplicicollis, Ischnura ramburii and Pantala hymenaea) collected in Arizona and Oklahoma, USA suggesting a larger distribution of these viruses and not surprising given the near global distribution of S. sclerotiorum. Dragonfly larvae-associated circular DNA viruses (DflaCVs) that were originally isolated in Odonata larvae samples from three New Zealand lakes were later recovered from water, benthic sediment, worms and molluscs from one of the lakes initially sampled, suggesting that these viruses are ubiquitous in freshwater environments. This study has attempted to generate baseline data of CRESS DNA viruses in certain environments using NGS-informed approaches. This data was used to try and establish whether viral distribution in different samples types can potentially be explained by the food web interactions between different samples types. Although the analysis did not show any significant relationships between sample type interactions and viral distribution a few common associations between Odonata larvae and benthic sediment were evident. This was expected as the larvae live within the sediment so it could be assumed that they potentially have similar CRESS DNA viral distribution. Although the distribution of viruses varied across sample types, molluscs proved the best sampling tool for isolating largest numbers of CRESS DNA viruses in an ecosystem with extensive diversity. Overall, this research demonstrates the applications of NGS for investigating the diversity of CRESS DNA viruses. It demonstrates that some sample types such as Odonata in terrestrial systems and molluscs in aquatic environments, can be used as effective sampling tool to determine the diversity of CRESS DNA viruses in different environments as well as detecting previously isolated viruses. The CRESS DNA viruses isolated in this body of work provides baseline data that can potentially be used in future research to investigate hosts of these viruses and their interactions with hosts and potential flow in their environments." (Author)] Address: not stated

18888. Garré, A. (2014): Biología de las larvas de Cyanallagma interruptum Selys (1876) (Odonata: Coenagrionidae). PhD thesis, Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata: 251 pp. (in Spanish) ["The order Odonata is composed of small to large, cosmopolitan, predatory, exopterygous, palaeopterous insects with hemimetabolous development: mostly aquatic larvae (nymphs or naiads) and aerial adults. The suborder Zygoptera consists of gracile, small to large organisms with generally slow flight. The larvae are slender with three conspicuous caudal lamellae at the posterior end of the abdomen. The family Coenagrionidae is one of the most numerous families within the suborder. The genus Cyanallagma was established by Kennedy in 1920. In Argentina it is represented by only three species: C. bonariense (Ris, 1913), C. interruptum (Selys, 1876) and C. nigrinuchale (Selys, 1876). Cyanallagma interruptum (Selys, 1876) is typical of Patagonia, generally inhabiting lentic environments of different types, temporary or permanent, (lagoons, ponds and mallines) in both forest and steppe areas. Post-embryonic development is little studied in Argentina and is important to better understand voltinism and seasonal regulation, as well as to identify species from early larval stages, which is a prerequisite for the study of larval ecology. On the other hand, the larval stage is highly specific to the water body it inhabits. The characteristics of the environment limit the survival of one species or another. The different larval stages are distributed differently within the water body, possibly due to the availability of food, the absence and/or presence of predators, or the preference for one or another substrate. The main objective of this thesis is to determine several biological aspects of natural (non-laboratory reared) larval populations of the species Cyanallagma interruptum (Selys, 1876) and their relationship with physical-chemical and biotic variables in two lagoons: El Trébol and Los Juncos in the Northern Region of Patagonia, Argentina. Nine larval stages of Cyanallagma interruptum (Selys, 1876) were obtained in El Trébol lagoon and 10 in Los Juncos lagoon. Cyanallagma interruptum is a summer species according to Corbet (1956, 1999, 2002) and no seasonal synchronisation was observed. In both lagoons the species showed univoltinism. The diapause phenomenon occurs in the winter months and in the large and intermediate size stages. The description of the last larval stage (F-0) differs from the description made by Bulla in 1973. There is sexual dimorphism in the larval stages of C. interruptum which is evident from F-4 to F-0 (last larval stage) by the presence of genitalic sketches. A significant difference in the spatial distribution of C. interruptum larval stages was observed from the coast towards the centre in both studied lagoons. Substrate preference was observed for the different larval stages of C. interruptum, with medium and larger larval stages selecting Potamogeton sp., small larval stages preferring Myriophyllum sp. and Potamogeton sp. Both lagoons exhibited oligotrophic characteristics during the period of this study. However, differences in the distribution and relative abundance of the associated faunal taxa and physico-chemical variables influenced the distribution of larval stages from the coast towards the centre of both studied lagoons. Ambient temperature and concentrations of P-PO4, N-NH4, N-NO2 and N-NO3 ions influenced the relative abundance of the associated fauna and thus the larval cycle of C. interruptum." (Authors/DeepL) The thesis can be downloaded at: http://sedici.unlp.edu.ar/handle/10915/33331] Address: not stated

18889. Perkin, E.K.; Hölker, F.; Tockner, K. (2014): The effects of artificial lighting on adult aquatic and terrestrial insects. Freshwater biology 59(2): 368-377.["There is a growing concern that artificial light might affect local insect populations and disrupt their dispersal across the landscape. In this study, we investigated experimentally the effect of artificial light on flying insects in the field, with an emphasis on aquatic insects. We asked whether lights prevented the ability of insects to disperse across the landscape, a process

that is crucial in colonising restored habitats. We set up six, c. 3.5 m high downward facing high-pressure sodium streetlights along a permanently connected oxbow in the Spree River of eastern Germany. We collected insects using 12 flight intercept traps, each with trays at three different heights (0.5, 1.5 and 2.5 m), placed at distances 0, 3, 40 and 75 m from the lights and 5, 8 and 80 m from water. The number of emerging aquatic insects in the study area was measured with six emergence traps. We emptied the traps 22 times between June and September 2010; the lights were on for 11 of these nights and off for the other 11. In total, we caught almost 27 times as many insects at traps 0 m from the lights when the lights were on than when they were off. Most insects caught when the lights were on were aquatic, with Diptera being the most common order. Furthermore, the proportion of aquatic insects caught at traps 0, 3 and 40 m from the lights when they were on was significantly higher than when they were off. On lit nights, more aquatic insects were captured per hour and m² (area in which flying insects were intercepted) at traps 0 m from the lights than emerged from per square metre per hour from the Spree River. Our results suggest that adult aquatic insects can be negatively affected by artificial light and that city planners should take this into account when designing lighting systems along rivers." (Authors) The study includes a passing reference to odonata.] Address: Perkin, Elizabeth, IGB, Leibniz-Institute of Freshwater Ecology & Inland Fisheries, 12587 Berlin, Germany. E-mail: eperkin@mail.ubc.ca

18890. Berquier, C. (2015): Etude écologique et patrimoniale du peuplement des odonates de Corse appliquée à la conservation des espèces et des zones humides à enjeux. PhD thesis, Ecologie, Environnement, Université de Corse, Pascal Paoli: 311 pp. (in French, with English summary) ["Corsica [France] is home to a great diversity of wetland subject to anthropogenic pressures and threats which have continued to grow and diversify in recent decades. The conservation of these environments with high heritage value and of the original Odonata community that develops in it, today represents significant environmental and societal challenges in order to preserve essential ecological services provided by these key elements of aquatic and terrestrial ecosystems. The applied research project developed as part of this thesis is focused on improving the knowledge available on the corsican dragonfly's community, to propose concrete conservation and management measures for this group and its main insular natural habitats. In this objective, the first part of this work has sought to fill principal knowledge gaps identified by previous studies on the situation of listed species, including by greatly intensifying exploration effort at the regional level. The special features, distribution, habitat requirements and ecological of many dragonflies growing in Corsica have been described with great precision. The information available on some taxa with high heritage value increased particularly as illustrated by the comprehensive definition of eco-bio-geographical situation of Chalcolestes parvidens. The second part of this work has sought to evaluate and compare the effectiveness of the main sampling methods commonly used for the study of dragonfly's populations. In this context, the extensive information collected on the spatial organization and dynamics of the populations studied were especially used to propose and recommend appropriate methods for evaluation and monitoring the species to high conservation issue to main managers of natural areas of the island (Country Councils, PNRC, PMIBB, municipalities ...), including the emblematic and threatened Lestes macrostigma. The third part of this work is devoted to the development of tools for monitoring the quality of the main Odonata habitats. It lead to the development of a whole new biological index adapted to assess the ecological status of corsican rivers: "Odonata Community Index – Corsica" (OCIC). This innovative tool, based on the study of characteristics of dragonflies community of watercourses, was particularly effective during its confrontation with other biological indicators (diatoms, macrophytes, benthic macroinvertebrates) currently used on the island. The OCIC index and the Odonata group today appear clearly as a potentially promising alternative solution to improve the efficiency of the ecological quality assessment system of the rivers of Corsica, given the representativeness vulnerabilities which have been highlighted by the tests performed. The fourth and final part of this thesis, based on heritage and environmental assessments of the insular dragonfly's community made with all the information produced, ended with the development and the proposal of several regional conservation devices whose implementation is encouraged by the state services: a first regional actions plan, a first red list of threatened species and an updated list of species determinative for natural areas of ecological, flora and fauna interest (ZNIEFF). These important features are intended to contribute to improve the overall state of conservation of Corsican dragonflies and main wetlands that support them. They should enable the implementation of truly operational management actions and ensure better consideration of the main regional conservation and valuation issues identified. In the end, this thesis work that increased more than triple the previously available data on dragonflies of Corsica, will provide a new framework to developpe the isular odonatology." (Author) The study can be downloaded at. https://tel.archives-ouvertes.fr/tel-01408080] Address: Berquier, C., Office de l'Environnement de la Corse, Observatoire – Conservatoire des Insectes de Corse, Lieu-dit "Lergie", RN 200, 20250 Corte, France. E-mail: cyril.berquier@oec.fr

18891. Bruens, A.; Drews, A.; Haacks, M.; Winkler, C. (2015): Die Libellen Schleswig-Holsteins. Arbeitskreis Libellen in der Faunistisch-Ökologischen Arbeitsgemeinschaft e. V. (Hrsg.). ISBN: 9783942062190: 542 pp. (in German) ["Dragonflies have been flying around the Earth for 300 million years already, and at the time they reached wingspans of about 70 centimeters. While many other animal species have become extinct over the course of time, the iridescent insects have survived. They are not only pretty to look at, they are also bioindicators of the quality of waters and wetlands. Even today there are some 5,600 species of this largest insects, and nationwide in Germany there are about 80

species. From the northernmost state of Schleswig-Holstein 65 species are known. The Libellen Schleswig-Holsteins is a comprehensive description of the distribution, population status, and ecology of, and threats facing, the species in this state. The text is illustrated by numerous photographs, graphics and tables. It also deals with the dragonfly species that occur in neighboring regions and are expected to show up in the future in Schleswig-Holstein. In addition to the faunal part, the work contains detailed chapters on other aspects of odonatology such as morphology and biology, the importance of different types of water, long-term development of stocks, legal safeguards and measures put in place to conserve species. The book is aimed not only at professionals and those working professionally with dragonflies, but also at all interested laypeople who are fascinated by these often colourful flying acrobats." (Publisher)] Address: Email: chr.winkler@email.de

18892. Laister, G. (2015): Libellen im Botanischen Garten Linz. ÖKO·L 37/4: 3-9. (in German) [20 dragonfly species were recorded in the Botanical Garden Linz (Austria), 14 of them possibly or definitely native. The dominant species are those that can be expected in garden ponds. However, garden ponds also have different characteristics and therefore attract different species because of the unequal demands that dragonfly species make on the habitat. Therefore, the composition of the dragonfly fauna of the water bodies also differs. For example, the two largest ponds (Pond 10 and Pond 11) attracted the most dragonflies with 17 and 18 species respectively. Ten and 11 species were seen at pond 2 and 3 respectively. However, this does not take into account whether the dragonflies also developed at these ponds. As good flyers, dragonflies can also be found - even regularly - at water bodies where they have not grown up.] Address: Laister, G., Naturkundliche Station, Neues Rathaus, Hauptstr. 1-5, 4041 Linz, Austria. E-mail: Gerold.Laister@mag.linz.at

18893. Schneider, W.; Samraoui, B. (2015): Chapter 5. The status and distribution of dragonflies and damselflies (Odonata) in the Arabian Peninsula. In: García, N., Harrison, I., Cox, N. and Tognelli, M.F. (compilers). (2015). The Status and Distribution of Freshwater Biodiversity in the Arabian Peninsula. Gland, Switzerland, Cambridge, UK & Arlington, USA: IUCN. ISBN: 978-2-8317-1706-7: 39-55. (in English) ["The number of dragonflies and damselflies of the Arabian Peninsula and the Socotra Archipelago amounts to 59 taxa with 5 additional species, Pseudagrion niloticum, Anax tristis, Sympetrum sinaiticum, Trithemis pallidinervis, and Tramea basilaris not evaluated. Pseudagrion niloticum has not been assessed because it was only recently discovered in Wadi Hadhramout (Schneider and Nasher 2013). For Sympetrum sinaiticum there is only a single record in northern Saudi Arabia at the southernmost border of the species' distribution. Although a female was collected during oviposition, its true status is unknown. The same holds true for the remaining three species: Anax tristis and Tramea basilaris are common migrants often spotted in the desert plains or far offshore. In Arabia Trithemis pallidinervis is only known from a single specimen collected in northern Oman. It is likely that the occurrence of this Indian species originated from a windborne migration. The species has obviously not established stable populations in Arabia. The validity of some taxa and their precise distribution deserves further investigation, with the larvae of several species insufficiently described or even unknown (Jödicke et al. 2004). The highest diversity of Odonata in the region is concentrated in the southern Arabian Peninsula, including parts of Yemen (67.2%), Saudi Arabia (64.1%) and Oman (64.1%) (Table 5.1, Fig. 5.1). The south-west of Saudi Arabia, a hotspot of Odonata diversity in the region, contrasts sharply with the much drier rest of the country." (Authors)] Address: Samraoui, B., Laboratoire de Recherche des Zones Humides, Universite d'Annaba, 4 rue Hassi-Beida, Annaba, Algeria. E-mail: bsamraoui@yahoo.fr

18894. Valeriano, W.W. (2015): Cores estruturais da asa da libélula: Chalcopteryx rutilans. MSc. thesis, Universidade Federal de Minas Gerais: 61 pp. (in Portuguese, with English summary) ["In dragonflies, color has many functions, the most important ones being sex recognition, courtship and territory defense behaviors. In C. rutilans - a dragonfly found in the Amazonian rain forest those functions are performed by displaying their strongly iridescent hind wings, whereas the hyaline forewings are used to maintain the flight. The phenomenon of iridescence results from physical optics effects such as diffraction and interference. The aim of this work is to study the structures responsible for the male wing iridescence in Chalcopteryx. Visible range reflectance was measured for each different colored region of the wings. In order to determine the internal microstructure of the region that exhibits the same color, Scanning Electron Microscopy SEM was performed in cross-sections of the wings, after cutting in situ by Focused-Ion Beam FIB. Transmission Electron Microscopy TEM images were obtained from ultrathin sections of osmium treated, resin embedded and uranyl-stained wing. The SEM and TEM images revealed that the wings have a multilayered structure alternating different electron density materials. The number and thicknesses of the layers change across the wing, correlating with the local color. The composition of the layers is considered as being of chitin with different levels of melanin pigmentation. The electron density of the SEM cross-section images was assumed as being directly proportional to the optical density, and was used to define the modulation of the refractive indexes in the multilayered structure. The optical reflectance resulting from a structure with such a modulated refractive index was calculated numerically, using the transfer matrix method. A good correlation is obtained between experiment and simulation, thus confirming that in C. rutilans male wings colors result from a multi-layer structure, i.e., these wings are natural one dimensional photonic crystals." (Author)] Address: Valeriano, W.W., Depto de Física, ICEx, Universidade Federal de Minas Gerais, Av. Antônio Carlos 6627, 31270-901 Belo Horizonte, Minas Gerais, Brazil. Email: wescleyvaleriano@gmail.com

Zimmermann, W. (2015): Besprechung: Die Libellen des Nationalparks Harz. Landschaftspflege und Naturschutz in

Thüringen 52(1): 47. (in German) Book review. Odonate fauna of Harz mountain National Park.] Address: Zimmermann, W., Thomas-Müntzer-Str. 5, D-99423 Weimar, Germany. e-mail: wolfgang.zimmermann.web@kabelmail.de

2016

18895. Aideo, S.N.; Mohanta, D. (2016): Limiting hydrophobic behavior and reflectance response of dragonfly and damselfly wings. Applied Surface Science 387: 609-616. (in English) ["In this work, through water contact angle (CA) measurements, we explore hydrophobic behavior of different parts of the hind wings of a dragonfly, *Gynacantha Dravida* and of a damselfly, *Pseudagrion Microcephalum*. As we move from the basal to distal region, the contact angle (θ) was found to vary in the range of 120–136° for both the species. Moreover, the wing of the dragonfly was seen to be more hydrophobic than that of the damselfly one. An attempt has also been made to link roughness factor (r_φ) and solid-water fraction (φ) through the simplified Wenzel and Cassie-Baxter models. We noticed that, r_φ and φ tend to follow a linear relation that gives $r_\varphi = 1.47$ in the limit, $\Delta\theta < 10.1°$, latter being recognized as the difference in angle between the measured CA over a surface to that of the CA (~105°) known for a smooth surface. Our experimental data, however, revealed empirical relations which predicted higher r_φ values, particularly when $\Delta\theta$ is large. While the overall reflectance response of the distal segment was believed to be stronger than that of the basal part, the edge parts of the dragonfly and damselfly wings exhibited exponential associated growing trends with increasing wavelength. The relative reflectance response, corresponding to ~494 nm and 370 nm peaks, gets nearly doubled for the edge specimen as compared to the distal and basal parts. The edge- specimen, which comprises of rectangular shaped, periodic microstructures, displayed carotenoid based two broad peak maxima at ~422 nm and ~494 nm. The surface roughness which arises through the distribution of oblate-shaped nano-fibrils is believed to be the basis of subsurface volume scattering. Interrelating nanostructure surface roughness based wettability and reflectance characteristics would provide new insights on structure-property relationship in naturally available soft matter systems including templates of biological origin.] (Authors)] Address: Mohanta, D., Nanoscience and Soft Matter Laboratory, Dept of Physics, Tezpur Univ., Napaam, Tezpur, Assam 784 028, India. E-mail: dmohanta1973@gmail.com

18896. Liu, X.; Chen, K.; Chen, Q.; Wang, M.; Wang, L. (2016): The community structure of macroinvertebrate and its relationship to the environmental factors in summer and autumn within typical reaches of Iluai River Basin. Acta Scientiae Circumstantiae 36(6): 1928-1938. (in Chinese, with English summary) ["Being an important component of river ecosystem, benthic invertebrate is sensitive to the changes of water environment and ecological status. The community structure characteristics of invertebrate can effectively indicate the status of water quality and river ecosystem condition. To assess the ecological health of Huai River system which is under strong human disturbances, monitoring on water quality, sediment and benthic invertebrate were conducted at 27 sampling sites in summer and autumn of 2014 in Huaihe mainstream and tributaries. Multivariate analysis methods were used to analyze the composition dominant species, biodiversity, temporal and spatial characteristics of macroinvertebrate assemblages, as well as their relationships to environmental factors. The results showed that 4297 macroinvertebrates of 62 taxa collected within two investigations were mainly composed by Mollusca and Insecta. Insecta mainly consisted of Diptera, Ephemeroptera and Odonata, accounting for 33.33%, 21.21% and 18.18% of the total number in Insecta taxa, respectively. Additionally, the average abundance and biomass of macroinvertebrate were 74.21 ind·m^{-2} and 7.89 g·m^{-2} in summer with the dominant species of Caridina and Bellamya aeruginosa, and were 27.53 ind·m^{-2} and 1.13 g·m^{-2} in autumn with the dominant species of Caridina, Orthocladius, Baetis and Cricotopus. The results of t-test showed that there was no significant difference (p=0.135) on spatial distribution of macroinvertebrate density between summer and autumn, while the spatial distribution of the biomass was significantly different (p=0.002). Based on the comparison of two investigations, it was found that the difference in macroinvertebrate abundance was mainly contributed by Mollusca and Crustacea; the individual number of Insecta also appeared the seasonal difference as the number of Trichoptera in summer is significantly higher than that of in autumn, and the numbers of Diptera and Ephemeroptera were obviously lower than that of in autumn. The results of Redundancy analysis (RDA) indicated that the gradient changes of water temperature, pH, total nitrogen, and heavy metals (Hg, Cd, Pb) were the main driving factors for the changes of benthic macroinvertebrate community structure. Furthermore, dam operation, slope solidification, riparian vegetation, and sand mining were major disturbances to habitats and biodiversity of benthic macroinvertebrates." (Authors)] Address: Liu, X., Center of Eco-Environmental Res., Nanjing Hydraulic Res. Inst., Nanjing 210029, China. E-mail; golx_2007@ 126.com

18897. Staufer, M. (2016): Erstnachweis der Kleinen Moosjungfer Leucorrhinia dubia (Vander Linden, 1825) für das Burgenland (Insecta: Odonata). Biodiversitat und Naturschutz in Ostösterreich - BCBEA 2/1. BCBEA 2/1 (Oktober 2016): 97-101. (in German, with English summary) ["First record of L. dubia from Burgenland (Insecta: Odonata). On July 21, 2013 L. dubia was recorded in Burgenland for the first time. In Austria the species inhabits typically pools in raised and transition bogs in montane to subalpine altitudes. A possibly indigenous population of L. dubia in Burgenland is discussed." (Author)] Address: Staufer, Martina, Lindenbauergasse 13, 1110 Wien, Austria. Email: m_staufer@web.de

18898. Tichanek, F. (2016): Ecology of endangered damselfly Coenagrion ornatum in post-mining streams in relation to their restoration. MSc. thesis, Faculty of Science, University of South Bohemia, Èeské Budìjovice, Czech Republic: 53 pp. (in English) ["Summary and synthesis: As the thesis results confirmed, the Radovesicka spoil heap represents a

regionally important secondary habitat for endangered C. ornatum. Although the high conservation value of the post-mining streams was already suggested (Tichanek & Tropek 2015), various opponents have been sceptical about residency of the threatened headwater species in the post-industrial freshwater sites. According to our results on the population size, the larval occurrence, and the species' spatial ecology, the population is confirmed to be resident. This detailed study of the endangered species shows that at least some of the habitat most specialised species are able to create rich and relatively stable local populations in human-made sites. It also supports indication, that the most interesting and valuable odonate communities are being formed in reclaimed parts of spoil heaps, contrasting thus to threatened terrestrial biota. Similarly, both studying the spatial ecology and detailed habitat requirements revealed the huge importance of small-scaled microhabitats formed by fine-leaved emergent vegetation (Eleocharis spp. in our study). Such microhabitats are favoured by both life stages, both sexes, and on both studied spatial scales. The patches without the microhabitat are colonized by fewer specimens which tend to emigrate soon. Supporting such microhabitats is thus extremely useful for the species conservation and should represent one from the main tools in restoration of post-mining flowing freshwaters. Because the species is sedentary, mostly operating within 100 m long sections, all conservation action potentially degrading the habitat from short-term point of view should be provided in maximally 100 meters long sections. Even short-term damage of longer sections via management suggested by the species' habitat preferences (removing sediments or too grown vegetation) could lead to fragmentation of the local population. Moreover, it would be highly desirable to establish good microhabitats at least with the frequency one short section per 100 m long section. This will keep a higher connectivity and thus viability of the population. Our results confirmed that sampling of larvae is still optimal. Larval response slightly differ from adults, mainly because of requiring finer-scale habitat heterogeneity, whereas they are not influenced by the banks characteristics. However, despite this, C. ornatum females have still relatively narrow distribution restricted to specific microhabitats which are very important also for larvae. Females and juveniles thus can be monitored as a very accurate proxy of the larval development and species residency. Finally, as number of present juveniles is decreasing shortly after start of the season, sampling should be provided in early species flight period to record sufficient abundances of the generally hardly detectable juveniles." (Author)] Address: not stated

2017

18899. Amann, P. (2017): Über das Vorkommen der Helm--Azurjungfer und anderer Libellen im Raum Dornbirn - Hohenems - Lustenau (Vorarlberg, Österreich). inatura – Forschung online 36: 21 pp. (in German) ["The aim of the research assignment was to document the dragonfly fauna in the greater Hohenems, Lustenau and Dornbirn area along ditches. One focus of the work was to record the populations of Coenagrion mercuriale, which was first recorded in the study area in 2007 (Hämmerle 2007: 313). In autumn 2015, the water bodies in the study area were surveyed and assessed as potential dragonfly habitats. 14 water bodies were selected for further investigation. From May 2016, the dragonfly fauna of the selected ditches could be examined. Five inspections were carried out per water body. A total of 28 dragonfly species were identified during this study; ten of the species found belong to an endangered category, two are considered to be threatened with extinction according to Hostettler (2001). In the course of the study, a previously unknown autochthonous occurrence of C. mercuriale was also discovered. This is the largest known population of this species in Vorarlberg. From a nature conservation perspective, the protection of this occurrence is of Europe-wide importance (C. mercuriale is listed in the Habitats Directive, Annex II)." (Authors/DeepL)] Address: Amann, P., Wiesenbachweg 8, 6824 Schlins, Austria. E-Mail: p.amann@aon.at

18900. Billqvist, M. (2017): Nya provinsfynd av trollsländor i Sverige 2009-2017 - New provincial records of Odonata in Sweden 2009-2017. Entomologisk Tidskrift 138(3-4): 209-225. (in Swedish, with English summary) ["The interest for dragonflies in Sweden have increased dramatically for more than a decade. This has brought on more knowledge and many new province records. Since year 2000 threre has even been six new species for the country: Sympecma paedisca, (in the year 2000), Anax imperator (2002), Erythromma viridulum (2004), Aeshna affinis, (2010), Anax parthenope (2010) and Sympetrum pedemontanum (2011). The Occurrence Catalogue (formerly known as the Landscape Catalogue) of dragonflies was last updated in March 2009. This article presents 128 new provincial findings made since then, most of them new records but also older reports that was not included in 2009. By 2017, 64 species of dragonflies have been found in Sweden. Out of these, 51 species have been reported from new provinces since 2009. With the sole exception of Lycksele lappmark, new species of dragonflies have been reported from every province." (Authors)] Address: Billqvist, M., Trollsländeföreningen / Swedish Dragonfly Society, Idrottsvägen 2, SE-243 72 Tjörnarp, Sweden. Email: magnus.billqvist@gmail.com

18901. Liechti, T. (2017): RKR2020 - Neukonzessionierung Kraftwerk Reckingen. Fachbericht Libellen. Anlage D 7.21. RKR2020 – Umweltplanung Modul 2: 21 pp. (in German) ["Five species of Gomphidae live on the High Rhine. Among them is Gomphus simillimus, which in Germany and Switzerland occurs almost exclusively on the Rhine between the outlet of Lake Constance and Breisach. Ophiogomphus cecilia, which occurs in low density on the Rhine, is listed in Annex 4 of the Habitats Directive and is thus strictly protected in Germany. Fauna databases of Switzerland and Germany were consulted and the results evaluated. In addition, five representative stretches were searched for exuviae in June 2015. The data and findings show that the Reckingen dam contains a large population of G. simillimus of probably several hundred individuals. Also common are G. vulgatissimus and Onychogomphus f. forcipatus. The latter prefers flowing stretches to backwater stretches with coarser bottom

substrate. O. cecilia is rare, but present in the area. On the High Rhine, exuviae of G. simillimus were found both on rapidly flowing and almost stagnant stretches. The highest hatching densities were found at sites with low flow velocity and accumulation of fine sediments, such as the boathouse at Rümikon (CH), which is located in a slightly wider section of the Rhine with large sand and silt deposits. The unchanged operation of the power plant is not expected to have any impact on the dragonfly species group. No valuable dragonfly habitats are affected by the construction of the fishway or replacement measures such as the creation of side channels." (Author; DeepL)] Address: Liechti, T., creato, Limmatauweg 9, 5408 Ennetbaden. Switzerland. E-mail: t.liechti@creato.ch

2018

18902. Cook, P.; Rasmussen, R.; Brown, J.M.; Cooper, I.A. (2018): Sexual conflict does not maintain female colour polymorphism in a territorial damselfly. Animal Behaviour 140: 171-176. (in English) ["Highlights: •We examined whether male damselflies discriminate between female colour morphs. •We used five populations that varied in male-like female morph frequency (0–86%). •Males approached, inspected and contacted both female morphs at similar rates. •Females experienced more tandem attempts and longer interaction duration than males. •In Megalagrion calliphya, there is little evidence of female harassment by males. Female-limited dimorphism is commonly hypothesized to be an adaptation resulting from male harassment or sexual conflict over female mating rate. We examined whether males discriminate between female colour morphs of the beautiful Hawaiian damselfly, Megalagrion calliphya, in order to evaluate whether male harassment could explain the existence and/or maintenance of this dimorphism. Previous studies of this species suggest that spatially varying ecological selection maintains the dimorphism, but these hypotheses are not mutually exclusive. Here, we used a common method of measuring male behaviour towards secured females at mating sites under naturally occurring conditions, using five populations that range in male-like female morph frequency from 0 to 0.86. We found very low rates of interaction in a total of 64 one-hour trials, and male behaviour towards females did not differ significantly between colour morphs. By comparing the populations that vary in female morph frequency, we found no evidence of frequency-dependent sexual selection on colour, suggesting that this polymorphism is maintained by selective forces other than sexual conflict." (Authors)] Address: Cooper, I., Biology Dept, James Madison University, 951 Carrier Dr., Harrisonburg, VA 22807, U.S.A. E-mail: cooperia@jmu.edu

18903. Miler, O.; Czarnecka, M.; Garcia, X.-F.; Jäger, A.; Pusch, M. (2018): Across-shore differences in lake benthic invertebrate communities within reed stands (Phragmites australis Trin. ex Steud.). International Revue Hydrobiology 103: 99-112. (in English) ["The spatial distribution of benthic macroinvertebrates along reed transects was studied in lakes with minimal human disturbances to enable a deeper understanding of the functioning of reed macroinvertebrate communities and relations to biotic and abiotic environmental variables. The taxonomic and functional macroinvertebrate community composition significantly differed between outer margin, center, and shore locations. At shore locations, higher proportions of Gastropoda, Hydrachnidia and Coleoptera, mobile swimmers/skaters, predators, and shredders were found. However, outer margin locations were characterized by a higher proportion of sessile filter-feeding Bivalvia and mining Diptera. At the outer margins, also greater contributions of taxa preferring pelal habitats and r-strategists typical for more disturbed environments were observed. An indicator species analysis revealed Asellus aquaticus (Crustacea) and Scirtidae Gen sp. (Coleoptera) as significant indicator taxa for shore locations and Valvata piscinalis (Gastropoda), Tinodes sp. and Orthotrichia sp. (Trichoptera) as significant indicator taxa for outer margin locations. The taxonomic composition of macroinvertebrate communities was significantly related to higher water depth, oxygen content, and pH at outer margin locations. Shore locations were characterized by higher amounts of woody debris, leaf litter, and decaying plant material. In summary, the taxonomic and functional composition of macroinvertebrates varied strongly from shore to outer margin locations and could be related to spatial changes in hydrodynamical and food conditions along the transects." (Authors) The study includes "Odonata" and "Ischnura elegans".] Address: Miler, M., Leibniz Inst. Freshwater Ecology & Inland Fisheries (IGB), Müggelseedamm 301, 12587 Berlin, Germany. E-mail: oliver.miler@web.de

18904. Seidu, I.; Nsor, C.A.; Danquah, E.; Lancaster, L.T. (2018): Odonata assemblages along an anthropogenic disturbance gradient in Ghana's Eastern Region. Odonatologica 47(1/2): 73-100. (in English) ["We assessed the effects of different levels of anthropogenic disturbance on Odonata species richness and assemblage composition in four different habitats in Ghana: mining sites, agricultural fields, human settlements, and primary forest habitat. A total of 992 individual adult Odonata representing 51 species (20 Zygoptera, 31 Anisoptera) in six families were recorded from 16 sites across these habitats. A majority of species (75 %) recorded across all sites were previously classified as habitat generalists, while 20 % represented specialists. The human settlement habitat exhibited the overall highest Odonata abundance (302 individuals), whereas the greatest species diversity was observed in the mining sites (D = 4.59). Agricultural fields had lowest abundance (n = 196 individuals), while primary forest sites exhibited the lowest diversity (D = 2.75), although these differences were not statistically significant. There was also no significant difference in adult Odonata richness D ($F_{3,59.72} = 2.48$, $p = 0.07$) among habitats. However, species composition differed significantly among the various habitats (ANOSIM: global $R = 0.73$, $p = 0.001$). A canonical correspondence analysis revealed that river flow rate, percentage of canopy cover and channel width were the key factors influencing Odonata assemblages. Generalist and heliophilic dragonflies dominated in human-altered habitats, while the matured forest habitat included

more specialists and stenotopic damselflies. The results suggest that specialist dragonflies can be used as freshwater habitat quality indicators, and their habitat requirements also support the need to maintain the remnant primary forest in the East Akim District." (Authors)] Address: Seidu, I., Dept Wildlife & Range Management, Fac. Renewable Nat. Resources, Kwame Nkrumah Univ. of Sci. & Tech., Kumasi, Ghana. E-mail: antwiseidu88@gmail.com

18905. Shapovalov, M.I.; Korotkov, E.A. (2018): Materials to the fauna of dragonflies (Odonata) of the botanical garden of Adyghe State University. Ekosistemy 16(46): 94-98. (in Russian, with English summary) ["The paper provides a list of dragonflies identified on the territory of the Botanical garden of the Adyghe State University (Republic of Adygeya). The list includes 21 species from 7 families: Calopterygidae: 1, Coenagrionidae: 3, Lestidae: 4, Platycnemididae: 2, Aeshnidae: 4, Gomphidae: 2, Libellulidae: 5. Gomphus schneiderii Selys, 1850 are recorded to Adygea and the North-Western Caucasus for the first time. Of the identified in the Botanical garden dragonflies, three species are protected: Anax imperator, Brachytron pratense, Chalcolestes parvidens." (Authors)] Address: Shapovalov, M.I., Lab. for Bioecological Monitoring of the Invertebrate Animals of Adygheya, Research Institute of Complex Problems, Adyghe State Univ., Gagarina str. 13, Maykop 385000, Adygheya Republic, Russia. E-mail: shapmaksim2017@yandex.ru

2019

18906. Archibald, S.B.; Cannings, R.A. (2019): Fossil dragonflies (Odonata: Anisoptera) from the early Eocene Okanagan Highlands, western North America. Canadian Entomologist 151(6): 783-816. (in English) ["We describe the first dragonflies (Odonata: Anisoptera) from the early Eocene Okanagan Highlands of far-western North America from nine fossils. Six are assigned to five species in four new, named genera of Aeshnidae: Antiquiala snyderaenew genus and species, Idemlinea versatilisnew genus and species, Ypshna brownleeinew genus and species, Ypshna latipennatanew genus and species, and Eoshna thompsonensis new genus and species; we treat one as Aeshnidae genus A, species A; one is assigned to Gomphidae: Auroradraco eosnew genus and species; and we treat a ninth, fragmentary fossil of unknown family affinity as Anisoptera indeterminate genus A, species A, which represents a seventh genus and eighth species. The dominance of Aeshnidae is consistent with other Paleocene and Eocene fossil localities. Auroradraco eos is the only fossil Gomphidae in the roughly 66-million-year gap between occurrences in mid-Cretaceous Burmese amber and the early Oligocene of France. Ypshna appears close to Parabaissaeshna ejerslevense from the early Eocene Fur Formation of Denmark; this is not surprising given Holarctic intercontinental connections at this time and a growing list of insect taxa shared between the Okanagan Highlands and the Fur Formation." (Authors)] Address: Archibald,S.B., Dept Biol. Sciences, Simon Fraser University, 8888 University Drive, Burnaby, British Columbia, V5A 1S6, Canadasba48@sfu.ca

18907. Bell, T.; Harriss, J.; Ruzaini, A.; Fernando, C.; Guay, P.J.; Weston, M.A. (2019): Flight initiation distance in dragonflies is species-specific, positively related to starting distance and sometimes body length. International Journal of Odonatology 22(3-4): 173-179. (in English) ["Predator escape behaviour is a critical component of dragonfly life history. Flight initiation distance is the distance at which escape commences, and is well studied in vertebrates, barely studied in invertebrates, and entirely unstudied in dragonflies. Here we test four principles regarding flight initiation distance as derived from studies of vertebrates to examine if they apply to dragonflies in Sri Lanka: (1) flight initiation distance is a species-specific trait; (2) flight initiation distance increases with starting distance (the distance at which the experimenter begins an approach); (3) larger individuals have longer flight initiation distances; and (4) flight initiation distance varies between the sexes in some species. We collected 105 flight initiation distances from 11 species (known sex and size). Flight initiation distances varied between species and positively with starting distance. In one of three data-rich species (n = 10), flight initiation distance was positively associated with body length. Flight initiation distance did not vary with sex in our sample. Escape responses evoked by standardised human approaches represent a fruitful methodology to study dragonfly escape behaviour in the wild." (Authors)] Address: Weston, M.A., Centre for Integrative Ecol., School of Life & Environmental Sciences, Fac. Science, Engineering & the Built Environment, Deakin Univ., Geelong, Australia. Email: mweston@deakin.edu.au

18908. Bielczynska, A. (2019): Wind exposure as a factor influencing the littoral macrozoobenthic community: a methodological approach and preliminary findings. Limnol. Rev. 19(3): 113-123. (in English) ["The aim of the work was to analyze the influence of wave activity on invertebrate fauna living in the littoral zone. For this purpose, an algorithm was developed to analyze spatial and meteorological data, calculating the values of fetch and wind exposure. The taxonomic composition of the fauna and the values of selected water quality indicators were analyzed against the background of varied wind exposure, trophy, and various habitats. A significant negative impact of wind exposure on the taxonomic variety of the macrozoobenthic community, the number of Coenagrionidae damselflies and Baetidae mayflies was found. It is difficult to separate the impact of waves on the fauna from the impact of other natural and anthropogenic factors, because those factors may also be affected by water movements. The tool produced as part of this work can also be used to further investigate the issue of impact of waves on all the communities living in the littoral zone." (Authors)] Address: Bielczyñska, Aleksandra, Dept Freshwater Protection, Institute of Environmental Protection – National Research Institute, Kolektorska 4, 01-692 Warsaw, Poland. Email: a.bielczynska@ios.edu.pl

18909. Brasil, L.S.; Silverio, D.V.; Cabette, H.S.R.; Batista, J.D.; Vieira, T.B.; Dias-Silva, K.; de Oliveira-Junior, J.M.B.; de Carvalho, F.G., Calvao, L.B.; Macedo, M.N.; Juen, L. (2019): Net primary productivity and seasonality of temperature and

precipitation are predictors of the species richness of the Damselflies in the Amazon. Basic and Applied Ecology 35: 45-53. (in English) ["Several hypotheses have been proposed to explain the mechanisms that generate temporal and spatial species richness patterns. We tested four common hypotheses (water, energy, climatic heterogeneity and net primary productivity) to evaluate which factors best explain patterns of Zygoptera species richness. Of these, we predicted that climatic heterogeneity would be the most important predictor for Zygoptera richness patterns. We sampled communities of adult Zygoptera in 100 small Amazonian streams. Based on generalized linear mixed models (GLMM), we found that net primary productivity and climatic heterogeneity comprised the best model of Zygoptera species richness in Amazonian streams, with an pseudo r^2 of 39.5%. Results indicate that species richness increases by one species per 1 kg of biomass per square meter in NPP, or with an increase of 2ºC in air temperature variability. Our work corroborates a recent study with other taxa in Brazilian Bioms. This suggests that temporal variation in climate and net primary productivity are important predictors of the macroecological patterns of richness for aquatic organisms in tropical regions." (Authors)] Address: Brasil, L.S., Programa de Pós-Graduação em Zoologia - Universidade Federal do Pará e Museu Paraense Emílio Goeldi. Belém, Pará, Brasil. E-mail: brasil_biologia@hotmail.com

