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2004

19086. Futahashi, R.; Futahashi, H.; Araki, Y.; Negoro, H. (2004): The dragonflies and damselflies of Toyama prefecture, central Honshu, Japan. Spec. Publs Toyama Sci. Mus. 17: ii + 220 pp. (in Japanese, with english summary) ["We investigated the odonata fauna in Toyama Prefecture mainly in the last 10 years. Our investigations were carried out on the largest scale in Japan at the prefecture level for the times of survey, the number of places, and the amount of data. In this report, we listed up the data of the 9,671 specimens of 84 odonate species belonging to 11 families contributed to Toyama Science Museum by Ryo Futahashi, Hiroyuki Futahashi and Yoshimasa Araki. Other original data mostly in Futahashi and Araki's collections were also reported. Consequently, many new records of collection and localities were added for many species. Based on these data, we reported 86 species and 5 hybrids from 11 families recorded in Toyama Prefecture. The characters such as distribution, life cycle, habitat, morphology, behavior were commented for each species. The present condition of Odonata fauna of Toyama Prefecture was comprehensively revealed. Only the following two have not been found in this investigation (the last collection year in parenthesis); Gomphus postocularis (1972) and Onychogomphus viridicostus (1959). Here we show three tables; Habitat, distribution in neighbor prefecture and behavior of 86 species known in Toyama Prefecture (Table 1). All the collection data of Odonata species for every city, town and village in Toyama Prefecture (Table 2). Fluctuation in adult occurrence for each of 86 species and 5 hybrids known in Toyama Prefecture (Table 3). In addition, a map of the distribution in Toyama Prefecture and a graph showing the seasons of occurrence of the adult are presented for each species and hybrids." (Authors) Address: Futahashi, R., Fujiwara Lab., Univ. Tokyo, Biosci. Bldg 501, Kashiwa, Chiba, 377-8562, Japan

19087. Groenendijk, D. (2004): Mogelijkheden voor monitoring van de rivierrombout. Rapportnummer VS2004.038,

De Vlinderstichting, Wageningen: 14 pp. (in Dutch) ["Introduction and Purpose: Stylurus flavipes belongs to a special dragonfly family. They are often difficult to find as a dragonfly, but the larval skins are often in a conspicuous place. The current situation is therefore that they are not well represented in the National Monitoring Network for Dragonflies, and it is therefore not possible to calculate trends for these species. Yet this is important, because within the Netherlands, two species of dragonflies, *S. flavipes* and *Ophiogomphus cecilia*, are listed on the Habitat Directive. Therefore, the aim of this study was to investigate whether there is a method of using larval skin counts to include the *S. flavipes* and possibly other species of Gomphidae in the dragonfly monitoring network. Method: *S. flavipes* was found again in 1996, after an absence of many years. Since then the species has made a considerable advance and is found in most larger river systems in the Netherlands. In 2004 eight counting routes of about one kilometre were set out in the catchment of the Rhine and Waal in the direct vicinity of Wageningen. These routes were all walked twice between 28 June and 17 July, with all larval skins recorded per groyne section. Results: In total, over 80 exuviae of the *S. flavipes* were found on the eight counting routes. Some imago were also found. Along the Rhine routes more larval skins were found in direct comparison to the routes along the Waal. Counting one counting route took on average over an hour. Conclusion: The results show that with a good choice of counting routes, counts of larval scales of the river scrub offer a good opportunity for inclusion in the NEM and then in the future counted by volunteer counters. This method of counting offers the best chance for *S. flavipes* and probably also for *Gomphus vulgatissimus*. It is important that the counting route is shortened to a maximum of 500 metres and that counting is not carried out at wind force 4B and above. About the necessary counting frequency no statements can be made yet." (Author/Deepl)] Address: De Vlinderstichting, Postbus 506, 6700 AM Wageningen, The Netherlands. E-mail: info@vlinderstichting.nl