18910. Buczynska, E.; Buczynski, P. (2019): Survival under anthropogenic impact: the response of dragonflies (Odonata), beetles (Coleoptera) and caddisflies (Trichoptera) to environmental disturbances in a two-way industrial canal system (central Poland). PeerJ 6:e6215: 31 pp. (in English) ["Ecological metrics and assemblages of three orders of aquatic insects (Odonata, Coleoptera and Trichoptera — OCT) in an industrial canal system affected by dredging were studied. Five sites (a river as a control site and canals) along the Vistula River in Central Poland were sampled during six sampling periods (2011 and 2013). Canonical correspondence analyses (CCA) was used to assess the influence of environmental variables on the distribution of 54 insect species in the following system of habitats—a river feeding the canals, river-fed inlet canals and outlet canals with cooling waters. Additionally, before and after control impact (BACI) was used to test for the impact of canal dredging in 2011 on the insect response metrics. Non-metric multidimensional scaling analysis differentiated insect assemblages of the three habitats and similarity percentage (SIMPER) indicated the species most responsible for the faunistic dissimilarities. Temperature was found to be a key factor governing the presence of insects in the outlet canals with cooling water. CCAs revealed that electrolytic conductivity (EC) and salinity had the greatest influence on the OCT fauna in the river and the inlet canals, whilst it was the dissolved oxygen and the level of development of aquatic plants that proved most important in the outlet canals. Modified ANOVAs showed that dredging significantly affected the mean species richness and the dominance in the canals. The changes in OCT species composition were highly informative. The comparison between tolerance patterns of the OCT orders against the five parameters (temperature, EC, total dissolved solids (TDS), pH and current) revealed that caddisflies are the most sensitive group, followed by Coleoptera while Odonata proved the most resistant. Dragonflies have the greatest potential to serve as bioindicators of industrially heated waters. The OCT fauna responded specifically to different environmental factors and stressors, it is strongly recommended to track the responses on different levels, not only metrics, but above all, species." (Authors)] Address: Buczynski, P., Dept of Zool., Maria Curie-Sklodowska Univ., Akademicka 19, 20-033 Lublin, Poland. E-mail: pawbucz@gmail.com

18911. Buczynski, P.; Takowski, A. (2019): Wazki (Odonata) rezerwatu przyrody „Jezioro Obradowskie" (Polesie Zachodnie) - Dragonflies (Odonata) of the nature reserve "Lake Obradowskie" (West Polesie). Parki Narodowe i Rezerwaty Przyrody National Parks and Nature Reserves (Parki nar. Rez. Przyr.) 38(3-4): 17-30. (in Polish, with English summary) ["The nature reserve "Lake Obradowskie" near Parczew in the Lublin Region (Central-Eastern Poland) lies in a drainage depression and encompasses: a slightly hypertrophic polyhumic lake, high and transitional peat bogs surrounding the lake and the canal connected to the lake. In 2019, 27 dragonfly species were found here. The fauna of the lake was the qualitatively richest (22 spp.). An assemblage found in the lake was typical of a small eutrophic lake, but poorer in species: lacking species preferring transparent water and the elodeid zone, and with a very poor representation of the fauna typical of the nymphaeid zone. This correlated with very poor development of tall vegetation, constant bloom of cyanobacteria and low oxygen content in the water. In the canal 16 spp. occurred; this was a poorer variant of the lake's fauna with the addition of the habitat disturbance indicator, Libellula depressa, which resulted from the almost complete drying out of the canal in the summer. 6-11 species were found on three studied open peat bogs, but they were almost exclusively foraging individuals from other habitats, and regular reproductive behaviour was observed only in Somatochlora flavomaculata. The studied nature reserve proved to be of little importance for the protection of dragonflies. (1) Its fauna was not too rich in species, the small size of the populations of most species was also unfavourable, which may reduce their stability. (2) Assemblages of dragonflies in individual habitats were of little value, common eurytopes dominated. The only recorded tyrphophile is S. flavomaculata. Stenotopes of other habitats only flew over the study area. (3) Only one of 16 species of dragonflies protected in Poland (Sympecma paedisca) was found, it was rare and showed no reproductive behaviour. (4) No species endangered in Poland and in the Lublin Province were found. The state of the fauna described above results from the high productivity of the lake and its dominance by algae but not macrophytes. However, this productivity is probably natural: in the geological base of West Polesie, limestone rocks dominate, which makes the pH of the lake waters high and there are good conditions for the development of bacteria that decompose organic matter. An important factor is also the lack of water bodies in the

peat bogs, which means that dragonflies do not develop on them (and probably valuable assemblages would be formed here, dominated by tyrphobionts and tyrphophiles), nor do they colonize lakes from them. Data from the nature reserve “Lake Obradowskie” indicates in particular that such colonization is crucial for the presence in the fertile lake of species associated with peat bogs. The authors suggest the protection of dragonflies in the studied reserve by manually digging small peat excavations in the peat bogs around the lake. This would create valuable habitats for hydrobionts associated with high and transitional peat bog waters without significantly interfering with water relationships. Such activities may soon be a sine qua non condition for the protection of this organisms in the case of rising air temperatures and drying out of peatlands." (Authors)] Address: Buczynski, P., Dept Zool., Maria Curie-Sklodowska Univ., Akademicka 19, PL-20-033 Lublin, Poland. E-mail: pawbucz@gmail.com

18912. Cerini, F.; Stellati, L.; Luiselli, L.; Vignoli, L. (2019): Long-term shifts in the communities of Odonata: effect of chance or climate change? North-western Journal of Zoology 16(1): 1-6. (in English) ["Global climate change has been causing growing concern among conservationists for its strong implications on biodiversity alteration and loss at different levels of organization. Odonata occur in habitats threatened by global warming, thus they represent an ideal model organism to study the correlation patterns of climate change with taxonomic composition and the ecological functioning of communities. We carried out climate and diachronic faunistic analyses of Odonata community changes in three countries (Tunisia, Mauritania, Sweden) to test if the patterns uncovered for single assemblages as a response to local climate change may resist to the generalization across regions and latitudes. Clear climate warming occurred in the analysed regions during the last five decades. We found three main patterns of diachronic shifts in Odonata assemblage species composition based on correlative evidence: i) Generalists are likely advantaged from warming processes that cause the loss of specific habitats (i.e. temporary wetlands, cool lentic waters) and the formation of new or altered habitats suitable for pioneer species (i.e. warm and intermittent pools), whereas specialists are more likely to go toward local extinctions; ii) In Tunisia and Sweden new colonizers expanded northward from their southern distributions; iii) The Odonata communities inhabiting lentic waters are more prone to show species turnover than communities from standing waters. Our results provide new insights on the possible impact of climate change on Odonata fauna from large areas (i.e. countries) at different latitudes and represent an attempt of a generalization of the effects of climate change on Odonata range shifts and expansions. Despite that Odonata global assessment of conservation status has been completed, insufficient information is available to robustly assess all the main threats affecting their status, and extensive new field surveys are required to test if major changes in fauna composition have occurred during the last decades." (Authors)] Address: Cerini, F., Dept of Science, Univ.Roma Tre, Viale Marconi, 446, 00146 Rome, Italy. E-mail: francesco.cerini@uniroma3.it

18913. Chakravorty, J.; Jugli, S.; Boria, M.; Meyer-Rochow, V.B. (2019): Arunachal’s Adi and Apatani tribes’ traditional knowledge of harvesting and using edible insects. Journal of Insects as Food and Feed 5(2): 125-135 . (in English) ["At least 65 insect species of 30 families and 9 orders, namely Orthoptera (15 species), Odonata (12), Coleoptera (11), Hymenoptera (10), Hemiptera (9), Lepidoptera (5) and one species each of Ephemeroptera, Isoptera and Mantodea find acceptance as food by Adi and Apatani tribals. Adi use overall more species than Apatani: 53 species of 24 families and 8 orders versus 49 species of 21 families and 8 orders. Odonata are highly appreciated by the Apatani whereas Adi consume more Orthopterans. Various harvesting systems exist and often methods like handpicking or using simple tools are involved with minimal environmental impact. However, depreciation of the environment, increased availability of conventional foodstuffs, rapid population growth and rising influence of westernisation collectively affect diversity, abundance and use of edible insects, leading to a decline of entomophagy among the tribal people." (Authors)] Address: Chakravorty, J., Dept of Zoology, Rajiv Gandhi University, Rono Hills 791112, Arunachal Pradesh, India. E-mail: jharnargu@gmail.com

18914. Chovanec, A. (2019): Bewertung von Oberflächengewässern anhand libellenkundlicher Untersuchungen (Odonata) – Methoden für stehende und fließende Gewässer sowie ihre beispielhafte Anwendung an der Mattig (Oberösterreich). Zeitschrift der Arbeitsgemeinschaft Österreichischer Entomologen 71: 13-45. (in German, with English summary) ["Assessment of surface waters based on odonatological investigations (Odonata) – methods for standing and running waters with an exemplary application at the river Mattig (Upper Austria). – In recent decades, the importance of odonatological studies in water management has greatly increased, since Odonata are good indicators of morphological and hydrological conditions of water bodies. The application of this guideline is intended to ensure the standardisation of dragonfly-based studies and thus the comparability of results. The aim of the field survey method described is to obtain as complete a picture as possible of the species spectrum reproducing at a given site by monitoring and recording adult dragonflies. Sightings of tenerals, additional recording of exuviae, estimates of the number of individuals as well as observations of reproductive behaviour serve to determine whether or not species are autochthonous to the site. According to the legal requirements of the EU Water Framework Directive and the Austrian Water Law (Wasserrechtsgesetz, WRG), the assessment is based on a comparison of the water-type-specific dragonfly fauna with the status quo. In accordance with WRG, various methodological approaches have been developed for standing and running waters, to which reference is made in this paper. As an example, the restructuring measures at the hyporhithron stretch of the river Mattig (Upper Austria) near its mouth into the river Inn have been evaluated by means of a study on dragonflies carried out in 2019. The longitudinal classification of the Odonata represents the methodological basis for determining the Odonata reference

species and any deviations." (Authors)] Address: Chovanec, A., Bundesministerium für Nachhaltigkeit & Tourismus, Abteilung Nationale & Internationale Wasserwirtschaft, Marxergasse 2, 1030 Wien, Austria. Email: andreas.chovanec@bmnt.gv.at

18915. de Omena, P.M.; Srivastava, D.S.; Romero, G.Q. (2019): Consumptive effects and mismatch in predator-prey turnover rates cause inversion of biomass pyramids. Oecologia 190(1): 159-168. (in English) ["The mismatch between the turnover rates of predators and prey is one of the oldest explanations for the existence of inverted trophic pyramids. To date, the hypotheses regarding trophic pyramids have all been based on consumptive trophic links between predators and prey, and the relative contribution of non-consumptive effects is still unknown. In this study, we investigated if the inversion of pyramids in bromeliad ecosystems is driven by (i) a rapid colonization of organisms having short cohort interval production (CPI), and (ii) the prevalence of consumptive or non-consumptive effects of top predators. We used a manipulative experiment to investigate the patterns of prey colonization and to partition the net effects of the dominant predator (damselfly larvae) on biomass pyramids into consumptive (uncaged damselfly larvae) and non-consumptive effects (caged damselfly larvae). Consumptive effects of damselflies strengthened the inversion of trophic pyramids. Non-consumptive effects, however, did not affect the shape of biomass pyramids. Instead, the rapid colonization of organisms with predominantly short CPI sustained the large biomass of top predators found in natural bromeliad ecosystems. Prey colonized bromeliads rapidly, but this high production was never visible as standing stock because damselflies reduce prey densities by more than a magnitude through direct consumption. Our study adds to the growing evidence that there are a variety of possible ways that biomass can be trophically structured. Moreover, we suggest that the strength of biomass pyramids inversion may change with the time of ecological succession as prey communities become more equitable." (Authors)] Address: de Omena, Paula, Depto de Biol. Animal, Inst. Biologia, Univ. Estadual de Campinas (UNICAMP), CP 6109, Campinas, SP, 13083-970, Brazil. paulaomena@gmail.com

18916. Gray, A.; Wilkins, V,; Pryce, D.; Fowler, L.; Key, R.S.; Mendel, H.; Jervois, M.; Hochkirch, A.; Cairns-Wicks, R.; Dutton, A.-J.; Malan, L. (2019): The status of the invertebrate fauna on the South Atlantic island of St Helena: problems, analysis, and recommendations. Biodiversity and Conservation 28(2): 275-296. (in English) ["We present an analysis of the invertebrates of St Helena using an invertebrate conservation evaluation framework, to review invertebrate data, highlight knowledge gaps and prioritise invertebrate conservation needs that perhaps could be applied to other regions of the world. St Helena's invertebrate fauna has 891 genera and 1133 species. The fauna has a high level of endemism with 450 species (equal to 96% of all native species) but the total species richness now comprises many introduced species (664) with 93 species in 24 orders that are entirely novel to St Helena. The elevation ranges of native species appear to be narrow, most being confined to higher elevations above 500 m. St Helena has had a large number of probable extinction events; 30 insects, and 19 molluscs, and the threat of further extinctions remains high. The cumulative invertebrate extinctions on St Helena exceed the global background extinction rate on an island barely covering 122 km². We present actions and timelines to focus invertebrate conservation on St Helena; taxonomy, ecology, long term monitoring and invasive species control are priority areas to reduce extinction risk. ... Extinct species declared on the Red List include ... the St Helena darter dragonfly, Sympetrum dilatatum ..." (Authors)] Address: Gray, A., NERC Centre for Ecology and Hydrology, Penicuik, UK. E-mail: alangray@ceh.ac.uk

18917. Hoffmann, J.; Donoughe, S.; Li, K.; Salcedo, M.; Rycroft, C. (2019): A simple developmental model recapitualtes complex insect wing veination patterns (A wingkle in time). Bulletin of the American Physical Society, APS March Meeting 2019, Monday–Friday, March 4–8, 2019; Boston, Massachusetts, Session A66: Morphogenesis I, 8:00 AM–11:00 AM, Monday, March 4, 2019, BCEC Room: 261: (in English) [Verbatim: Geometric patterns in nature have long been a matter of fascination and intrigue. Veins bifurcate insect wings into a diverse and complicated menagerie of shapes. For many insect species, even the left and right wings from the same individual have veins with unique topological arrangements, and little is known about how these patterns form. We present a quantitative study of the fingerprint-like "secondary veins." We compile a dataset of wings from 232 species and 17 families from the order Odonata, a group with particularly elaborate vein patterns. We characterize the geometric arrangements of veins and develop a simple model of secondary vein patterning. Last, we show that our model is capable of recapitulating the vein geometries of species from other, distantly related winged insect clades.] Address: not stated

18918. Kärcher, O.; Hering, D.; Frank, K.; Markovic, D. (2019): Freshwater species distributions along thermal gradients. Ecology and evolution 9(1): 111-124. (in English) ["The distribution of a species along a thermal gradient is commonly approximated by a unimodal response curve, with a characteristic single optimum near the temperature where a species is most likely to be found, and a decreasing probability of occurrence away from the optimum. We aimed at identifying thermal response curves (TRCs) of European freshwater species and evaluating the potential impact of climate warming across species, taxonomic groups, and latitude. We first applied generalized additive models using catchment-scale global data on distribution ranges of 577 freshwater species native to Europe and four different temperature variables (the current annual mean air/water temperature and the maximum air/water temperature of the warmest month) to describe species TRCs. We then classified TRCs into one of eight curve types and identified spatial patterns in thermal responses. Finally, we integrated empirical TRCs and the projected geographic distribution of climate warming to evaluate the effect of rising temperatures

on species' distributions. For the different temperature variables, 390–463 of 577 species (67.6%–80.2%) were characterized by a unimodal TRC. The number of species with a unimodal TRC decreased from central toward northern and southern Europe. Warming tolerance (WT = maximum temperature of occurrence—preferred temperature) was higher at higher latitudes. Preferred temperature of many species is already exceeded. Rising temperatures will affect most Mediterranean species. We demonstrated that freshwater species' occurrence probabilities are most frequently unimodal. The impact of the global climate warming on species distributions is species and latitude dependent. Among the studied taxonomic groups, rising temperatures will be most detrimental to fish. Our findings support the efforts of catchment-based freshwater management and conservation in the face of global warming." (Authors) Modelling includes molluscs, fish, plants, odonates and crayfish] Address: Kärcher, O., Faculty of Business Management and Social Sciences, Osnabrück University of Applied Sciences, Osnabrück, Germany. E-mail: o.kaercher@hs-osnabrueck.de

18919. Khelifa, R. (2019): Female "assist" sneaker males to dupe dominant males in a rare endemic damselfly: Sexual conflict at its finest. Bulletin of the Ecological Society of America 100(4): 1-5. (in English) ["Study Description: One common view in sexual selection is that females select the fittest male. By investigating the reproductive behavior of an endemic damselfly, Colopteryx exul, in Northeast Algeria. I showed that this is not always the case.To avoid the costly repeated copulations, the female hosting the sneaker's sperm (low-quality male) tends to avoid the dominant male by landing near another female, which confuses the dominant male who ends up copulating with a different female. Hence, the female indirectly assists the sneaker male. This finding advances our view about the mechanisms underlying the maintenance of phenotypic and genetic variability." (Author)] Address: Khelifa, R., Biodiversity Res. Center, Univ. British Columbia, 2212 Main Mall, Vancouver. B.C. V6T1Z4, Canada. Email: rassimkhelifa@gmail.com

18920. Khelifa, R.; Zebsa, R.; Amari, H.; Mellal, M.K.; Mahdjoub, H. (2019): Field estimates of fitness costs of the pace-of-life in an endangered damselfly. Journal of evolutionary biology 32(9): 943-954. (in English) ["Theory predicts that within-population differences in the pace-of-life can lead to cohort-splitting and produce marked intraspecific variation in body size. While many studies showed that body size is positively correlated with fitness, many argue that selection for the larger body is counterbalanced by opposing physiological and ecological selective mechanisms that favor smaller body. When a population split into cohorts with different paces-of-life (slow or fast cohort), one would expect to detect the fitness-size relationship among and within cohorts, that is, (1) slower-developing cohort has larger body size and higher fitness than faster-developing cohort, and (2) larger individuals within each cohort show higher fitness than smaller individuals. Here we test these hypotheses in capture-mark-recapture field surveys that assess body size, lifespan, survival, and lifetime mating success in two consecutive generations of a partially bivoltine aquatic insect, Coenagrion mercuriale, where the spring cohort is slower-developing than the autumn cohort. As expected, body size was larger in the slow-developing cohort, which is consistent with the temperature-size rule and also with the duration of development. Body size seasonal variation was greater in slow-developing cohort most likely because of the higher variation in age at maturity. Concordant with theory, survival probability, lifespan, and lifetime mating success were higher in the slow-developing cohort. Moreover, individual body size was positively correlated with survival and mating success in both cohorts. Our study confirms the fitness costs of fast pace-of-life and the benefits of larger body size to adult fitness." (Authors)] Address: Khelifa, R., Biodiversity Res. Center, Univ. British Columbia, 2212 Main Mall, Vancouver. B.C. V6T1Z4, Canada. Email: rassimkhelifa@gmail.com

18921. Kosterin, O.E. (2019): On Odonata of Phnom Tumpor (Cambodia) in the late dry season (March 2019). International Dragonfly Fund Report 132: 1-26. (in English) ["Phnom Tumpor is a scarcely accessible basalt table mountain in the Cardamom Mts. in Pursat Province of Cambodia. On top surface it bears tall evergreen forest (ca 1100 m a.s.l.), concealing a slow rivulet, O'Gran, being a chain of deep pools. It was examined odonatologically on March 14-18th, 2019. Six common species were recorded in dry and burnt scrub on the Phnom Tumpor slopes and ten on the forested upper surface at O'Gran, among them Polycanthagyna erythromelas (Selys, 1891) and Macromia sp. cf. pinratani Asahina, 1987 for the first time in Cambodia. The peculiarities of the males of Coeliccia kazukoae Asahina, 1984 from Phnom Tumpor and the problem of distinguishing females of M. pinratani and M. moorei are discussed." (Author)] Address: Kosterin, O.E., Institute of Cytology and Genetics, Siberian Branch, Russian Academy of Sciences, Lavrentiev Ave 10, RUS-630090 Novosibirsk, Russia. E-mail: kosterin@bionet.nsc.ru

18922. Laschet, V.; Schneider, S.; Proess, R.; Rademacher, M. (2019): Vorkommen der Helm-Azurjungfer (Coenagrion mercuriale Charpentier, 1840) in Luxemburg: Untersuchungen zur Ökologie der Fortpflanzungshabitate. Bulletin de la Société des naturalistes luxembourgeois 121: 189-202. (in German, with English summary) ["C. mercuriale is a protected species with a single known population in Luxembourg, situated along the upper reaches of a stream named "Wollefsbaach". The aim of the present study is to develop a better understanding of the ecological parameters that govern the population at this specific site. To do so, the populated stream segment was surveyed botanically and a number of physico-chemical water parameters were measured. Over the course of seven site visits, damselflies were recorded and categorised according to behaviour (searching for food, mating, ovipositing) and abundance. For analysis, the populated stream segment was divided into five sections, which were then compared. The results confirm that suitable habitats for C. mercuriale are characterized by the presence of the preferred egg deposition plants (especially

Berula erecta), lots of light, a slow water velocity, open water areas and warm and alkaline water." (Authors)] Address: Laschet, Valérie, 79, route des 3 Cantons, 4790 Bettange-Mess, Luxembourg. E-mail: valerie.laschet@web.de

18923. Pacioglu, P.; Satmari, A.; Petrovici, M.; Pirvu, M.; Cimpean, M., Battes, K.P.; Lele, S.F.; Curtean-Banaduc, A.; Parvulescu, L. (2019): Flash-floods influence macroinvertebrate communities distribution in lotic ecosystems. Transylv. Rev. Syst. Ecol. Res. 21.1: 45-56. (in English, with French an Romanian summaries) ["Stream dwelling invertebrate populations are facing an ample array of stressors including the habitat imbalance caused by important floods. In this research we used a novel way to estimate the impact of floods upon the substrate, by utilising a remote variable named “flash-flood potential” (FFP), which accounts for the site slope and the average slope of the upstream catchment. The results showed that certain groups are sensitive to the influence of the FFP whereas other are not. We propose this remote variable as a surrogate for assessing stress imposed by floods and sediment scouring for lotic macroinvertebrates." (Authors) Taxa - including Odonata - are treated at the order level.] Address: Pârvulescu, L., “Lucian Blaga” University of Sibiu, Faculty of Sciences, Applied Ecology Research Center, Dr. Ion Raþiu Street 5-7, RO-550012 Sibiu, Romania. E-mail: ad.banaduc@yahoo.com

18924. Pattanayak, A.; Azad, N.D.; Pahari, P.R.; Deen, S.Y. (2019): Community structure of odonata naiads of a fish farming pond in costal area of West Bengal, India. Journal of Pharmacognosy and Phytochemistry 2019; SP5: 437-440. (in English) ["Community structure of Odonata larvae was investigated in a fish farming pond at Tamluk located in the coastal belt of West Bengal, India. In total 12 species under 3 families and 2 suborder were recorded during study period. Suborders Anisoptera was the most dominant (76.16%) group. Family Gomphidae had the lowest abundance (1.93%) and Family Libellulidae had highest abundance (76.66%). All the species were not found throughout the year. Some species such as Pantala flavescens ... was found only in rainy months thus behaving as species associated with rains. Species diversity, dominance index, equitability index and evenness indices during study period, suggest a moderately stressed and disturbed environment." (Authors)] Address: Pattanayak, A., PG Dept. Zool. Magadh University. Bodh-Gaya, Gaya, Bihar, India

18925. Rae, M; Miró, A.; Hall, J.; O'Brien, K.; O'Brien, D. (2019): Evaluating the validity of a simple citizen science index for assessing the ecological status of urban drainage ponds. Ecological Indicators 98: 1-8. (in English) [oas 59 ; "•Simple citizen science tool as effective as complex assessments of ecological quality. •Assessment correlated with status established through five ecological indicators. •Assessment consistent across the entire range of scores, •Assessment tool consistent for different invertebrate groups involved. Abstract: Citizen science approaches are valuable tools for biodiversity management and conservation, particularly in urban areas. The OPAL Water Survey is a citizen science approach to assessing water quality by recording the presence/absence of 13 easily identifiable freshwater invertebrate groups. The survey generates a score (the Pond Health Score) that can usefully inform urban freshwater wildlife conservation, as well as engaging urban residents with nature. The main aim of this study was to investigate the capability of the OPAL Pond Health Score to assess the overall ecological status of urban drainage ponds. We applied linear regression between the OPAL Score from 78 drainage ponds across Scotland and a measure of ecological status obtained by the dimension reduction (Principal Coordinate Analysis) of five widely-used ecological indicators: taxonomic richness of amphibians, macroinvertebrates and macrophytes, and adjacent terrestrial habitat richness and degree of urbanization. The OPAL Pond Health Score was strongly correlated with ponds’ ecological status established using the five ecological indicators (Pearson’s r = 0.86, P < 0.0001). Furthermore, this relationship was generally consistent, both across the entire range of OPAL Scores, and in relation to the different invertebrate groups involved. Thus, the OPAL Pond Health Score has great value as a quick stand-alone assessment method, and offers clear opportunities for collaboration between citizen scientists, government agencies and professional researchers." (Authors) Data are classified in the Odonata case at suborder level.] Address: O'Brien, K., Highland Council, Glenurquhart Road, Inverness IV3 5NX, UK. E-mail: David.OBrien@nature.scot

18926. Rane, R.V.; Ghodke, A.B.; Hoffmann, A. A.; Edwards, O.R.; Walsh, T.K.; Oakeshott, J.G. (2019): Detoxifying enzyme complements and host use phenotypes in 160 insect species. Current Opinion in Insect Science 31: 131-138. (in English) ["Highlights: • 160 insect genomes screened for esterase, GST and cytochrome P450 genes. • Omnivores and herbivores eating chemically complex tissues have many of these genes. • Species using chemically simpler tissues like sap, nectar and blood have relatively few. • Polyphages have more than other species using the same tissue type. Abstract: We use the genomes of 160 insect species to test the hypothesis that the size of detoxifying enzyme families is greater in species using more chemically diverse food resources. Phylogenetically appropriate contrasts in subsamples of the data generally support the hypothesis. We find relatively high numbers of cytochrome P450, glutathione S-transferase and carboxyl/choline esterase genes in omnivores and herbivores feeding on chemically complex tissues and relatively low numbers of these genes in specialists on relatively simple diets, including plant sap, nectar and pollen, and blood. Among Lepidoptera feeding on green plant tissue and Condylognatha feeding on sap we also find more of these genes in highly polyphagous species, many of which are major agricultural pests. These genomic signatures of food resource use are consistent with the hypothesis that some taxa are preadapted for insecticide resistance evolution." (Authors) Calopteryx splendens] Address: Rane, R.V., CSIRO, Clunies Ross St, (GPO Box 1700), Acton, ACT 2601, Australia. E-mail: rahul.rane@csiro.au

18927. Rathod, P.P.; Raja, I.A.; Milind, K. (2019): Contrast behavior by female dragonfly, Orthetrum sabina while mating with its territorial male. Bioscience Biotechnology Research Communications 12(4): 927-933. (in English) ["There is variation in receptiveness of female dragonfly to male waiting in territorial ponds. The present study reported how a female of Orthetrum sabina agreed or not for mating with a male in different situations. In usual or first case after grasping female by male, female helped him for flying at perch and to make copulatory wheel the 'tandem'. But in the second case, a non receptive female denied territorial male for making tandem was also noted. It was observed that non receptive female was evasive to make tandem and appeared to be resisting the males grasp by her wing vibration. She got clung to male's abdomen remained inactive for 7 minutes in motionless pose and appeared like dead. Although she injured her wings by vibrating she tried to escape and got freed from the grasp of male without copulation. One failure of copulation added to account of that territorial male was seen. We conclude that in second case the female may be immature and not ready for mating, or the male was not of her choice, may be the eggs deposition by her would have already been accomplished for the day or female may already have carried the sperms so she rejected that territory owner. The significance of this study is to understand different ways for breeding behavior in selected species to save their future." (Authors)] Address: Raja, I.A., B.S. Patel College of Arts Commerce and Science, Pimpalgaon Kale 443403, India. Eemail: poneprince@gmail.com

18928. Ribeiro, S.M. (2019): Análise de metais potencialmente tóxicos em ambientes aquáticos (Da Água e dos insetos da ordem Odonata) para biomonitoramento ambiental. Ph.D. thesis, Universidade Federal de São Carlos: 83 pp. (in Portuguese, with English summary) [Analysis of potentially toxic metals in aquatic environments (from water and insects of the order Odonata) for environmental biomonitoring: "Analysis of potentially toxic metals in aquatic environments (Water and Odonata insects) for environmental biomonitoring. Potentially toxic metals are among the most common contaminants in waters and their origin may be both natural and anthropogenic. As soon as they come into contact with the aquatic ecosystem, the metals can be transported to the various compartments of the environment, such as soil, sediment, plants and animals, and may become bioaccumulative. With the increase of activities of anthropic origin and the degradation of water resources, biomonitoring becomes an effective way to expose various types of stress that may occur in the environment, serving as an alarm for declines in the quality of the environment and populations. With the determination of the adverse effects of the presence of contaminants in water bodies, it is becoming increasingly important to indicate environmental disturbances from possible contaminating sources such as agriculture. The objective of this study was to determine the levels of Zn^{2+}, Cd^{2+}, Cu^{2+}, Co^{2+}, Pb^{2+}, Cr^{2+}, Mn^{2+}, Al^{3+} in the water and larvae of the order Odonata in dams 1 and 2, related to the conventional and organic planting of a plantation orange. The collected samples were previously digested and subjected to the analysis of determination of the potentially toxic metals using the atomic emission spectrometry equipment with microwave plasma (MP-AES). The water samples indicated for some metals a concentration above the limit allowed by CONAMA Resolution n° 357/2005, in the following order Cu^{2+}> Pb^{2+}> Mn^{2+} in both dams near conventional and organic cultivation. Cr ions were observed only in dam 1 (close to conventional planting) and Al ions in dam 2 (close to organic planting). In the Odonata larvae, the presence of metals Zn^{2+}> Cu^{2+}> Pb^{2+}> Mn^{2+} was observed in both dams close to conventional and organic cultivation. All other metals were found in dams and larvae, even in small concentrations. It is concluded that the insects of the order Odonata absorb considerable concentrations of metals in the organism, the metals found in the Odonata resemble the metals found in the water, and it can be reinforced the concept that the Odonata are important indicators to monitor contaminations of metals in agricultural areas." (Author)] translated with www.DeepL.com/Translator (free Version)] Address: not stated

18929. Ruch, D.G.; Stoelting, T.; Simpson, B.; Brodman, R.; Cole, L.; Fisher, B.E.; Holland, J.D.; Jean, R.P.; Milne, M.; Namestnik, S.; Roth, K.; Russell, S.; Sterrenburg, L.; Strang, C.; Walters, B.; Whitaker, Jr. J.O.; Chamberlain, A. (2019): Results of the second (2016) Goose Pond fisch and wildlife biodiversity survey, Green County, Indiana. Proceedings of the Indiana Academy of Science 128(1): 13-27. (in English) ["The Friends of Goose Pond, the Indiana Academy of Science, the Indiana Department of Natural Resources – Division of Fish and Wildlife, the Sassafras Audubon Society, and Duke Energy Foundation hosted the second biodiversity survey or bioblitz at Goose Pond Fish and Wildlife Area, Greene County, on 18–19 June 2016. Over 95 scientists, naturalists, students, and other volunteers on 17 different taxonomic teams observed and reported 883 taxa during the event. The 17 taxonomic teams included aquatic macroinvertebrates, bats, bees, beetles, birds, butterflies, fish, freshwater mussels, herpetofauna, small mammals, moths, fungi and slime molds, non-vascular plants, odonates, singing and non-singing insects, spiders, and vascular plants. State listed animal species included … the state rare jade clubtail (Arigomphus submedianus). … This manuscript presents both a brief history of the bioblitz sites and a summary overview of the results. Detailed results are available on the Indiana Academy of Science website." (Authors) "33 species of Odonates (22 dragonflies and 11 damselflies); 7 Greene County records plus a visual sighting of Epiaeschnia heros (swamp darner); 1 rare species in Indiana, Arigomphus submedianus (jade clubtail)." "Odonates (dragonflies and damselflies).— Odonates were surveyed using observation primarily with 83 binoculars and/or photography. This approach allowed the benefit of rapid assessment and more distance covered than collection would have afforded. The methods used in the 2016 bioblitz contrast with those of the 2010 Goose Pond bioblitz (Karns et al. 2012) which used insect nets and dip netting for aquatic larval specimens. Due to more distance covered in a short period of time during the 2016 survey, it is possible that

many Odonate species were not detected. Importantly, the 2016 survey might not include species which are primarily larval at the time of the survey, whereas dip netting may have detected some of these. Despite this impediment, the 2016 survey detected one more species of dragonfly and two more species of damselfly than the 2010 bioblitz. It should be noted that differences in the species counts should not be attributed only to survey methods, as many other differences, such as time of year and weather events, can affect Odonate abundance. Eleven species of damselfly (Zygoptera) and twenty-two species of dragonflies (Anisoptera) were observed during the bioblitz. Most of the common Odonates were ubiquitous throughout the Goose Pond habitat areas. While no endangered, threatened, or rare species were observed, eight potential Greene County records were noted, i.e., Swamp Darner (Epiaeschna heros), Illinois RiverCruiser (Macromia illinoiensis), Jade Clubtail (Arigomphus submedianus), Plains Clubtail (Gomphus externus), Common Sanddragon (Progomphus obscurus), Blue-faced Meadowhawk (Sympetrum ambiguum), Skimming Bluet (Enallagma geminatum), and Slender Bluet (E. traviatum) (Curry 2001; Abbott 2006–2016; Karns et al. 2012). In summary, GPFWA produced the diversity and abundance of Odonates that should be expected of a large area of such varied aquatic habitats.With only the two sampling events of the 2010 and 2016 bioblitzes, the Goose Pond complex has an odonate list that includes 28 dragonflies and 13 damselflies. This represents 26% of the Indiana's known dragonflies (Curry 2001; Mauffray 2008), and 30% of the state's known damselflies (Williamson 1917). Undoubtedly, additional odonate surveys, especially in August or September, would add to this list."] Address: Ruch, D.G., Department of Biology, Ball State University, Muncie, IN 47306 USA Travis Stoelting: Property Manager, Goose Pond FWA, 13540 W County Road 400 S, Linton, IN 47441 USA. E-mail: druch@bsu.edu.

18930. Rychla, A.; Buczynski, P.; Czechowski, P.; Dumanski, J.; Kusal, K.; Lewandowska, E.; Lewandowski, K.; Michalczuk, W.; Niewolik, J.; Orska, M.; Ostrowski, K.; Pielot, M.; Rauner-Bunczynska, E.; Switała, D.; Switala, M.; Tanczuk, A.; Tarkowski, A.; Tonczyk, G.; Wakulski, R.; Wasylków, E.; Wereniewicz, K.; Wiszniowska, M. (2019): The earliest records of dragonflies and damselflies (Odonata) in Poland in April and May 2018. Odonatrix 15_4: 10 pp. (in Polish, with English summary) ["In the temperate zone, the beginning of emergence of adult dragonflies and damselflies depends largely on the weather conditions, principally air temperature. High temperatures are conducive to the earlier appearance of adults, while low ones can delay it. In spring 2018, Poland was constantly under the influence of hot, dry air masses arriving from the south, mainly from Africa. This resulted in positive air temperature anomalies throughout the country of as much as 3-6 °C in April and 3-5 °C in May, compared to the long-term average (1971-2000). As such warmer weather could have had affected the phenology of many odonates, we undertook to compile a list of the earliest emergence dates of dragonfly and damselfly species, recorded by a group of volunteers (professionals and amateurs) from the beginning of the season until the end of May 2018. In addition, we compared our results with the hitherto known flight periods of odonates in Poland (Milaczewska 2010) to see whether any shifts in dates of emergence had occurred in response to climatic changes." (Authors)] Address: Rychła, Anna, ul. Osiedlowa 12, Płoty, 66-016 Czerwieńsk, Poland. Email: rychlan@op.pl.