19088. Lazaridou-Dimitriadou, M.; Koukoumides, C.; Lekka,

E.; Gaidagis, G. (2004): Integrative evaluation of the ecological quality of metalliferous streams (Chalkidiki, Macedonia, Hellas). *Environmental Monitoring and Assessment* 91: 59-86. (in English) ["The present study reports on a year-long (November 1997–November 1998) study of water quality in streams of the Olympias and Skouries areas of Chalkidiki (Hellas), subject to past and present mining activities. Benthic macroinvertebrates were collected from 18 sampling sites at five sampling intervals, while several physico-chemical parameters of the water (D.O., pH, temperature, nutrients etc.) were also measured. Five European biotic indices and scores and two multivariate statistical methods (CANOCO, FUZZY) were applied to the macroinvertebrate data. The concentration of various trace metals in the water, sediment, fish and crustaceans were also measured. Most sampling stations exhibited a highly diverse macroinvertebrate fauna during the whole year. However, a slight amelioration of water quality was observed during the high-flow period (winter and early spring), regarding diversity of several invertebrate groups, especially pollution-sensitive families, which decreased. The European biotic indices and scores proved to be relatively ineffective in describing water quality and it is suggested that an Hellenic biotic indice or score should be created. The bioaccumulation studies indicated variable effects of trace metals and organic load on macroinvertebrates according to the degree of load." (Authors) Odonata; "Gomphidae, Aeshna, Calopteryx, Cordulegaster spp."] Address: Lazaridou-Dimitriadou, M., Dept Zool., School of Biology, Fac. Sci., Aristotle Univ., Thessaloniki, Greece. E-mail: mLazarid@bio.auth.gr

19089. Lill, S. (2004): Die Libellenfauna im Einzugsgebiet der Pfrimm (Pfalz) unter besonderer Berücksichtigung der Indikatorqualitäten der Imagines von *Calopteryx virgo*, *Platycnemis pennipes*, *Orthetrum cancellatum* und *Crocothemis erythraea*. Diplomarbeit. Universität des Saarlandes: 164 pp. (in German) [Rheinland-Pfalz, Germany. "In the years 2001 to 2003 (with a focus on April to October 2003), the occurrence and distribution of the dragonfly fauna in the catchment area of the Pfrimm was investigated. The selected area lies between the source of the Pfrimm southwest of Sippersfeld and the eastern border of the Donnersberg district between Zellertal and Wachenheim. It includes parts of the natural areas Pfälzerwald, Nordpfälzer Bergland and Rheinhesisches Tafel- und Hügelland. The survey of odonates mainly focused on the observation of reproductive and hatching imagines. Dragonflies were searched for at selected flowing and still waters and their surroundings. In addition, larvae and exuviae were also observed. A total of 32 dragonfly species were found in the study area, 29 of which were considered to be native to the area. It is noteworthy that only 3 of the odonates recorded were purely running water species. Of the 32 dragonflies recorded, 21 (= 64 %) are considered endangered according to the Rhineland-Palatinate Red List (EISLÖFFEL et al. 1993), which means that 33 % of the "endangered species" in Rhineland-Palatinate occur in the study area. The detected dragonflies were briefly described with regard to their ecology, and possible reasons for their distribution in the area were discussed. An

essential part of this work was the investigation of the indicator suitability of the imagines of *C. virgo*, *P. pennipes*, *O. cancellatum* and *C. erythraea*. The following results were found for the study area: *C. virgo* is a good indicator for open, sunny stream sections with well-developed vegetation structures in the study area. Monotonous stream sections lined with gallery forest and thus shaded were avoided due to the lack of favourable vegetation conditions here. In the study area, *P. pennipes* is only suitable to a limited extent as an indicator for permanent, sunny still waters with structurally rich vegetation at the edge of the bank and in the direct vicinity of the water body, whereby a preference for ponds is obvious. At less diverse or less vegetated stillwaters, the species flew only in smaller numbers of individuals. *P. pennipes* occurred extremely rarely and in low abundance at the watercourses in the study area; the streams are not suitable or at best suboptimal for the species. *O. cancellatum* has only limited indicator qualities in the study area. All habitats had in common a continuous exposure to sunlight, the size of the water body played a rather subordinate role in the colonisation. A completely free water surface as well as shore areas free of or poor in vegetation could be found predominantly, but not at all water bodies surveyed. However, large abundances on the sparsely vegetated bank sections of the surveyed sampling sites suggest that a lack of vegetation played a corresponding role in the choice of habitat. In the study area, *Crocothemis erythraea* can be regarded as a good indicator for eutrophic, well-sunlit, wind-protected still waters with sufficient shallow water zones in climatically favourable locations. The occurrence of the fire dragonfly in the Pfrimm is probably promoted by the presence of habitat structures that provide wind protection and at the same time cause heat accumulation. The distribution focus of *C. erythraea* in the study area is in the climatically favoured Rheinhesische Tafel- und Hügelland. The findings at the sampling sites in the Pfälzerwald and Nordpfälzer Bergland indicate a possible spread of the dragonfly in these areas as well. Of the proportionate natural areas in the study area, the largest number of dragonfly species was recorded in the Rheinhesisches Tafel- und Hügelland. Due to the favourable climatic conditions of this area, most of the warmth-loving species were observed here, as expected, but the Euro-Siberian species also experienced their strongest distribution here. In the study area, protection and management measures are particularly appropriate along the watercourses. The partly complete shading of the streams by a uniform, monotonous gallery forest only allows colonisation by stream dragonflies in the few open areas. By thinning out sections of the wooded area, which also takes into account the requirements of other species groups, more favourable settlement opportunities could be created for dragonflies of flowing waters." (Author/DeepL) People interested in relationship between music and dragonflies will be interested in the current activities of Stefan Lill: <https://www.vandenplas.de/band/> Address: not stated