18931. Start, D.; Gilbert, B. (2019): Trait variation across biological scales shapes community structure and ecosystem function. Ecology 100(9). e02769: 9 pp. (in English) ["Trait variation underlies our understanding of the patterns and importance of biodiversity, yet we have a poor understanding of how variation at different levels of biological organization structures communities and ecosystems. Here we use a mesocosm experiment to test for the effects of a larval dragonfly functional trait on community and ecosystem dynamics by creating artificial populations to mirror within- and between-population trait variation observed in our study area. Specifically, we manipulate variation in activity rate, a key functional trait shaping food webs, across three levels of biological organization: within-populations (differences in trait variation in a population), among-populations (differences in population mean trait values), and among-species (species-level differences of co-occurring dragonflies). We show that differences in activity rate alter prey communities, trophic cascades, and multiple ecosystem processes. However, trait variation among populations had much larger effects than differences between co-occurring species or even the presence of a predator, whereas within-population variation had a relatively minor impact. Interestingly, combined with earlier work in the same system, our study suggests that the relative importance of species versus individual level differences for ecosystem functioning will depend on the spatial scale considered. Ecological processes, including biodiversity-ecosystem functioning relationships, cannot be understood without accounting for trait variation across biological scales of organization, including at fine scales." (Authors)] Address: Start, D., Department of Ecology and Evolutionary Biology, University of Toronto, 25 Willcocks Street, Toronto, Ontario, M5S3B2 Canada. E-mail: denon.start@utoronto.ca

18932. Steinhoff, P.O.M.; Ahmad, R.; Butler, S.G.; Choong, C.Y.; Dow, R.A.; Reels, G.T. (2019): Odonata of Gunong Mulu National Park in Sarawak, Malaysian Borneo. International Dragonfly Fund Report 141: 1-50. (in English, with Bahasa Melayu summary) ["Records of Odonata collected in Gunong Mulu National Park in Sarawak are presented. Between 2005 and 2019, in 12 surveys that lasted between one week and five months, 163 species were collected. The collections from Gunong Mulu National Park are of importance for the taxonomic study of dragonflies and damselflies in Borneo; several species have been described based on material collected in the Park." (Authors)] Address: Steinhoff, P.O.M., General and Systematic Zoology, Zoological Institute and Museum, University of Greifswald, Loitzer Strasse 26, 17489 Greifswald, Germany. E-mail: philipsteinhoff@gmail.com

18933. Takahashi, M.; Takahashi, Y.; Kawata, M. (2019): Candidate genes associated with color morphs of female-limited polymorphisms of the damselfly Ischnura senegalensis. Heredity 122: 81-92. (in English) ["Many Odonata species exhibit female-limited polymorphisms, where one morph is similar to the conspecific male in body color and other traits (andromorph), whereas one or more other morphs differ from the male (gynomorphs). Here we investigated the differentially expressed transcripts (DETs) among males and two female morph groups (gynomorphs and andromorphs) using RNA-seq to identify candidate transcripts encoding female-limited polymorphisms in the damselfly Ischnura senegalensis. Seven DETs that had significantly different expression levels between males and gynomorphs, but not between males and andromorphs, were identified. The expression levels of four of these candidate genes, doublesex (dsx), black, ebony, and chaoptin (chp), were selected for further analysis using qRT-PCR. Sequence analysis of the dsx amplicons revealed that this gene produced at least three transcripts. Two short transcripts were mainly expressed in males and andromorphs, whereas the long transcript was specifically expressed in both morph female groups; that is, the expression pattern of the dsx splice variants in andromorphs was an intermediate between that of males and gynomorphs. Because the dsx gene functions as a transcription factor that regulates the sex-specific expression of multiple genes, its splice variants in I. senegalensis may explain why the andromorph is female but exhibits some masculinized traits. Because we did not detect different coding sequences of the candidate genes among the different morphs, a diallelic genomic region controlling alternative splicing of dsx, thus determining female-limited polymorphism in I. senegalensis most likely lies in a non-coding region of the dsx gene or in a gene upstream of it." (Authors)] Address: Takahashi, Y., Department of Biology, Faculty of Science, Chiba University, 1-33 Yayoi, Inage, Chiba, 263-8522, Japan

18934. Therry, L.; Cote, J.; Cucherousset, J.; Finn, F.; Buoro, Y.; Blanchet, S. (2019): Genetic and environmental contributions to the impact of a range- expanding predator on aquatic ecosystems. Journal of Animal Ecology 88: 35-46. (in English) ["1. Global change is altering biodiversity locally and globally and subsequently affecting the dynamics of communities and ecosystems. Biodiversity can be impacted both at the interspecific (i.e., species composition of communities) and at the intraspecific (evolutionary modification of phenotypic traits through selection or plasticity) levels. Changes in intraspecific diversity have been demonstrated to generate evolutionary feedbacks acting on ecological dynamics. Quantifying the role of intraspecific trait variation, global change and their interactions on ecological dynamics is of utmost importance. 2. Here, we used the range-expanding dragonfly Crocothemis erythraea as a model species to test the relative effects of intraspecific trait variation in larvae and thermal conditions on the dynamics of freshwater community and ecosystem functioning. Using experimental mesocosms, we manipulated intraspecific trait variation arising from genetic (G), early developmental environment (Ee) and late developmental environment (EL) contributions in a full factorial design. 3. We showed that intraspecific trait variation arising from genetic effects has the strongest consequences on community and ecosystem dynamics relative to trait variation driven by the thermal environment (Ee and EL). Importantly, the ecological effects of trait variation due to genetic effects were partly modulated by thermal conditions (G * EL, and to a lesser extent G * Ee interactions) and varied among ecological response variables. For instance, the strongest G * EL effects were observed on primary productivity and zooplankton dynamics. Trait variation driven by plasticity related to early or late developmental environments has an overall weak effect on ecological dynamics. 4. Intraspecific trait variation induced by genetic effects can affect ecological dynamics (evo-to-eco dynamics) more strongly than variation induced by the developmental environment. However, they likely interact to modulate the structure of communities and the functioning of ecosystems, highlighting the strong context (environmental) dependency of evo-to-eco dynamics." (Authors)] Address: Blanchet, S., Lab. Évolution et Diversité Biologique (EDB UMR 5174), Univ. de Toulouse, CNRS, IRD, UPS, Toulouse, France. E-mail: simon.blanchet@sete.cnrs.fr

18935. Van Dievel, M.; Janssens, L.; Stoks, R. (2019): Additive bioenergetic responses to a pesticide and predation risk in an aquatic insect. Aquatic Toxicology 212: 205-213. (in English) ["Highlights: • Effects of predation risk and chlorpyrifos on life history and physiology were tested. • Only chlorpyrifos was lethal, yet both stressors reduced growth. • Both stressors negatively affected the bioenergetics at organismal and cellular level. • Predation risk and chlorpyrifos consistently interacted in an additive way. Abstract: Ignoring natural stressors such as predation risk may contribute to the failure of ecological risk assessment of pesticides to protect freshwater biodiversity. To better understand combined effects of multiple stressors, bioenergetic responses are important as these inform about the balance between energy input and consumption, and provide a unifying mechanism to integrate the impact of multiple stressors with different modes of action. We studied in Enallagma cyathigerum damselfly larvae the single and combined effects of exposure to the pesticide chlorpyrifos and predation risk on life history (survival and growth rate) and bioenergetic response variables at the organismal level (assimilation and conversion efficiency) and the cellular level (cellular energy allocation CEA, energy storage Ea, and energy consumption Ec). Chlorpyrifos exposure almost halved the survival of the damselfly larvae, while predation risk had no effect on survival. Both exposure to the pesticide and to predation risk reduced larval growth rates. This was caused by a reduced conversion efficiency under chlorpyrifos exposure, and by a reduced assimilation efficiency under predation risk. Both chlorpyrifos and predation risk reduced the CEA because of a decreased Ea, and for chlorpyrifos also an increased Ec. The lower Ea was driven by reductions in the fat and glycogen contents. Effects of the pesticide and predation risk were consistently additive and for most variables the strongest response was detected when

both stressors were present. The absence of any synergisms may be explained by the high mortality and hypometabolism caused by the pesticide. Our results indicate that CEA can be a sensitive biomarker to evaluate effects of not only contaminants but also natural stressors, such as predation risk, and their combined impact on organisms." (Authors)] Address: Van Dievel, Marie, Evolutionary Stress Ecology and Ecotoxicology, University of Leuven, Charles Deberiotstraat 32, B-3000 Leuven, Belgium. Email: vandievel@kuleuven.be

18936. Verheyen, J. (2019): Evolutionary-ecotoxicological study of the effects of daily temperature fluctuations on pesticide toxicity in damselfly larvae. PhD thesis, Department of Biology, Ecology, Evolution and Biodiversity Conservation, KU Leuven - University: (in English) ["In natural ecosystems animals encounter several environmental stressors that furthermore can interact with pollutants and potentially increase their toxicity. This is considered one of the underlying reasons why current ecological risk assessment is possibly failing to protect natural ecosystems as it may be lacking realism by being based on pesticide toxicity testing under standard laboratory conditions. While it is widely known that an increase in mean temperature increases the toxicity of pollutants, studies largely ignored the effects of daily temperature fluctuations (DTFs) on pesticide toxicity and never tested pollutant toxicity under both global warming stressors (the more realistic scenario in which both the mean temperature and the DTF increase). Furthermore, how DTFs shape pesticide toxicity is mostly unknown, which asks for an integrated approach including life history and physiology. In this thesis, I tested for the single and combined effects of exposure to the pesticide chlorpyrifos (CPF) and warming (+ 4 °C increase in mean temperature and a + 5 °C increase in DTF) in Ischnura elegans damselfly larvae by executing a series of common-garden experiments. I studied effects on life history traits, heat tolerance and candidate underlying physiological mechanisms. Thereby, I used damselfly larvae across a latitudinal gradient (European low- and high-latitude populations) to study the role of thermal adaptation in shaping the sensitivity to pesticides under global warming. The mean summer water temperatures and maximum summer DTFs in shallow freshwater ponds located in southern France (low latitude) are 24 °C with 10 °C DTF, and in southern Sweden (high latitude) are 20 °C with 5 °C DTF. This 4 °C difference in mean temperature and 5 °C difference in maximum DTF also matches the predicted increase in both factors by 2100 under the IPCC RCP 8.5 scenario, which allows for applying a space-for-time substitution to test if gradual thermal evolution in high-latitude populations may buffer for the increased pesticide toxicity under global warming (increase in both mean temperature and DTF). I reviewed the strengths and weaknesses of this approach in chapter I. In the second chapter, I studied the effects of global warming in the absence of the pesticide and I found that DTFs only had negative effects on growth rate under the 4 °C warming treatment. While 4 °C warming was beneficial for larvae of both latitudes, this changed in a negative effect in the presence of high DTF. These negative effects of DTF were stronger in high-latitude larvae and already occurred at low DTF, indicating local thermal adaptation. This also suggests that if high-latitude populations are able to gradually thermally evolve into 'low-latitude' populations, they would no longer suffer a growth reduction in the presence of DTF under 4 °C warming. When studying the effects of DTFs on pesticide toxicity in chapter III, I found the striking result that while the used chlorpyrifos concentration was not affecting the damselfly larvae's life history at a constant temperature of 20 °C, it did strongly decrease survival and growth in the presence of DTFs around 20 °C. These results suggest that in standard pesticide toxicity tests, which are carried out by current risk assessment, this concentration would have been regarded as safe. Thereby, this highlights it is crucial to integrate DTFs in current risk assessment to reach more realistic predictions about pesticide toxicity in natural systems. In the last three chapters, I studied the effects of pesticides under global warming, thereby including the predicted increases in both mean temperature and DTF. The toxicity of chlorpyrifos was magnified by the increase in both mean temperature and DTF, but especially at their combination. Furthermore, I described in chapter V a novel, likely general mechanism that contributes to the higher chlorpyrifos toxicity under global warming by coupling two general principles: the widespread temperature-size rule and the size-pesticide sensitivity pattern. Larvae got smaller under DTFs, and these smaller larvae were more vulnerable to the pesticide, hence the higher chlorpyrifos toxicity under DTFs was partly mediated through DTF-induced reductions in body size. In terms of physiological variables, I found evidence of chlorpyrifos-induced effects being stronger under DTFs in terms of oxidative damage to lipids, which may contribute to the mortality patterns. Further, in my last chapter, I observed that the chlorpyrifos-induced reductions in bioenergetic response variables (energy availability and net energy budget) were stronger when the high mean temperature was combined with the high DTF. Moreover, I also showed that the bioenergetic responses contributed to the higher chlorpyrifos toxicity under global warming as treatment combinations with lower net energy budgets showed higher mortality and lower growth rates. Although I did not always find evidence that possible gradual thermal evolution in high-latitude damselflies would buffer for the increased chlorpyrifos toxicity under global warming, I did find a strong signal in chapter IV. Latitude-specific thermal adaptation to both mean temperature and DTF buffered for the chlorpyrifos-induced reduction in heat tolerance, meaning that possible gradual thermal evolution in high-latitude populations may buffer for the negative effects of chlorpyrifos on heat tolerance under warming, unless the DTF increase is taken into account. My results indicate that it is crucial to not only consider DTFs, but also their interaction with increasing mean temperatures, and to integrate gradual thermal evolution to make more realistic predictions of pesticide toxicity in the current climate and in a warming world." (Author)] Address: Verheyen, Julie, Ecology, Evolution & Biodiversity Conservation, Charles Deberiotstraat 32 - box 2439, 3000 Leuven, Belgium. Email: julie.verheyen@kuleuven.be

18937. Zheng, D.; Zhang, H.; Jarzembowski, A.; Wang, B. (2019): Electrodysagrion neli sp. nov., the second Cretaceous dysagrionine damselfly (Odonata: Zygoptera: Dysagrionidae) from Kachin amber, northern Myanmar. Palaeoentomology 2(6): 556-559. (in English) ["The dysagrionid damselflies, characterized by a broad quadrilateral discoidal cell, are widely recorded in the Lower Cretaceous–lower Oligocene, and frequently found in mid-Cretaceous Kachin amber (Zheng et al., 2016, 2017a, b, 2018a). Three genera and four species of Dysagrionidae have been described from Kachin amber, including Burmadysagrion zhangi Zheng, Wang & Nel, 2016, Electrodysagrion lini Zheng, Nel & Wang, 2017, Palaeodysagrion cretacicus Zheng et al., 2017 and Palaeodysagrion youlini Zheng, Chang & Wang, 2018 (Zheng et al., 2016, 2017a, b, 2018a). The dysagrionid damselflies have several types of discoidal cells seen in the Kachin amber species, contributing to evaluating the early evolution and diversification of the discoidal cell. For example, Burmadysagrion has the anterior and posterior sides of the discoidal cell not parallel, and the basal side longer than the distal side; Electrodysagrion has the anterior and posterior sides of the discoidal cell not parallel, and distal side longer than the basal side; and Palaeodysagrion has a long and narrow discoidal cell. In the present paper, a new dysagrionine damselfly is described representing the second dysagrionine in Kachin amber. The new damselfly allows for the revision of the generic characters of Electrodysagrion Zheng, Nel & Wang, 2017." (Authors)] Address: Zheng, D., State Key Laboratory of Palaeobiology & Stratigraphy, Nanjing Inst. of Geology & Palaeontology & Center for Excellence in Life & Paleoenvironment, Chinese Acad. Sciences, 39 East Beijing Road, Nanjing 210008, China

18938. Zia, A.; Hussain, I.; Mehmood, S.A.; Ahmad, S.; Shah, M.; Bhatti, A.R. (2019): Richness and distribution of Odonata in Kurram District, Khyber Pakhtunkhwa. Pakistan Journal of Agricultural Research 32(4): 589-594. (in English) ["District Kurram represents an important geographical position. It shares its border with Afghanistan and possesses unlimited water resources. Due to prolonged uncertain ground conditions, this area remains unexplored for insect fauna. Present study was carried out in to record richness, abundance and species complex of Odonata. It revealed four families, fifteen genera and twenty-six species. Among recorded fauna, family Libellulidae appeared to be a dominant group representing 19 species, followed by family Coenagrionidae with 5 species and family Calopterygoidae and Aeshnidae representing single species each. Being a flying insect group, seasonal surveys and temporal data collection for odonates in this ecologically rich area can surely bring forward important information for the migratory species between Afghanistan and Pakistan." (Authors)] Address: Zia, A., National Insect Museum, NARC, Islamabad, Pakistan.

18939. Zou, P.Y.; Lai, Y.-H.; Yang, J.-T. (2019): Effects of phase lag on the hovering flight of damselfly and dragonfly. Phys. Rev. E 100, 063102 – Published 4 December 2019: (in English) ["In this work we studied the differences in flight kinematics and aerodynamics that could relate to differences in wing morphologies of a dragonfly and a damselfly. The damselflies and dragonflies normally fly with the fore wing or hind wing in the lead, respectively. The wing of the damselfly is petiolate, which means that the wing root is narrower than that of the dragonfly. The influence of the biological morphology between the damselfly and the dragonfly on their hovering strategies is worthy of clarification. The flight motions of damselflies and dragonflies in hovering were recorded with two high-speed cameras; we analyzed the differences between their hovering motions using computational fluid dynamics. The distinct mechanisms of the hovering flight of damselflies (Matrona cyanoptera) and dragonflies (Neurothemis ramburii) with different phase lags between fore and hind wings were deduced. The results of a comparison of the differences of wing phases in hovering showed that the rotational effect has an important role in the aerodynamics; the interactions between fore and hind wings greatly affect their vortex structure and flight performance. The wake of a damselfly sheds smoothly because of slender petiolation; a vertical force is generated steadily during the stage of wing translation. Damselflies hover with a longer translational phase and a larger flapping amplitude. In contrast, the root vortex of a dragonfly impedes the shedding of wake vortices in the upstroke, which results in the loss of a vertical force; the dragonfly hence hovers with a large amplitude of wing rotation. These species of Odonata insects developed varied hovering strategies to fit their distinct biological morphologies." (Authors)] Address: Yang, J.-T., Department of Engineering Science and Ocean Engineering, National Taiwan University, 10617 Taipei, Taiwan. Email: jtyang@ntu.edu.tw

2020

18940. Alves, A.F. (2020): Revisão sistemática de autotomia em larvas de Odonata: um método de defesa com alto custo na sobrevivência. BSc thesis, Entomologia – Laboratório de Ecologia Comportamental e Interações (LECI), Universidade Federal de Uberlândia: 41 pp. (in Portuguese, with English summary) ["Autotomy is a phenomenon of predetermined biological rupture, where an animal detaches a part of the body, with the function of defending itself. Thus, the autotomy occurs in response to a perceived threat, acting as a proximal defense strategy for the individual. Thus, the autotomy has evolved at different rates, as in the order Odonata. However, there are consequences caused by such a process, such as loss of mobility and additional energy expenditure. With that, this study carried out a systematic review of studies related to autotomy of caudal lamellae in nymphs of the order Odonata, in order to discuss what knowledge they have of this process, within the taxonomic group (Odonata) and understand what are the possible costs of this defensive process. This review will show that the autotomy of the caudal appendages is beneficial for the individual, as it allows survival, even with the high costs it represents. "Author)] Address: not stated

18941. Araujo, B.R. (2020): Taxonomia e diversidade das

libélulas (Insecta: Odonata) do Mananciais da Serra, Município de Piraquara, Estado do Paraná, Brasil. Dissertação (mestrado) - Universidade Federal do Paraná, Setor de Ciências Biológicas, Programa de Pós-Graduação em Ciências Biológicas (Entomologia): 70 pp. (in Portuguese, with English summary) ["Human activities alter the structure, dynamics and energy flow of aquatic environments. For example, damming rivers increases solar incidence, water permanence and temperature, interfering with dragonfly communities (order Odonata). The sensitivity of Odonata species to disturbances makes them model organisms of bioindicator of environmental quality, however, knowledge of dragonfly fauna in Brazil is concentrated close to institutions with specialists and most of the territory is undersampled. The objectives of this research were: (1) to present a comprehensive checklist of Odonata species for the protected area of Mananciais da Serra, (2) to provide taxonomic notes for rare or littleknown species and finally (3) to investigate the influence of the dam on the structure and composition of the Odonata community in a subtropical area. The research was conducted in the threatened Atlantic Forest domain, in the Serra do Mar mountain chain in a well-preserved area in the municipality of Piraquara, state of Paraná, Brazil. The sampling effort took place between 2017 and 2019, using different collection methods in different mesohabitats in with dragonflies occurs from bromeliads and small streams to large reservoirs. Two communities were considered, one from a forested area (local community, MS) and another from a reservoir (homogeneous landscape community, RP). The alpha and beta-diversity of MS and RP were investigated to infer about the homogenization of the landscape. In addition, two bioindicator tools for habitat quality were applied to our data. The amount of 1,627 specimens from 9 families, 42 genera and 83 species were sampled. A total of 53 new occurrence records were detected for Paraná, bringing to 113 the number of dragonfly species reported to the state, while Micrathyria venezuelae De Marmels, 1989 is registered for the first time in Brazil. The female from the original description of Neocordulia mambucabensis Costa & T.C. Santos 2000 is another species of Neocordulia In addition, two females, four species not described and larvae of the last stage of development of four species were detected. Larvae sampling increased the abundance of rare species and females. Alpha diversity showed the RP community as the most diverse, a result related to the high occurrence of generalist species. The composition of species and typical species configure greater heterogeneity for MS. The high turnover characterizes a Clementsian pattern for the metacommunity, probably due to the conversion and homogenization of the aquatic system, therefore the reservoir has almost no capacity to maintain the local fauna. Finally, the habitat quality bioindication tools were efficient, considering MS as more preserved than RP, however, the Zygoptera / Anisoptera ratio was less accurate than the Libellulidae / other Anisoptera and Coenagrionidae / Zygoptera ratios, respectively. The estimated richness for Mananciais da Serra is over one hundred, corresponding to at least 60% of the species known for Paraná and 10% of Brazilian species, the country richest in species in the world. The reservoir excludes local species, giving rise to a high diversity of more generalist species; however, its surrounding areas are preserved maintaining part of the natural habitat and local biodiversity, a positive aspect that mitigates the homogenization of the landscape." (Author)] Address: Araujo, B.R., Lab. de Sistemática de Insetos Aquáticos, Depto Zool., Univ. Federal do Paraná, Caixa Postal 19020, 81531-980 Curitiba, PR, Brazil. E-mail: breno.rda94@gmail.com

18942. Ayres, C.; Domínguez-Costas, M. (2020): Primeira cita de Diplacodes lefebvrii (Rambur, 1842) (Odonata: Libellulidae) en Galicia. Braña 18: 17-18. (in bilingual in Spanish and English) [14-VII-2020, wetland near the Miño river in the municipality of As Neves (29TNG55).] Address: Ayres, C., AHE-Galicia. Barcelona, 86-6C. 36211, Vigo (Pontevedra). Spain. E-mail: galicia@herpetologica.org

18943. Baaloudj, A. (2020): Aspects of life history of the Afrotropical endangered Acisoma inflatum (Selys, 1889) (Odonata: Libellulidae) in Northeast Algeria. Annales de la Société entomologique de France (N.S.) 56(2): 180-188. (in English, with French summary) ["A. inflatum is a threatened dragonfly in the Mediterranean, where only a few relict populations remain. It is listed as endangered in North Africa, where no data on its biology, behaviour or ecology are available. These latter are important to understand how this species is adapted to local environmental conditions and for establishing effective conservation plans. In this study, the life history of A. inflatum is investigated in a north-east Algerian population. By combining field and laboratory investigations on embryonic development and regular collection of exuviae during the emergence season, it is revealed that the species has direct and synchronous embryonic development, with 75% of all eggs hatching after 10 days of oviposition, and a hatching period ranging from 9 to 15 days. Emergences were asynchronous with half of the larval population (EM50) emerging within the first 25 days of a 64-day emergence season, which matches a typical 'summer species' emergence pattern. Sex ratio at emergence was not significantly different from unity. Body size of exuviae did not show a significant pattern across the season. Exuviae males and females did not differ in their vertical stratification. Height of exuviae fixation during mergence was not random, but was rather positively correlated with support height where the relationship was logarithmic. Apparent lifespan of adults was not significantly different between sexes with a mean of 4.6 ± 2.9 days (± SD). Males and females reached their sexual maturity after two days of emergence. The information provided in this study has not been reported before and thus will be helpful in future conservation efforts." (Author)] Address: Baaloudj, Affef, Lab. LBEE: Biol., Water & Environment, Fac. SNV-STU, Univ. 8 May 1945 Guelma, BP 401 24000, Guelma, Algeria. Email: bafef@yahoo.fr

18944. Balázs, A.; Fric, Z.F.; Holuša, O. (2020): Flying activity and population dynamics of Cordulegaster heros Theischinger, 1979 (Insecta: Odonata: Cordulegastridae) in Slovakia. International Journal of Odonatology 23(3): 1-9. (in English) ["In 2017, we investigated the population dynamics

and flying activity of the south-east European endemic C. heros. This research was conducted in the southern part of Central Slovakia in the Revúcka vrchovina Upland at a submountainous stream called Drienok. The mark-release-recapture method was applied to study the population. C. heros was observed 775 times during the midsummer season. We found out that the species has bimodal diurnal activity pattern with a highest peak from 17:00 until 19:00 hours, but the species had a short peak before noon as well. The differences between sexes in the sense of entering new individuals to the population were low during the main flying period. Estimated population size for males surpassed the population size of females. Probability of capture decreased by the end of the flying season without differences in sexes. This article is the first on the flying activity and population dynamics of C. heros." (Authors)] Address: Balazs, A., Dept of Zoology, Fisheries, Hydrobiology & Apiculture, Faculty of AgriSciences, Mendel University in Brno, Brno, Czech Republic. Email: balazsaeko@gmail.com

18945. Baldo, F.; Cáceres, F.B.; Díaz-Martínez, C. (2020): Primeros registros de Trithemis kirbyi Selys, 1891 (Odonata: Libellulidae) de Guadalajara (Castilla-La Mancha, España). Boletín de la Sociedad Entomológica Aragonesa 67: 405-406. (in Spanish, with English summary) ["Trithemis kirbyi is recorded for the first time in Guadalajara province, extending the known range of the species in central Spain and taking the provisional Odonata checklist of the province to 48 species." (Authors) 2017: parque natural del Alto Tajo (balsa de incendios de Selas, 30T 573169 4528688, datum ETRS89, 1.205 m); 2018: parque natural (Río Ablanquejo en Huertahemando, 30T 558734 4521587,1.160 m); 2020: canal artificial de agua del barranco del Alamín (30T 485462 4499 107, 640 m)] Address: Baldo, F., Sociedad Entomológica y Ambiental de Castilla-La Mancha. C/ Londres, 7. 45003 Toledo, Spain. fdbravo@jccm.es

18946. Bandara, C.D.; Ballerin, G.; Leppänen, M.; Tesfamichael, T.; Ostrikov, K.; Whitchurch, C.B. (2020): Resolving bio-nano interactions of E. coli bacteria-dragonfly wing interface with Helium ion and 3D-structured illumination microscopy to understand bacterial death on nanotopography. ACS Biomaterials Science & Engineering 6(7): 3925-3932. (in English) ["Obtaining a comprehensive understanding of the bactericidal mechanisms of natural nanotextured surfaces is crucial for the development of fabricated nanotextured surfaces with efficient bactericidal activity. However, the scale, nature, and speed of bacteria-nanotextured surface interactions make the characterization of the interaction a challenging task. There are currently several different opinions regarding the possible mechanisms by which bacterial membrane damage occurs upon interacting with nanotextured surfaces. Advanced imaging methods could clarify this by enabling visualization of the interaction. Charged particle microscopes can achieve the required nanoscale resolution but are limited to dry samples. In contrast, light-based methods enable the characterization of living (hydrated) samples but are limited by the resolution achievable. Here we utilized both helium ion microscopy (HIM) and 3D structured illumination microscopy (3D-SIM) techniques to understand the interaction of Gram-negative bacterial membranes with nanopillars such as those found on dragonfly wings. Helium ion microscopy enables cutting and imaging at nanoscale resolution while 3D-SIM is a super-resolution optical microscopy technique that allows visualization of live, unfixed bacteria at ~100 nm resolution. Upon bacteria-nanopillar interaction, the energy stored due to the bending of natural nanopillars was estimated and compared with fabricated vertically aligned carbon nanotubes. With the same deflection, shorter dragonfly wing nanopillars store slightly higher energy compared to carbon nanotubes. This indicates that fabricated surfaces may achieve similar bactericidal efficiency as dragonfly wings. This study reports in situ characterization of bacteria-nanopillar interactions in real-time close to its natural state. These microscopic approaches will help further understanding of bacterial membrane interactions with nanotextured surfaces and the bactericidal mechanisms of nanotopographies so that more efficient bactericidal nanotextured surfaces can be designed, fabricated, and their bacteria-nanotopography interactions can be assessed in situ." (Authors)] Address: Bandara, C.D., The ithree Institute, Univ. Technology Sydney, Ultimo, NSW 2007, Australia. Email: chaturangab@yahoo.com

18947. Bastos, R.C. (2020): Respostas ecológicas de espécies de Odonata (Insecta) a um gradiente de múltiplos usos do solo na Amazônia Oriental. Universidade Federal do Pará – UFPA Instituto de Ciências biológicas Embrapa Amazônia Oriental Programa de Pós-Graduaçao em Ecologia, Belém: 11 + 33 pp. (in Portuguese, with English summary) ["Ecological responses of Odonata species (Insecta) to multiples land uses gradient in the Oriental Amazon: Several factors can influence, jointly or separately, the communities structuration through space and time, such as niche, dispersal ability and evolutionary history of species. For this reason, environmental, morphological and phylogenetic factors are constantly focused in studies about community ecology. In this sense, the goal of this study is to evaluate the response pattern of Odonata adult species to an environmental change gradient in the Amazon, to identify species subgroups that respond to the environmental filter in a similar way. The study hypothesis is that the species subgroups would have similar responses to the environmental gradient will be structured phylogenetically and They will be morphologically similar among themself than to the other species. The adult Odonata were collected in 98 amazon streams, where 48 streams in the Santarém and Belterra region and 50 in the Paragominas municipality, both in the state of Pará, Brazil. It was used distribution modeling methods jointly with statistical methods to identify the species subgroups that have similar responses, in other words it is the latent classes. Subsequently, it was analyzed the relationship between the structuring patterns of these latent classes and the communities' morphological and phylogenetic factors. Overall 3,588 adult Odonata individuals were sampled, representing 131 species distributed in 49 genera. Of the species sampled, 34 were classified as well-modeled

and formed four latent classes, for each of the regions. The findings show that phylogenetic and morphological factors may influence the latent classes structuring of Odonata species. However, the patterns were not the same for all classes and regions. Furthermore, it is likely that the classes structuring may be related to more complex and/or dynamic processes, not considered in this study, such as intra and/or interspecific relationships, adaptation ability or even differences in the land use historic between the regions studied. Therefore, these results show the importance of more detailed studies in the Amazon using that approach. Thus, it can help to understand better the distribution/response patterns of Odonata species in the face of environmental changes across landscapes in a scenario of multiple land uses." (Authors)] Address: not stated

18948. Beckstead, R.; Beckstead, R.B.; Anderson, K.; McDougald, L.R. (2020): Oviduct fluke (Prostagonimus macrorchis) found inside a chicken egg in North Carolina. Avian Diseases 64(3): 352-353. (in English) ["A video received by faculty at NC State Universitas Prestage Department of Poultry Science revealed a live parasite inside a chicken egg. The parasite was identified as an oviduct fluke (Prosthogonimus macrorchis), a trematode with a three host life cycle: the primary host, a galliform bird, then an aquatic snail, and finally a dragonfly larva or adult consumed by the infected bird. The egg was from a „backyard flock“ with access to a watercourse. No other instances of this parasite were seen in eggs from the flock. The presence of this parasite inside an egg suggests that the worms had migrated above the shell gland in the oviduct, to be incorporated inside the egg. Currently, the occurrence of an oviduct fluke inside an egg in the US is rare. Such parasites are not found in eggs from caged layers, as those birds do not have access to watercourses. This case reinforces the view that parasites requiring intermediate hosts may become more common in birds reared under „free range“ conditions." (Authors)] Address: Beckstead, R., University of North Carolina at Greensboro Associate Professor Prestage Department of Poultry Science 2711 Founders Drive 261 Scott Hall UNITED STATES Raleigh North Carolina

18949. Bender Kotzian, C.; Marques Pires, M.; Ubiratan Hepp, L. (2020): Effects of spatial distances on the assemblage dissimilarity of macroinvertebrates with different dispersal pathways and abilities in southern Brazilian streams. Ecological Research 35(5): 826-837. (in English) ["The magnitude of distance–decay relationships (DDRs) in stream macroinvertebrates can vary with their preferential dispersal pathways (overland and watercourse) and abilities as well as with environmental dissimilarity. We assessed DDRs in the compositional dissimilarity of macroinvertebrate assemblages in southern Brazilian streams using overland and watercourse distances (WD) as explanatory variables. We conducted additional separate assessments for taxonomic groups and according to a classification that took into account differences in the dispersal abilities and main pathways among macroinvertebrates. Assessments were conducted separately for (a) strong-flying insects with overland dispersal (Anisoptera), (b) weak-flying insects dispersing preferably through riparian corridors (Chironomidae, Ephemeroptera, Plecoptera, Trichoptera and Zygoptera), and (c) watercourse dispersers (Mollusca, Psephenidae and Elmidae). The environmental dissimilarity associated with spatial extent was accounted for via partial Mantel tests. Overland and WD were positively correlated with the dissimilarity of the total macroinvertebrate assemblage, weak-flying insects, watercourse dispersers, and most taxonomic groups. DDRs were stronger with overland than WD. However, no consistent pattern emerged after accounting for environmental dissimilarity. Strong- and weak-flying insects were correlated with environment, while watercourse dispersers, with geographic distances. Additionally, taxonomic groups were differently related with environment and geographic distances. The distinct responses of each taxonomic group to the environmental specificities of the study area such as substrate composition and land use likely explain the observed results. Thus, our findings indicate that combining taxonomic and natural history information is an effective approach for comprehending the underlying mechanisms generating spatial structure in stream macroinvertebrate assemblages." (Authors)] Address: Marques Pires, M., Laboratory of Ecology and Conservation of Aquatic Ecosystems, University of Vale do Rio dos Sinos, Sao Leopoldo, Brazil. Email: marquespiresm@gmail.com

18950. Beukema, J.J. (2020): Is it wise to terminate counting along transects where Odonata can no longer be found? Brachytron 21: 3-11. (in Dutch, with English summary) ["Regular counts of the numbers of Odonata during 14 years (2007-2020) along several transects in the dune area Grafelijkheidsduinen near the town of Den Helder (northwest Netherlands) yielded significantly positive correlations between total numbers and numbers in several species as observed at different groups of transects, and with water levels. Significantly negative correlations were found with year numbers. At two transects (along the same lake), numbers declined to (close to) 0 in the course of the years and termination of counting along these transects was considered (but dismissed). From the above correlations, it is concluded that (1) monitoring of part of a large area would generally be sufficient to follow the fluctuations in population sizes in the entire area; (2) water level (resulting from the difference between rain fall and evaporation) is of decisive influence for the numbers of Odonata present; (3) total numbers and numbers in about half of the species showed a significantly declining long-term trend. Long-term local trends deduced from monitoring might be biased by decisions to terminate counting at transects when numbers there decline to very low levels. In the calculations of the national trend this is being corrected for." (Authors)] Address: Beukema, J.J. Email: jan.beukema@outlook.com

18951. Billqvist, M. (2020): Nya provinsfynd av trollsländor (Odonata) i Sverige 2018–2020. Entomologisk Tidskrift 141 (4): 173-189. (in Swedish, with English summary) ["During the last three years we have seen a further increase in submitted Odonata observations to the Species Observation

System (Artportalen). More than 15 000 observations have been submitted annually 2018–2020. This after the interest for and the knowledge of dragonflies in Sweden already had increased dramatically for more than a decade. The paper presents the 47 new provincial records of 23 species made in 2018-2020. Included is the first ever Crocothemis erythraea (Brullé, 1832) in Sweden, which increases the amount of species registered in Sweden to 65. With the sole exception of Lycksele lappmark, new provincial records of dragonflies have been made in every province since 2009. There are still gaps in our knowledge regarding the range of several species. In the northernmost provinces we yet lack observations of even some of the more common species. Since the interest still is on a rise and many dragonflies show a northern expansion shift, we should in the years to come continue to get more new provincial records." (Author)] Address: Billqvist, M., Trollsländeföreningen / Swedish Dragonfly Society, Idrottsvägen 2, SE-243 72 Tjörnarp, Sweden. Email: magnus.billqvist@gmail.com

18952. Bobrek, R. (2020): High biodiversity in a city centre: Odonatofauna in an abandoned limestone quarry. European Journal of Environmental Sciences 10(2): 107-114. (in English) ["Limestone quarries are known to be places where the diversity of xerothermophilic organisms is promoting diversity and in some, there are water bodies that potentially support the presence of hydrobionts. These include dragonflies (Insecta: Odonata), which, as amphibiotic insects, use both aquatic and terrestrial habitats. The purpose of this paper was to determine whether there was a high diversity of odonatofauna in an old limestone quarry with well-developed aquatic habitats, located in an urban environment in the Central-European city of Kraków (S Poland). For this purpose, dragonflies in the quarry were monitored regularly, focusing on the reproductive status and relative abundance of each species. In 2017–2018, 37 species belonging to seven families of Odonata were recorded in the quarry, which is 50% of the Poland's odonatofauna. Of these, 33 species were considered indigenous to the quarry. Among them, 30% were moderately urbanophobic or urbanophobic taxa. Habitat specialists made up 39% of the species. Some rare and declining species, i.e. Leucorrhinia pectoralis and L. rubicunda, were abundant at this site. The study shows that a well-preserved secondary habitat, located in the centre of a city and not subject to urban management, can support a high diversity of odonates. Such limestone quarries in highly transformed urban environments can be valuable sites for this indicator group of organisms and should be identified, evaluated and conserved." (Author)] Address: Bobrek, R., Polish Society for the Protection of Birds, Odrowaza 24, 05-270 Marki, Poland. E-mail: rafal.bobrek@gmail.com

18953. Bobrov, V.V. (2020): Rare and endangered species of invertebrate animals of Mongolia: Current status, threats and measures of protection. Environment and Human: Ecological Studies 10(2): 121-132. (in Russian, with English summary) ["Based on the information provided in the 2nd and 3rd editions of the Red Book of Mongolia, the current state of the rare and endangered species of mollusks, crustaceans and insects of Mongolia and the threat to their existence are analyzed: water pollution and accidental catch during fishing (for aquatic species); degradation of habitats (haying, draining of swamps); overgrazing; collecting. The effectiveness of protection measures has been identified: the habitats of some species are included in the boundaries of specially protected natural territories; some species are listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora which will establish strict control over the international trade of rare and endangered species of invertebrates in Mongolia. It is indicated that the conservation of certain species of molluscs, crustaceans and insects requires additional and more specific measures: prevention of habitat degradation, including overgrazing and pollution of water bodies; a ban on collecting; conducting research to identify the concentration of populations, as well as assess the resources of food plants." (Authors) Aeshna juncea] Address: Bobrov, V.V., A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Moscow, 117091, Russian Federation

18954. Borisov, S.N.; Iakovlev, I.K.; Borisov, A.S.; Ganin, M.Yu.; Tiunov, A.V. (2020): Seasonal migrations of Pantala flavescens (Odonata: Libellulidae) in Middle Asia and understanding of the migration model in the Afro-Asian region using Stable Isotopes of hydrogen. Insects 2020, 11, 890; doi:10.3390/insects11120890: 12 pp. ["Simple Summary: Large-distance migrations of insects have been recognized for many years, but many details of this behaviour remain unknown. The globe skimmer dragonfly has the most extensive cosmopolitan range among all dragonfly species. Migrations of these dragonflies are noted on all continents (except Antarctica), over both land and the oceans, but the patterns of their seasonal movements are still poorly understood. We aimed to confirm seasonal latitudinal migrations of the globe skimmer in Middle Asia and to clarify its migration pattern in extended areas. We used stable isotope composition of hydrogen in wings of dragonflies as an intrinsic marker of their places of origin. Combining phenological data and a comparison with published isotopic data on migratory insects, our results suggest that in spring, the already-mature dragonflies arrive in Middle Asia for reproduction from tropical parts of East Africa and/or the Arabian Peninsula, and, in autumn, summer-generation dragonflies migrate to the south. We conclude that in the Afro-Asian region there is an extensive migration circle of the globe skimmer covering East Africa, Central Asia and the Indian subcontinent with a total length of more than 14,000 km." Abstract: In Middle Asia, the dragonfly Pantala flavescens makes regular seasonal migrations. In spring, sexually mature dragonflies (immigrants) arrive in this region for reproduction. Dragonflies of the aboriginal generation (residents) develop in about two months, and migrate south in autumn. Residents of Middle Asia have significantly lower δ-H values (-123.5 (SD 17.2)‰, n = 53) than immigrants (-64.4 (9.7)‰, n = 12), as well as aboriginal dragonfly species from Ethiopia (-47.9 (10.8)‰, n = 4) and the Sahel zone (-50.1

(15.5)‰, n = 11). Phenological data on P. flavescens in the Afro-Asian region and a comparison with published isotopic data on migratory insects from this region suggest that (i) the probable area of origin of P. flavescens immigrants is located in tropical parts of East Africa and/or the Arabian Peninsula and (ii) the autumn migration of Middle Asian residents to the south may also pass through the Indian Ocean. We assume that in the Afro-Asian region, there is an extensive migration circle of P. flavescens covering East Africa, Central Asia and the Indian subcontinent with a total length of more than 14,000 km." (Authors)] Address: Borisov, S.N., Inst. of Systematics & Ecology of Animals, Siberian Branch of the Russian Academy of Sciences, Frunze str., 11, 630091 Novosibirsk, Russia. E-mail: borisov-s-n@yandex.ru

18955. Borisov, S.N.; Iakovlev, I.K.; Borisov, A.S.; Zuev, A.G.; Tiunov, A.V. (2020): Isotope evidence for latitudinal migrations of the dragonfly Sympetrum fonscolombii (Odonata: Libellulidae) in Middle Asia. Ecological Entomology 45(6): 1445-1456. (in English) ["1. Sympetrum fonscolombii dragonflies are believed to migrate seasonally. In the spring and early summer, the already-mature dragonflies arrive in Middle Asia for reproduction. In the late summer and autumn, summer-generation dragonflies migrate to the south. Their wintering places remain unknown. 2. Stable hydrogen (δ^2H) and oxygen ($\delta^{18}O$) isotope analyses were conducted to confirm the migration of S. fonscolombii and determine the wintering area. Stable isotope composition of carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) in wings and legs was used to clarify the habitats in which dragonfly development took place. 3. Three cohorts of dragonflies collected in different regions of Middle Asia were used for analysis: (i) immigrants that arrived in the spring, (ii) residents that developed in Middle Asia, and (iii) transit dragonflies migrating to the south during autumn. 4. The average δ^2H values in the wings were significantly higher in immigrants (-96‰) than in residents (-134‰) and transit individuals (-124‰). High $\delta^{18}O$ and δ-N values in the tissue of immigrants confirmed their southerly origin. 5. Based on the species range and the global distribution of annual averages of δ^2H and $\delta^{18}O$ values in precipitation, the latitudinal migrations of S. fonscolombii were inferred to cover the area from the proposed natal regions of immigrants in South-West Asia (below ~36°N) to Southern Ural and the south of Western Siberia in the north (54–55°N) with a maximum migration distance of more than 4000?km." (Authors)] Address: Borisov, S., Institute of Systematics and Ecology of Animals, Russian Academy of Sciences, Siberian Bran, Frunse str. 11, Novosibirsk 630091 Russia. E-mail: borisov-s-n@yandex.ru

18956. Bos, F.; Faber, R. (2020): More Water Soldier (Stratiotes aloides) in the province of Utrecht. Brachytron 21: 20-30. (in Dutch, with English summary) ["At the beginning of this century, a large number of conservation plans for the Green Hawker (Aeshna viridis) were drawn up. Despite that, the Green Hawker and Water Soldier (Stratiotes aloides) have declined. In agricultural areas, Water Soldier has disappeared in many places. The reasons for this are the deteriorated water quality, incorrect management and conditions of the Water boards. The province of Utrecht and the nature collective Rijn, Vecht and Venen have started a pilot to clarify the correct management of ditches with Water Soldier and to reintroduce the plant at a number of locations. The results of the pilot are presented." (Authors)] Address: Frank Bos. E-mail: Frank.bos@provincie-utrecht.nl

18957. Bota-Sierra, C.A.; Novelo-Gutierrez, R. (2020): Two new species of Colombian Epigomphus (Odonata: Gomphidae). Zootaxa 4896(2): 265-276. (in English) ["The Neotropical genus Epigomphus Hagen in Selys, 1854 groups 31 species distributed from Mexico to northern Argentina. Only two species have been recorded so far from Colombia. Here we present two new species found in the north of the Andean Colombian Cordillera Central, Epigomphus rufus sp. nov. and Epigomphus brillantina sp. nov. Full descriptions of adult male and female and adult male respectively, plus diagnoses, pictures of the diagnostic characteristics, natural history notes, and a distribution map are provided." (Authors)] Address: Bota-Sierra, C.A., Instituto de Ecología, A.C. Red de Biodiversidad y Sistemática. Carretera Antigua a Coatepec 351, El Haya, 91070 Xalapa, Veracruz, Mexico. E-mail: corneliobota@gmail.com

18958. Boudot, J.-P.; Monnerat, C.; Juillerat, L.; Feulner, G.R.; Kunz, B.; Corso, A.; Vigano, M.; Brochard, C. (2020): Range, distribution, field identification, behaviour and exuvia description of Orthetrum ransonnetii (Odonata: Libellulidae). Odonatologica 49(3/4): 199-244. (in English) ["Based on numerous records of Orthetrum ransonnetii from southeastern Arabia, the Middle East, the Maghreb and the Canary Islands in recent decades, the range of this species is characterised in relation to climate and habitat parameters. The species is mostly found in hot, arid, rocky environments. Its flight period extends year-round, with an apparent bivoltine cycle at lower elevations and in the southernmost part of its range. The range of its known distribution in certain areas, particularly in the mountains of central and western Morocco, is extended. There it was met with, sometimes as permanent reproductive populations, on the northern slopes of the Moroccan High Atlas, a montane area with a heavy winter snow cover, distinct from most of its previously known Saharo-Arabian-Iranian habitats. The absence of earlier records in some regions may be attributable to both difficulties in identification and confusion with the more common and widespread O. chrysostigma and O. brunneum and also with O. brevistylum and O. taeniolatum, with which O. ransonnetii is sympatric in Central Sahara and part of Southwest Asia, respectively. Field identification criteria and the unique behaviour of the species are described. The combination of black antenodal subcostal cross-veins in dorsal view and fully hyaline hind wings is sufficient to differentiate O. ransonnetii from all other Orthetrum in the Palaearctic area. The species can be distinguished in the field from sympatric congeners, particularly O. chrysostigma, if good views or photographs are available, on the basis of several readily observable visual characteristics. The identification of the exuviae is difficult but O. ransonnetii is unique

among its known West Palaearctic congeners in having more than 10 setae (instead of 3 to 8) at the base of the movable hook on each labial palp of the prementum." (Authors)] Address: Boudot, J.-P., Immeuble Orphée, Apt 703, F-54710 Ludres, France. E-mail: jean.pierre.boudot@numericable.fr

18959. Brasil, L.S.; Vieira, T.B.; Andrade, A.F.A.; Bastos, R.C.; Montag, L.F.; Juen, L. (2020): The importance of common and the irrelevance of rare species for partition the variation of community matrix: implications for sampling and conservation. Scientific Reports volume 10, Article number: 19777 (2020): 8 pp. (in English) ["In community ecology, it is important to understand the distribution of communities along environmental and spatial gradients. However, it is common for the residuals of models investigating those relationships to be very high (>50%). It is believed that species' intrinsic characteristics such as rarity can contribute to large residuals. The objective of this study is to test the relationship among communities and environmental and spatial predictors by evaluating the relative contribution of common and rare species to the explanatory power of models. Our hypothesis is that the residual of partition the variation of community matrix (varpart) models will decrease as rare species get removed. We used several environmental variables and spatial filters as varpart model predictors of fish and Zygoptera communities in 109 and 141 Amazonian streams, respectively. We built a repetition structure, in which we gradually removed common and rare species independently. After the repetitions and removal of species, our hypothesis was not corroborated. In all scenarios, removing up to 50% of rare species did not reduce model residuals. Common species are important and rare species are irrelevant for understanding the relationships among communities and environmental and spatial gradients using varpart. Therefore, our findings suggest that studies using varpart with single sampling events that do not detect rare species can efficiently assess general distributional patterns of communities along environmental and spatial gradients. However, when the objectives concern conservation of biodiversity and functional diversity, rare species must be carefully assessed by other complementary methods, since they are not well represented in varpart models." (Authors)] Address: Brasil, L.S., Programa de Pos.Graduacao em Zoologia, Universidade Federal do Para, Belem, Para, Brasil. E-mail: brasil_biologia@hotmail.com

18960. Bried, J.; Ries, L.; Smith, B.; Patten, M.; Abbott, J.; Ball-Damerow, J.; Cannings, R.; Cordero-Rivera, A.; Córdoba-Aguilar, A.; De Marco, Jr, P.; Dijkstra, K.D.; Dolný, A.; van Grunsven, R.; Halstead, D.; Harabiš, F.; Hassall, C.; Jeanmougin, M.; Jones, C.; Juen, L.; Kalkman, V.; Kietzka, G.; Searles Mazzacano, C.; Orr, A.; Perron, M.A.; Rocha-Ortega, M.; Sahlén, G.; Samways, M.; Siepielski, A.; Simaika, J.; Suhling, F.; Underhill, L.; White, E. (2020): Towards global volunteer monitoring of Odonate abundance. BioScience 70(10): 914-923. (in English) ["Insects are reportedly experiencing widespread declines, but we generally have sparse data on their abundance. Correcting this shortfall will take more effort than professional entomologists alone can manage. Volunteer nature enthusiasts can greatly help to monitor the abundance of Odonata, iconic freshwater sentinels and one of the few nonpollinator insect groups appreciated by the public and amenable to citizen science. Although counting individual odonates is common in some locations, current data will not enable a global perspective on odonate abundance patterns and trends. Borrowing insight from butterfly monitoring efforts, we outline basic plans for a global volunteer network to count odonates, including organizational structure, advertising and recruiting, and data collection, submission, and synthesis. We hope our proposal serves as a catalyst for richer coordinated efforts to understand population trends of odonates and other insects in the Anthropocene." (Authors)] Address: Hassall, C., School of Biology, Univ. of Leeds, Woodhouse Lane, LS2 9JT, Leeds, UK. E-mail: c.hassall@leeds.ac.uk

18961. Cerini, F.; Stellati, L.; Vignoli, L. (2020): Segregation structure in Odonata assemblages follows the latitudinal gradient. Oecologia 194: 15-25. (in English) ["Latitude is known to deeply affect life with effects generalizable into ecological rules; the increasing species diversity toward tropics is the most paradigmatic. Several hypotheses tested patterns of biotic interactions' intensity along latitude. Negative interactions (i.e. competition and predation) are expected to be among the processes that produce checkerboard distribution of species. However, no relationship between checkerboardness and latitude has been uncovered. We tested Odonata assemblages worldwide for segregation patterns using a faunistic dataset (395 species arranged in 386 natural communities) spanning a wide latitudinal range (87°). We used co-occurrence analyses (C-score index and Standardized Effect Size) as an estimate of checkerboardness then correlated the occurrence of segregation to latitude. Odonata followed the Latitudinal Diversity Gradient at the regional scale (i.e. country scale) within our analyzed assemblages spanning, whereas local richness (i.e. community scale) did not follow the same pattern. Odonata assemblages structured with segregation are more common going from high to low latitudes, and local species richness have no effect on the pattern. We summarized hypotheses on how biotic interactions or ecological and historical processes can influence the spatial patterns in the checkerboards of assemblages and presented promising ways to help to gain a better mechanistic understanding of the drivers of the Latitudinal Diversity Gradient." (Authors)] Address: Cerini, F., Dept of Science, Univ. Roma Tre, Viale Marconi, 446, 00146 Rome, Italy. E-mail: francesco.cerini@uniroma3.it

18962. Chazanah, N.; Muntalif, B.S.; Rahmayani, R.A.; Sudjono, P. (2020): Macrozoobentos distribution as a bioindicator of water quality in the upstream of the Citarum River. Journal of Ecological Engineering 21(3): 10-17. (in English) ["This study aims to prove the type and abundance of macrozoobenthos are affected by the physico-chemical condition of the habitat so that it can be used as a bioindicator in assessing river water quality with a case study in

the Upstream of Citarum River. The method used in this study consists of two stages, namely determining the status of river quality with pollution index and determining the components to see the relationship of the water quality parameters to the abundance of macrozoobenthos with principal component analysis. On the basis of these studies, the results were that at the location of the study status of the river quality is slightly polluted and mildly polluted. For the slightly polluted status Corbicula sp. was used as the dominant macrozoobenthos parameter with the parameters of dissolved oxygen, organic carbon and N-O in the clay-dominated sediments. In turn, for the river areas with mild pollution, Enallagma sp. [sic], Tubifex sp., and Chironomous sp. were used as bioindicators and they have a relationship with the parameters of nitrate, TSS, and P-total." (Authors)] Address: Chazanah, N., Faculty of Civil & Environmental Engineering, Bandung Institute of Technology, Indonesia. E-mail: nurul.chaza@yahoo.com

18963. Chelmick, D.; Lambret, P. (2020): Lestes macrostigma (Eversmann), the Dark Spreadwing. J. Br. Dragonfly Society 36(2): 84-108. (in English) ["L. macrostigma occurs across the southern Palearctic from the Atlantic coast as far east as Mongolia. It is locally common in the central part of its range, including Greece and Bulgaria, but becomes increasingly rare in the western parts of the region where, with notable exceptions, it is essentially coastal. It is very much associated with temporary, brackish and saline habitats and, very often, with Bolboschoenus maritimus. Many of its coastal habitats are under threat, especially from wetland transformation schemes of various types and, for that reason, the species is listed as Endangered in the European Red List." (Authors)] Address: Chelmick, D., Macromia Scientific 31 High Beech Lane, Haywards Heath West Sussex UK RH16 1SQ

18964. Chen, X.; Yu, X. (2020): A description of the final stadium larva of Calicnemia gulinensis Yu & Bu, 2008 (Odonata: Platycnemididae). International Journal of Odonatology 23(2): 191-197. (in English) ["The final stadium larva of Calicnemia gulinensis is described here for the first time. The larva can be distinguished from other known species of the genus Calicnemia by the arrangement of setae on premental edges and the number of setae on labial palpi. The important morphological characters of the caudal gills and the possible functional adaptation are discussed briefly." (Authors)] Address: Yu, X., College Life Sciences, Chongqing Normal Univ., Chongqing, PR China. Email: lannysummer@163.com

18965. Chitsaz, N.; Marian, R.; Chahl, J. (2020): Experimental method for 3D reconstruction of Odonata wings (methodology and dataset). PLoS ONE 15(4): e0232193: 18 pp. (in English) ["Insect wings are highly evolved structures with aerodynamic and structural properties that are not fully understood or systematically modeled. Most species in the insect order Odonata have permanently deployed high aspect ratio wings. Odonata have been documented to exhibit extraordinary flight performance and a wide range of interesting flight behaviors that rely on agility and efficiency. The characteristic three-dimensional corrugated structures of these wings have been observed and modeled for a small number of species, with studies showing that corrugations can provide significant aerodynamic and structural advantages. Comprehensive museum collections are the most practical source of Odonata wing, despite the risk of adverse effects caused by dehydration and preservation of specimens. Museum specimens are not to be handled or damaged and are best left undisturbed in their display enclosures. We have undertaken a systematic process of scanning, modeling, and postprocessing the wings of over 80 Odonata species using a novel and accurate method and apparatus we developed for this purpose. The method allows the samples to stay inside their glass cases if necessary and is non-destructive. The measurements taken have been validated against micro-computed tomography scanning and against similar-sized objects with measured dimensions. The resulting publicly available dataset will allow aeronautical analysis of Odonata aerodynamics and structures, the study of the evolution of functional structures, and research into insect ecology. The technique is useable for other orders of insects and other fragile samples." (Authors)] Address: Chitsaz, N., School of Engineering, Univ.y of South Australia, Adelaide, SA, Australia, 2 Joint & Operations Analysis Division, Defence Science & Technology Group, Melbourne VIC, Australia. Email: nasim.chitsaz@mymail.unisa.edu.au

18966. Choong, C.Y.; Dow, R.A.; Ng, Y.F. (2020): Additional records of Odonata from Kelantan and Terengganu, Malaysia. International Dragonfly Fund Report 144: 1-26. (in English, with Malaysian summary) ["We report here the results from field trips to collect Odonata in the northeastern parts of Kelantan state and the north of Terengganu state, Peninsular Malaysia. Eighty four species were collected, and four of these are new records for the state Kelantan and 10 are new records for the state of Terengganu. Notable records obtained from the field trips were Euphaea masoni, Coeliccia sameerae, Pseudagrion ?lalakense, Leptogomphus tioman and Macromia cupricincta. Checklists for Kelantan (140 species) and Terengganu (132 species) are given in an appendix." (Authors)] Address: Choong, C.Y., Centre for Insect Systematics, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia. E-mail: cychoong@ukm.edu.my

18967. Chovanec, A. (2020): Best Practice-Projekt im Rahmen der Kampagne Vielfaltleben IV „Die Blauflügel-Prachtlibelle“ – libellenkundliche Untersuchung an der Piesting 2019/2020 (Niederösterreich). im Auftrag des Naturschutzbund NÖ, Juli 2020: 55 pp. (in German) ["In 2019 and 2020, a total of six surveys were carried out on a metarhithral section of the Piesting River in the area of Gutenstein and Pernitz (Lower Austria) to survey the aspect-forming dragonfly fauna. The mapping aimed at recording newly hatched and adult dragonfly imagines as well as observations of reproductive behaviour. A total of 19 species were recorded, eleven of which were classified as definitely or probably native. Seven species were found on the Piesting itself and 17 on

a tributary connected to the main river. The near-natural state of the watercourse section is reflected in the detection of the two native aquatic species Calopteryx virgo ("potentially endangered" according to the Red List for Austria) and Onychogomphus forcipatus ("endangered"). C. virgo occurred in the highest abundance class ("massed"). Accompanying species specific to the water body type were also sighted. The dragonfly ecological status of the watercourse section is rated "very good". The observations of the two "endangered" species Lestes virens and Coenagrion ornatum (this species is listed in Annex II of the Habitats Directive) at the tributary are also worth mentioning." (Author/DeepL)] Address: Chovanec, A., Krotenbachgasse 68 2345 Brunn am Gebirge, Austria. E-mail: andreas.chovanec@bmlrt.gv.at

18968. Codina Montiel, T.; Gomez Subarroca, A.; Rodríguez González, M. (2020): Aproximació a l'estudi faunístic i poblacional dels odonats de la Segarra. Sikarra. Revista del Centre d'Estudis Segarrences 1 / 2020: 26-36. (in Catalan, with English summary) [Catalonia, Spain "The first dragonfly catalogue regarding la Segarra shire shows twenty-two species of these animals, twelve of which belong to the Zygoptera families and ten to the Anisoptera ones; the results also reveal five species which had never been mentioned before in this geographic region i.e. Coenagrion caerulescens, Pyrrhosoma nymphula, Aeshna affinis, Anax ephippiger and Anax parthenope. The register, which lasted eight months, was carried out in 2014 and four locations were sampled: Peixera del riu Llobregós (Llobregós river pond), bassa de Puig-Arner (Puig-Arner pond), Patamolls de Granollers (Granolllers wetland area) and bassa de la Morana (Morana pond). Furthermore, the flying period of these insects was also analyzed and the results obtained were compared with those of previous studies. The findings also reflect the high diversity of dragonflies in la Segarra shire, which displays a 31.88 % of the whole dragonfly biodiversity in Catalonia. However, some of these species show changes in their behaviour, the exact interpretation of which is still poorly-understood. Consequently, further studies on dragonflies are required in la Segarra in order to extend the existing knowledge." (Authors)] Address: Codina Montiel, Tània: E-mail: taniacodina22@gmail.com

18969. Conesa Garcia, M.A.; Bernal Sánchez, A.; Evangelio Pinach, J.M.; Teruel Montejano, S. (2020): Descripción de la larva F0 de Onychogomphus cazuma Barona, Cardo y Díaz, 2020 (Anisoptera, Gomphidae) y notas sobre su ecología y protección. Boln. Asoc. esp. Ent. 44(3-4): 429-449. (in Spanish, with English summary) [Description of the F0 larva of O. cazuma and notes on its ecology and protection. The F0 larva of O. cazuma, of which only the final exuvia was known, is described, and illustrated for the first time, from materials collected in two locations in the Valencian Community (Spain). The morphological characteristics of the larvae are analysed, and a key is built for the determination of the five species of the genus Onychogomphus present in the Iberian Peninsula and the Maghreb. A key is also provided to separate the genus Gomphus from the genus Onychogomphus, without using the palp structure of the prementum. Additional data about the habitat of the species are provided and a protection figure is proposed at the regional level." (Authors)] Address: Conesa Garcia, M.A. E-mail: mconesa@libelulas.org

18970. Corso, A.; Penna, V.; Janni, O.; De Lisio, L.; Biscaccianti, A.; Holusa, O.; Mastropasqua, F. (2020): New data on the distribution of the Italian endemic Cordulegaster trinacriae (Odonata: Cordulegastridae). Odonatologica 49(3/4): 259-287. (in English) ["Data on the northern and eastern limits of the distribution of the Italian endemic C. trinacriae are reported, together with further details on the first records for Abruzzo and Puglia, thereby re-defining its known range. The species is common in suitable habitats in central-southern Italy, extending further north along the Adriatic. In contrast to previous reports, along the central Tyrrhenian area C. boltonii and its hybrids replace C. trinacriae with phenotypically pure specimens only in southern Lazio and northern Campania. The flight period extends from late May to late September. The known altitudinal distribution ranges from 9 to 1 639 m a.s.l. We consider the possibility that former records of C. boltonii from Abruzzo, Molise and Campania resulted from confusion with C. trinacriae. In these regions C. boltonii either never occurred or has now been largely replaced by C. trinacriae and is extremely localised." (Authors) Holusa was promoted by IDF, never didn't submit any report nor acknowledged IDF nor reacted on any e-mail.] Address: Corso, A., Via Camastra, 10, 96100 Siracusa (SR), Italia. E-mail: zoologywp@gmail.com

18971. Cuellar-Cardozo, J.A.; Fonseca-Santanilla, E.B. (2020): Concentración letal (CL50 y CL95) de nitrógeno reactivo en larvas de Hetaerina caja. Revista de toxicología 37: 101-105. (in Spanish, with English summary) ["Lethal concentration (CL50 and CL95) of reactive nitrogen in larvae H. caja. In aquatic ecosystems, the nitrogen is a limiting element inside the environment where minimal variations in its concentration could cause strong alterations in the biodiversity. However, wastes from agricultural processes where is used agrochemicals and fertilizers riches in nitrogen, represent a huge increase in the amount of nitrogen into the water bodies causing alterations in the environment, especially the aquatic food web. In recent years, new researches have promoted the use of Odonata, focused on their aquatic larval growth, as bioindicators of environmental damage, especially in the Neotropical region. The larvae of H. caja are strongly associated with aquatic environmental characteristics, as well as being a taxon that has been well studied letting a better discussion on issues such as development and ecological importance. Therefore, our research aims to quantify the lethal concentrations of total nitrogen over Hetaerina individuals, facilitating the knowledge of the damages caused by the nitrogen additions. As result, nitrogen CL50 for H. caja specimens is 21.8 ppm and CL95 is 28,070.42 ppm until 72 hours after the exposition. Also, this research represents a first step in Colombia to develop the Odonata as an ecotoxicology tool and how this insect group responds to environmental changes." (Authors)] Address:

Cuéllar-Cardozo, J.A.Bioprospección y Biodiversidad Colombiana. Maestría en Recurso Hídrico Continental. Departamento de Ciencias Básicas. Universidad La Salle. Cra 2 # 10-70; Bogotá. Colombia

18972. Damm, A.; Bode-Oke, A.T.; Dong, H. (2020): Aerodynamics and wing-wing interaction during the pre-oviposition flight of the damselfly. American Institute of Aeronautics and Astronautics 2020-1780. Published Online:5 Jan 2020. https://doi.org/10.2514/6.2020-1780: (in English) ["Damselflies have four wings that are controlled independently during flight. The fore and hindwings typically beat out of phase, and the interactions which enhance or attenuate flight forces of the wing pairs are phase-dependent. During oviposition, however, there exists a species (Neurobasis chinensis) that flies by beating only the forewings while the hindwings are kept outstretched and stationary. Using computational fluid dynamics simulations based on high-speed photography, we examined the aerodynamics of this unique flight behavior. We hypothesized that the hindwings passively benefit from the wake of the forewings without moving. Our findings elucidate the interactions between a flapping and stationary wing and add to our understanding of insect flight, which serves as an inspiration for micro-aerial vehicle design.] Address: Bode-Oke, A.T., Mechanical & Aerospace Engineering, Univ. of Virginia, Charlottesville, VA 22903, USA

18973. Deacon, C.; Samways, M.J.; Pryke, P.S. (2020): Determining drivers of dragonfly diversity patterns and the implications for conservation in South Africa. Biological Conservation 245 (2020) 108548: 10pp. (in English) ["Highlights: • Climate gradients drive the rich South African dragonfly fauna. • Assemblage composition varies substantially across the region. • Assemblage-turnover boundaries are gradual at the regional scale. • Turnover boundaries are determined by topography and spatial climatic variation. • The conservation network of South Africa represents dragonflies well. Abstract: Knowing where species occur is essential for conservation planning. In South Africa, regional climatic variation is subject to effects of oceanic current systems, which in turn, determine species diversity patterns. We hypothesize that regional climates and topography are important drivers of aquatic insect species richness, endemism, and assemblage composition, and expect strong assemblage-turnover boundaries to be concurrent with topographical features. We also expected that current conservation networks do not represent aquatic insect species richness and endemism. We used generalized linear mixed models and generalized dissimilarity models to determine drivers of South African Odonata species richness and assemblage-turnover, as well as to investigate the extent of assemblage-turnover boundaries. We found that climate gradients were significant drivers, and found significant variation in assemblages between sub-regions. Turnover boundaries were gradual but concurrent with topographical features and/or areas with spatial changes in sub-regional climate. Modern-day climate and topography partially explained dragonfly diversity patterns, but other local factors and past geological events likely both contribute to current dragonfly diversity patterns. The existing conservation network in South Africa represents areas of high dragonfly species richness and endemism. We recommend additional conservation efforts in areas outside of protected areas with high species richness and endemism levels, but importantly also in areas with high assemblage-turnover rates to ensure protection of as many species as possible. We also propose further searches in areas with high endemism and high assemblage-turnover for possible discovery of unknown species, and further searches in under-represented areas to improve distribution data for known species." (Authors)] Address: Deacon, C., Room 3014, JS Marais Build., Victoria St., Stellenbosch, South Africa. E-mail: charldeacon@sun.ac.za

18974. Dennis, D.S. (2020): Ethology of Proctacanthus gracilis Bromley, 1928 (Diptera: Asilidae) in Northeastern Florida, U.S.A.. Journal of the Entomological Research Society 22(3): 255-273. (in English) ["P. gracilis forages primarily from vegetation, capturing prey in flight, and immobilizing them in flight or on the ground. Identified prey is in eight insect orders (Coleoptera, Diptera, Hemiptera, Hymenoptera, Lepidoptera, Neuroptera, Odonata, and Orthoptera), with Orthoptera making up 63.0%. Mating occurs in the tail-to-tail position and oviposition is in the ground. This species exhibits a distinct daily rhythm of activity for feeding and mating. Grooming behavior resembles that described for other species of robber flies. Morphology, habitats and distribution in Florida, resting behavior, and predators and parasites also are discussed." (Author) The list of prey includes Erythrodiplax minuscula, 24.07.2015 (1 ♀).] Address: Dennis, D.S., 1105 Myrtle Wood Dr., St. Augustine, Florida 32086-4838, USA. Email: dstevedennis@msn.com

18975. Díaz-Martínez, C.; Yela, J.L. (2020): Contribución al conocimiento histórico de la odonatofauna de Trillo (Guadalajara, centro de España) (Odonata). Boletín de la Sociedad Entomológica Aragonesa 67: 403-404. (in Spanish, with English summary) ["22 unpublished records of 13 species of Odonata are reported, based on specimens collected in Trillo (Guadalajara, Spain) between 1970 and 1985. Among them is the first provincial record of Anax ephippiger." (Authors)] Address: Díaz-Martínez, Cecilia, Sociedad Entomológica y Ambiental de Castilla-La Mancha, c/Londres, 7, 45003 Toledo, Spain. E-mail: cdiaz.cuenca@gmail.com

18976. Dickens, J.K.; Schoenberger, D.; VanCompernolle, M. (2020): Guide to the Odonata of central Ñeembucú, Paraguay: indicator species of wetland habitats. International Journal of Odonatology 23(3): 239-289. (in English) ["The department of Ñeembucú, in south-western Paraguay, is home to the virtually unexplored Ñeembucú Wetlands, the second largest wetland system in the country, representing a major gap in biodiversity knowledge. As organisms ubiquitous with wetlands, the Odonata ... have the potential to be effective indicators of wetland habitats in the face of increasing anthropogenic impacts in the region. We therefore comprehensively surveyed the Odonata in central Ñeembucú over a period of two years using a listing method. Here, we present an annotated checklist and identification

key to the species present in central Ñeembucú with details on their habitat preferences, phenology and behaviour. We found 60 species but estimate a total of between 62 and 90 species. Eleven (18%) are new records for Paraguay. Species composition is similar to the Argentine Humid Chaco, with four bioregional endemics, whilst representatives from the Andean-Patagonian subregion are present in open areas. Such partitioning of species from different bioregions into different habitats is typical of ecotonal regions. Two further species are endemic to the Paraná-Paraguay basin and three are highly localised, indicating the high conservation value of the Ñeembucú Wetlands. Eleven species have the potential to be effective indicators of the Paraguay River, large permanent wetlands, grassy temporary wetlands and wooded temporary wetlands, providing an effective tool to identify critical wetland ecosystems in the face of the growing threats from human activities. We also provide recommendations for the protection and management of wetlands in the region." (Authors)] Address: Dickens, J.K., Fundación Para La Tierra, Centro IDEAL, Pilar, Paraguay. Email: jerdickens@gmail.com

18977. Ducotterd, C.; Crovadore, J.; Lefort, F.; Guisan, A.; Ursenbacher, S.; Rubin, J.-F. (2020): The feeding behaviour of the European pond turtle (Emys orbicularis, L. 1758) is not a threat for other endangered species. Global Ecology and Conservation 23 (2020) e01133: 13 pp. (in English) ["Molecular technologies, such as metabarcoding, have become powerful tools for conservation purposes. Here, we present a non-invasive study analyzing the diet of one population of E. orbicularis during its whole activity period and of four other populations during the same period, based on faecal sample, and using for the first time on this species, a long metabarcoding approach. E. orbicularis is an emblematic freshwater species of wetlands in Europe. In several countries, this species is endangered and, in Switzerland, E. orbicularis is ranked as critically endangered on the Swiss Red List. A national conservation program was created to reintroduce this species and raised the question if this reintroduced species could be a threat for other endangered species. We developed a new method of long metabarcoding analysis, using universal PCR primers to determine prey species occurrence in the faeces. The analysis conducted on 174 faeces collected on 142 individuals revealed 1153 preys from 270 species. E. orbicularis consumed plants throughout the year with a more diverse diet during the reproduction period (April-June). This study therefore not only determines precisely the omnivorous and opportunistic diet of the E. orbicularis, but also shows that this species is not a threat to its environment, as 85.5% of the consumed species were not list on the Swiss Red List. Moreover, it also demonstrated that the genetic analyses of faeces could be an efficient tool to determine trophic interaction with a high level of precision, yielding promising perspectives for food web ecology." (Authors) Prey items included one Coenagrion pulchellum.] Address: Ursenbacher, S., Info Fauna e Centre Suisse de Cartographie de la Faune (CSCF) and Centre de Coordination pour les Reptiles et les Amphibiens de Suisse (Karch), Bellevaux 51, CH-2000, Neuchâtel, Switzerland

18978. Ekpah, O.; Kemabonta, A.K.; Ogbogu, S.S.; Fomekong, L.-J. (2020): Records of lost and associated species of Odonata in Cross River National Park, Nigeria. Odonatologica 49(3/4): 245-258. (in English) ["A number of species of Odonata in south-eastern Nigeria have not been seen for decades, while others have not been recorded since their description. The Mango River in the Oban division of the Cross River National Park (CRNP) in eastern Nigeria was visited three times every month in September 2019, January and March 2020, to survey species of Odonata. The survey was carried out with a view to rediscovering lost species or species that are hitherto not known to occur in the study area. Micrographs of the thorax and wings of specimens suspected to be relict species of Odonata were taken and compared with data in literature to determine their actual identities. A total of 61 individuals of Odonata belonging to 34 species in nine families were collected. Of the 34 species, three, Africocypha lacuselephantum (Vulnerable), the relict Pentaphlebia stahli (Vulnerable) and Umma purpurea (Endangered) are new records for Nigeria. This record of rare and common species provides a preliminary baseline data for a checklist of the Odonata fauna in Oban Hills for possible formulation of conservation strategies for threatened species in the area in particular and south-eastern Nigeria at large." (Authors)] Address: Ekpah, O., Nigerian Conservation Foundation, Nigeria. Email: davisugwa@gmail.com

18979. Ekpah, O.; Williams, A.B.; Kehinde, K.A. (2020): An inventory of Odonata in relation to water quality in Lekki Conservation Centre, Nigeria. British Entomological and Natural History Society 33: 367-382. (in English) ["A survey of the Odonata fauna of Lekki Conservation Centre, southwestern Nigeria was carried out from May to December 2019, to investigate how water quality affects species composition. Two study areas were identified and classified as forest swamp (sampling points SW1 to SW7) and forest grassland (G1 to G7). Adult Odonata were collected once a week throughout the study period using an aerial net. Twenty-five species in seven families were recorded of which Chalcostephia flavifrons and Ceriagrion glabrum were the most abundant species throughout the survey period. Five families were represented by a single species, namely: Anax tristis, Phyllomacromia contumax, Phaon iridipennis, Chlorocypha cf. curta and Copera sikassoensis. Data analyses revealed that the forest swamp was the marginally richer area with Shannon and Simpson indices of 0.88 and 2.4, respectively. Some species such as Agriocnemis maclachlani and Copera sikassoensis shared a similar microhabitat. The sum of the African Dragonfly Biotic Index (ADBI) scores for all species in the study was 16 with Ceriagrion rubellocerinum Fraser with the highest ADBI score of 4. Lekki Conservation Centre should therefore be considered an important refuge for Odonata." (Authors)] Address: Ojonugwa, E., Nigerian Conservation Foundation, Lagos, Nigeria. E-mail: davisugwa@gmail.com

18980. Erasmus, J.H.; Malherbe, W.; Zimmermann, S.; Lorenz, A.W.; Nachev, M.; Wepener, V.; Sures, B.; Smit, N.J. (2020): Metal accumulation in riverine macroinvertebrates

from a platinum mining region. Science of The Total Environment 703 (2020) 134738: (in English) ["Highlights: • Quantification of Cr, Ni, Cu, Zn, Cd, Pt, Pb in water, sediment and macroinvertebrates. • Metal contamination increased in water and sediment downstream of mining activities. • Metal bioaccumulation was significant in macroinvertebrate families. • Macroinvertebrate families showed different grades of bioaccumulation. • Urban and informal settlements also contributed to metal pollution. Abstract: South Africa is the world's main supplier of Pt. The Bushveld Igneous Complex in South Africa contains 75% of the world's Pt resources. Mining of this precious metal requires large volumes of water for production and removal of waste products. Most of this wastewater is discharged into river systems. Although the source of contamination with Pt in aquatic systems due to mining activities is known, little to no information is available about the impact of Pt on aquatic organisms. Additionally, other metals are released as byproducts of Pt mining, which might also be discharged into the environment. Therefore, concentrations of Cr, Ni, Cu, Zn, Cd, Pt and Pb were determined in water, sediment and macroinvertebrate samples from a reference site (Site 1), a highly impacted site (Site 2) and a moderately impacted site (Site 3) along the Hex River, South Africa. Aquatic invertebrate families representing different functional feeding groups i.e. scraper-grazers (Lymnaeidae), collector-gatherers (Potamonautidae, Hydropsychidae, Tubificidae and Chironomidae), shredders (Baetidae) and predators (Coenagrionidae and Libellulidae) were studied. In the sediments, the concentrations of Cr and Pt were significantly higher at Site 2 than at Sites 1 and 3, respectively, whereas concentrations of Ni, Cu, Cd, and Pb showed no significant differences between the sites. Depending on the metal, the aquatic invertebrate families showed different grades of bioaccumulation. The results from especially Lymnaeidae, Baetidae, Tubificidae and Chironomidae showed great promise for the use of these taxa for biomonitoring of metal contaminations. The macroinvertebrates accumulated metals associated with Pt mining, with epi-benthic dwelling taxa (Tubificidae) accumulating higher concentrations of Pt and Cr than other families (e.g. Potamonautidae, Coenagrionidae and Lymnaeidae). These results provide valuable information on the behavior of metals related to Pt mining in aquatic ecosystems and therefore can contribute to the risk assessment of these intensive mining activities." (Authors)] Address: Lorenz, A.W., Dept of Aquatic Ecology & Centre for Water & Environmental Research, Univ. of Duisburg-Essen, Universitätsstr. 2, 45141 Essen, Germany. E-mail: armin.lorenz@uni-due.de

18981. Flechoso, F.; Morales, J.; Lizana, M. (2020): Comunidades de odonatos (Insecta: Odonata) en tramos de diferentes características hidrotérmicas en la cuenca de río Carrión. - Communities of odonata (Insecta: Odonata) along sections of the basin of the river Carrión with different hydrothermic characteristics.. Munibe, Cienc. nat. 68: 19-33. (in Spanish, with Euskara and English summaries) ["The diversity of Odonata in the area around Velilla del Río Carrión (NW of Palencia) was analyzed in relation to the water temperature and the modification of the water regime by the Compuerto reservoir. The communities along the main axis of the Carrión river were compared in three sections with different dynamics with respect to a section of the Besandino river, not influenced by the presence of a large nearby reservoir. The results contributed the presence of 11 species (6 Zygoptera and 5 Anisoptera) in 23 records obtained between June and September during 2014 and 2015. Due to the release of water for irrigation in summer, the temperature and flow in the river Carrión were inverted below the reservoir and were associated with a decrease in the specific richness of Odonata showing evidence of reproduction, indicated by the presence of larvae and exuviae. Downstream from the Compuerto dam, despite being a long and varied section, only one species was found of a specimen observed in flight and with no evidence of reproduction, while in the rest of the areas a larger number of species appeared with signs of reproduction in all of them. The thermal effect of a smaller dam was attenuated and did not restrict the presence of Odonata in the same way." (Authors)] Address: Flechoso, F., Univ. de Salamanca, Dpto. Biología Animal, Campus Miguel de Unamuno, E-37007. Spain. E-mail: fabioflechoso@usal.es

18982. Fletcher, D.E.; Lindell, A.H.; Stankus, P.T.; Fletcher, N.D.; Lindell, B.E.; McArthur, J.V. (2020): Metal accumulation in dragonfly nymphs and crayfish as indicators of constructed wetland effectiveness?. Environmental Pollution 256, January 2020, 113387: (in English) ["Highlights: • Dragonfly genera differ in levels of metal accumulation, influenced by habitat use. • Dragonfly genera accumulating highest concentrations differ most among sites. • Biomonitor metal accumulation often not reduced downstream of constructed wetland. • Elevated metals in downstream biota despite wetlands reducing total and dissolved metal concentrations at base flow. Abstract: Constructed wetland effectiveness is often assessed by measuring reductions of contaminant concentrations in influent versus departing effluent, but this can be complicated by fluctuations in contaminant content/chemistry and hydrology. We assessed effectiveness of a constructed wetland at protecting downstream biota from accumulating elevated metal concentrations—particularly copper and zinc in effluents from a nuclear materials processing facility. Contaminants distributed throughout a constructed wetland system and two reference wetlands were assessed using six dragonfly nymph genera (Anax, Erythemis, Libellula, Pachydiplax, Tramea, and Plathemis) as biomonitors. Additionally, the crayfish, Cambarus latimanus, were analyzed from the receiving and two reference streams. Concentrations of Cu, Zn, Pb, Mn, Cr, Cd, and Al were evaluated in 597 dragonfly nymph and 149 crayfish whole-body composite samples. Dragonfly genera varied substantially in metal accumulation and the ability to identify elevated metal levels throughout components of the constructed wetland. Genera more closely associated with bottom sediments tended to accumulate higher levels of metals with Libellula, Pachydiplax, and Erythemis often accumulating highest concentrations and differing most among sites. This, combined with their abundance and broad distributions make the latter two species suitable candidates

as biomonitors for constructed wetlands. As expected, dragonfly nymphs accumulated higher metal concentrations in the constructed wetland than reference sites. However, dragonfly nymphs often accumulated as high of metal concentrations downstream as upstream of the water treatment cells. Moreover, crayfish from the receiving stream near the constructed wetland accumulated substantially higher Cu concentrations than from downstream locations or reference streams. Despite reducing metal concentrations at base flow and maintaining regulatory compliance, metal fluxes from the wetland were sufficient to increase accumulation in downstream biota. Future work should evaluate the causes of downstream accumulation as the next step necessary to develop plans to improve the metal sequestering efficiency of the wetland under variable flow regimes." (Authors)] Address: Fletcher, D.E., Savannah River Ecology Lab., Univ. of Georgia, P. O. Drawer E, Aiken, SC 29802, USA. Email: fletcher@srel.uga.edu

18983. Gärtner, F.; Joest, R. (2020): Quelljungfern im FFH-Gebiet Arnsberger Wald. Situation und Gefährdung nach dem Dürrejahr 2018. Natur in NRW 2/2020: 17-21. (in German) [Nordrhein-Westfalen, Germany "Cordulegastridae are typical representatives of the biocoenosis of near-natural springs and flowing waters. Larval mapping at 13 streams in the Arnsberg Forest FFH area showed that both species were still present here even after the extremely dry summer of 2018. However, in the early summer of 2019, 14 percent of the 223 100-metre segments surveyed, or even five of 13 streams surveyed, fell at least partially dry. With a continuing trend towards a negative water balance, a new hazard factor has thus emerged. In addition, the bark beetle mass reproduction as a result of the drought led to large-scale dieback of spruce stands in the Arnsberg Forest. In particular, the habitats of the rarer striped spring damselfly are strongly altered by the clearing of formerly shaded spring areas and sensitive sites are endangered by forestry work. As protective measures, the careful conversion of spruce forests in the stream valleys into site-appropriate deciduous trees and the renaturation of the watercourses as well as the dismantling of all melioration measures in the forest such as piping, fortifications and shortening of courses as well as the drainage into side ditches of the forest roads are recommended." (Authors(DeepL) Address: Joest, R., Arbeitsgemeinschaft Biologischer Umweltschutz – Biologische Station Soest, Bad Sassendorf-Lohne, Germany. E-mail: r.joest@abu-naturschutz.de

18984. Galimberti, A.; Assandri, G.; Maggioni, D.; Ramazzotti, F.; Baroni, D.; Bazzi, G.; Chiandetti, I.; Corso, A.; Ferri, V.; Galuppi, M.; Ilahiane, L.; La Porta, G.; Laddaga, L.; Landi, F.; Mastropasqua, F.; Ramellini, S.; Santinelli, R.; Soldato, G.; Surdo, S.; Casiraghi, M. (2020): Italian Odonates in the Pandora's Box: A comprehensive DNA barcoding inventory shows taxonomic warnings at the Holarctic scale. Molecular Ecology Resources 21: 183-200. (in English) ["The Odonata are considered among the most endangered freshwater faunal taxa. Their DNA-based monitoring relies on validated reference datasets that are often lacking or do not cover important biogeographical centres of diversification. This study presents the results of a DNA barcoding campaign on Odonata, based on the standard 658 bp 5' end region of the mitochondrial COI gene, involving the collection of 812 specimens (409 of which barcoded) from peninsular Italy and its main islands (328 localities), belonging to all the 88 species (31 Zygoptera and 57 Anisoptera) known from the country. Additional BOLD and GenBank data from Holarctic samples expanded the dataset to 1294 DNA barcodes. A multi-approach species delimitation analysis involving two distance (OT and ABGD) and four tree-based (PTP, MPTP, GMYC, bGMYC) methods were used to explore these data. Of the 88 investigated morphospecies, 75 (85%) unequivocally corresponded to distinct Molecular Operational Units, whereas the remaining ones were classified as 'warnings' (i.e., showing a mismatch between morphospecies assignment and DNA-based species delimitation). These results are in contrast with other DNA barcoding studies on Odonata showing up to 95% of identification success. The species causing warnings were grouped in three categories depending on if they showed low, high, or mixed genetic divergence patterns. The analysis of haplotype networks revealed unexpected intraspecific complexity at the Italian, Palearctic, and Holarctic scale, possibly indicating the occurrence of cryptic species. Overall, this study provides new insights into the taxonomy of odonates and a valuable basis for future DNA and eDNA-based monitoring studies." (Authors)] Address: Galimberti, A., ZooPlantLab. Dept of Biotechnology & Biosciences. University of Milano - Bicocca, P.za Della Scienza 2, 20126-1 Milan. Italy. Email: andrea.galimberti@unimib.it