19090. Pagel, M. (2004): Maßnahmenkonzept zur Optimierung der Lebensräume von Amphibien und Libellen im

Zollhausried bei Blumberg. Diplomarbeit. Hochschule Nürtingen: 127 pp. (in German) [Baden-Württemberg, Germany. "In the present work, the amphibian and dragonfly species of the Zollhausried nature reserve are first presented and their population trends are shown on the basis of earlier mapping results and extensive current surveys. It becomes clear, especially in the case of amphibians, that a decline in species as well as a decrease in abundance can be observed in the area for all ten species studied. The Great Crested Newt (species of Community interest according to Annex II of the Habitats Directive), the Midwife Toad and the Natterjack Toad could no longer be detected in 2004. The dragonflies of the study area are less specially adapted, but here too a decline can be observed, especially in the Red List species. As a further basis, numerous structural and vegetation-typical features of all reproduction waters were recorded and described in a uniform and comparable manner using various evaluation matrices. The current habitat availability was then compared with the requirements of the amphibian and dragonfly species currently or formerly occurring there. The deficits that became apparent could be compiled in a catalogue, which forms the sound basis for numerous measures, all of which pursue a common goal: The enhancement of the amphibian and dragonfly habitats of the Zollhausried. A particular deficit was identified as the lack of dynamics of the former peat digging, which had a landscape-altering effect and created vegetation-free areas. It is precisely on these sites that the species of the former stream and river floodplains are dependent. By designing several measures, a careful attempt is being made to integrate some dynamic structures into the sensitive lowland moorland. The occurrence of the individual species and the redesign measures are also shown in maps." (Author/DeepL)] Address: not stated

19091. Polhemus, D.A.; Helgen, K. (2004): Preliminary studies on the biodiversity of mammals and aquatic insects in East Timor. Report to the Ministry of Environment, Dili, Timor-Leste: 35 pp. (in English) ["Seventeen sampling stations in East Timor, ranging in elevation from 0 to 1585 meters elevation, were sampled for aquatic insects from 11 to 21 November 2003. The sampling stations included sites on the Mt. Ramilau massif, the Baucau Plateau, and the limestone mountain ranges near Lospalos, in the far east. Sampling concentrated on three major groups that had been employed in previous aquatic biodiversity surveys in the Australasian region: Heteroptera (aquatic true bugs), Zygoptera (damselflies), and Gyrinidae (whirlygig beetles), with other aquatic insect taxa also collected on an opportunistic basis. Thirty-eight species in 26 genera of aquatic Heteroptera were collected, of which at least 7 are new to science, and 2 others are described species reported from Timor for the first time. In the Zygoptera, 5 species in 4 genera were collected, all representing species previously reported from the island. In the Gyrinidae, 4 species in 3 genera were collected, all once again representing previously reported species, although many of these had not been collected in over 70 years. Aquatic insect diversity in East Timor was moderately high by regional standards, and similar to that seen in