18985. Garzón-Salamanca, L.L.; Rivera-Rondón, C.A.; Aristizabal, H.; Forero, D. (2020): Exploring the ecology and indicator value of some larvae of Odonata genera in Colombia. Environmental Entomology 49(4): 829-837. (in English) ["Bioindication is a method to assess environmental conditions using indicator organisms. In Colombia, water quality evaluation is mostly performed following the Biological Monitoring Working Party/Colombia method (BMWP/Col), which uses aquatic macroinvertebrates at the taxonomic family level. Studies on potential bioindicators are important to produce comprehensive information on the requirements of macroinvertebrates and their value for water quality bioindication. We studied the larval ecology of several common genera of Odonata from Colombian freshwater ecosystems and assigned an indicator value to each genus. The physical and chemical water characteristics of 1,022 sites surveyed in Colombia from 2005 to 2016 were analyzed using a principal component analysis (PCA). The relationship between environmental conditions and Odonata genera found was studied using multiple logistic regressions between sample coordinates of the first three axes of the PCA and occurrence of the respective genus. We assigned an indicator value for each genus using the logistic regression and the water quality of samples. The highest indicator values were assigned to genera, which were mainly explained by the PCA axis associated with water quality, showed a high odds ratio to this axis, and were found in ecosystems with

excellent water quality. The indicator values suggested for each taxon are, Brechmorhoga Kirby, 1894, 8; Macrothemis Hagen, 1868, 4; Micrathyria Kirby, 1889, 4 (Libellulidae); Progomphus Selys, 1854, 7 (Gomphidae); Acanthagrion Selys, 1876, 4; and Argia Rambur, 1842, 7 (Coenagrionidae). Differences in water quality preferences in genera of the same family suggest that higher taxonomic resolution may allow more detailed environmental assessments." (Authors)] Address: Garzón-Salamanca, Laura L., Laboratorio de Limnología, UNESIS, Departamento de Biología, Pontificia Universidad Javeriana, Bogotá, Colombia. E-mail: lgarzons@javeriana.edu.co

18986. Genise, J.F.; Sánchez, V.; Poiré, D.G.; González, M.G. (2020): A fossorial petalurid trace fossil from the Albian of Patagonia. Cretaceous Research 116, December 2020, 104591: (in English) ["Highlights: • Maichnus wetkaroae igen. isp. nov. is a new trace fossil from the Albian of Patagonia. • It is the first trace fossil attributable to Odonata recorded from paleosols. • It is one of the oldest insect trace fossils recorded from paleosols. • It provides the first and unique evidence of ancestral burrowing behavior of petalurids. • This evidence supports some previous theoretical evolutionary scenarios for Odonata. Absract: Maichnus wetkaroae igen. isp. nov., from the Albian of Patagonia, is composed of two or three ellipsoidal oblate chambers connected to shafts that show swellings and concentrically laminated linings. Such laminated linings are also present in chambers, and probably originated by radial backfilling and/or the successive discharges of liquid organic excretions. This unique morphology occurs in paleosols showing evidence of waterlogging. Trace fossil morphology and the occurrence of traces in clusters in waterlogged soils indicate that M. wetkaroae igen. isp. nov. represents larval burrows of fossorial petalurids. This is the first record of Odonatan trace fossils from paleosols and also the oldest one. M. wetkaroae igen. isp. nov. is one of the oldest insect trace fossils recorded from paleosols. It represents the first and unique paleontological evidence of the ancient origin of the burrowing behavior of petalurids postulated only theoretically until now in evolutionary scenarios of Odonata." (Authors)] Address: Genise, J.F., CONICET, División Icnología, Museo Argentino de Ciencias Naturales, Av. Ángel 7 Gallardo 470, Buenos Aires, Argentina. E-mail address: jgenise@macn.gov.ar

18987. Gezie, A.; Legesse Mulat, W.; Anteneh, W.; Dejen, E.; Kloos, H.; Mereta, S.T. (2020): Habitat suitability modelling of benthic macroinvertebrate community in wetlands of Lake Tana watershed, northwest Ethiopia. Wetlands 40: 853-864. (in English) ["Predictive modelling corroborates decision-making in the development of a standard habitat assessment protocol. In this study, we modelled environmental requirements of benthic macroinvertebrates. Classification and regression tree models (CART) and ordination analysis were performed to identify important variables affecting macroinvertebrate community pattern in the Lake Tana Watershed. A dataset of 95 samples was collected from eight wetlands. Among the modelled taxa, Coenagrionidae and Libellulidae had substantial predictive performance based on Kappa statistic ($\kappa > 0.6$) whereas Baetidae, Physidae, Tipulidae and Hydrophilidae had moderate predictive model performance ($\kappa \geq 0.4$). Vegetation cover, leather tanning, vegetation clearance and nitrate ion were the topmost selected environmental variables influencing the occurrence of macroinvertebrate taxa. The conditional analysis depicted that the abundance of Coenagrionidae and Libellulidae increased with the increasing in vegetation cover. Overall, macroinvertebrate taxa have a clear habitat requirement within the habitat gradient studied and hence, could be a potential candidate for biomonitoring and provide valuable information in the development of a standard wetland assessment protocol." (Authors)] Address: Gezie, A., Dept of Biology, Bahir Dar University, Bahir Dar, Ethiopia

18988. Gómez-Llano, M.; Narasimhan, A.; Svensson, E. (2020): Male-male competition causes parasite-mediated sexual selection for local adaptation. The American Naturalist 196(3): 344-354. (in English) ["Sexual selection has been suggested to accelerate local adaptation and promote evolutionary rescue through several ecological and genetic mechanisms. Condition-dependent sexual selection has mainly been studied in laboratory settings, while data from natural populations are lacking.One ecological factor that can cause condition-dependent sexual selection is parasitism. Here, we quantified ectoparasite load (Arrenurus water mites) in a natural population of Ischnura elegans over 15 years. We quantified the strength of sexual selection against parasite load in both sexes and experimentally investigated the mechanisms behind such selection. Then we investigated how parasite resistance and tolerance changed over time to understand how they might influence population density. Parasites reduced mating success in both sexes, and sexual selection was stronger in males than in females. Experiments show that male-male competition is a strong force causing precopulatory sexual selection against parasite load. Although parasite resistance and male parasite tolerance increased over time, suggestive of increasing local adaptation against parasites, no signal of evolutionary rescue could be found. We suggest that condition-dependent sexual selection facilitates local adaptation against parasites and discuss its effects in evolutionary rescue." (Authors)] Address: Gómez-Llano, M., Dept of Biological Sciences, Univ. Arkansas, Fayetteville, Arkansas 72701, USA. Email: mgomezllano@gmail.com

18989. Grupo Ibérico de Odonatología (2020): Homenaje a Francisco J. Ocharan Larrondo (Bilbao 1946 - Oviedo 2019). Grupo Ibérico de Odonatología (GIO). Boletín de la Sociedad Entomológica Aragonesa 67: 326-335. (in Spanish) [Tribute to Francisco J. Ocharan Larrondo (Bilbao 1946-Oviedo 2019). The following authors contributed to this tribute: Marta I. Saloña, José Antonio Quirce, Adolfo Cordero Rivera, Rocío Ocharan, Rocío Rosa García, Antonio Torralba-Burrial, Cinta Quirce Vázquez, Ricard Martín, Iñaki Mezquita Aranburu & David Outomuro] Address: Grupo Ibérico de Odonatología (GIO). Email: gi.odonatologia@gmail.com

18990. Grupo Ibérico de Odonatología (2020): Una mirada

odonatológica a las publicaciones de Francisco J. Ocharan. Boletín de la Sociedad Entomológica Aragonesa 67: 326-335. (in Spanish) [Chronological and thematic analysis of the publications of the recently deceased (2019) professor of the University of Oviedo (Dept. of Biology of Organisms and Systems), from an odonatological perspective, within the tribute published by the Iberian Odonatology Group. Includes a thematic list of his publications.] Address: Grupo Ibérico de Odonatología (GIO): Email: gi.odonatologia@gmail.com

18991. Harabiš, F.; Jakubec, P.; Hronková, J. (2020): Catch them if you can! Do traits of individual European dragonfly species affect their detectability?. Insect Conservation and Diversity 13(3): 303-312. (in English) ["1. Odonates are an ancient group of freshwater invertebrates that have complex life cycles and highly variable phenotypes and behaviours. These traits make odonates a very attractive model group to study various aspects and phenomena in the fields of ecology, behaviour, and evolutionary biology. 2. Such variability in appearance and behaviour can influence the detectability of individual species under natural conditions; and this variability in detection rates, if not statistically treated, may lead to significant distortions of results and misleading conclusions. 3. In the present study, we used detectability models to predict the time to detection (TTD) of individual odonate species and generalised linear mixed models to analyse the effects of morphological and behavioural traits on the TTD of the first individual of a species. 4. We found that only abundance had a significant effect on the TTD of both Anisoptera and Zygoptera, while the larger Anisoptera were generally detected earlier. No such patterns were observed in Zygoptera; however, dispersal ability was found to have had some influence. 5. Surprisingly, coloration and activity were not found to influence the TTD of odonates. Therefore, although there are considerable differences between species, with the exception of abundance and size, we did not detect any easily measurable traits that would unequivocally explain the differences in the detection rates of individual species." (Authors)] Address: Harabiš, F., Department of Ecology, Faculty of Environmental Sciences, Czech University of Life Sciences Prague, Kamýcká 129, Praha – Suchdol 165 00, Czech Republic. E-mail: harabis@fzp.czu.cz

18992. Hashimoto, K.; Kasai, A.; Hayasaka, D.; Goka, K.; Hayashi, T.I. (2020): Long-term monitoring reveals among-year consistency in the ecological impacts of insecticides on animal communities in paddies. Ecological Indicators 113, June 2020, 106227: (in English) ["Highlights: • The effects of three insecticides on animals in paddies were assessed for three years. • Animal community composition significantly differed among years. • Some taxa were decreased by each insecticide irrespective of year. • These taxa can be used as robust indicators of the effects of each insecticide. • Long-term monitoring may be useful in identifying ecotoxicological effect indicators. Abstract: Semi-natural mesocosm experiments have been proposed as a powerful approach for evaluating the realised rather than potential ecotoxicological effects of agrochemicals on biological communities. However, there is uncertainty in the results from such experiments due to spatio-temporal variability in various ecological factors, such as community composition. Therefore, long-term studies evaluating such variability are critical for assessing the utility of mesocosm experiments, although few studies have been conducted over multiple years. We conducted a multiple-year (i.e., three-year) mesocosm experiment to examine the effects of three systemic insecticides (clothianidin, fipronil, and chlorantraniliprole) on aquatic animal communities in experimental paddies, and we evaluated the among-year variability in these ecotoxicological effects. We found substantial variation in community composition among years. However, when we controlled for this variability by performing partial redundancy analysis (partial RDA), we found that paddy community composition was significantly different between the three insecticide treatments irrespective of year. Moreover, we identified some taxa that consistently decreased in abundance following exposure to each insecticide and may thus be regarded as indicator taxa of the environmental stress caused by the insecticides (e.g., clothianidin: Gerris lacustris (water striders), fipronil: Orthetrum albistylum speciosum (dragonflies), and chlorantraniliprole: Hydroglyphus japonicus (beetles)). Our study suggests the utility of multiple-year, semi-natural mesocosm experiments not only for evaluating the temporal variability in ecotoxicological effects but also for identifying potential robust indicator organisms that consistently decrease in abundance in response to specific agrochemicals irrespective of the variability in ecological factors under realistic conditions.] Address: Hashimoto, K., Faculty of Agriculture, KINDAI University, Nakamachi 3327-204, Nara 631-8505, Japan. Email: atrophaneura4@gmail.com

18993. Hasik, P. (2020): A macroevolutionary view on extinction risk in Aves, Chiroptera, and Odonata. MSc thesis Arkansas State University: 31 pp. (in English) ["A central goal of conservation biology is to identify and understand the factors that lead to extinction. The Earth is currently undergoing a 6th mass extinction event, in large part because of human activity. In the last century, rates of extinction have increased anywhere from 8-100 times the background rate of 2 extinctions per 10,000 species every 100 years. However, there remains a debate over whether certain species are predisposed to a higher extinction risk. In particular, it is not known if the macroevolutionary history of a lineage is a major contributor to the probability of extinction, nor is it clear whether the current rise in extinction rates is due strictly to anthropogenic activity. Using life history trait information and the International Union for Conservation of Nature (IUCN) Red List rankings for bats, birds, and odonates in combination with a novel diversification method, MiSSE (Missing State Speciation and Extinction), we test if there is an evolutionary signal of extinction susceptibility independent of the influence that traits can have on rates of diversification. Phylogenetic and non-phylogenetic regressions were run to determine if any specific traits correlated with extinction risk ranking. We find that there is no correlation between diversification rates and IUCN extinction risk. However, larger

clutch sizes and range sizes correlated with lower extinction risk and that longer generation lengths for birds did correlate with higher levels of extinction risk. We found no correlation of extinction risk and life history traits in bats and odonates. Our modeling suggests that other factors, such as human-mediated activities, better explain the increased extinction rates." (Author)] Address: not stated

18994. Herzog, R. (2020): Global change genomics: comparative genomic analyses on environmental associated speciation and adaptation processes in Odonata. Dissertation, Naturwissenschaftlichen Fakultät der Gottfried Wilhelm Leibniz Universität Hannover: XIX, 154 pp. (in English, with German summary) ["Proceeding global and local environmental changes require innovative conservation concepts and animal model systems which integrate empirical and genomic data. Odonata are a highly suitable model system for the evaluation of ecosystems and on top hold an evolutionary key position at the base of winged insects. The rapid (r)evolution of genetic methods in the last two decades has allowed the transition of traditional ecological field model systems (which cannot or only with difficulty be kept in the laboratory in contrast to traditional genetic model organisms) to model systems of integrative research. This raises the possibility of closing the gap between ecological factors and their genetic consequences and / or causes. Here, the order Odonata plays a prominent role based on the solid foundation of extensive ecological data and now numerous genetic research approaches for dragonflies. Consequently, the presented dissertation deals with two odonate species with very different ecological niches, almost opposing adaptation strategies and distributional dynamics. These are on the one hand Lestes macrostigma, an endangerd, stenotopic damselfly adapted to temporary, brackish ecosystems with spatially very limited distribution. The other target species is the cosmopolitan, abundant and migratory Pantala flavescens, inhabiting all kinds of temporary waters created by local rains as an ecological generalist. Due to their temporary nature, both habitats are particularly prone to climate change, but they differ significantly in their spatio-temporal occurrence. The resulting different adaptation strategies and distributional dynamics of both species were therefore genetically characterized in this work on (i) temporal, (ii) local and (iii) global levels to compare potential “winners” and “losers” in terms of the current insect extinction and rapidly changing environmental conditions: A long-term local monitoring of a population of L. macrostigma in southern France revealed highly fluctuating population sizes resulting in genetic bottlenecks. These results were associated with fluctuating precipitation and drought periods and were compared to populations covering the entire distribution range of this species and are discussed in a geographic context. The global comparison approach reveals that the fragmented population structure is reflected in the genetics of this species and that populations are even genetically isolated. Furthermore, two conservation units were discovered in Spain and France requiring the re-evaluation of the conservation status of these populations by the relevant authorities. Finally, a new dispersal model of this species was proposed, suggesting that this species originated in Asia with a subsequent westward expansion. A first global population study on the cosmopolitan dragonfly species P. flavescens surprisingly revealed contradicting geographic structuring based on mitochondrial and nuclear data. Despite their extraordinary migratory potential, island populations of P. flavescens show genetic signals of local adaptation processes, going along with phenotypic differences and behavioral adaptations. In particular, the investigated population on Easter Island is genetically isolated and depleted whereas all other populations show remarkably high intraspecific diversity. However, nucleotide and amino acid diversity indicate saturation of the CO1 barcode gene fragment, highlighting the limited suitability of marker for population genetic studies as local adaptations could not be detected. To complement single marker gene analyses and to pave the way for genomic studies on insect migration, the complete mitochondrial genome of an Easter Island indivdual of P. flavescens was characterized and compared to mitogenomes of the key odonate species Anax imperator, Ischnura elegans, and Megaloprepus caerulatus. These new mitogenome data are a highly valuable resource for future comparative mitogenome studies on the population level and for insect migration. Migration of flying insects has so far only been studied in detail on two phylogenetically very derived model systems (Danaus plexippus and Locustra migratoria). Since dragonflies are phylogenetically placed on the base of winged insects, studies on P. flavescens open up the possibility of tackling the question of the evolution of migration and its genetic mechanisms." (Author)] Address: Herzog, Rebecca, ITZ, Ecology & Evolution, University of Veterinary Medicine Hannover, Hannover, Germany. E-mail: rebecca.herzog@ecolevol.de

18995. Houard, X. (coord.) (2020): 2020 – Plan national d’actions en faveur des « libellules » - Agir pour la préservation des odonates menacés et de leurs habitats 2020-2030. Office pour les insectes et leur environnement – DREAL Hauts-de-France - Ministère de la transition écologique: 66 pp. (in French, with English summary) ["12 actions implemented during 10 years for saving French dragonflies and damselflies endangered species National Action Plans (NAPs) are strategic tools from the French Ministry in charge of biodiversity issues. They are intended to ensure the maintenance or restoration of populations of endangered species or species of special interest in a favorable conservation status. In a legal framework, the NAPs then organize the preservation of these species by implementing a voluntary and structuring approach. The overall objective of this plan and its regional implementations is to safeguard the dragonflies and damselflies through specific measures to stop the direct causes of their disappearance (destruction of their habitat, drying, pollution, damage to dispersal abilities, climate change...) starting with the issues concerning the species considered as the most "patrimonial" (threatened and / or protected). This plan requires the mobilisation of all, both public authorities (State services, local authorities) and rural stakeholders (breeders, farmers, foresters ...), managers of spaces and / or natural resources (quarry operators, owners,

riparians ...) encouraging them to favor appropriate management for the conservation of the target species. Finally, considering the "bioindicator" qualities of dragonflies and damselflies, this plan targets all naturalist citizens wishing to contribute to a better collection of scientific information. Researchers should be also interested in better detailed assessment of practices related to wetlands preservation." (Author)] Address: Direction générale de l'aménagement, du logement et de la nature, Direction de l'eau et de la biodiversité, Sous-direction de la protection et de la restauration des écosystèmes terrestres, Tour Séquoia- 92055 La Défense cedex, France

18996. Huang, D.-Y.; Nel, A.; Ngo-Muller, V. (2020): The sixth species of the damselfly family Burmacoenagrionidae (Odonata) endemic to the mid-Cretaceous Burmese amber. Palaeoentomology 3(6): 564-568. (in English) ["Burmagrion azari sp. nov., sixth species of the small damselfly family Burmacoenagrionidae, is described and illustrated. This family is currently only recorded from the mid-Cretaceous Burmese amber and is possibly endemic to this isolated island of the Tethys Ocean at that time. The presence of slender, elongate legs with very long tarsi is a putative synapomorphy of the Burmacoenagrionidae, as present in Burmagrion and Burmacoenagrion. The type specimen of the new genus and species is dislocated together with several fragments of flies, suggesting that these fossils are possibly the result of a regurgitation by a small vertebrate passing aside the fresh resin. The female of Burmagrion azari sp. nov. was probably laying its eggs inside plant cuticles. Its ovipositor is described." (Authors)] Address: Nel, A., Lab. Ent.. Mus. Natn. Hist. Nat., 45 rue Buffon, F-75005 Paris, France. E-mail: anel@cimrs1.mnhn.fr

18997. Jooste, Mi.J.; Samways, M.J.; Deacon, C. (2020): Fluctuating pond water levels and aquatic insect persistence in a drought-prone Mediterranean-type climate. Hydrobiologia 847: 1315-1326. (in English) ["In dry areas, natural and artificial ponds experience frequent water level fluctuation, affecting conditions for some aquatic and amphibiotic taxa. Water beetles, bugs, and dragonflies make up much of pond diversity, and are responsive to changes in environmental conditions. Using a drought-prone pondscape within the Greater Cape Floristic Region biodiversity hotspot, we determine (1) the relative extent to which species richness, abundance, and composition are affected by pond water level fluctuation, (2) the effects of environmental variables and vegetation characteristics relative to fluctuating water levels, and (3) make recommendations to improve pondscape conservation. We found that the degree of fluctuation had a significant effect on beetle species richness, but had no significant effect on the other focal taxa. Water temperature, pH, and conductivity, and vegetation cover and composition were drivers of aquatic insect species richness, abundances, and assemblage structures. Habitat heterogeneity supported rich aquatic insect assemblages. We recommend that a range of ponds with various degrees of water level fluctuation should be maintained, along with naturally diverse marginal vegetation. Such a dynamic pondscape can contribute greatly towards maintenance of local and regional aquatic insect diversity in drought-prone regions and should be considered as a main focus in conservation efforts." (Authors)] Address: Deacon, C., Dept of Conservation Ecol. & Ento., Stellenbosch Univ., South Africa. E-mail: charldeacon@sun.ac.za

18998. Kamnananda, H.T.A.R.; Gnnawardena, M.P. (2020): Diversity of Odonata at Ramsar City - Colombo, Sri Lanka. Symposium on Applied Sciences (SAS) 2020: 124-131. (in English) ["Urban wetlands are water-rich natural areas that lie within the boundaries of a city or town known to provide many valuable ecological benefits to urban ecosystems. Wetlands restore drinking water, reduce flooding, play a vital role in filtering waste and also provide urban green spaces. More importantly, the wetlands provide a good feeding and breeding habitat for urban wildlife. The present study investigated the effects of urbanization 011 the diversity of dragonflies and damselflies in major wetlands located in the Ramsar City, Colombo. Sri Lanka. The selected wetlands are 'Diyasanf Weltland Park. 'Baddagana' Wetland Park, 'Pelawatha' Wetland and 'Thalawathugoda' Wetland. Dragonflies and damselflies were used as an indicator species as they are found commonly in wetlands and are very sensitive to any change in the environment. Sampling was conducted at 3 points for a period of 10 minutes at each location. The type of species and the number of individuals observed within a 10m radius were recorded. Opportunistic observations were taken when a dragonfly was encountered in the field other than the time interval. The number of species and individuals recorded at 'Diyasanf, 'Baddagana'. 'Pelawatha' and 'Thalawathugoda' wetlands were 11/75, 8/43. 9/97 and 8/56 respectively. A total of 37 species were found in all four locations (opportunistic species) indicating that these wetlands still have a good diversity of dragonflies and damselflies. However, dining the study, garbage and other sewage waste were dumped at all four study sites. These waste materials may increase the environmental pollution potential of the aquatic ecosystem and alter the habitat structure of wetland organisms. Further study is needed 011 communities of Odonata living in differently polluted habitats to understand the impact of pollution loads 011 theirdiversity and abundance." (Authors)] Address: Kamnananda H.T.A.R., Faculty of Science, Horizon Campus, Malabe, Sri Lanka. E-mail: htarkarunananda@gmail.com

18999. Karube, H.; Terayama, H.; Kaga, R.; Sato, T.; Sakabe, K. (2020): Contamination implications of the neonicotinoid insecticide for the habitat of the endangered dragonfly Sympetrum maculatum in the Tonoh area, Gifu Prefecture. Tombo 62: 26-37. ["S. maculatum Oguma, 1915, which inhabits small reservoirs in hilly areas, is an endemic dragonfly of Japan and ranked as an endangered species in the Japanese Red List. Recently a serious decline in the species has been observed in the Tonoh area, in the southeast part of Gifu Prefecture. The reason for the decline is still not clear, but we presume the decline was initiated by Chemical pollution of neonicotinoid insecticide, and in the autumn of 2018 we reported that acetamiprid in the species habitat

had exceeded the allowable limits set by the Ministry of the Environment (Karube et aL, 2019). In 2019, we investigated these insecticides in the habitat of S. maculatum in May and July, during the period of the larval stage. As a result, 8 substances of neonicotinoid insecticides were detected from almost all samples, which indicates Chemical pollution has spread widely in this area. Especially notable was the concentration of acetamiprid in the habitat that highly exceeded the allowable limits, in addition to thiacloprid, clothianidin and fiproml that also exceeded allowable limits. The values of the neonicotinoid insecticide were highest in May, compared to other seasons (e.g. imidacloprid: 13.94-41.34 times that of 2018 autumn data; acetamiprid: 11.47-1362.12 times as that of 2018 autumn data). These results suggests that neonicotinoid insecticide is one of the main factors for the dragonflies decline." (Authors)] Address: Karube, H., Kanagawa Prefect. Mus. Nat. Hist., 499 Iryuda, Odawara, Kanagawa, 250, Japan. E-mail: paruki@nh-kanagawa-museum.jp

19000. Kaunisto, K.M.; Roslin, T.; Forbes, M.R.; Morrill, A.; Sääksjärvi, I.E.; Puisto, A.I.E.; Lilley, T.M.; Vesterinen, E.J. (2020): Threats from the air: Damselfly predation on diverse prey taxa. Journal of Animal Ecology 89(6): 1365-1374. (in English) ["1. To understand the diversity and strength of predation in natural communities, researchers must quantify the total amount of prey species in the diet of predators. Metabarcoding approaches have allowed widespread characterization of predator diets with high taxonomic resolution. To determine the wider impacts of predators, researchers should combine DNA techniques with estimates of population size of predators using mark–release–recapture (MRR) methods, and with accurate metrics of food consumption by individuals. 2. Herein, we estimate the scale of predation exerted by four damselfly species on diverse prey taxa within a well-defined 12-ha study area, resolving the prey species of individual damselflies, to what extent the diets of predatory species overlap, and which fraction of the main prey populations are consumed. 3. We identify the taxonomic composition of diets using DNA metabarcoding and quantify damselfly population sizes by MRR. We also use predator-specific estimates of consumption rates, and independent data on prey emergence rates to estimate the collective predation pressure summed over all prey taxa and specific to their main prey (non-biting midges or chironomids) of the four damselfly species. 4. The four damselfly species collectively consumed a prey mass equivalent to roughly 870 (95% CL 410–1,800) g, over 2 months. Each individual consumed 29%–66% (95% CL 9.4–123) of its body weight during its relatively short life span (2.1–4.7 days; 95% CL 0.74–7.9) in the focal population. This predation pressure was widely distributed across the local invertebrate prey community, including 4 classes, 19 orders and c. 140 genera. Different predator species showed extensive overlap in diets, with an average of 30% of prey shared by at least two predator species. 5. Of the available prey individuals in the widely consumed family Chironomidae, only a relatively small proportion (0.76%; 95% CL 0.35%–1.61%) were consumed. 6. Our synthesis of population sizes, per-capita consumption rates and taxonomic distribution of diets identifies damselflies as a comparatively minor predator group of aerial insects. As the next step, we should add estimates of predation by larger odonate species, and experimental removal of odonates, thereby establishing the full impact of odonate predation on prey communities." (Authors)] Address: Kaunisto, K.M., Zoological Museum, Biodiversity Unit, University of Turku, Turku, Finland

19001. Kebede, G.; Mushi, D.; Linke, R.B.; Dereje, O.; Lakew, A.; Hayes, D.S.; Farnleitner, A.H.; Graf, W. (2020): Macroinvertebrate indices versus microbial fecal pollution characteristics for water quality monitoring reveals contrasting results for an Ethiopian river. Ecological Indicators 108 (2020) 105759: 10 pp. (in English) ["Awash River is one of the major surface water sources used by millions of people in the central Highlands of Ethiopia. However, numerous pollution sources exert significant pressure on the river. Different approaches for assessing the status of water quality exist, but few studies compared the performance of distinct methods. Therefore, this study aims to evaluate the consistency of fecal indicator bacteria for environmental health assessment of rivers by comparing them to assessments of physicochemical tests as well as newly developed macroinvertebrate indices. Physicochemical, biological (macroinvertebrates) and microbiological (Escherichia coli and Enterococci) parameters were assessed at five sites along the upper Awash River. For E. coli and Enterococci moderate to strong fecal pollution levels, ranging from 7.9×10^2 to 7.6×10^3 cfu/100 ml and 7.6×10^2 to 1.1×10^4 cfu/100 ml, were observed, respectively. The concentrations of both fecal indicator bacteria exceeded the standards set by the European Union and the World Health Organization for safe recreational water. Hence, all sites were categorized as poor for swimming and recreation. In contrast, three African benthic macroinvertebrate indices (South African Scoring System 5, Tanzanian River Scoring System, Ethiopian Biotic Score) indicated a natural or good water quality with slight ecological degradation at the upstream sites, and a moderate to poor ecological status at the downstream sites. While macroinvertebrate communities were able to reflect anthropogenic disturbances, mainly caused by different land uses, fecal indicator bacteria, most likely driven by the high pressure of extensive livestock fecal emission and overgrazing in the whole catchment, did not. This study underpins the necessity of combining different indicator systems to analyze human pressures in Africa in a holistic way, which can serve as a basis for management and sustainable use of fundamental resources such as water from freshwater ecosystems." (Authors) Odonata are treated at the family level.] Address: Kebede, G., Ambo University, Department of Biological Sciences, P.O. Box 95, Ambo, Ethiopia

19002. Keetapitchayakul, T.S.; Sripanya, J.; Phlai-Ngam, S.; Tungpairojwong, N. (2020): Description of the final stadium larva of Bayadera serrata Davies & Yang, 1996 (Odonata: Euphaeidae) from Thailand. Zootaxa 4894(1): 98-110. (in English) ["The damselfly genus Bayadera Selys, 1853 comprises 17 species, but the larvae of only four species have been described. Here we describe the final stadium

larva of another species—Bayadera serrata Davies & Yang, 1996. Larvae were collected from a headwater stream at Nam Nao National Park, Phetchabun Province, Thailand. The larva of B. serrata is distinguished from congener species following the presence of one to three distinct spines on the genae, two pairs of setae on the ligula, one pair of setae on the ventral side of prementum, the presence of three teeth of the distal end of the labial palp, the presence of a plate-like spine on the gonapophyses, the presence of a row of rod-like setae on the distal end of the tibial comb, the presence of a cluster of long simple setae on the abdominal terga S3–9, and the presence of short terminal filament of the caudal gills. The larvae of genus Bayadera have been compared with other known larvae from family Euphaidae. Key is provided to the genera with known Southeast Asian euphaeid larvae: Anisopleura, Bayadera, and Euphaea." (Authors)] Address: Keetapitchayakul, T.S., 1225 moo 1, Viangkum Sub-district, Kumpawapi District, Udonthani Province, Thailand 41110. E-mail: Keetapithchayakul.TS@gmail.com

19003. Khan, M.K.; Herberstein, M.E. (2020): Ontogenetic habitat shifts reduce costly male–male interactions. Evolutionary Ecology 34(5): 735-743. (in English) ["Ontogenetic habitat shifts are predicted to increase the fitness and survival of individuals by allowing effective utilization of spatially distributed resources. Evidence supports nutritional requirements and predation pressure as drivers of habitat shifts. Likewise, intraspecific interactions are thought to lead to ontogenetic habitat shifts, however, empirical evidence is lacking. Here, we test if intraspecific male–male interactions are responsible for ontogenetic habitat shifts in Xanthagrion erythroneurum, a damselfly that undergoes developmental colour change. The juvenile males are yellow and change colour to red with sexual maturity. Field observations showed that the proportion of juvenile males is higher in adjacent woods than in primary mating arenas by ponds. We measured male–male interactions by the pond and in the woods, predicting the habitat switch would reduce male antagonistic interactions such as male aggression and male–male mating attempts. We showed that juvenile males receive less aggression in woods than at the pond mating arena. We conclude that lower population density and lower male encounter rates in the woods reduce the cost of male aggression for juvenile males. Our study provides evidence that stage-dependent habitat choice resulting from intrasexual antagonistic interactions may drive ontogenetic habitat shifts." (Authors)] Address: Khan, M.K., Dept of Biological Sciences, Macquarie Univ., Sydney, NSW, 2109, Australia

19004. Khan, M.K. (2020): Female pre-reproductive colouration reduces mating harassment in damselflies. Evolution 74(10): 2293-2303. (in English) ["Conspicuous female colouration can evolve through male mate choice or via female-female competition thereby increasing female mating success. However, when mating is not beneficial, such as in pre-reproductive females, selection should favour cryptic rather than conspicuous colouration to avoid male detection and the associated harassment. Nevertheless, conspicuous female colouration occurs in many pre-reproductive animals, and its evolution remains an enigma. Here, I studied conspicuous female colouration in Agriocnemis femina, in which the conspicuous red colour of the immature females changes to a less conspicuous green approximately a week after their emergence. I measured body size, weight and egg numbers of the female morphs and found that red females are smaller, lighter and do not carry developed eggs. Finally, I calculated the occurrence frequency and mating frequency of red and green females in several populations over a three-year period. The results demonstrate that red females mated less frequently than green females even when red females were the abundant morph in the populations. I concluded that conspicuous female colouration is likely to function as a warning signal of sexual unprofitability, thereby reducing sexual harassment for females and unprofitable mating for males." (Author)] Address: Khan, M.K., Dept Biol. Sciences, Macquarie Univ., Sydney, NSW, 2109 Australia. E-mail: bmbkawsar@gmail.com

19005. Korkeamäki, E. (2020): Local extinction risk and community structure of Odonata populations in Fennoscandia. Annales Universitatis Turkuensis Ser. A II 366: 46 pp. (in English, with Finnish summary) ["A key need in conservation biology is to identify the ecological traits of a species that make it vulnerable. This thesis focuses on population traits and extinction risk of dragonflies and damselflies (order Odonata) in Finland and Sweden. First, I examined whether species occupancy frequency distributions (SOFD) of odonates vary among the lakes and ponds of four geographical regions. Second, I determined the main habitats, species traits, and local population distributions of Odonata in Central Finland. I found that in the southern regions, the SOFD was dominated by species that occur at few sites, while in the northern regions the distribution was bimodal. In the northern parts of the range, rare species inhabited only high-quality sites. Size of the geographical range, breeding habitat requirements, and degree of generalism/specialism largely explained the observed variation in species occupancy frequency. Specialized species with limited distributions had a greater extinction risk than widely distributed generalist species. However, when the effect of species' geographical range sizes was controlled, I found that extinction risk was actually lower for specialist species than for generalist species, probably due to the fact that generalist species occur in both low- and high-quality habitats. In particular, an extremely high extinction rate was found for peatland-associated species and dynamic lotic headwater populations. Taken together, my results indicate that extinction risk is shaped by the relationship between species population size, distribution, specialization, and habitat quality. The results of this thesis are consistent with existing predictions of species vulnerability and source-sink theory. In conclusion, my research highlights the necessity for conservation biologists to study the quality of freshwater habitats, because this is likely to be an important factor affecting the likelihood of extinction for populations in aquatic environments." (Author)] Address: Korkeamäki, E., Karkunkatu 18 a 4 b, FIN-48600 Karhula, Finland.

19006. Kosterin, O.E. (2020): Erratum: OLEG E. KOSTERIN (2019) Amendments and updates to F.C. Fraser's key to Indian Lestes spp. (Odonata: Lestidae) to resolve confusion of L. patricia Fraser, 1924 and L. nigriceps Fraser, 1924, with notes on L. nodalis Selys 1891 and L. garoensis Lahiri, 1987. Zootaxa, 4671: 297–300.. Zootaxa 4885(4): 600- (in English) Address: Kosterin, O.E., Institute of Cytology and Genetics, Siberian Branch, Russian Academy of Sciences, Lavrentiev Ave 10, RUS-630090 Novosibirsk, Russia. E-mail: kosterin@bionet.nsc.ru

19007. Li, F.; Tokin, J.D.; Haase, P. (2020): Local contribution to beta diversity is negatively linked with community-wide dispersal capacity in stream invertebrate communities. Ecological Indicators 108: 9pp. (in English) ["It is increasingly well understood that stream communities are regulated by both local niche and regional dispersal processes, but comprehensive tests of these factors with datasets that cover extensive spatial and temporal scales are rare. Based on 1180 benthic invertebrate community samples from 2005 to 2012 in central low mountain streams of Germany, we tested the hypotheses that: 1) local contribution to beta diversity (LCBD: a measure of the uniqueness of communities) would decline with increasing average community dispersal capacity; and 2) owing to the relatively large spatial extent of the study region, regional dispersal processes would override local niche controls in structuring community composition. We found considerable temporal variation in LCBD and a negative correlation between LCBD and community dispersal capacity. However, no statistically significant correlation between species contribution to beta diversity (SCBD) and species dispersal capacity was observed. The large-scale spatial structure among locations (representative of dispersal limitation) was important in structuring benthic communities. Although much of the variation was explained by the shared effects of local processes and large-scale spatial variables, environmental controls were stronger than regional processes in few cases in the variance partitioning analysis, with the annual mean temperature and mean diurnal range of temperature being the important drivers. Given the highly varied correlates of beta diversity over time, we urge researchers to focus on not only spatial variation in diversity, but also the context of temporal variation." (Authors) The study includes "Odonata".] Address: Li, F., Dept River Ecology & Conservation, Senckenberg Research Inst. & Natural History Museum Frankfurt, 65371 Gelnhausen, Germany

19008. Li, X.; Li, Y.; Muzammil, I.; Lei, M. (2020): Antireflection and antiwetting functionalities of plasma-nanotextured polymer surfaces with biomimetic nanopillars. Plasma Processes and Polymers 17(11); e2000050: 14 pp. (in English) ["Inspired by the antireflection and antiwetting functionalities of dragonfly wings decorated with random nanopillars and a wax layer, a facile technique to endow the same functionalities has been devised. In this two-step plasma nanotexturing technique, first oxygen plasma treatment is implemented to grow the random nanopillars on the polymethyl methacrylate (PMMA) surfaces, and then C4F8 plasma polymer deposition is carried out so that the thin fluorocarbon film with a low surface free energy and refraction index covers the random nanopillars. The biomimetic PMMA surfaces exhibit excellent broadband and omnidirectional antireflection properties and robust antiwetting properties under the water droplet impact. The superhydrophobicity at the slippery Cassie state was maintained under the natural oscillation of residual droplets." (Authors)] Address: Lei, M., Surface Engineering Laboratory, School of Materials Science and Engineering, Dalian University of Technology, 116024 Dalian, China. Email: surfeng@dlut.edu.cn

19009. Liu, C.; Zhang, Y.; Liu, X. (2020): Geographical fauna of Odonata in Xiangtoushan National Reserve, Guangdong province. Forestry and Environmental Science: 92-99. (in Chinese, with English summary) ["The field investigation of Odonata in Xiangtoushan national nature reserve was carried out from March 2017 to December 2019. The results showed that there were 122 species of Odonata, belonging to 14 families and 74 genera, in the reserve. The species number of Libellulidae (33 species) is the highest, followed by Gomphidae (28 species). The dominant species are Neurobasis chinensis, Mnais mneme, Gomphidia kruegeri, Asiagomphus hainanensis, Macromia calliope, Orthetrum glaucum, Pantala flavescens and Trithemis festiva etc. The world faunal characteristics of Odonata in this reserve showed that 92 species (occupied 75.41%) are oriental, 28 species (occupied 22.95%) are oriental-palearctic. Meanwhile, all these species construct 10 distribution groups in 7 Chinese Zoogeographic subregions. There are 50 (40.98%) species in South China subregion, 13 (10.66%) species in South and Southwestern subregions, 19 (15.77%) species in South and Central-China subregions, and 20 (16.39) species live in three subregions of South–Central–North China simultaneously. The results of Odonata fauna are consistent with the place of Xiangtoushan national reserve." (Authors)] Address: Liu, C., Administration of Guangdong Xiangtoushan National Nature Reserve, Huizhou Forestry Science Research Institute, China

19010. Lozano, F.; del Palacio, A.; Ramos, L.; Muzón, J. (2020): The Odonata of Argentina: state of knowledge and updated checklist. International Journal of Odonatology 23(2): 113-153. (in English) ["An updated checklist of the 282 species of Odonata known to occur in Argentina is presented along with distributional information by province and ecoregion. Ten new records for the country and 87 new provincial records are provided. At present, 17 species of Odonata are considered endemic to Argentina, and distribution maps for each of them are provided. Information on larvae and conservation status according to the IUCN Red List of Threatened species is also provided; there are still 98 larvae unknown and 169 species unassessed." (Authors)] Address: Lozano, F., Lab. de Biodiversidad y Genetica Ambiental (BioGeA), Universidad Nacional de Avellaneda, Pineyro, Argentina. Email: flozano@undav.edu.ar

19011. Mafuwe, K.; Moyo, S. (2020): Dragonfly (Odonata) community structure in the Eastern Highlands Biodiversity

Hotspot of Zimbabwe: potential threats of land use changes on freshwater invertebrates. International Journal of Odonatology 23(4): 291-304. (in English) ["We examined the diversity and potential drivers of dragonfly distribution in a biodiversity hotspot of Southern Africa (Eastern Highlands, Zimbabwe) by surveying 30 sites (13 lentic and 17 lotic habitats) located within this region. Additionally, we identified the anthropogenic factors that may threaten Odonata diversity and abundance. Our results revealed that 27 odonate species are associated with dams and ponds, one species is associated with streams and four species are associated with swamp forests. Considering odonate diversity between protected and unprotected areas, we found significantly higher diversity of odonates in streams in protected areas compared to non-protected areas. Broadly, we found anthropogenic activities (e.g. commercial exotic tree plantations, mining activities, vegetation clearing) possibly affect Odonata diversity (by decreasing abundance and diversity) compared to those within protected and undisturbed habitats. Our results reveal that several human activities like human encroachment into riverine habitats potentially threaten the existence of freshwater species in this biodiversity hotspot and biodiversity hotspots elsewhere." (Authors)] Address: Mafuwe, K., Dept Ento., Natural History Mus. of Zimbabwe, Bulawayo, Zimbabwe. Email: kudzimaffy@gmail.com

19012. Manasov, S.; Suhling, F. (2020): Hiding among traps? Mortality of early instar odonate larvae in the presence of bladderwort plants. International Journal of Odonatology 23(2): 103 -111. (in English) ["We investigated the effects of the presence of bladderwort plants on survival of early instar larvae of one coenagrionid and two libellulids in laboratory experiments. In all three species survival was reduced compared to treatments with a non-carnivorous submerged plant, with effective mortality that could be related to bladderwort being 19–45% dependent on the prey species. Individuals of all species were found in capture bladders. We also recorded the microhabitat use of the early instar larvae and found that the species with highest use of vegetation had highest mortality due to bladderwort. We conclude that bladderwort may have effects on odonate larvae that translate into natural conditions and we discuss factors that may affect predation by bladderwort on odonates in the field." (Authors)] Address: Suhling F., Inst. Geoökologie, TU Braunschweig, Langer Kamp 19c, D-38102 Braunschweig, Germany. E-mail: f.suhling@tu-bs.de

19013. Masius, P. (2020): Veränderung der Libellenfauna auf der Ostseeinsel Wollin (Polen) – eine Fallstudie. Libellula 39(1/2): 79-90. (in German, with English summary) ["Changes in the dragonfly fauna on the island of Wolin (Baltic Sea, Poland) – a case study – Changes in the dragonfly fauna of the Island of Wolin (Baltic Sea) are shown on the basis of two studies at ten selected waterbodies. The first study took place between 1970 and 1976, the second 2018 and 2019. The temporal comparison reveals the immigration of eleven new species, while three species could not be recorded anymore. For each water body the species-exchange-quota is rather high. The findings are discussed mainly in the light of climatic changes." (Author)] Address: Masius, P., Talstr. 56, 35457 Lollar, Germany. E-mail: patrick_masius@gmx.de

19014. Meijer, A. (2020): Voortplantingspoelen van de gevlekte witsnuitlibel in het duingebied van Kennemerland. Onderzoek naar de verspreiding en voortplantingslocatievoorkeur van de gevlekte witsnuitlibel (Leucorrhinia pectoralis) in de Amsterdamse Waterleidingduinen en het Noordhollands Duinreservaat [Reproduction pools of the large white-faced darter in the dune area of Kennemerland. Research on the distribution and reproductive site preferences of Leucorrhinia pectoralis in the Amsterdam Water Supply Dunes and the Noordhollands Duinreservaat]. BSc. thesis, Aeres Hogeschool Almere: 31 pp. (in Dutch, with English summary) ["In 2018, L. pectoralis was discovered at a number of new locations in the Dutch dunes. Despite the fact that L. pectoralis is appointed as a target species for the Noordhollands Duinreservaat area, under the Habitats Directive of the European Union (Natura 2000), not much is known about the habitat preferences of this dragonfly in coastal areas. In this study, it was examined in which specific bodies of water this species reproduced in 2018. Every dune pool with a known observation from 2018 was re-examined in 2020 to find out whether the dragonfly had reproduced. When the species was discovered at a pool in both 2018 and 2020, this pool was designated as a reproductive site. Twenty pools where the dragonfly was not observed in 2018 were also examined. If the dragonfly was not observed in 2020, the pool was designated as a non-reproductive site, and would thus function as a control pool. Subsequently, various characteristics of the reproductive and non-reproductive sites were compared, in order to answer the main question: What are the specific physical and botanical characteristics of the reproductive pools of L. pectoralis, in the Noordhollands Duinreservaat and the Amsterdamse Waterleidingduinen? Results indicate that L. pectoralis in the dunes of Kennemerland reproduce in, on average, larger pools that are largely sedimentized, and contain a well-developed submersed and riparian vegetation. All examined pools, reproductive and non-reproductive, contained submerse vegetation, with a coverage larger than 50%. Reproductive sites did however contain a higher percentage of riparian vegetation, with no upper limit restrictions, since the dragonfly reproduced in pools with banks covered with vegetation. The sedimentation percentage of the reproductive sites was, on average, greater than that of the non-sedimentized sites, 41.7% and 25% respectively. There was, however, an upper limit to the percentage of sedimentation of 60%. The dragonfly will not recognize a body of water if the percentage of sedimentation is over 60% and thus will not reproduce at this site. To take the dragonfly into account when performing management, it is advisable to make sure the pools are not too deep and to avoid rigorous cleaning, to stimulate sedimentation and the development of riparian vegetation. If the sedimentation process progresses beyond 60% sedimentation, it is advisable to clean the pool, leaving half of the riparian vegetation and a third of the submerse vegetation intact." (Author)] Address: not stated

19015. Miralles-Núñez, A.; Esteban-Resino, J.; García-Pozuelo Ramos, C.; Gómez, J.A. (2020): Nuevos registros de Diplacodes lefebvrii (Rambur, 1842) y Orthetrum chrysostigma (Burmeister, 1839) (Odonata: Libellulidae) en el centro de la península ibérica. Boletín de la Sociedad Entomológica Aragonesa 67: 396-398. (in Spanish, With English summary) ["Diplacodes lefebvrii (Rambur, 1842) is recorded for the first time from Toledo province (Castilla-La Mancha) and Orthetrum chrysostigma (Burmeister, 1839) from Toledo and Madrid provinces, contributing to the knowledge of these species in the centre of the Iberian Peninsula." (Authors)] Address: Miralles-Núñez, Adriá , Grup d'Estudi deis Odonats de Catalunya (Oxygastra-GEOC), Institució Catalana d'História Natural, Barcelona Spain. Email: amirallesl 0@gmail.com

19016. Mora, A.; Sebteoui, K. (2020): Trithemis arteriosa (Burmeister, 1839) (Odonata: Libellulidae) in Hungary: can aquarium trade speed up the area expansion of Mediterranean species?. North-Western Journal of Zoology16(2): 237-238. (in English) ["At the end of October 2020, the authors received a photo of a dragonfly for identification. The photo was taken in August 2020 in a small private garden pond in the city of Pécs, Southwest Hungary. The specimen was identified ... as a teneral female of T. arteriosa, which species has never been recorded before in Hungary or in the Carpathian Basin biogeographical region. The new occurrence of T. arteriosa in Hungary is very far from the known distributional area, suggesting that the species did not appear naturally here. The eggs or larvae were possibly transported from Cyprus to Hungary with aquatic plants (water lilies, Nymphaea 'Cypriana') in January 2020. After an approximately 13-hour long journey, the plants were placed in a garden pond where potential food sources (e.g. chironomid and culicid larvae) were available for larvae. Unfortunately, the exuvium of the emerged specimen was not taken. After the recognition of the species the pond was searched for dragonfly larvae, but only those of Libellula depressa Linnaeus, 1758, a common European and Hungarian species with large body size, were found." (Authors)] Address: Mora, A., Department of Hydrobiology, Faculty of Sciences, University of Pécs, H-7624 Pécs, Ifjúság útja 6., Pécs, Hungary. E-mail: marnold@gamma.ttk.pte.hu

19017. Nakanishi, K.; Koide, D.; Yokomizo, H.; Kadoya, T.; Hayashi, T.I. (2020): Investigating effect of climate warming on the population declines of Sympetrum frequens during the 1990s in three regions in Japan. Scientific Reports 10:12719: 10 pp. (in English) ["Climate warming is of concern as a key factor in the worldwide decline in insect populations. In Japan, numbers of a common dragonfly in rice paddy fields, Sympetrum frequens, decreased sharply in the 1990s. Because S. frequens migrates to cooler mountains in summer, climate warming has been suggested as one of the main causes of the population decline in addition to agronomic factors. Here, we analysed the relation between summer temperatures and population densities of S. frequens and the related S. infuscatum, which does not migrate to mountains in summer, using published population monitoring data and temperature data from three regions (Toyama, Ishikawa, and Shizuoka) in Japan. Decadal differences in summer temperatures lay within the range of fluctuations among years, suggesting that an increase in summer temperatures cannot explain the past sharp population declines. However, regression analyses using monitoring data from Toyama showed that the population dynamics of both species in autumn are negatively correlated with summer temperatures in the same year. These results suggest that high temperatures in summer directly affect adult mortality to an extent that results in a decrease in population growth." (Authors)] Address: Nakanishi, K., National Institute for Environmental Studies, Onogawa 16.2, Tsukuba, Ibaraki 305.8506, Japan. E-mail: nakanishi.kosuke@nies.go.jp

19018. Nel, A.; Pouillon, J.-M. (2020): The second genus of the 'libelluloid' family Araripephlebiidae (Odonata, Clavilabiata). Palaeoentomology 3(3): 240-244. (in English) ["The Lower Cretaceous Crato Formation is a well-known Konservat Lagerstätte with a very rich entomofauna. The Odonata are especially very diverse and extensively studied (Bechly, 1998, 2000, 2007, 2010; Nel et al., 1998; Bechly et al., 2001; Bechly & Ueda, 2002) with representatives of all the extant anisopteran main subgroups. This fauna is especially interesting because it comprises some of the oldest and most 'basal' groups of the highly diverse extant 'libelluloid' dragonflies, or Clavilabiata Bechly, 1996. Among these, the monospecific family Araripephlebiidae Bechly, 1998 is remarkable in the highly specialized hind wing cubito-anal area that contains a curious supplementary longitudinal vein more or less parallel to AA and CuA, unique among the Odonata. Nevertheless, this family remained rather poorly known by three described specimens, only females." (Authors)] Address: Nel, A., Lab. Ent.. Mus. Natn. Hist. Nat., 45 rue Buffon, F-75005 Paris, France. E-mail: a-nel@cimrs1.mnhn.fr

19019. Nikolaus, R.; Matern, S.; Schafft, M.; Klefoth, T.; Maday, A.; Wolter, C.; Manfrin, A.; Lemm, J.U.; Arlinghaus, R. (2020): Einfluss anglerischer Bewirtschaftung auf die Biodiversität von Baggerseen: Eine vergleichende Studie verschiedener gewässergebundener Organismengruppen. Lauterbornia 87: 153-187. (in German, with English summary) ["Impact of recreational fisheries management on the biodiversity of gravel pit lakes: a comparative study involving several groups of aquatic and riparian organisms: We mapped all lakes in Lower Saxony and show that gravel pit lakes are the dominant lake type in the study region. Furthermore, we compared gravel pit lakes managed and not managed by recreational fisheries in terms of biodiversity across a range of aquatic and riparian taxa. Although the angling lakes were used more intensively for recreation, no differences in species richness and the Simpson diversity index were detected for plants, amphibians, Odonata, and birds. The only relevant biodiversity effect detected in response to fisheries management related to fish communities, which were found to be more species-rich in angler

managed lakes compared to unmanaged ones. We conclude that management by anglers promotes the water-type-specific fish species diversity in gravel pit lakes, and recreational angling is unlikely a relevant factor influencing the species richness under the social-ecological conditions of Lower Saxony." (Authors) The list of taxa includes 33 odonate species/taxa.] Address: Nikolaus, R., Leibniz-Institut für Gewässerökologie & Binnenfischerei, Müggelseedamm 310, 12587 Berlin, Germany

19020. Ocharan, F.J.; Ocharan, R. (2020): Los odonatos de la cuenca del río Segura (Sureste de Espana) (Odonata). Boletín de la Sociedad Entomológica Aragonesa 67: 375-385. (in Spanish, With English summary) ["The dragonflies and damselflies of the Segura river basin (south-eastern Spain) (Odonata) Abstract: Records of 43 species of Odonata, obtained between 1995 and 2005, from 66 sampling points in the Segura Basin, south-eastern Spain (provinces of Albacete, Alicante, Jaén and Murcia) are provided. The odonate fauna of this basin is reviewed, with remarks on Coenagrion mercuriale, C. caerulescens, C. scitulum, Lestes macrostigma, Gomphus simillimus, Onychogomphus costae, Orthetrum nitidinerve and Zygonyx torridus. Onychogomphus cazuma is recorded for the first time from the Murcia administrative region, thus extending its known distribution in the Iberian Peninsula." (Authors)] Address: Ocharan, R., Universidad de Santiago de Compostela, Spain. E-mail: rocio.lindenia@gmail.com

19021. Odume, O.N. (2020): Searching for urban pollution signature and sensitive macroinvertebrate traits and ecological preferences in a river in the Eastern Cape of South Africa. Ecological Indicators 108 (2020) 105759: 10 pp. (in English) ["Urbanisation of riverine landscapes is a major threat to river ecosystems because of the ecological consequences of the so called urban stream syndrome. Taxonomically, certain macroinvertebrate metrics such as the diversity of species of Ephemeroptera, Plecoptera and Trichoptera (EPT) are known to be sensitive to urban pollution, whereas chironomids and oligochaetes are relatively tolerant. Trait correlates of such taxonomic metrics are yet to be established even though traits are less constrained by geographical differences. Using the Swartkops as a case study of a river receiving urban pollution, the pattern of trait distribution in relation to a gradient of urban pollution was examined, and urban pollution signature and sensitive traits identified. Macroinvertebrates and physico-chemical analysis were undertaken over a period of three years between August 2009 and September 2012 at one control site and three impacted downstream sites. Seven traits resolved into 32 trait attributes including body size, respiration, body shape, mobility, biotope preference, preferred food, and feeding habits were fuzzy coded and analysed using RLQ and fourth-corner analyses. Of the 32 trait and ecological attributes, four, including large body size (> 20 to 40 mm), animal materials as preferred food, predation and a preference for vegetation biotope, which were associated with the impacted sites, and were also significantly positively correlated with at least one physico-chemical indicator of increasing urban pollution were deemed signature traits. Three traits, swimming, fine particulate organic matter and grazing, associated with the control site, which showed significant negative correlations with at least one physico-chemical indicator of increasing urban pollution were identified as sensitive traits. The results indicate that urban pollution differentially influenced macroinvertebrate traits, with the identification of pollution signature and sensitive traits seen as an important step towards the development of trait-based indices for riverine monitoring of urban pollution effects." (Author) Odonata are treated at the family level.] Address: Odume, O.N., Unilever Centre for Environmental Water Quality, Institute for Water Research, Rhodes University, P.O. Box 94, Grahamstown, South Africa

19022. Orda-Dejtzer, C. (2020): Besiedelung renaturierter Moorflächen durch Amphibien und Libellen in der Neumarkter Passlandschaft. MSc thesis, Karl-Franzens-Universität Graz: 276 pp. (in German, with English summary) ["This study deals with the Amphibians and Odonata of four revitalized and recultivated peat bog areas in the „Neumarkter Passlandschaft“ (near Murau, Styria, Austria) in 800-900m a.s.l. Field trips were conducted in the year 2016 for Amphibians (26 field days/nights from March to September) and dragonflies (5 visits per site from May to September) to get information about the recultivating success and the species composition and abundance of both groups within the four study sites. In context of this work a positive acceptance was documented for the studied water bodies both by amphibians and dragonflies. Species-specific preferences concerning vegetational cover, habitat structures and aquatic parameters were registered. In total 8 species of Amphibia and 23 of Odonata were detected. The species richness and the abundance of species increased in recultivated areas with increasing age of the sites. The number of aquatic habitats and the size of the water body are limiting factors at the sites. Semi-natural standing water bodies with a high occurrence of vegetational and structural elements are recorded as species rich, but size and depth of the water body do not seem to be have great influence on the species composition of the two animal groups. The increasing diversity of vegetation and habitat structures according to increasing age of the peat bog areas has a positive influence on species diversity and abundance. By individual recognition of yellow-bellied toads (Bombina variegata), it was possible to document migratory behavior of single individuals. Photographs of 72 toads were made, 11 could be recaptured. A maximum migration distance of 110m was documented." (Author)] Address: not stated

19023. Osejos Merino, M.A.; Merino Conforme, M.C.; Merino Conforme, M.V.; Solis Barzola, J.L. (2020): Macroinvertebrados como bioindicadores de la calidad del agua de la parte céntrica del rio Jipijapa - Ecuador. Recimundo 4(4): 454-467. (in Spanish, with English and Portuguese summaries) ["The following research was conducted in the city of Jipijapa with the use macroinvertebrates as bioindicators of the water quality of the central part of the Jipijapa river. One of the main problems of the River is the discharge

of untreated domestic wastewater, because it receives a high load of nutrients and organic matter, whose degradation is critical for the water quality that flows through its channel. In this research the evaluation was carried out using benthic macroinvertebrates as bioindicators of water quality, using the following methodology with the application of the Biological Monitoring Working Party (BIPA), the technique used in the study was the Surber to capture the individuals studied, the results showed that the only order found in the study area is Odonata, of which five families and six genera were identified with a total of 93 individuals analyzed, after the field study and laboratory was obtained a total of 34 points which is within the range (16-35), concluding that the water quality in the Jipijapa river is bad and very polluted according to the applied biological index, which evidences effects of contamination." (Authors)] Address: Osejos Merino, M.A., Magister en Docencia Mención Gestión en Desarrollo del Currículo; Doctor en Ciencias Ambientales; Diplomado en Autoevaluación y Acreditación Univ.; Biólogo Pesquero; Docente de la Universidad Estatal del Sur de Manabí; Jipijapa, Ecuador. E-mail: miguel.osejos@unesum.edu.ec

19024. Outomuro, D.; Utku Urhan, A.; Brodin, A.; Johansson, F. (2020): Preference for supernormal stimuli tends to override initially learned associations for conspicuous prey traits: implications from a laboratory study. Journal of Ethology 38: 365-371. (in English) ["How predators select on conspicuous prey traits is not well understood. We used a laboratory setup to investigate the role of learning in predator choice of conspicuous visual traits. We used a generalist predator, the great tit, and coloured wings of males of two species of damselflies as prey. Wing pigmentation differs between the species in colour (green [Calopteryx virgo] vs. blue [Calopteryx splendens]) and size (large vs. small). Wing pigmentation is a sexually selected trait that experiences negative selection by avian predators. Inexperienced great tits showed no preference for the colour or the size of wing pigmentation. Great tits were then repeatedly exposed to rewarded wings with either large or small wing patch size. When these experienced birds were exposed to both wing patch sizes for the first time, they tended to prefer the wings with the large patch, irrespective of their previous experience. Our results suggest that the choice of the predator was based on an initial association of the trait to a reward followed by a preference for a supernormal stimulus, probably due to a larger sensory stimulation. We discuss the implications of our laboratory results in the light of previous estimates of damselfly predation risk under field conditions." (Authors)] Address: Outomuro, D., Dept of Ecology and Genetics, Animal Ecology, Evolutionary Biology Centre, Uppsala University, Norbyvägen 18D, 75236 Uppsala, Sweden. E-mail: outomuro.david@gmail.com

19025. Pastorino, P.;Brizio, P.; Abete, M.C.; Bertoli, M.; Oss Noser, A.G.; Piazza, G.; Prearo, M.; Elia, A.C.; Pizzul, E.; Squadrone, S. (2020): Macrobenthic invertebrates as tracers of rare earth elements in freshwater watercourses. Science of the Total Environment 698 (2020) 134282: 9 pp. (in English) [Highlights: • Rare earth elements were detected in macrobenthic communities from six watercourses. • Higher concentrations were measured in sites affected by anthropogenic activities. • A positive correlation exists between La, Ce, Gd and collector-gatherer density. • Functional feeding guilds of macrobenthic invertebrates influenced REE accumulation. • Macrobenthic invertebrates appear to be good indicators of REEs. Abstract: Rare earth elements (REEs) are emergent contaminants in aquatic ecosystems in parallel with their growing use in science, technology, and industry. In this study we measured the concentration of 16 REEs in freshwater marcobenthic invertebrates from 6 watercourses in northeast Italy to determine their potential use as ecological tracers of REEs in aquatic ecosystems. The total REE concentration at the sampling sites followed this order: site 6 (7.05 mg Kg^{-1}) N site 3 (5.76 mg Kg^{-1}) N site 4 (3.58 mg Kg^{-1}) N site 1 (3.0mg Kg^{-1}) N site 5 (2.36 mg Kg^{-1}) N site 2 (1.95 mgKg^{-1}). Therewere no significant differences in REE concentrations across the six samplings sites (Kruskal Wallis test, p=0.1773), but two (site 3 and 6) had higher amount of REEs and were classified with the ecological status “Moderate” sensuWater Framework Directive since affected by anthropogenic activities. Light REE were always greater than heavy REE concentrations at all six sites. A positive correlation was observed between certain REEs (La, Ce, Gd) and the density of genera Caenis and Baetis (Ehemeroptera, collectorgatherers) (ρS range 0.795–0.812), suggesting that non-predatory macrobenthic invertebrates accumulate more REEs than predatory organisms and that the intake of sediment is the most effective route of assimilation." (Authors) Odonata are represented by the geni Calopteryx and Onychogomphus.] Address: Dept Life Sci., Univ. of Trieste, via Giorgieri 10, 34127 Trieste, Italy

19026. Pearce-Higgins, J.W.; Chandler, D. (2020): Do surveys of adult dragonflies and damselflies yield repeatable data? Variation in monthly counts of abundance and species richness. Journal of Insect Conservation 24: 877-889. (in English) ["There is considerable debate over the most appropriate method for surveying dragonflies and damselflies (odonates). Using data from 62 survey locations nested within 26 waterbodies at 15 sites (discrete parcels of common ownership) in West Suffolk, UK, we show that short (20 m line transects or 3 min duration point counts), monthly counts of adults are repeatable. Correlations between predictions from models accounting for variation in ambient conditions and time of day and 52 separate counts used for validation equalled r = 0.87 for total abundance and r = 0.75 for species richness. Correlation coefficients between observed and modelled abundance exceeded 0.5 for eight of fourteen species modelled individually. Ambient temperature was the most important weather variable that influenced survey results, affecting the abundance of nine species, total abundance and species' richness. Most of the spatial variation in survey results was between waterbodies, rather than between sites or at individual survey locations, suggesting that adult counts may indicate aspects of waterbody quality, although differences in these patterns were observed between Anisoptera and Zygoptera. Encouraging relatively infrequent and rapid counts of flying adults may

therefore be used to increase volunteer participation in citizen (community) science odonate monitoring schemes whilst also providing repeatable abundance and species richness data that can contribute to research and monitoring programmes." (Authors)] Address: Pearce-Higgins, J.W., Cambridge Univ., The David Attenborough Building, Pembroke Street, Cambridge CB2 3QZ, UK. Email: james.pearce.higgins@bto.org

19027. Pella, C.; Nel, A. (2020): A hawker dragonfly (Odonata: Liupanshaniidae) from the Lower Cretaceous Crato Formation, northeastern Brazil. Cretaceous Research 116, December 2020, 104559: (in English) ["The hawker dragonfly Cratoliupanshania magnifica gen. et sp. nov. is described from the Lower Cretaceous Crato Formation in Brazil, corresponding to the third genus of this Mesozoic family from this formation. This family is otherwise known from the Lower to 'mid'-Cretaceous of China, Central Asia, and France. This new discovery shows that the Odonata from the Crato Formation, although extensively studied, can hold interesting surprises." (Authors)] Address: Nel, A., Lab. Ent.. Mus. Natn. Hist. Nat., 45 rue Buffon, F-75005 Paris, France. E-mail: anel@cimrs1.mnhn.fr

19028. Pérez, P.; Ruiz-Herrera, A.; SanLuis, A.M. (2020): Management guidelines in disturbance-prone populations: the importance of the intervention time. Journal of Theoretical Biology 486, 7 February 2020, 110075: (in English) ["Highlights: • There exists a broad range of management strategies to mitigate the possible damages after a natural catastrophe. However, their efficacy in real situations is not well understood. • We derive management guidelines in disturbance-prone populations regarding the external introduction of individuals and the ecological restoration. • The intervention time plays a critical role in the efficacy of most management strategies. • The presence of disturbance events produces many non-monotone and unexpected behaviours in the populations. • We illustrate our results with real data from three different species, mayfly, dragonfly and ostracod. Abstract: The use of conservation and management practices to buffer possible damages after disturbance events is growing to become popular worldwide. However, little is known about their efficacy in real-life situations. To fill this gap, we will derive management guidelines in disturbance-prone populations regarding the external introduction of individuals and the ecological restoration. We will also discuss the efficacy of these practices in the population dynamics of three species (a fast life-cycle mayfly, a slow life-cycle dragonfly and an ostracod) when their habitat suffers from periodic controlled flooding. One of the main messages of this paper is that the interplay between the inherited parameters of the population and disturbance events is a source of rich and unexpected behaviours. More importantly, intervention time plays a critical role in the performance of many management strategies." (Authors)] Address: Ruiz-Herrera, A., Dept of Mathematics, University of Oviedo, Oviedo 33001, Spain. Email: alfonsoruiz@dma.uvigo.es

19029. Pestana, G.C. (2020): Seleção sexual e a ordem Odonata: uma abordagem teórica e experimental. Dissertação Universidade Federal de São Carlos, Centro de Ciências Biológicas e da Saúde, Programa de Pós-Graduação em Ecologia e Recursos Naturais: 73 pp. (in Portuguese, with English summary) ["Sexual Selection theory was proposed by Darwin in 1871 and, thenceforth, has been widely discussed and tested in several taxonomic groups. Complementary hypotheses were formulated by different researchers aiming to understand the mechanisms and evolutionary processes related to sexual secondary characters and reproductive behaviors. Insects of the order Odonata, also known as dragonflies and damselflies, are used as models due to the presence of coloring patterns on the body and wings that act as sexual ornaments, and the diversity of behaviors related to reproduction. Thus, studies on the use of sexual traits before and after copulation, in different mating systems, are carried out with different species in this group. In this context, the present dissertation is focused in evolutionary models of sexual selection in odonates as study models. The first part contains two chapters: the first is a review of the mechanisms, costs and some hypotheses related to sexual selection, mainly related to the presence and function of sexual ornaments in males; and the second chapter, a scientometric analysis of published studies on the role of male sexual ornamentation and the different sperm competition strategies. The results of the scientometric analysis showed a difference in pre- and post-mating studies, in relation to the years in which there is a greatest number of publications with these themes, countries where the studies were developed, species analyzed and main authors. In the second part of this dissertation an observational study was carried out in order to verify the relationship between pre- and post-mating sexual traits, analyzing wing pigmentation proportion, sperm viability, total number of sperm, muscle mass, fat reserve and body size in two species: H. longipes and H. rosea. The results were discussed based on two hypotheses of sexual selection: the sperm competition game, which proposes a trade-off between sexual traits; and the fertility-linked phenotype, which predicts that the male sexual ornament co-vary with the individual's fertility. The results obtained suggest that both hypotheses can be corroborated, since males of H. longipes, presented a trade-off between the traits evaluated, while males of H. rosea presented a positive relationship between these traits." (Author)] Address: Pestana, Gabrielle Cristina, Dept of Hydrobiology, Federal Univ. of São Carlos, São Carlos, Brazil. E-mail: jpestana@ua.pt

19030. Piersanti, S.; Rebora, M.; Salerno, G. (2020): The antennal pathway of dragonfly nymphs, from sensilla to the brain. Insects 11(12). 10.3390/insects11120886: 15 pp. (in English) ["Simple Summary: The study of the sensory biology in aquatic insects undergoing incomplete metamorphosis, passing from nymphal life in fresh water to adult aerial life, provide great opportunities to understand how Arthropod nervous systems can adapt in response to critical ecological challenges. Here we investigate the antennal sensilla, and the related sensory pathways in the brain, of nymphs of an evolutionarily ancient hemimetabolous aquatic insect,

the dragonfly Libellula depressa, and compare them with previous data on adults. While antennal sensilla are dramatically different between L. depressa nymphs and adults, responding to the need to perceive different cues in water and air, the general morphology of the brain and the sensory circuitry remain quite similar during development. That suggests that the same brain centers are able to process highly diverging information, provided through different sensory structures adapted to water and air. This is in agreement with developmental plasticity that serves as a mechanism to maintain functionality throughout ontogenesis, when the lack of a pupal stage does not allow metamorphic changes of the nervous system. The present data also advance the knowledge on the biology of Odonata, threatened insects in fragile ecosystems, and thus present important results from an evolutionary and conservation biology perspective. Abstract: Dragonflies are hemimetabolous insects, switching from an aquatic life style as nymphs to aerial life as adults, confronted to different environmental cues. How sensory structures on the antennae and the brain regions processing the incoming information are adapted to the reception of fundamentally different sensory cues has not been investigated in hemimetabolous insects. Here we describe the antennal sensilla, the general brain structure, and the antennal sensory pathways in the last six nymphal instars of L. depressa, in comparison with earlier published data from adults, using scanning electron microscopy, and antennal receptor neuron and antennal lobe output neuron mass-tracing with tetramethylrhodamin. Brain structure was visualized with an anti-synapsin antibody. Differently from adults, the nymphal antennal flagellum harbors many mechanoreceptive sensilla, one olfactory, and two thermo-hygroreceptive sensilla at all investigated instars. The nymphal brain is very similar to the adult brain throughout development, despite the considerable differences in antennal sensilla and habitat. Like in adults, nymphal brains contain mushroom bodies lacking calyces and small aglomerular antennal lobes. Antennal fibers innervate the antennal lobe similar to adult brains and the gnathal ganglion more prominently than in adults. Similar brain structures are thus used in L. depressa nymphs and adults to process diverging sensory information." (Authors)] Address: Piersanti, Silvana, Dipto di Chimica, Biologia e Biotecnologie, Univ. of Perugia, 06123 Perugia, Italy

19031. Pinach, J.M.E.; Notario Maroto, C.; Alcaide Gil, M.I.; Torres López, J.; Muñoz Escribano, J.; López, E.; Morales, L.F.; Morales de Campos, P.; Carro Redondo, J.A.; García-Pozuelo-Ramos, C.; Padilla, M.B.; González Hitos, M.J.; Chelmick, D.; Sánchez, J.R.; Álvarez, X.P. (2020): Nuevas aportaciones odonatológicas (Odonata) para Castilla-La Mancha (centro-este de España). Jesús M. Evangelio. Boletín de la Sociedad Entomológica Aragonesa 67: 343-362. (in Spanish, with English summary) ["New contributions to the dragonfly fauna (Odonata) of Castilla-La Mancha (central-eastern Spain). Abstract: The first records of Lestes dryas and Diplacodes lefebvrii from Albacete province and Trithemis annulata from Guadalajara province are reported. The provisional list of Castilla-La Mancha dragonflies is updated to 65 species and records of 54 species of dragonflies from 104 localities in the region are provided, which add some 10x10 km UTM grid squares to the known distribution of some taxa such as Aeshna isoceles, Platycnemis acutipennis or Lestes sponsa. All the species mentioned here are rare in the province where they are recorded from and/or in the Castilla-La Mancha administrative region (less than 20 provincial records and/or less than 50 regional published records); some of them are of African origin with a very restricted distribution in Europe (Orthetrum trinacria, Paragomphus genei or Diplacodes lefebvrii), of African origin and rapidly expanding throughout the Iberian Peninsula (Trithemis kirbyi), or appear in the Red List of the Invertebrates of Spain (e.g. Lestes macrostigma, Onychogomphus costae or Sympetrum flaveolum)." (Authors)] Address: Notario Maroto, C., Grupo de odonatos del Museo de Ciencias Naturales AVAN. Calle Real, 39.13770 Viso del Marqués (Ciudad Real, Castilla-La Mancha, Spain. Email: carlos.notario@gmail.com

19032. Pouillon, J.-M.; Nel, A. (2020): The third skimmer dragonfly species from the Lower Cretaceous (Aptian) Crato Formation in Brazil (Odonata, Cavilabiata, Araripelibellulidae). Cretaceous Research 115, November 2020, 104565: (in English) ["Araripelibellula sennlaubi sp. nov., third species of this genus, is described from the Lower Cretaceous Crato Formation Araripe Basin, NE Brazil. This genus was previously known by its type species A. martinsnetoi from the same Formation and A. britannica from the Lower Cretaceous of UK. The new species is the third representative of the Cretaceous family Araripelibellulidae from Crato, and the ninth species of this family." (Authors)] Address: Nel, A., Lab. Ent.. Mus. Natn. Hist. Nat., 45 rue Buffon, F-75005 Paris, France. E-mail: anel@cimrs1.mnhn.fr

19033. Pregawati, O.; Ramadhan, T.H.; Syahputra, E. (2020): The study types of dragonflies (Odonata) In paddy fields. Jurnal Sains Mahasiswa Pertanian 9(4): 1-10. (in Indonesian, with English summary) ["The study was aimed to collect data on the types of dragonflies in the rice fields in the Village of Parit Keladi Sungai Kakap Sub-district Kubu Raya Regency. The type of this research is Descriptive research with survey methods, sampling was taken at 3 location points, namely; a) river banks, b)open areas on every irrigation system of rice fields, c)in rice paddy areas. The results of this study were found in 9 species, 8 species included in the Anisoptera sub-ordo, the Libellulidae family, Orthetrum sabina, Pantala flavencens, Tolymis tillarga, Brachythemis contaminata, Neurothemis ramburii, Lathrecista asiatica, Blue lilallula, Rhythemis phylis and 1 species included in the Zygoptera sub-family, the Coenagrionidae familial, Ischnura senegalensis. Dragonfly index value in the rice field area of Parit Keladi, Sungai Kakap Sub-district, Kubu Raya Regency is 0.91, including the low category and index value of dragonflies in 3 observation locations, location A; which is the riverbank 1.49, location B; irrigation 0.91, and location C; 0.31 paddy fields, all observations had a low level of dragonfly diversity." (Authors)] Address: Pregawati, O., Tanjungpura University Pontianak, Indonesia

19034. Ramos, K.A.M.; Nuòeza, O.M.; Villanueva, R.J.T. (2020): Species diversity of Odonata in Mimbilisan Protected Landscape, Misamis Oriental, Philippines. Asian Journal of Conservation Biology 9(2): 280-289. (in English) ["The sensitivity of Odonata to changing ecological conditions makes this group an effective indicator of aquatic and terrestrial health. The present study aimed to determine the species diversity and endemism of Odonata in Mimbilisan Protected Landscape. Sampling activity was conducted on July 18 to 28, 2017, using sweep-netting and handpicking methods in two forested sites and one riparian site. 176 individuals comprising 27 species under 10 families and 18 genera of Odonata were documented. Overall, endemism was recorded at 62.96%, including five species exclusive to Mindanao Island. Orthetrum pruinosum clelia and Risiocnemis appendiculata were the most abundant dragonfly and damselfly species, respectively. Findings also revealed highest species richness (S=24) and diversity (H'=2.732) in the forest stream (riparian site). Even distribution of species was observed in all sampling sites. Human-made disturbances were observed in the area. High level of endemism and moderate diversity of Odonata indicate that Mimbilisan Protected Landscape is a healthy area and conservation measures need to be sustained." (Authors)] Address: Ramos, Kate Anne, Department of Biological Sciences, College of Science and Mathematics, MSU-Iligan Institute of Technology, Andres Bonifacio Avenue, Tibanga, Iligan City, 9200 Philippines. E-mail: olgamnuneza@yahoo.com

19035. Ripoll, J.; Becerra García, F.; Ruiz, J.C.; Carmona,M.; Moreno-Benítez, J.M.; Vázquez Toro, F.E.; Winter, P.D. (2020): Los odonatos (Odonata) de la Sierra de las Nieves (Málaga, sur de la Península Ibérica). Boletín de la Sociedad Entomológica Aragonesa 67: 363-374. (in Spanish, with English summary) ["The Odonata of Sierra de las Nieves (Málaga, southern Spain) Abstract: All the available information, both bibliographic and from the samplings carried out by the authors during 2017 and 2018, is compiled, providing data on the presence of 37 species of Odonata in the Sierra de las Nieves Natural Park, among which stand out the presence of three threatened, protected species - Gomphus graslinii, Oxygastra curtisii and Macromia splendens. The main aquatic ecosystems in the protected area are described." (Authors)] Address: Ripoll, J., C/ Ronda Poniente, 6. Villafranco del Guadalhorce (Málaga), Spain. E-mail: javier.ripoll.rodriguez@gmail.com

19036. Rodriguez-Tapia, G.; Rocha-Ortega, M.; Cordoba-Aguilar, A. (2020): An index to estimate the vulnerability of damselflies and dragonflies (Insecta: Odonata) to land use changes using niche modeling. Aquatic Insects 41(3): 254-272. (in English) ["We developed an index of vulnerability for odonates (IVO) that occurred predominantly in Mexico to assess land use change. Vulnerability was defined as a function of A) habits of the species and B) ecological niche models. Index validation was done by relating it to rate of vegetation cover change, with the habitat preferences of each species and with species' sensitivity to habitat deterioration. Thus, the most sensitive species would be found in areas with no change in land use. IVO values ranged from a maximum of three (i.e., the most sensitive) to a minimum of one (i.e., the least sensitive). As it was demonstrated in other studies, odonates did not show a clear preference between conserved and perturbed land uses. Interestingly, the few sensitive species were clearly resilient and can be found in a wide range of land use types, thus they may be more generalist than previously thought." (Authors)] Address: Rodriguez-Tapia, G., Unidad de Geomática, Inst. Ecol., Univ. Nac. Autonoma México, México City, México

19037. Román-Heracleo, J.; Novelo-Gutiérrez, R.; Springer, M. (2020): First description of the larva of Psaironeura, based on specimens of P. angeloi from Costa Rica (Odonata: Coenagrionidae: Protoneurinae), with a key to the genera of Central American Protoneurinae. International Journal of Odonatology 23(2): 183-190. (in English) ["The larva of Psaironeura is formally described for the first time, based upon reared specimens of Psaironeura angeloi from the Tirimbina Biological Reserve, Sarapiquí, Heredia Province, Costa Rica. Detailed illustrations are also provided. The larva is characterized by a slender dark brown body, premental setae 2+1, six palpal setae, male cerci globose, and caudal lamellae markedly slender, 3.5–4 times longer than wide, with tips bi- or trilobated." (Authors)] Address: Román-Heracleo, J., Sistema de Estudios de Posgrado en Biología,Univ. de Costa Rica, San José, Costa Rica. Email: romanjareth@gmail.com

19038. Romero-Lebrón, E.; Gleiser, R.M.; Petrulevicius, J.F. (2020): Geometric morphometrics of endophytic oviposition traces of Odonata (Eocene, Argentina). R. Soc. Open Sci. 7(12): 201126: 14 pp. (in English) ["The insertion of the Odonata ovipositor in the plant tissue generates a scar that surrounds the eggs (trace). In insects, individual egg traces are known to vary in size, but their variation in individual shape is mostly unknown. 24 specimens were obtained from the Laguna del Hunco (Lower Eocene, Chubut) and Río Pichileufú (Middle Eocene, Río Negro), Argentina, which had 1346 oviposition traces (MEF Collection). For the first time, a study of the shape and size of a large number of individual Odonata endophytic egg traces was carried out using traditional (general and mixed linear models) and geometric morphometrics (Fourier elliptical series) to elucidate whether there are changes in size or shape of the individual endophytic egg traces associated with the substrate used at the time of oviposition, if the Lower Eocene traces have varied in relation to those of the Middle Eocene, and if the ichnological classification (Paleoovoidus arcuatus, P. bifurcatus and P. rectus) reflects such variations. We found differences in size ($p < 0.05$), but not in shape, in relation to the variables studied. This could reflect that the shape of Odonata eggs (inferred from the traces), unlike their size, could have a strong evolutionary constraint already observed since the Eocene." (Authors)] Address: Romero-Lebrón, Eugenia, Centro de Relevamiento y Evaluación de Recursos Agrícolas y Naturales (IMBIV, UNC-CONICET), 5000 Córdoba, Argentina. E-mail: eugeniaromerolebron@gmail.com