corresponding elevational zones in western Timor. The richest overall site sampled was the Tchino River south of Lospalos, which supported 17 species of aquatic Heteroptera, 2 species of Gyrinidae, and 2 species of Zygoptera. The richest individual site for Zygoptera was the Irasiquero River east of Lospalos, where 4 species were collected. The richest sites for Gyrinidae were the Tchino River near Lospalos and the upper Eralisau River south of Maubisse, both of which harbored completely different sets of 2 species each; the latter site was also the second richest site for aquatic Heteroptera, supporting 12 species. The site with the highest number of Timor-endemic taxa across these three groups combined was the Tchino River, which supported 11 Timor endemics out of the 21 taxa present, for an local endemism rate of over 50 percent. Throughout East Timor there was clear evidence of catchment degradation due to overgrazing by domesticated ungulates such as goats and banteng in the lowlands and water buffalo in the highlands, which have damaged riparian zones across all elevational ranges. The rivers in best overall condition were those of the far east, in the Lospalos area, where higher rainfall and some degree of local fencing serve to mitigate ungulate impacts. Due to poorly functioning water systems in East Timor at the present time, this catchment degradation has a direct effect on the quality of water supplies being used by local families, and it is suggested that a program of selective fencing around watercourses, coupled with construction of livestock watering troughs at some distance from streams, would benefit both stream ecology and public health." (Authors)] Address: Polhemus, D., Dept. of Natural Sciences, Bishop Museum, 1525 Bernice St., Honolulu, HI, 96817, USA. Email: bugman@bpbm.org

19092. Towers, N.M. (2004): Invertebrate community structure along a habitat-patch size gradient within a bog pool complex. Doctor of Philosophy thesis, University of Edinburgh: Vii, 152 pp. (in English) ["This thesis characterises species richness and community structure over a habitat patch size gradient of a typical bog-pool complex, investigating the effect of pool size on aquatic invertebrate communities. In this study, twenty-two pools were surveyed ranging in area from 8.6 m² to 280.9 m² within a single complex at Forsinard in the north of Scotland. Three different sampling methods were used: baited and unbaited activity traps and a sediment sampler. Univariate and multivariate methods were used to investigate the effects of pool size and pool location within the complex on species richness and community structure. The research expands our knowledge of peatland pool invertebrates by providing a comprehensive survey of the aquatic invertebrate fauna representative of the Flow Country of northern Scotland. Two IUCN British Red Data Book species were recorded: *Coenagrion hastulatum*, and the cased caddisfly, *Nemotaulius punctatolineatus* (Retzius). Three species of aquatic Coleoptera were collected that have Nationally Notable status according to Ball (1986): *Dytiscus lapponicus* Gyllenhal, *Ilybius aenescens* Thomson and *Gyrinus minutus* Fabricius. All these species are typical of, and often restricted to, this habitat type. The three different sampling methods differed in their sampling

efficiency and each gave a different species spectrum. A distinct seasonal change in the samples was also observed. The number of taxa caught per standardised sampling unit (taxon density) was investigated over the pool size gradient. Relationships between taxon density and area were weak or non-existent in both unbaited activity traps and sediment samples. However, the number of beetle species caught in baited activity traps increased significantly with pool size, indicating that the total number of beetle species per pool may also increase over the size gradient. Ratios of the number of predator taxa to prey (non-predator) taxa for each pool ranged from 0.34 to 0.78 with a mean of 0.49 and were not affected by pool area or total taxonomic richness. Taxa displayed a positive abundance-occupancy relationship and the possible underlying mechanisms involved in creating this pattern are discussed. Multivariate techniques showed that pool area, depth, and distance from the centre of the pool complex (periferality) all had a small but significant affect on community composition and that between certain taxa there were distinctly different optima along the pool size gradient. These results are discussed in the context of species area theory." (Author)] Address: not stated

2016

19093. Andersen, E.; Nilsson, B.; Sahlén, G. (2016): Survival possibilities of the dragonfly *Aeshna viridis* (Insecta, Odonata) in southern Sweden predicted from dispersal possibilities. *Journal of Insect Conservation* 20(2): 179-188. (in English) ["We use public records from 1980 to 2014 to analyse survival of the EU Annex IV species *Aeshna viridis* in Sweden, a dragonfly strongly associated with the plant *Stratiotes aloides*. We clustered localities with *S. aloides* based on assumed dispersal abilities of *A. viridis*, using a dispersing radius of 2–100 km, calculating the proportion of sites with *S. aloides* that *A. viridis* is able to reach. If mean dispersal capability is high (40 km or above) 92.6 % or more of the localities are connected. For a good disperser, the probability of long-time survival is good. We further analysed the species richness of other Odonata and aquatic plants at 98 localities from the dataset. *A. viridis* co-occurred with more Odonata in the presence of *S. aloides* and running water but not in lakes. *S. aloides* sites had a higher number of other aquatic plants. Area had no impact on the occurrence of the species. For the present situation we surveyed 32 localities with known occurrence of the species. Only half of the sites for *S. aloides* contained any specimens while *A. viridis* occurred in the same number of sites. The species co-occurred in only 8 of 32 sites. In four sites *A. viridis* larvae appeared among *Menyanthes trifoliata*, *Phragmites australis*, *Potamogeton natans* and *Sphagnum* spp., indicating that at high latitudes *A. viridis* breeds among other species. Indirect monitoring based only on *S. aloides* would underestimate the number of populations of the dragonfly." (Authors)] Address: Sahlén, G., Ecology and Environmental Sciences, School of Business, Engineering and Science, Halmstad University, P.O. Box 823, 30118, Halmstad, Sweden