19039. Saetung, T.; Makbun, N.; Sartori, M.; Boonsoong, B. (2020): The subfamily Platycnemididae (Zygoptera: Platycnemididae) in Thailand, with description of the final stadium larva of Copera chantaburii Asahina, 1984. International Journal of Odonatology 23(3): 219 -237. (in English) ["Within the damselfly subfamily Platycnemidinae, eight species are currently recognized in South-East Asia. The final stadium larvae of only three of them have been so far described. The final stadium larva of Copera chantaburii is described and illustrated for the first time, based on reared specimens, and new provincial records both of larvae and adults of C. chantaburii are also provided. The larva of C. chantaburii can be distinguished from known species by the following combination of characters: square or almost horizontal rectangular shape of the outer lobe of the labial palp and fimbriated caudal lamellae that are stout at the base and narrow to an acute tip. The final stadium larva of Pseudocopera ciliata is redescribed with possibly diagnostic characters, such as the shape of the distal margin of the labial palp, the ratio of the length of caudal lamellae length and body length, setae on the margin of caudal lamellae and the setae on the terminal filament of the caudal lamellae." (Authors)] Address: Boonsoong, B., Animal Systematics & Ecology Speciality Research Unit (ASESRU), Dept of Zoology, Faculty of Science, Kasetsart University, Bangkok, Thailand. Email: fscibtb@ku.ac.th

19040. Sajan, K.C.; Gurung, J.B. (2020): Records of dragonflies and damselflies (Insecta: Odonata) of Dipang Lake, with two new records to Nepal. Journal of Threatened Taxa 12(8): 15955-15961. (in English) [Nepal; during April and May of 2019, at Dipang Lake, Lekhnath, Kaski (28.1800N & 84.0660E, 670–700 m.a.s.l.) a total of 28 Odonata species was recorded including Aciagrion approximans (Selys, 1876) and Ceriagrion cerinorubellum (Brauer,1865)] Address: Sajan, K.C., Independent Researcher, Pokhara-06, Lakeside, Nahar Marga, House No 126, Gandaki Province, Kaski 33700, Nepal. E-mail: sajankc143@gmail.com

19041. Samways, M.J.; Deacon, C.; Kietzka, G.J.; Pryke, J.S.; Vorster, C.; Simaika, J.P. (2020): Value of artificial ponds for aquatic insects in drought-prone southern Africa: a review. Biodiversity and Conservation 29: 3131-3150. (in English) ["Artificial ponds assure continuous societal water supply, especially during droughts. Obligate aquatic and amphibiotic insects readily inhabit novel water bodies, as many possess mobility traits for opportunistic colonization. We review here the value of artificial ponds (<2 ha) (and reservoirs; >2 ha) for local aquatic insect diversity in mostly dry and drought-prone southern Africa. We compare these ponds to natural pools, wetlands, and stream deposition pools. The region has a highly varied topography and physiographical zones. Flat, arid areas largely support widespread insect generalists, while the mountainous orographic zones support an additional rich fauna of localized endemics. However, the many ponds (>0.5 million) have greatly changed the local distribution patterns of surface freshwater across the region, increasing the area of occupancy for many aquatic insect species, especially dragonflies. We focus on the extent to which aquatic insect assemblages have benefitted from new ponds and reservoirs. We conclude that these novel ecosystems benefit almost all lentic aquatic insect species, while also enabling population resilience during droughts. However, while these benefits are substantial, these ponds are not a substitute for natural still waters, which are still required to maintain all indigenous lentic aquatic insect diversity.] Address: Deacon, C., Dept of Conservation Ecology & Entomology, Stellenbosch University, South Africa. E-mail: charldeacon@sun.ac.za

19042. Sánchez-Guillén, R.A.; Fadia-Ceccarelli, S.; Villalobos, F.; Neupane, S.; Rivas-Torres, A.: Sanmartín-Villar, I.; Wellenreuther, M.; Bybee, S.M.; Velásquez-Vélez, M.J.; Realpe, E.; Chávez-Ríos, J.R.; Dumont, H.J.; Cordero-Rivera, A. (2020): The evolutionary history of colour polymorphism in Ischnura damselflies (Odonata: Coenagrionidae). Odonatologica 49(3/4): 333-370. (in English) ["A major challenge in evolutionary biology concerns how genetic and phenotypic variation is created and maintained. In this study, we investigated the origin(s) and evolutionary patterns of the female-limited colour polymorphism in Ischnura. This involves the presence of one to three colour morphs: one androchrome morph with coloration that resembles that of the male, and two gynochrome morphs (infuscans and aurantiaca) with a female-specific coloration. We documented the colour of 44 and mating system of 36 of the 76 species within Ischnura to investigate the ancestral state of both traits and the correlated evolution and to infer directionality of trait-state transitions. The ancestral state reconstructions suggest that the most recent common ancestor of the ischnuran damselflies was most likely polymorphic and polyandrous. Our results give some support to the evolutionary correlation between female-limited colour polymorphism and mating system in Ischnura. That correlation is consistent with the idea that sexual selection through sexual conflict over the frequency of matings has selected for polymorphic females to reduce the overall intensity of male mating harassment, and our finding that the same phenotypic morphs have evolved multiple times (convergent evolution) suggests that several species in this genus might be experiencing similar selective pressures." (Authors)] Address: Sánchez-Guillén, Rosa, Biología Evolutiva, Inst. de Ecología A.C. (INECOL) C.P. 91073 Xalapa, Veracruz, México. Email: rosa.sanchez@inecol.mx

19043. Santos, L.R.; Ribeiro, C.; Mariano, R.; Rodrigues, M.E. (2020): Description of the larva of Leptagrion dispar Selys, 1876 (Odonata: Coenagrionidae) with notes on distribution and ecology of the species. Zootaxa 4896(1): 131-139. (in English) ["The genus Leptagrion Selys, 1876 comprises 17 described species. Of these species, only eight have their immature stage described. In this work, we describe the last instar larva of L. dispar. The specimens were collected in areas of Atlantic Forest in three municipalities of the southern region of Bahia, Brazil, in phytotelmata habitats of bromeliads. Larvae were described based on the characteristics of the preserved F-0 larvae and exuviae of the emerged specimens in the laboratory. We added information about the habitats where the specimens were found.

We extended occurrence records to other regions of the state of Bahia and presented a comparative table with morphological characteristics of all Leptagrion larvae already described." (Authors)] Address: Rodrigues, M.E., Ciências Biológicas, Universidade Estadual de Santa Cruz (UESC), Ilhéus, BA, Brasil. E-mail: merodrigues@uesc.br

19044. Schmidt Furieri, K.; Dondoni Colombo, L. (2020): A contribiçao da coleçao entomologica da Reserva Natural Vale para Odonata (Insecta). Tópicos Integrados de Zoologia 2: 10-17. (in Portuguese, with English summary) ["The dragonflies and damselflies (Odonata) are predatory insects that need water to reproduce. The males, sexually active, seek to live near to aquatic environments, and females visit the water, usually for copulation (mating) and laying (egg release). Biological collections are important sources of information. So that collections can, for example, effectively contribute to the construction and updating of the lists of Threatened Species, the specimens deposited therein must be identified at the species level and their data organized in a digital repository of records. This work aims to analyze the information available in the repository of records of the Reserva Natural Vale (RNV) about the Order Odonata. We found 200 specimens of Odonata, of which 18 (9%) are Aeshnidae, seven (3.5%) are Calopterygidae, 15 (7.5%) are Coenagrionidae, one (0.5%) are Dicteriadidae, 129 (64,5%) are Libellulidae, four (2%) are Heteragrionidae and 26 are (13%) specimens without any identification. Considering that 45 (21%) of the species registered in Espírito Santo (Brazil) do not have information about the locality of occurrence, identifying all the specimens and performing a biological survey for Odonata in the RNV may contribute significantly to the knowledge about this group of insects and to the analysis of the risk of extinction, as well as to the conservation of the species that inhabit there. Considering that there is no information on the place of occurrence for 21% (45) of the species recorded in Espírito Santo, the identification of the unidentified specimens and a specific survey for Odonata in the RNV may contribute significantly to the knowledge on this group of insects and for the analysis of the risk of extinction, as well as for the conservation of the species that live there. We suggest the increase in the collection of specimens from the RNV, since there is no systematized survey of these insects for this area. Even with few specimens of Odonata identified at the species level, the information available in the book of record of the Vale Natural Reserve (RNV) showed its relevance, because records of two species of dragonflies threatened with extinction were found. Therefore, the identification of the remaining dragonflies (85.5%) recorded in the yearbook may significantly contribute to the understanding of Odonata in Espírito Santo and consequently in Brazil. " (Authors) (Translated with www.DeepL.com/Translator (free version)] Address: Schmidt Furieri, Karina, UFES, Campus São Mateus, Departamento de Ciências Agrárias e Biológicas, São Mateus – Espírito Santo, Brazil

19045. Schoten, H.H. (2020): Oostermaet, an unknown but rich dragonfly site. Brachytron 21: 12-19. (in Dutch, with English summary) ["Systematic monitoring since 2019 at Oostermaet near Deventer, reveals the area has a relatively high diversity of Odonata species. A total of 32 species of damselflies and dragonflies has been observed on the monitoring routes at Oostermaet. The various landscapes and different types of water, specific site management and the influx of extra water in times of drought are plausible key factors. Some odonate species show a strong yearly variation in local population numbers. This can be coherent with natural factors, but may also result from the counting method used." (Authors)] Address: Schoten, H. Email: hhschoten@hetnet.nl

19046. Shah, R.D.T.; Sharma, S.; Bharati, L. (2020): Water diversion induced changes in aquatic biodiversity in monsoon-dominated rivers of Western Himalayas in Nepal: Implications for environmental flows. Ecological Indicators 108: 8 pp. (in English) ["Highlights: • Water diversions for irrigation, water mills, and micro-hydropower are prolific. • Effects of water diversions on the macroinvertebrate community composition are significant. • Macroinvertebrates abundance is sensitive metric rather than taxonomic richness. • Stream flow during baseflow season is critical for maintaining aquatic biodiversity. Abstract: Water diversion projects across the world, for drinking water, energy production and irrigation, have threatened riverine ecosystems and organisms inhabiting those systems. However, the impacts of such projects on aquatic biodiversity in monsoon-dominated river ecosystems are little known, particularly in Nepal. This study examines the effects of flow reduction due to water diversion projects on the macroinvertebrate communities in the rivers of the Karnali and Mahakali basins in the Western Himalayas in Nepal. Macroinvertebrates were sampled during post-monsoon (November), baseflow (February) and pre-monsoon (May) seasons during 2016 and 2017. Non-metric Multidimensional Scaling (NMDS) was performed to visualize clustering of sites according to percentage of water abstractions (extraction of water for various uses) and Redundancy Analysis (RDA) was used to explore environmental variables that explained variation in macroinvertebrate community composition. A significant pattern of macroinvertebrates across the water abstraction categories was only revealed for the baseflow season. NMDS clustered sites into three clumps: “none to slight water abstraction (<30% – Class 1)”, “moderate water abstraction (>30% to <80% – Class 2)” and “heavy water abstraction (>80% – Class 3)”. The study also showed that water abstraction varied seasonally in the region (Wilk’s Lambda = 0.697, $F_{(2, 28)}$ = 4.215, P = 0.025, n^2 = 0.23). The RDA plot indicated that taxa such as Acentrella sp., Paragenetina sp., Hydropsyche sp., Glossosomatinae, Elmidae, Orthocladiinae and Dimesiinae were rheophilic i.e. positively correlated with water velocity. Taxa like Torleya sp., Caenis sp., Cinygmina sp., Choroterpes sp., Limonidae and Ceratopogoniidae were found in sites with high proportion of pool sections and relative high temperature induced by flow reduction among the sites. Indicator taxonomic groups for Class 1, 2 and 3 water abstraction levels, measured through high relative abundance values, were Trichoptera, Coleoptera,

Odonata ["Gomphidae"] and Lepidoptera, respectively. Macroinvertebrate abundance was found to be the more sensitive metric than taxonomic richness in the abstracted sites. It is important to understand the relationship between flow alterations induced by water abstractions and changes in macroinvertebrates composition in order to determine sustainable and sound management strategies for river ecosystems." (Authors)] Address: Bharati, L., Intern. Water Management Institute, Nepal. E-mail: L.bharati@cgiar.org

19047. Sharma, P.; Kumar, D. (2020): Odonata diversity in and around Vadodara, Gujarat, India. Entomon 45(1): 43-51. (in English) ["Investigation on the diversity of Odonates revealed a total of 38 species belonging to two suborders, six families, and 24 genera in and around Vadodara, in Gujarat, which included 15 species of Zygoptera and 23 species of Anisoptera. Out of the 38 species, 10 species are new records for the Vadodara. Most number of species was found in water reservoirs as compared to urban ponds and area around Mahi River. Furthermore, it was observed that areas around the rivers were adversely affected because of nearby sand mining. Amongst damselflies and dragonflies the population of damselflies was richer. Renovation of urban ponds leads to decrease in their diversity due to loss of vegetation indicating anthropogenic pressure on species diversity." (Authors)] Address: Sharma, P., Division of Entomology, Department of Zoology, The Maharaja Sayajirao University of Baroda, Vadodara 390 002, Gujarat, India. E-mail: pankajshrm640@gmail.com

19048. Sigutova, H.; Šigut, M.; Kovalev, A.; Gorb, S.N. (2020): Wing wettability gradient in a damselfly Lestes sponsa (Odonata: Lestidae) reflects the submergence behaviour during underwater oviposition. R. Soc. Open Sci. 7: 201258: 11 pp. (in English) ["The phenomenon of hydrophobicity of insect cuticles has received great attention from technical fields due to its wide applicability to industry or medicine. However, in an ecological/evolutionary context such studies remain scarce. We measured spatial differences in wing wettability in Lestes sponsa, a damselfly species that can submerge during oviposition, and discussed the possible functional significance. Using dynamic contact angle (CA) measurements together with scanning electron microscopy (SEM), we investigated differences in wettability among distal, middle and proximal wing regions, and in surface nanostructures potentially responsible for observed differences. As we moved from distal towards more proximal parts, mean values of advancing and receding CAs gradually increased from 104° to 149°, and from 67° to 123°, respectively, indicating that wing tips were significantly less hydrophobic than more proximal parts. Moreover, values of CA hysteresis for the respective wing parts decreased from 38° to 26°, suggesting greater instability of the structure of the wing tips. Accordingly, compared with more proximal parts, SEM revealed higher damage of the wax nanostructures at the distal region. The observed wettability gradient is well explained by the submergence behaviour of L. sponsa during underwater oviposition. Our study thus proposed the existence of species-dependent hydrophobicity gradient on odonate wings caused by different ovipositional strategies." (Authors)] Address: Šigutová, Hana, Department of Biology and Ecology/ENC, Faculty of Science, Univ. of Ostrava, Chittussiho 10, 71000 Ostrava, Czech Republic. E-mail: hana.sigutova@osu.cz

19049. Silva dos Anjos, C.; Milani, L.R.; Magalhães de Souza, M. (2020): Odonata (Insecta) species richness in the Parque Estadual do Ibitipoca, Southeast Brazil. Revista Agrogeoambiental 12(3): 79-90. ["There are few studies on Odonata communities in Brazil, even in its most deeply studied states, such as Minas Gerais. Therefore, it is proposed the presentation of results on the Odonata species richness of Parque Estadual do Ibitipoca (Ibitipoca State Park), located at the Zona da Mata region in the Minas Gerais state, Brazil. This Conservation Unit is considered a priority area for the conservation of the state's invertebrates. The objective of this study was to know the number of species within the area. 100 hours of sampling were carried out, distributed amongst five campaigns of four consecutive days between November 2016 and July 2017. There were recorded 20 different species, including a new record for the state and one potential new species. Species richness was low due to the sampling being focused exclusively on lotic systems, and also to the environment's homogeneity. Despite the low number of species, Parque Estadual do Ibitipoca is relevant to the conservation of the Minas Gerais state's Odonata." (Authors)] Address: Silva dos Anjos, C., Universidade Federal do Paraná, Setor de Zoologia, Programa de Pós-graduação em Entomologia. Discente. Laboratório de Sistemática de Insetos Aquáticos, Brasil. E-mail: caioanjos_bd@hotmail.com

19050. So, K.Y.K.; Dudgeon, D. (2020): Conservation management of abandoned paddy fields in Asia: Semi-natural marshes with low-intensity bovid grazing have higher biodiversity. Aquatic Conservation: Marine and Freshwater Ecosystems 30(1): 1934-1944. (in English) ["1. Semi-natural marshland is becoming increasingly prevalent in Asia as a result of the continuing abandonment of rice cultivation. Although these marshes are important habitats for aquatic animals, they are susceptible to terrestrialization. Large mammalian herbivores that can retard terrestrialization are in decline globally, but domesticated bovids may serve as their surrogates, and could be used for managing semi-natural marshes. Relevant research in Asia is lacking, however. 2. Aquatic macroinvertebrates were sampled in both the wet and dry seasons from 26 freshwater marshes (abandoned paddy fields) across Hong Kong, encompassing 15 sites grazed by feral bovids (yellow cattle and water buffalo) and 11 ungrazed sites. The aim was to investigate seasonal variation in the effects of bovids on macroinvertebrate communities in monsoonal marshes. 3. Four decades after paddy cultivation had been abandoned, semi-natural marshes with low-intensity bovid grazing (0.06–0.14 cattle ha-1) had significantly higher (16%) site-scale ?-diversity. Macroinvertebrate communities at grazed sites had more Coleoptera and larval Odonata, and differed markedly from those at ungrazed sites. The effects of grazing on

diversity and composition were unaffected by season, but season itself was a significant predictor of a- and ß-diversity and species composition. 4. This study is the first to record the responses of aquatic macroinvertebrate diversity and composition to large-mammal grazing in Asian marshlands. Given that bovid grazing at low intensity can control plant growth, with concomitant benefits for wetland diversity, it is suggested that targeted grazing of short duration could be used for conservation management of abandoned paddy fields." (Authors) Agriocnemis femina, Agriocnemis pygmaea, Anax guttatus, Ceriagrion auranticum, Neurothemis tullia] Address: Dudgeon, D., Division of Ecology & Biodiversity, School of Biological Sciences, Univ. of Hong Kong, Pok Fu Lam Road, Hong Kong. E-mail: ddudgeon@hku.hk

19051. Sowa, A.; Krodkiewska, M.; Halabowski, D. (2020): How does mining salinisation gradient affect the structure and functioning of macroinvertebrate communities?. Water Air Soil Pollut (2020) 231: 453: 19 pp. (in English) ["Elevated salinity creates degrading conditions for the development of aquatic biota in different regions of the world. There is a need for research on freshwater salinisation in order to understand how this stressor alters ecosystem function and to predict changes in biodiversity globally. Such data are missing from Central Europe, and therefore, the presented study was performed in inland anthropogenic ponds with different salinity levels located in the second largest European hard coal basin. The researcher indicated a positive correlation between water salinity and the biomass and density of macrozoobenthos as well as the percentage of shredders and the abundance of alien species, whereas there was a decrease in taxa diversity and richness and the abundance of filtering and gathering collectors and predators along with increasing salinity. The survey showed that a high level of nutrients and organic matter were also significantly correlated with the distribution of the macroinvertebrate taxa and functional feeding groups. The conducted research confirmed that mining salinisation acts as a strong filter that shapes the biodiversity because it affects the composition, abundance, biomass and functional traits of benthic macroinvertebrates and significantly contributes to the invasion of alien species." (Authors) Taxa - including Odonata - are treated family wise.] Address: Sowa, Agnieszka, Inst. Biol., Biotech. & Environmental Protection, Faculty of Natural Sciences, Univ. of Silesia in Katowice, Bankowa 9, 40–007 Katowice, Poland. E-mail: agsowa@us.edu.pl

19052. Sparrow, D.J.; De Knijf, G.; Smith, M.S.; Sparrow, R.; Michaelides, M.; Konis, D.; Siedle, K. (2020): The circumtropical Pantala flavescens is a regular visitor to Cyprus and reproducing on the island (Odonata: Libellulidae). Odonatologica 49(3/4): 289-311. (in English) ["Although considered one of the most widespread dragonflies in the world, Pantala flavescens is rarely recorded in Europe and only irregularly observed in the eastern Mediterranean. The first published records of P. flavescens from Cyprus date back to 1957. There are no further published records from Cyprus until 2010 when a single individual and a copula were observed. The latter is also the first record of reproductive activity of the species in the eastern Mediterranean. Since the systematic monitoring of Odonata in Cyprus began in 2013, P. flavescens has been recorded on the island every year with one to 13 records each year from 2013 to 2017, 45 in 2018, and with a significant increase to 146 records in 2019, giving a total of 237 records. Reproductive behaviour of P. flavescens has been observed 19 times on Cyprus and in 2018 we found a larva and a teneral male. Oviposition mode showed high plasticity and was observed in five cases in non-contact guarding behaviour; five times females were ovipositing alone (unguarded oviposition) and oviposition in tandem was seen only once. Our observations are the first proof of successful reproduction of P. flavescens in the eastern Mediterranean." (Author)] Address: Sparrow, D.J., Cyprus Dragonfly Study Group, P.O. Box 62624, 8066, Paphos, Cyprus. E-mail: davidrospfo@hotmail.com

19053. Su, X.; Zhang, K.; Zheng, J.; Zhao, Y.; Han, R.; Zhang, J. (2020): Investigation of high lift force generation of dragonfly wing by a novel advanced mode in hover. Fluids 2020, 5, 59: 16 pp. (in English) ["In the paper, a novel flapping mode is presented that can generate high lift force by a dragonfly wing in hover. The new mode, named partial advanced mode (PAM), starts pitching earlier than symmetric rotation during the downstroke cycle of the hovering motion. As a result, high lift force can be generated due to rapid pitching coupling with high flapping velocity in the stroke plane. Aerodynamic performance of the new mode is investigated thoroughly using numerical simulation. The results obtained show that the period-averaged lift coefficient, CL, increases up to 16% compared with that of the traditional symmetrical mode when an earlier pitching time is set to 8% of the flapping period. The reason for the high lift force generation mechanism is explained in detail using not only force investigation, but also by analyzing vortices produced around the wing. The proposed PAM is believed to lengthen the dynamic stall mechanism and enhance the LEV generated during the downstroke. The improvement of lift force could be considered as a result of a combination of the dynamic stall mechanism and rapid pitch mechanism. Finally, the energy expenditure of the new mode is also analyzed." (Authors)] Address: Su, X., School of Hydraulic Engineering, Dalian University of Technology, Dalian 116024, China. E-mail: sxh@dlut.edu.cn

19054. Svensson, E.I.; Gomez-Llano, M.; Waller, J.T. (2020): Selection on phenotypic plasticity favors thermal canalization. Proc. Natl. Acad. Sci. U.S.A. 117: 29767-29774. (in English) ["Climate change affects organisms worldwide with profound ecological and evolutionary consequences, often increasing population extinction risk. Climatic factors can increase the strength, variability, or direction of natural selection on phenotypic traits, potentially driving adaptive evolution. Phenotypic plasticity in relation to temperature can allow organisms to maintain fitness in response to increasing temperatures, thereby “buying time” for subsequent genetic adaptation and promoting evolutionary rescue. Although many studies have shown that organisms respond plastically to increasing temperatures, it is unclear

if such thermal plasticity is adaptive. Moreover, we know little about how natural and sexual selection operate on thermal reaction norms, reflecting such plasticity. Here, we investigate how natural and sexual selection shape phenotypic plasticity in two congeneric and phenotypically similar sympatric insect species. We show that the thermal optima for longevity and mating success differ, suggesting temperature-dependent trade-offs between survival and reproduction in both sexes. Males in these species have similar thermal reaction norm slopes but have diverged in baseline body temperature (intercepts), being higher for the more northern species. Natural selection favored reduced thermal reaction norm slopes at high ambient temperatures, suggesting that the current level of thermal plasticity is maladaptive in the context of anthropogenic climate change and that selection now promotes thermal canalization and robustness. Our results show that ectothermic animals also at high latitudes can suffer from overheating and challenge the common view of phenotypic plasticity as being beneficial in harsh and novel environments." (Authors)] Address: Svensson, E.I., Department of Biology, Lund University, SE-223 62 Lund, Sweden. E-mail: erik.svensson@biol.lu.se

19055. Tang, C.; Zhang, X.; Li, J.; Li, Z.; Huang, M.; Duan, H.; Lu, Z.; Li, Q.; Chen, Y. (2020): Diversity and bioindication of Odonata in the Qinghuahai National Wetland Park in Baoshan City. Wetland Science 18(6): 712-718. (in Chines, with English summary) ["In order to understand the species diversity of Odonata in Baoshan Qinghuahai National Wetland Park, the field surveys were conducted on the adults and larva of Odonata insects in the ecological conservation area, restoration and reconstruction area, rational utilization area of Baoshan Qinghuahai National Wetland Park and Datianba wetlands restorated naturally by sweep-net and dipnet methods in July17-27, 2018, October 13-17, 2018, August 7-14, 2019, and June 19-22, 2020. The 205 adult specimens and670 larval specimens of Odonata were collected, and the diversity of Odonata in 4 different regions of Qinghuahai National Wetland Park was analyzed. The results showed that 205 adult specimens belong to 24 species in 6 families, 8 genera, and 670 larval specimens belong to 25 species(morphological species) in 4 families, including 10 species of Odonata recorded newly in Baoshan city. There was no significant difference in terms of abundance, species richness and adaptive coherence estimator value of adults of Odonata among ecological conservation area, reconstruction and restoration area and rational utilization area in the wetland park, but species richness and adaptive coherence estimator value of larvae of Odonata in the reconstruction and restoration area were significantly lower than those in ecological conservation area and rational utilization area. The community structure of adults of Odonata in ecological conservation area was significantly different from those in reconstruction and restoration area and rational utilization area, there were significant differences in the community structure of larvae of Odonata in the 4 areas. Totally, there were high level of Odonata diversity in ecological conservation area and rational utilization area, there was a low level of Odonata diversity in the reconstruction and restoration area. The biological indicator effect of larvae of Odonata were better than that of the adults, and the identification of larvae at the morphological species level or the family level could meet the demand to indicate wetland environment quality." (Authors)] Address: Tang, C., Southwest Forestry University, Kunming 650224, Yunnan, P.R. China. E-mail: m15680711287@163.com

19056. Tang, Y.; Sun, H.; Qin, Z.; Yin, S.; Tian, L.; Liu, Z. (2020): Bioinspired photocatalytic ZnO/Au nanopillar-modified surface for enhanced antibacterial and antiadhesive property. Chemical Engineering Journal Volume 398, 15 October 2020, 125575: (in English) ["Highlights: • ZnO/Au nanopillars are fabricated by hydrothermal and photo-reduction. • PDMS-ZnO/Au shows a mechanical antimicrobial effect in the dark. • A two-fold antibacterial action occurs for PDMS-ZnO/Au under visible light. • The modified PDMS could also function as an antifouling surface. Abstract: Biological contamination of surfaces is a thorny issue that brings series of adverse factors to the daily life and industrial manufacture. A dragonfly-wing-mimicking nanopillar array of ZnO/Au on Polydimethylsiloxane(PDMS-ZnO/Au) with two-fold bactericidal activity as well as the antiadhesive property has been developed. In this process, ZnO nanopillar is obtained using a hydrothermal method followed by the introduction of plasmonic gold nanoparticles (AuNPs) via a photo-reduction protocol. The obtained PDMS-ZnO/Au surface demonstrates physical antibacterial performance, resulting in a killing rate of 65.5% in dark. Furthermore, the surface effectively inactivates bacteria under visible light irradiation, yielding a lethality >99.9% in 30 minutes. The advantages of high lethality rate and short action time are endowed to PDMS-ZnO/Au by a two-fold antibacterial action combining the enhanced photocatalysis upon the introduction of Au nanoparticles and the mechanical property of biomimetic nanostructure. Meanwhile, the nanopillar-modified PDMS can also function as a superhydrophobic surface and efficiently impede bacterial adhesion by over 99.9%. Therefore, the approach presented here holds a promising solution to tackle biological contamination for medical paint, catheter and implant equipment." (Authors)] Address: Sun, H., Key Laboratory of Bionic Engineering, College of Biol. & Agricultural Engineering, Jilin University, Changchun, Jilin Province 130022, PR China. Email: sunhang@jlu.edu.cn

19057. Theodoropoulos, C.; Karaouzas, I.; Vourka, A.; Skoulikidis, N. (2020): ELF – A benthic macroinvertebrate multi-metric index for the assessment and classification of hydrological alteration in rivers. Ecological Indicators 108: 11pp. (in English) ["Hydrological alteration prevents unpolluted rivers from reaching acceptable ecological conditions. In Europe, 40% of rivers are degraded due to hydrological alteration but the indices currently used in ecological monitoring cannot quantify the degree of hydrological alteration or discriminate between pollution and hydrological alteration. In this article, we demonstrate the development, calculation and validation of the Hellenic Flow Index (ELF), a new macroinvertebrate-based multi-metric index to assess, quantify and classify hydrological alteration in Greek

streams and rivers. 1351 samples collected throughout Greece were partitioned in reference and test datasets and were pre-classified in varying levels of pollution and hydrological alteration. Optimal flow ranges for benthic macroinvertebrates were calculated and flow sensitivity metrics were developed. We tested the predictive accuracy of 607 versions of the ELF index, that is, 607 combinations of seven hydrologically sensitive macroinvertebrate metrics. The developed index is a combination of two ELF versions that had the highest predictive accuracy on two validation datasets. The index developed can assess, quantify and classify hydrological alteration and is also capable of discriminating between pollution and hydrological alteration. The ELF's overall predictive accuracy was 75% and the index was equally accurate in discriminating between clean, polluted and hydrologically altered sites. Within the regular ecological monitoring, water agencies, managers and decision makers can now use a tool that will quickly flag watercourses that specifically need hydrological restoration instead of pollution mitigation measures and thus apply targeted actions towards the ecological restoration of rivers." (Authors) Odonata are treated at the family level.] Address: Hellenic Centre for Marine Research, Institute of Marine Biological Resources & Inland Waters, 46.7 km Athens – Sounio Ave., 19013 Anavyssos, Greece

19058. Tüzün, N.; Debecker, S.; Stoks, R. (2020): Strong species differences in life history do not predict oxidative stress physiology or sensitivity to an environmental oxidant. Journal of Animal Ecology 89(7): 1711-1721. (in English) ["Species typically align along a fast-slow life-history continuum, yet it is not clear to what extent oxidative stress physiology can be integrated with this continuum to form a 'pace-of-life syndrome', especially so in invertebrates. This is important, given the assumed role of oxidative stress in mediating life-history trade-offs, and the prediction that species with a faster pace should be more vulnerable to oxidative stress. We tested whether a species' life-history pace, here represented by its growth rate, can predict species-level differentiation in physiology and sensitivity to oxidative stress. Therefore, we exposed four species of Ischnura damselflies that strongly align along a fast-slow life-history continuum to different levels of ultraviolet (UV) radiation. We measured an extended set of physiological traits linked to the pace-of-life: standard metabolic rate (SMR), oxidative stress physiology (antioxidant enzymes and oxidative damage), and defence/condition traits (investment in immune function, energy storage, and structural defence). Despite strong species differences in growth rate and physiology, growth rate did not predict species-level differentiation in physiology. Hence there was no support for the integration of metabolic rate, oxidative stress physiology or defence/condition traits into a species-level syndrome. UV exposure affected nearly all traits: it reduced growth rate and increased metabolic rate, affected all oxidative stress physiology traits and increased the two defence traits (immune function, and melanin content). Nevertheless, the pace-of-life based on growth rate did not predict sensitivity to UV. Instead, the observed pattern of investment in structural UV defence (melanin) might have reduced the need for enzymatic antioxidant defence, this way potentially decoupling the covariation between the life-history pace and oxidative stress physiology. The absence of an integrated axis of life-history and physiological variation indicates no major constraints for the evolution of these traits among the studied damselfly species. Our study highlights that ecological differences between species may decouple covariation between species' life-history pace and their physiology, as well as their sensitivity to environmental stressors." (Authors)] Address: Tüzün, N., Evolutionary Stress Ecology & Ecotoxicology, Univ. of Leuven, Leuven, Belgium. Email: nedim.tuzun@kuleuven.be

19059. Tüzün, N.; De Block, M.; Stoks, R. (2020): Live fast, die old: oxidative stress as a potential mediator of an unexpected life-history evolution. Oikos 129(9): 1330-1340. (in English) ["Intraspecific latitudinal patterns in life history are well documented, yet underlying mechanisms of such patterns are poorly understood. To advance our insights in the evolution of latitudinal differences in two key traits, growth rate and lifespan, we evaluated the potential costs of rapid growth in terms of reduced adult lifespan, and the mediatory role of oxidative stress. We studied latitudinal differentiation in routine and experimentally increased (compensatory) larval growth rates, and in adult lifespan under common garden conditions in low- and high-latitude populations of the damselfly Ischnura elegans. The low-latitude populations showed not only higher routine growth rates but also a stronger compensatory growth response after a transient food shortage compared to the high-latitude populations. In contrast with a tradeoff scenario, adults of the faster growing low-latitude populations lived longer, had higher levels of antioxidant enzymes, and tended to experience lower oxidative damage. Importantly, these latitudinal patterns were largely mirrored at the treatment level, where experimentally induced compensatory growth rates were associated with neither oxidative damage nor shorter adult lifespans. Moreover, individuals with a higher growth rate after the transient food shortage did not have shorter adult lifespans or higher oxidative damage, but instead showed a stronger antioxidant defense. Our data indicate that an overcompensatory, hormetic response in antioxidant defense, potentially induced by the higher routine growth rates, resulting in less oxidative damage may underlie these unexpected growth-lifespan patterns. Our results highlight the added value of incorporating oxidative stress physiology, and the need to consider multivariate trade-offs in which animals optimize multiple traits, when studying life-history evolution." (Authors)] Address: Stoks, R., Evolutionary Stress Ecology and Ecotoxicology, University of Leuven, Deberiotstraat 32, 6 3000 Leuven, Belgium. E-mail: robby.stoks@kuleuven.be

19060. Uboni, C.; Jugovic, J.; Tordoni, E.; Pizzul, E.; Riservato, E.; Bacaro, G. (2020): Dragonfly (Odonata) diversity patterns in mixohaline coastal wetlands. Estuaries and Coast 43: 375-386. (in English) ["Salinity is a limiting factor for many invertebrates, especially for Odonata which are typically associated with freshwater ecosystems. In Europe, 15 Odonata species inhabit brackish wetlands and only few

detailed data on their tolerance towards salinity are available. We investigated Odonata fauna in 11 sampling stations situated in three estuarine areas (northern Adriatic coastline) which differed in salinity conditions (freshwater-polyhaline habitats) in order to assess affinity of Odonata species to brackish habitats and to describe their distribution pattern in coastal wetlands. Adults, exuviae (the remains of the exoskeleton after the last larval instar), and the main chemical and physical water parameters were sampled every 2 weeks for 1 year in each station. In total, 25 species were detected and 56% of them were able to complete their life cycle in brackish water environments. Our results showed that freshwater and oligohaline ponds were the most favorable for dragonflies, with an overall higher species richness. There was a high species turnover along the salinity gradient, with a strong differentiation among the communities along the gradient. Considering the exuviae, we observed a high specificity with respect to the habitat conditions (seven species exclusive of freshwater sites and six of oligohaline ones, respectively). Among the adults, four species were found exclusively in freshwater habitats and no species seemed to be strictly connected with oligohaline habitats. Coastal wetlands are composed by a mosaic of different habitats especially when freshwater and seawater are close together, supporting many Odonata species with different tolerance toward salinity conditions. They also provide useful insights for conservation and management actions. ... In total, we identified 4963 adults and 1907 exuviae belonging to 25 species of Odonata (Zygoptera: 7 spp., Anisoptera: 18 spp.). Considering the different habitat types (freshwater, oligohaline, mesohaline, and polyhaline water), 32% of species (Coenagrion puella, C. scitulum, Aeshna isoceles, Orthetrum albistylum, Libellula depressa, Ischnura pumilio, Lindenia tetraphylla, Anax parthenope) and 25% of species (Aeshna cyanea, A. affinis, Lestes parvidens, L. depressa, C. scitulum, Hemianax ephippiger, Brachytron pratense, Orthetrum cancellatum, O. albistylum, Sympetrum fonscolombii, S. striolatum, S. vulgatum, I. pumilio) were exclusive of only one habitat type for adults and exuviae, respectively. Moreover, 28% of adult species (Anax imperator, O. cancellatum, Sympetrum meridionale, Erythromma viridulum, Ischnura elegans, Aeshna mixta, S. fusca) were present in all habitat types, whereas none of all sampled species was breeding all along the gradient (Table S2 of supplementarymaterial).We found a low share of rare species expressed as singletons and doubletons (namely the number of unique species represented by one or two individuals, respectively): one singleton (L. tetraphylla) and one doubleton (A. isoceles) for adults; for exuviae, four singletons (I. pumilio, B. pretense, A. cyanea, H. ephippiger) and no doubletons at all." (Authors)] Address: Uboni, Costanza, Dept Life Sciences, Univ. of Trieste, Via L. Giorgeri 10, Trieste, Italy. Email: costanza.uboni@gmail.com

19061. Uyizeye, E. (2020): Developing an odonate-based index for monitoring freshwater ecosystems in Rwanda: Towards linking policy to practice through integrated and adaptive management. Ph.D., Antioch University, Antioch New England: Environmental Studies: 179 pp. (in English) ["Worldwide, the decline of biodiversity in freshwater ecosystems is occurring at an alarming rate, due to anthropogenic threats, which directly impact humans in a variety of ways. Freshwater ecosystems occupy an integral part of political, socio-economic and ecological spheres. Integrated Watershed Management (IWM) and Adaptive Management (AM) conceptual frameworks provide an underpinning holistic platform from which to evaluate the performance of policies and actions on the ground in relation to freshwater ecosystem management. I investigate the extent to which environmental policies and practices embrace IWM and AM frameworks in Rwanda. Furthermore, this dissertation develops an odonate-based ecological monitoring tool, referred to as Dragonfly Biotic Index (DBI). The development of this tool involved surveying adult odonates, water physical-chemical variables, habitat characteristics and weather conditions across the six ecological zones of Rwanda. An average of 16 sites per each ecological zone were surveyed in a short rainy season and revisited in a short dry season. This countrywide survey added 25 new odonate species to the national check list, which increased it to 114 species. The abundance of odonates was significantly different between ecological zones and between seasons. The DBI developed here consists of three sub-indices: distribution-based score, sensitivity-based score and threat-based score as per IUCN Red List categories. To validate DBI, I examined its effectiveness in reflecting habitat integrity. This included using DBI to assess the relationship of land uses (agriculture and mining) and environmental, and physical- chemical variables of freshwater ecosystems. DBI values were significantly lower in agricultural and mining sites than their control sites. Also, significant changes in some environmental variables were associated with the two land uses. These included the degradation of riparian vegetation as associated with both agriculture and mining. While agriculture was significantly associated with higher conductivity, mining exhibited a significant relationship with higher water turbidity and higher sandy substrates than their control sites. In conclusion, not only will DBI enable deeper investigation of the extent to which land uses affect freshwater ecosystems, but also will be instrumental in prioritization for habitats that need crucial conservation. Additionally, this monitoring tool is meant to make data on ecosystem status readily available to facilitate analysis of ecological responses to socio-economic, political and pragmatic interventions. Thus, these data can be used to inform all spheres involved: ecological, political and socio-economic. The use of odonates, which are charismatic insects, will potentially engage and promote citizen-based monitoring. This will ultimately instill pro-environmental attitudes within local communities and set the stage for collaboration between stakeholders." (Author)] Address: not stated

19062. Valdivia, F.G.A.; Alves-Silva, E.; Del-Claro, K. (2020): Differences in size and energy content affect the territorial status and mating success of a neotropical dragonfly. Austral Ecology 45(6): 748-758. (in English) ["In male odonates, both size and fat content are related to territory defence and mating success. Males that are larger and have

higher energy reserves win relatively more disputes for territory and attract more females. Wing colour has also been regarded as a mechanism that influences agonistic behaviour between males, as wing pigmentation might be regarded as a sign of male quality. In this study, we analysed whether a set of male physical (body size and wing colour), physiological (body fat content) and behavioural (disputes between males) characteristics were involved in the territory defence and mating behaviour of the neotropical dragonfly Zenithoptera lanei Santos, 1941 (Anisoptera: Libellulidae). Males were characterised as territorial whenever they warded-off other males and remained in the same place within the pond for two consecutive days. In general, these territorial males were larger and had more abdominal and thoracic fat, engaged in pursuits more frequently, spent more time on sexual behaviour and female guarding, and mated more in comparison to subordinate males. By evaluating whether the percentage of wing area covered by black ink influenced male behaviour, we found that territorial males tended to act aggressively towards other males whose wings were partially painted, and sexually towards females irrespective of wing area painted. In Z. lanei, both body size and fat content play a role in defining territoriality. By subduing competitors and dominating preferred locations within high-quality sites, these males are likely to be visited by females and engage in mating." (Authors)] Address: DelClaro, K.U, niversidade de São Paulo, Avenida Bandeirantes No. 3900, CEP 14040901 Ribeirão Preto, São Paulo, Brazil. Email: kdelclaro@gmail.com

19063. Verheyen, J.; Stoks, R. (2020): Negative bioenergetic responses to pesticides in damselfly larvae are more likely when it is hotter and when temperatures fluctuate. Chemosphere 243, March 2020, 125369: (in English) ["Highlights: • Chlorpyrifos (CPF) reduced cellular energy allocation (CEA) in Ischnura elegans. • CPF had little effect on CEA values under standard test conditions (constant 20°C). • CPF reduced CEA, mainly at the most stressful (hottest) thermal regime. • CPF reduced CEA, mainly by reducing energy availability (fat and sugar declines). • Testing at standard conditions would underestimate the bio-energetic impact of CPF. Abstract: To make more realistic predictions about the current and future effects of pesticides, we need to better understand physiological mechanisms associated with the widespread higher toxicity of many pesticides under increasing mean temperatures and daily temperature fluctuations (DTFs). One overlooked, yet insightful, mechanism are bioenergetic responses as these provide information about the balance between energy gains and costs. Therefore, we studied how the bioenergetic responses to the insecticide chlorpyrifos were affected by a higher mean temperature and a higher DTF in Ischnura elegans damselfly larvae. To quantify bioenergetic responses we measured energy availability (Ea), energy consumption (Ec) and total net energy budget (cellular energy allocation, CEA). Exposure to chlorpyrifos considerably reduced CEA values when a high mean temperature was combined with a high DTF (up to -18%). Notably, chlorpyrifos had little effect on CEA at a constant 20°C, meaning that the bioenergetic impact of chlorpyrifos would have been underestimated if we had only tested under standard testing conditions. The chlorpyrifos-induced reductions in CEA under warming were driven by reductions in Ea (up to -16%, mainly through large reductions in sugar and fat contents) while Ec was unaffected by chlorpyrifos. Treatment groups with a lower CEA value showed a higher mortality and a lower growth rate, indicating bioenergetic responses are contributing to the higher toxicity of chlorpyrifos under warming. Our study highlights the importance of evaluating the effects of pesticides under an increase in both mean temperature and DTF to improve the ecological risk assessment of pesticides under global warming." (Authors)] Address: Stoks, R., Lab. voor Aquatische Ecologie, K.U.Leuven, De Beriotstraat 32, 3000 Leuven, Belgium. E-mail: robby.stoks@bio.kuleuven.ac.be

19064. Vinko, D.; Šalamun, A.; Tratnik, A.; Erbida, N.; Pirnat, A.; Bahor, M.; Kablar, D.; Kogovsek, P.; Šramel, N.; Hostnik, M.; Krelj, N.; Šabeder, N.; Tivadar, N.; Snoj, J.; Bedjanic, M.,3 (2020): Dragonfly fauna (Odonata) of the Ribniki v dolini Drage pri Igu Nature Reserve (Ljubljansko barje, Central Slovenia). Natura Sloveniae 22(2): 5-28. (in Slovene, with English summary) ["The current knowledge of the odonate fauna in the Ribniki v dolini Drage pri Igu Nature Reserve at the south-eastern outskirts of Ljubljansko barje is summarized, based on studies carried out in the 2018–2020 period and on older unpublished data of the authors and literature. Of the 72 species of Odonata known for Slovenia, 49 have been listed so far in the study area. Of these, 17 species are endangered, 5 protected and 2 listed in the appendices to the Habitats Directive, while 15 species are rare in the area. The local odonate fauna is compared with the odonate fauna of the wider area, with a list of 51 odonate species provided for the entire Ljubljansko barje, of which 7 have so far been found only in the area of Draga pri Igu. Nature conservation aspect is discussed with an emphasis on the species from the appendices of the Habitat Directive, Leucorrhinia pectoralis, which has recently not been recorded elsewhere in central Slovenia, and Cordulegaster heros. Furthermore, we provide recommendations for further management of the nature reserve. The main threat factors affecting the odonate fauna in the area are listed and the need for monitoring the threatened species and further research is highlighted. To protect the odonate fauna in this part of Slovenia, the introduction of adapted and to nature conservation subordinated extensive management of wetlands and fishponds in the nature reserve is implicit." (Authors)] Address: Bedjanic, M., Nac. inšt. biol., Veèna pot 111, 1000 Ljubljana, Slovenia. Email: matjaz.bedjanic@nib.si

19065. Vorster, C.; Samways, M.J.; Simaika, J.P.; Kipping, J.; Clausnitzer, V.; Suhling, F.; Dijkstra, K.-D.B. (2020): Development of a new continental-scale index for freshwater assessment based on dragonfly assemblages. Ecological Indicators Volume 109, February 2020, 105819: 12 pp. (in English) ["Highlights: • A new, continental-scale freshwater assessment tool, African Dragonfly Biotic Index. • 604 African dragonfly species are evaluated. • This index determines deterioration or recovery of a freshwater site. • It also

compares freshwater quality at different sites. • The index is a foundation for developing other national Dragonfly Biotic Indices. Abstract: African freshwater ecosystems are increasingly being impacted by humans, requiring an effective tool to assess these impacts for future conservation action. Such a tool, the Dragonfly Biotic Index (DBI), was earlier developed to assess the quality of South Africa's freshwater ecosystems and is based on combining the scores of three sub-indices (geographical distribution, threat status, and habitat sensitivity) for each South African dragonfly species. The sum of the DBI scores for all the species recorded at assessed sites indicates the relative quality of these sites. The International Union for the Conservation of Nature/Species Survival Commission (IUCN/SSC) has assessed the threat status of certain aquatic taxa in Africa, including dragonflies. These assessments, coupled with the latest information on the geographical distribution of each species, makes it possible here to geographically expand the South African DBI into a continental-scale assessment index (the African Dragonfly Biotic Index (ADBI)) by adapting the South African DBI sub-indices. We develop this continental index here. However, there are challenges when undertaking an assessment at the continental scale compared to a national scale. In particular, the habitat sensitivity sub-index of the South African DBI is a relative, quantitative measure based on numbers of individual dragonflies recorded from natural versus human-modified or artificial freshwater systems. While the data for the two sub-indices, species' geographical distribution and Red List threat statuses, are available across the continent, this is not the case for the habitat sensitivity sub-index at this large spatial scale. This meant that an alternative sub-index measure was required. We overcame this challenge by exploring an alternative sub-index, i.e. the 'species vulnerability sub-index', based on knowledge of the vulnerabilities of the species to certain types of landscape transformation. Then, the species vulnerability sub-index scores were calculated and combined with the geographical distribution and Red List threat status sub-index scores to develop ADBI scores for a core of 604 dragonfly species with adequate data across the African continent. These ADBI scores provide a workable framework and baseline for determining freshwater quality, both lotic and lentic, relative to human disturbance at a continental spatial scale. The ADBI enables the monitoring of quality changes, for better or worse, over the continent in years to come. Overall, the ADBI also has the potential to help identify threats to, and sensitivities of, African freshwater ecosystems, leading to conservation action.] Address: Kipping, J., BioCart Ökologische Gutachten, Taucha/Leipzig, Germany. E-mail: biocartkipping@email.de

19066. Waldhauser, M. (2020): Records of Dragonflies from the Dead Sea Basin (Isreal, West Bank, Jordan) with the records of Orthetrum abbotti and Crocothemis sanguinolenta (Odonata: Libellulidae). Libellula 39(1/2): 49-61. (in English, with German summary) ["25 species of Odonata were found on two short holiday trips to the southern part of the Dead Sea Basin in May 2018 and April 2019. Occurrence of O. abbotti and C. sanguinolenta in Jordan was confirmed, many new localities of O. ransonnetii in Israel and Jordan were discovered." (Author)] Address: Waldhauser, M., Petrovice 136, Jablonné v Podještìdí, 471 25, Czech Republic. Email: martin.waldhauser@nature.cz

19067. Walia, G.K.; Devi, M. (2020): Cytogenetic characterization of five species of genus Coeliccia of family Platycnemididae (Odonata: Zygoptera) using C-banding, silver nitrate staining and sequence specific staining. The Nucleus 64(1): 1-6. (in English) ["Cytogenetic characterization of five species of genus Coeliccia of family Platycnemididae has been done by conventional staining, C-banding, silver nitrate staining and sequence specific staining. These species were collected from the localities present in Andretta, Bilaspur (Himachal Pradesh) and Nongkhyllem (Meghalaya), India. All the species possess n=13 as haploid chromosome number, which is the type number of the family with X0–XX sex determining mechanism except Coeliccia bimaculata with n=12, originated by the fusion of two autosome pairs as complement is characterized by the presence of one large bivalent. m chromosomes are absent in all the species. Mostly, light/dark terminal C-bands and NOR's are seen on the autosomal bivalents, while X chromosome shows variations as large terminal C-band on one side of X chromosome is present in all the species except C. renifera, it is C-positive. Moreover, X chromosome possesses terminal NOR on one side in C. chromothorax, while NOR-positive in C. renifera and NOR-negative in C. bimaculata, C. didyma and C. fraseri. In sequence specific staining, autosomal bivalents are homogeneously stained with both DAPI and CMA3 dyes in C. bimaculata, C. renifera and C. chromothorax, while whole chromosome complement of C. didyma is CMA3 bright and C. fraseri is DAPI bright.] Address: Walia, G.K., Dept of Zoology & Environmental Sciences, Punjabi Univ., Patiala, Punjab, 147002, India

19068. Wan, L.; Long, Y.; Hui, J.; Zhang, H.; Hou, Z.; Tan, J.; Pan, Y.; Sun, S. (2020): Effect of norfloxacin on algae–cladoceran grazer–larval damselfly food chains: Algal morphology-mediated trophic cascades. Chemosphere 256 (2020) 127166: 11 pp. (in English) ["Highlights: • Without NOR, suppressed grazer density by damselflies promoted algal growth. • NOR increased the positive impacts of damselflies on C. vulgaris growth. • NOR reduced the positive impacts of damselflies on S. quadricauda growth. • NOR altered trophic cascades and showed species-specific differences. • The above differences depend on algal morphology-mediated indirect interactions. Abstract: Antibiotic norfloxacin (NOR) has recently been demonstrated to affect the swimming behavior of zooplankton species and phytoplankton-zooplankton interactions, which may further affect trophic cascades. To test this hypothesis, two food chains (Scenedesmus quadricauda–Daphnia magna–larval damselfly and Chlorella vulgaris–D. magna–larval damselfly) were used to examine the effect of NOR concentrations (0, 0.5, 5, and 25 mg L^{-1}) on trophic cascades. In the absence of NOR, larval damselflies reduced grazer density and increased algal density, regardless of algal species. In the presence of NOR, increasing NOR concentration strengthened

the positive effect of larval damselflies on the growth of C. vulgaris because larval damselflies suppressed grazer density more efficiently resulting from reduced swimming ability in the grazers. Conversely, increasing NOR concentration reduced the positive effect on the growth of S. quadricauda due to inhibited grazer-induced colony formation in S. quadricauda. Therefore, exposure to NOR altered the direction and strength of trophic cascades and showed species-specific differences, depending on algal morphology-mediated indirect interactions. These findings provide novel insights into how NOR affects aquatic food chains and reveal the importance of algal traits in determining trophic cascades." (Authors)] Address: Pan Y., School Ecol. & Environ. Sci. & Yunnan Key Lab. for Plateau Mountain Ecol. & Restoration of Degraded Environments, Yunnan Univ., Kunming, Yunnan, 650091, China. E-mail: panying@ynu.edu.cn

19069. Wang, Y.-J.; Stoks, R.; Sentis, A.; Tüzün, N. (2020): Support for the climatic variability hypothesis depends on the type of thermal plasticity: lessons from predation rates. Oikos 129(7): 1040-1050. (in English) ["Plastic and evolutionary changes in traits related to biotic interactions are crucial for the local persistence of populations under global warming. Yet, how acute and developmental thermal plasticity evolve and shape predation rates has been poorly studied, especially in the context of latitude-driven thermal evolution. A powerful predictive framework is given by the climatic variability hypothesis (CVH) stating that thermal plasticity and acclimation capacity evolve to be higher in high-latitude populations because these are exposed to higher thermal seasonal variability. We tested the CVH for predation rates and evaluated if the support for the CVH depended on the type of plasticity and acclimation metric. We examined effects of developmental temperature (20 and 24°C) and acute changes in mean and extreme temperatures (20, 24 and 32°C) on the predation rates of high- and low-latitude populations of a predatory aquatic insect, the damselfly Ischnura elegans. We documented opposing and interactive effects between developmental and acute temperatures, which urges caution when using thermal performance curves to forecast the impact of global warming on biotic interactions. Predation rates were higher in low-latitude than high-latitude predators, especially at the warmer developmental and test temperatures, suggesting thermal adaptation to the higher low-latitude temperatures. The latitudinal patterns in acute and developmental plasticities differed, providing mixed support for the CVH. Moreover, there was no latitudinal pattern in post-acclimation thermal sensitivity, indicative of perfect thermal compensation in predators from both latitudes. Strikingly, the acclimation capacity leading to perfect thermal compensation was ~6 times higher in high-latitude than in low-latitude predators. Our study provides new insights into the climatic variability hypothesis (CVH) by documenting that its support is critically dependent on the type of plasticity and acclimation metric used." (Authors)] Address: Stoks, R., Lab. voor Aquatische Ecologie, K.U.Leuven, De Beriotstraat 32, B-3000 Leuven, Belgium. E-mail: robby.stoks@bio.kuleuven.ac.be

19070. Ward, J. (2020): Predator-Prey Interactions between Paranephrops zealandicus and Odonata species in semi-natural aquaculture environments. MSc. thesis, University of Otago: 101 pp. (in English) ["Interactions between predator and prey contribute towards shaping food webs and can be responsible for the composition of species in an ecosystem. In semi-natural aquaculture ponds, interactions between predators and competitors can be unfavorable for farmed species as they might reduce biomass in ponds and therefore economic growth. Juvenile farmed species are significantly more vulnerable in pond aquaculture as size is usually the factor that dictates trophic levels in aquatic habitats. Odonata are a family of pond invertebrates that are considered opportunistic predators and are known to feed on the prey of many juvenile vertebrate and invertebrate ponds species. Their ability to successfully capture prey makes them top invertebrate predators and how they interact with farmed species, specifically juveniles in aquaculture pond systems has been speculated. In New Zealand (NZ), semi-natural aquaculture ponds are used to cultivate the freshwater water crayfish species Paranephrops zealandicus yet how this species interacts with other pond invertebrates, particularly odonate larvae has not been studied. It was therefore the aim of this thesis to further investigate the predator-prey interactions between NZ odonate larvae and the farmed species P. zealandicus in semi-natural aquaculture ponds. This thesis examines predator-prey interactions based on species spatial patterns and habitat use in ponds, as well as stomach content and stable isotope analysis on study species. Results indicate odonate larvae have no significant effect on the abundance of P. zealandicus in ponds. Vegetation and the densities of P. zealandicus in ponds are more likely to have a greater impact on odonate larvae and juvenile P. zealandicus abundance. Desirable habitat was occupied by larger P. zealandicus which forced juvenile P. zealandicus to seek refuge in areas of the pond that were not attractive for larger territorial individuals. Based on stomach content analysis, odonate larvae were found to primarily feed on small sedentary pond invertebrates such as Chironomidae P. zealandicus tissue was exceptionally low in odonate larvae stomachs. Stable isotope analysis further showed all odonate larvae had lower trophic levels to juvenile P. zealandicus indicating odonate larvae are unlikely to be major predators of juveniles. P. zealandicus diets reflected their omnivorous nature feeding on both plant detritus and invertebrate tissue, however P. zealandicus were highly cannibalistic with adults found to have high volumes of P. zealandicus tissue in their stomachs. Stable isotope analysis showed between P. zealandicus and juvenile crayfish there was no significant difference in trophic levels. Year 1 crayfish represented much of the P. zealandicus sample used for stable isotope analysis and adults were poorly represented in the sample which could be the reason for this result. Therefore Year 1 P. zealandicus are unlikely to be feeding on juveniles, however more research needs to be carried out looking at the trophic interactions between adult P. zealandicus and year of young. Ultimately, odonate larvae are not likely to be major predators of juvenile P. ze-

alandicus, and cannibalism is more likely to be the main factor for low juvenile success in ponds. Future research investigating other pond invertebrates and ways to mitigate cannibalism in ponds is speculated." (Author)] Address: not stated

19071. Wildermuth, H.; Monnerat, C. (2020): Fakten und Indizien zum Besiedlungs- und Ausbreitungsverhalten von Coenagrion scitulum in der Schweiz (Odonata: Coenagrionidae). Libellula 39(3/4): 123-147. (in German, with English summary) ["Colonisation and dispersal behaviour of C. scitulum in Switzerland – facts and evidence – In Europe, C. scitulum is mainly distributed in the Mediterranean area. Since the 1990s the species has extended its range north- and eastwards successively. In Switzerland, it established itself since 2002. Based on comprehensive faunistic data we tried to reconstruct its immigration from France and dispersal routes in Switzerland. Accordingly, during a first advance through the Burgundy Gate it arrived at the Ajoie region and from there it reached the central and eastern Plateau. The second advance followed from the French Rhone Valley into the Geneva Basin and further on to the western Plateau. In the Valais and the Ticino it firstly appeared in 2020. The colonization of Switzerland proceeded dynamically, in short but occasionally also in long leaps. In many cases, the first newcomers at waters were single specimens or small groups of individuals. According to their behaviour it is inferred that single males and females intensively searched for mates. If they remained unsuccessful, they soon moved on. Frequently, small populations were formed that existed only temporarily. Large and permanent populations occurred very rarely. The dispersal of C. scitulum was especially promoted by the availability of suitable habitats, i.e. by freshly created or revitalized water bodies. In addition, the sp. would also have profited from climate warming." (Authors)] Address: Wildermuth, H., Haltbergstr. 43, 8630 Rüti, Switzerland. E-mail: hansruedi@wildermuth.ch

19072. Yu, Y.; Pu, G.; Jiang, T.; Jiang, K. (2020): A dragonfly wing inspired biomimetic aerodynamic thrust bearing for increased load capacity. International Journal of Mechanical Sciences 176(6): (in English) ["Highlights: • A novel biomimetic aerodynamic bearing is designed. • Five most representative surface structures of dragonfly wings are mimicked on the surface of thrust air bearings. • The load capacity of the five surface structures are compared under various velocity angles. • The optimal surface structure and velocity angle are taken to design the biomimetic bearing. • The designed biomimetic bearing achieves a 46.11% higher load capacity than the optimized conventional spiral grooved bearing, verified by experiments. Abstract: A novel biomimetic aerodynamic thrust bearing is developed and investigated. The surface structure of the bearing is evolved from the micro-grids of dragonfly wings, which presumably aid flying and maneuver ability of dragonflies. The topography of the micro-grids of dragonfly wings was studied and five most representative geometries were extracted before being put on thrust bearings for performance examination. A theoretical model, solved with finite different and finite volume method, is developed to compare the static load capacity of the bearings under various velocities and flow angles, and the best geometry and velocity angle were selected and manufactured on the bearing surface for experimental tests. The dragonfly wing biomimetic bearing is found to increase load capacity by up to 46.11% in comparison with an optimized conventional spiral grooved bearing by experiments." (Authors)] Address: Yu, Y., Dept of Mech. Engineering, Univ. Birmingham, Birmingham B15 2TT, UK

2021

19073. Aguzzi, S.; Orioli, V. (2021): Somatochlora arctica (Odonata: Corduliidae) oviposing at a “lower than usual” altitude for Italy and the Mediterranean Region and first observation for the Varese Province (Northern Italy). Natural History Sciences. Atti Soc. it. Sci. nat. Museo civ. Stor. nat. Milano 8(2): 79-82. (in English, with Italian summary) ["S. arctica is an endangered dragonfly with populations characterized by low density and scattered distribution. The presence of the species in the Varese Province, recorded during the specific monitoring operations for Nehalennia speciosa, is reported for the first time. The observation of an oviposing female was carried out in a peat bog placed at 550 m a.s.l., the lowest altitude for the species in Italy and one of the most unusual for the Mediterranean Region. The peculiarities of this record are shown." (Authors)] Address: Stefano Aguzzi, Società Italiana per lo Studio e la Conservazione delle Libellule ODV, c/o Università degli Studi di Perugia; Fondazione Lombardia per l’Ambiente, Seveso (MB), Italy. Email: stefano.aguzzi@gmail.com

19074. Akindele, E.O.; Adedapo, A.M.; Adu, B.W.; Ogbogu, S.S. (2021): First report of the larva of a vulnerable damselfly in Nigeria, with some ecological notes: A case for umbrella species conservation approach. Tropical Conservation Science 14: 1-7. (in English) ["Background and Research: Lack of information on the distribution of threatened aquatic species impedes their conservation, thus predisposing them to extinction risk before being reported. Hence, this study reports in Nigeria, for the first time, the occurrence and habitat specificity of the larva of Pentaphlebia stahli (Zygoptera: Pentaphlebiidae) a vulnerable damselfly. Methods: Samples of P. stahli were collected in July and December 2020 from a rural stream situated at the Ekor Waterfalls in the Cross River State of Nigeria and very close to the Nigeria-Cameroon border. Some water quality parameters were also measured in each sampling period. Results: A total of 27 larvae of P. stahli and 1 teneral adult emerging from its exuvia were recorded in the two sampling periods. The habitat was a forested stream characterized by rapids, falls, and dark rock substrata. Water flows at a fast rate of 1min 3 or 4 seconds, thus characterizing a rifle and headwater stream. Dissolved oxygen concentration was between 8.05 and 8.09 mg/L, while dissolved oxygen saturation was ~ 98%. Biological oxygen demand was between 1.04 and 1.08 mg/L, while pH ranged from 7.28 and 7.56. Conclusion: The stream could be described as having high ecological integrity as evidenced in its optimum range of values

for the investigated water parameters and the presence of a threatened species. Implications for Conservation: Based on habitat specificity, P. stahli is considered an umbrella species required for conserving other co-occurring species in the tropical stream and its riparian forest." (Authors)] Address: Akindele, E.O., Room 1.07, Dept Zoology, Obafemi Awolowo Univ., Ile-Ife, Osun State, Nigeria. Email: eoakindele@oauife.edu.ng

19075. Bechly, G.; Garrouste, R.; Aase, A.; Karr, J.A.; Grande, L.; Nel, A. (2021): The damselfly palaeofauna from the Eocene of Wyoming and Colorado, USA (Insecta, Odonata, Zygoptera). Papers in Palaeontology 7(3): 1373-1402. (in English) ["A new family, five new genera, and nine new species of fossil damselflies (Insecta, Odonata, Zygoptera, Calopterygida) from the USA are described, seven from the Eocene Fossil Lake deposits and one from Lake Uinta deposits, both from the Green River Formation, and an additional specimen from the Wind River Formation of Wyoming and Colorado. Namely, Carlea eocenica gen. et sp. nov. (in Carleidae fam. nov.), Labandeiraia riveri sp. nov., L. browni sp. nov., Eodysphaea magnifica gen. et sp. nov., Litheuphaea sp. cf. coloradensis Petrulevicius et al., 2007, Zacallites cockerelli sp. nov., Dysagrion integrum sp. nov., Tenebragrion shermani gen. et sp. nov., Tynskysagrion brookeae gen. et sp. nov., and Oreodysagrion tenebris gen. et sp. nov. Epallagoidea and Amphipterygoidea are most common while Calopterygoidea, Coenagrionoidae and Lestoidea damselflies are less diverse. Genera of zygopteran Dysagrionidae are known from Europe and North America, further supporting the hypothesis of Palaeogene terrestrial interchange. Representatives of Epallagoidea and Amphipterygoidea in the Green River Formation confirm that warm conditions occurred at the time of deposition." (Authors)] Address: Bechly, G.B, iologic Institute, 16310 NE 80th Street, Redmond, WA, 98052 USA. Email: gbechly@biologicinstitute.org

19076. Brockhaus, T. (2021): Einige Libellenbeobachtungen am Czorneboh im Oberlausitzer Bergland (Odonata). Mitteilungen Sächsischer Entomologen 40(140): 154-155. (in German) [Sachsen, Germany. A locality, 120 years ago known as habitat of Nehalennia speciosa, was reexamined. Five excursions in 2006 and 2007 resulted in 15 odonate species, including Coenagrion hastulatum and Lestes virens, Aeshna juncea, Leucorrhinia dubia, L. rubicunda, Sympetrum danae,. N. speciosa was not traced.] Address: Brockhaus, T., An der Morgensonne 5, D-09387 Jahnsdorf, Germany. E-mail: T.Brockhaus@t-online.de

19077. Choong, C.Y.; Mahadimenakbar, M.D. (2021): Dragonflies and Damselflies (Odonata) of Kadamaian, Kinabalu Park, Sabah. Journal of Tropical Biology and Conservation 18: 71-79. (in English) ["The Odonata fauna of Kadamaian was surveyed from 15th to19th October, 2019 during the Borneo Geographic Expedition 2019 Kadamaian. The altitude of the survey area ranged from 400 m to 850 m above sea level, representing the lower part of Kinabalu Park. A total of 23 species in nine families were recorded – 10 species in Libellulidae, three species in Platycnemididae, two species each in Platystictidae, Calopterygidae and Coenagrionidae, and one species each in Chlorocyphidae, Devadattidae, Euphaeidae and Synthemistidae. Of these, only one species is a new record for Kinabalu Park – Pericnemis dowi. The published Odonata records were compiled to produce a species list known from Kinabalu Park. The total number of species known to Kinabalu Park is now 71. Many more parts in Kinabalu Park need to be explored for a more comprehensive Odonata fauna of the park." (Authors)] Address: Choong, C.Y., Centre for Insect Systematics, Faculty Science & Technology, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia. Email: cychoong@ukm.edu.my

19078. Chovanec, A. (2021): Libellenkundliche Bewertung von Restrukturierungsmaßnahmen an einem Fließgewässer in Österreich durch Prae- und Post-Monitoring (Trattnach, Oberösterreich) - Odonatological assessment of river rehabilitation by pre- and post-monitoring (River Trattnach, Upper-Austria). International Dragonfly Fund - Report 163: 1-43. (in German, with English summary) ["In 2019, a 500 m section of the River Trattnach, which is situated in the municipality Schlüßlberg in the Austrian province Upper Austria, has been ecologically enhanced by restructuring the riverbed. The investigation of the Odonata carried out in 2016 (pre-monitoring) and 2021 (post-monitoring) aimed at the evaluation of the success of these measures. Five field trips at three 100 m stretches situated in this section were performed in both years. The regeneration measures at the river caused an increase of the total species number from five to ten and an increase of the number of the certainly, probably and possibly autochthonous species from four to eight. In 2021, four of the five rivertype-specific target reference species were detected: Calopteryx splendens, Calopteryx virgo, Gomphus vulgatissimus, and Onychogomphus forcipatus. The autochthonous occurrence of these rheophilous species and their abundances confirm the river-type specific biocoenotic region of this river section (transition between hyporhithron and epipotamon) and indicate the existence the existence of riverbank vegetation as well as of heterogeneous morphological features causing the formation of a mosaic of different current and sediment conditions. The riverbed restructuration had only little influence on the general course of the river channel, which remained mainly straightened. Therefore, limnophilous accompanying reference species benefited only to a small extent from the regeneration measures. The detection of freshly emerged G. vulgatissimus and O. forcipatus two years after finishing the measures documented the early colonisation of the modified river section by these species. The assessment of the dragonfly-based ecological status of the whole section subjected to rehabilitation measures and of the individual stretches was based on comparing the current dragonfly fauna with a river-type-specific reference community. The Rhithron-Potamon Concept represented the methodological framework. Possible differences between the status quo of the dragonfly fauna and the reference were assessed by the Odonata-River-Zonation-Index and by a scheme of five classes of ecological status stipulated by the EU Water

Framework Directive: “high ecological status”, which corresponds to the reference state, “good ecological status”, “moderate ecological status”, “poor ecological status” and “bad ecological status”. The rehabilitation measures caused an improvement of the dragonfly-based ecological status: According to the results gained in the pre-monitoring, the dragonfly-based ecological status of the whole section was classified as “moderate”. The three individual stretches investigated were ranked as “poor” and “moderate”. The results of the post-monitoring revealed the “good dragonfly-based ecological status” for both, the whole section and the stretches. Even the ecological status of a regulated control-stretch, which was not subjected to rehabilitation measures, changed from “poor” to “moderate”. “Spread effects” from the enhanced section to the still regulated section are assumed to be the reason for this improvement." (Author)] Address: Chovanec, A., Krotenbachgasse 68, 2345 Brunn am Gebirge, Austria. Email: andreas.chovanec@bmlrt.gv.at

19079. Coram, R.A.; Jarzembowski, E.A. (2021): Immature insect assemblages from the Early Cretaceous (Purbeck/Wealden) of Southern England. Insects 2021, 12(10), 942: 23 pp. (in English) ["Simple Summary: The non-marine Lower Cretaceous Purbeck and Wealden rocks of southern England provide an important record of insects that lived alongside the dinosaurs. Most fossil remains are those of adult insects from orders alive today, but immature insects and their trace fossils occur in the same deposits. Terrestrial immatures comprise mostly sessile nymphs of true bugs, whereas the aquatic immature fauna is represented by stoneflies and mayflies (rarely), dragonflies (uncommonly), true bugs and true flies (often common in the Purbeck), and the cases of caddisflies (locally common in the Wealden). These fossils help to shed light on the local palaeoenvironment, such as the salinity of water bodies, as well as on the processes that lead to the fossilization of generally fragile insect remains. Abstract: The record of immature insects from the non-marine Purbeck and Wealden groups (Lower Cretaceous) of southern England is reviewed and expanded. Fossils of adult terrestrial insects are locally common, but terrestrial immature remains are restricted to transported hemipterans, most of which are sessile nymphs or puparia resembling those of extant whiteflies (Aleyrodidae). Remains of immature aquatic insects are more diverse and comprise the extant orders Plecoptera, Ephemeroptera, Odonata, Trichoptera, Hemiptera and Diptera. The Trichoptera are represented by larval cases constructed from a variety of materials corresponding to several ichnogenera. The Wealden immature insects were preserved in predominantly freshwater fluvial settings, whereas the Purbeck ones occur in lagoonal palaeoenvironments, ranging in salinity from brackish to hypersaline. The composition of aquatic immature insect faunas in the latter offers potential for palaeosalinity analysis, although there are complicating factors relating to habitat stability. Uncommon trace fossils such as beetle borings in wood provide evidence of immature insects not represented by body fossils." (Authors)] Address: Coram, R.A., School Earth Sciences, Univ. of Bristol, Bristol BS8 1RJ, UK. Email: rob@britishfossils.co.uk

19080. Dej Vignesh, K.; Manivannan, S. (2021): Diversity of Odonata (Insecta) in Rural and Urban Wetlands of Coimbatore, Tamil Nadu, India. The Indian Forester 147(10): 992-999. (in English) ["A study was conducted to assess the diversity of Odonata in the rural and urban wetlands of Coimbatore, Tamil Nadu, India from August 2018 to January 2019. A total of 4 wetlands from rural and urban were surveyed with a total of 8 families of 32 genera and 45 species were recorded. Among them, 8 families of 21 genera and 26 species from Kallar a tributary stream and 4 families of 20 genera and 25 species from Ukkulam lake of rural whereas 4 families of 15 genera and 18 species from Singanallur lake and 3 families of 9 genera and 10 species from Kurichi lake of urban. Among the anisopterans, Brachythemis contaminata was abundant in the urban lakes, Pantala flavescens in the rural stream and Diplacodes trivialis in the rural lake whereas in the zygopterans, Neurobasis chinensis dominated in the rural stream, and Ischnura aurora dominated over the lakes." (Authors)] Address: Dej Vignesh, K., Zoological Survey of India, Southern Regional Centre, Chennai - 600028, India

19081. Dow, R.A.; Choong, C.Y. (2021): Previously unpublished Odonata records from Sarawak, Borneo, part VII: Odonata from Limbang Division. Faunistic Studies in South-East Asian and Pacific Island Odonata 37: 1-18. (in English) ["Records of Odonata from Limbang Division in Sarawak are presented, based on two surveys. The first survey was made in 2010 by the second author in the Paya Maga area at the border with Sabah. The second survey was made by the first author in 2020, mostly within the Ravenscourt Forest Management Unit, but with two days spent at Paya Maga. 54 species are listed from these two surveys. Several species were recorded from Sarawak for the first time during the surveys reported on: Devadatta tanduk Dow, Hämäläinen & Stokvis, 2015 and two as-yet-unnamed species of Coeliccia; all of these species were previously known from Sabah. Many of the other records are firsts for Limbang Division. Other particularly significant records include Indolestes dajakanus, Protosticta joepani, Telosticta ulubaram, Euphaea basalis, Rhinoneura caerulea, Idionyx montana, Procordulia fusiformis, Hylaeothemis clementia and Orthetrum borneense. Xiphiagrion cyanomelas (form B as discussed in Dow et al. (2021)) is reported using surface tension to perch on the surface of a pond. The identity of the unidentified Devadatta species recorded from the Long Seridan area in Miri Division by Dow et al. (2021) is discussed further. With the records presented here 123 species of Odonata have now been recorded from Limbang Division and 312 from Sarawak as a whole." (Authors)] Address: Dow, R.A., Institute of Biodiversity and Environmental Conservation, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia. Email: rory.dow230@yahoo.co.uk

19082. DuBois, R.B.; Tennessen, K.J. (2021): The puzzling presence of Lestes australis (Odonata: Lestidae) in Wisconsin — Does this species migrate? The Great Lakes Entomologist 54(1&2): 67-73. (in English) ["Lestes disjunctus australis Walker, 1952 (Odonata: Lestidae) was described

as a subspecies of Lestes disjunctus Selys, 1862. In recent decades it has been considered deserving of full species status by most specialists. The core of its eastern North American range is south of Wisconsin, but during April through June of some years, mature individuals, and occasionally reproductive behavior, are observed at shallow ponds and wetlands mostly in the southern half of the state. Since first recorded in Wisconsin in 2002, it has been detected in 13 of Wisconsin's 72 counties. However, there has been no unequivocal documentation of successful reproduction in the state. Various possibilities regarding long-range dispersal or facultative migration of this species and other species of Zygoptera are discussed." (Authors)] Address: DuBois, R.B., Dept Natural Resources, Bureau Natural Heritage Conservation, 1701 North 4th Street, Superior, Wisconsin 54880, USA. Email: rbdubois@gmail.com

19083. Ertas, A., Yasartürk, M., Boz, T.; Kizilkaya, I.T.; (2021): Evaluation of the water quality of Karabal stream (Gediz River, Turkey) and comparative performance of the used indices. Acta Aquatica Turcica 17(3): 334-349. (in English, with Turkish abstract) ["We used seven biotic indices to determine the water quality of Karabal Stream (Gediz River) in West Anatolia, Turkey. The indices were based on benthic macroinvertebrate and physicochemical parameters: Saprobi Index (SI), Biological Monitoring Working Party (BMWP), Average Score per Taxon (ASPT), Family Biotic Index (FBI), Belgian Biotic Index (BBI), EPT-Taxa [%] were used as biotic indices and Shannon-Weaver index (SWDI), Simpsons index (SDI) and Margalef index (MDI) for diversity. Ten taxonomic groups were found in Karabal Stream consisting of Crustacea, Oligochaeta, Gastropoda, Ephemeroptera, Plecoptera, Trichoptera, Odonata, Coleoptera, Diptera, and Hemiptera. The water quality along the stream varied from good class in the upstream stations, to moderate in downstream stations according to the most suitable indices. According to canonic correspondence analysis (CCA), the distributions of Diptera, Oligochaeta, and Hemiptera species are positively correlated to EC, Cl, Turbidity, Temperature, NH_4-N, NO_2-N, and NO_3-N while they are negatively correlated to DO, DOS and pH. The distributions of EPT species are positively correlated to DO, DOS and pH. According to Pearson's correlation, the BBI, BMWP (Original), BMWP (Spanish), and EPT-Taxa [%] metrics were sufficient in the estimation of water quality in the examined watercourse. Considering studies in surface waters of Turkey, the BMWP and EPT-Taxa [%] indices reflect the water quality as correctly in all studies we examined, however, BBI did not always show reliable results. Therefore there is a need for the establishment of a Turkish Biotic Index which takes into account country-specific macroinvertebrates, their abundance, biology, and ecology.] Address: Ertas, A., Ege University, Faculty of Science, Dept of Biology, 35100 Bornova, Izmir, Turkey. Email: alperenertas@hotmail.com

19084. Ferreira, T. (2021): Odonata da Coleção Entomológica Adalberto Antônio Varela-Freire: inventário, identificação e curadoria. BSc. thesis, Centro de Biociências, Universidade Federal do Rio Grande do Norte, Natal: 31 pp. (in Portuguese, with English summary) ["Odonata is an insect order with broad geographic distribution, popularly known as dragonflies and damselflies. They are predators associated with water ecosystems, and therefore they are often used for environmental quality studies. The objective of this study was to inventory the odonates from the Coleção Entomológica Adalberto Antônio Varela-Freire and their storage conditions, to identify the specimens and to indicate measures of curatorship to ensure their long term preservation in accordance to practices conventionally adopted by other entomological collections. A total of 3181 specimens was inventoried, most preserved dry, kept in envelopes in varying conditions (2319 specimens) or ethanol (860 specimens). The identified specimens belong to 2 families (Aeshnidae and Libellulidae) and 14 genera, some of which were recorded for the first time in Rio Grande do Norte. Two hundred specimens were curated, with the major changes being the use of poliethylene zipper lock envelopes and printed labels with data obtained through the processo of inventory. This study increases to 18 the number of species/genera recorded from the state. Even though the number of localities represented in the collection was limited, it still constitutes an important record of the state's dragonfly fauna, which should be further studied and have its data uploaded to public biodiversity databases, so that it becomes more accessible to researchers and to the general population as well." (Author)] Address: not stated

19085. Joshi, V.; Mysa, R.C. (2021): Hydrodynamic analysis of tandem flapping hydrofoils. International Conference on Ocean, Offshore, and Arctic Engineering (OMAE). Vol. 6. Paper No: OMAE2021-62191, V006T06A006: 12pp. (in English) ["Flapping hydrofoils in tandem configuration find applications in wave gliders, dragonfly, dorsal-tail fin interaction in fishes, among others. The flapping motion consists of a combination of heaving and pitching motion. This type of motion involves complex interaction of the vortices shed from the upstream hydrofoil with the downstream hydrofoil, thus influencing the performance of the downstream hydrofoil. A two-dimensional stabilized finite element moving mesh framework is utilized for the current study. The important parameters which influence the flow interactions are the chord size ratio and the gap between the hydrofoils. The size ratio is defined as the ratio of the chord of the upstream hydrofoil to that of the downstream hydrofoil. The size ratio is varied from 0.25 to 1. The gap is varied from one chord length to 3 chord lengths of the downstream foil. The study focuses on the effect of the size ratio, gap and flapping kinematics based on sinusoidal heaving and pitching motion on the detailed flow dynamics of the tandem hydrofoils. The effect on the thrust coefficient and hydrodynamic efficiency is explored and compared with that of an isolated hydrofoil. The results obtained from the study can pave way for a better understanding with regard to engineering designs based on biomimetics." (Authors)] Address: Vaibhav Joshi, V., Birla Institute of Technology & Science Pilani, Goa, India