19094. Banjo, F.M.; Sebiomo, A. (2016): Biodiversity and

seasonal variation of macro invertebrates in four water bodies in Odogbolu Local Government area of Ogun State. *African Journal of Science and Nature* 3: 57-61. ["The biodiversity and seasonal variation of aquatic macroinvertebrates in four different water bodies in Ijagun, Ijele, Odepo and Imaweje in Odogbolu Local Government Area of Ogun State were investigated using modified kick sampling technique between July and December 2014. The aquatic macroinvertebrates were sampled twice in a month using a scoop net (0.5mm mesh size with 0.4m diameter). The collected samples were preserved separately in 10% formalin and later identified. The physical properties (air and water temperature (oC), water current and water depth) of the water bodies were measured. Analysis of variance and spear man analytical tools were used to analyze the collected data. The different aquatic macro-invertebrates encountered belong to the super phylum Arthropoda, and three phylaviz: Mollusca, Annelida and Nematoda. The most abundant macro-invertebrate group was insects belonging to the orders Diptera (*Simulium* sp., *Chironomus* sp., *Anopheles* sp., and *Cricotopus* sp.), Odonata (*Agrocnemis femina*, *Macromia* sp and *Calopteryx* sp.), Coleoptera (*Dysticus marginalis* and *Hydrophilus* sp.), and Heteroptera (*Gerris lacustris*). The correlation coefficients (rho) of water depth, water current, water and air temperature in relation to frequency of occurrence of macro invertebrates were found to be -6.2, -4.2, -4.6 and -2.6 respectively. Water depth was the strongest factor that could determine the abundance of organisms. All physical properties showed inverse relationship with variation of aquatic macro invertebrates in the water bodies." (Authors)] Address: Banjo, Folake Mary, Department of Biology Education, Tai Solarin University of Education, Ijagun, Ogun State E-mail: flkmary@yahoo.com

19095. Beukema J.J.; Smit, H. (2016): Counts of Odonata in the Zwanenwater nature reserve. *Brachytron* 18(1): 30-37. (in Dutch, with English summary) ["Zwanenwater is a dune area in the northwestern part of the Netherlands. Most of the Odonata in the area occur at small (some tens to a few hundreds of m²) and shallow pools. In dry periods, part of these pools dry up completely. At 12 pools, numbers of Odonata were counted 4 to 8 times per year during the 9-year period 2007-2015. A second observer counted independently at the same pools. Due to a slight difference in counting method, he recorded about 15% more individuals. Nevertheless, highly similar long-term fluctuation patterns and local differences in Odonata abundance were found by the two observers. Particularly few Odonata were encountered in 2010 and 2011 after a serious drought at the end of the summer of 2009, causing complete drying up of several pools and serious reduction of the surface area in the remaining pools. Recovery of numbers was a slow process, in particular in Zygoptera. In 2010, individuals of these small-sized species were even fully absent at the pools that had been completely dry in 2009. Only by 2013 (deeper pools) or 2014 (shallower pools) had the numbers and species composition recovered to pre-drought levels. We recommend deepening of the central parts of some shallower pools by about 0.5 m to create more stability in Odonata

abundance." (Authors)] Address: Beukema, J.J. E-mail: Jan.beukema@nioz.nl

19096. Billqvist, M. (2016): Genomgång och digitalisering av trollsländor och dykarskalbaggar på Lunds Zoologiska museum. Naturvårdsverket 106 48 Stockholm: 9 pp. (in Swedish) ["The collections of previously unrecorded and in many cases unidentified dragonflies and divers at the Biological Museum, Lund University, have been reviewed, and from the material species occurring in the Habitats Directive have been sorted out. Five of the six species of dragonflies listed in the Directive were found in Sweden: green mosaic dragonfly *Aeshna viridis* (18 records), green river dragonfly *Ophiogomphus cecilia* (9), powdered dragonfly *Leucorrhinia albifrons* (69), broad dragonfly *Leucorrhinia caudalis* (21) and lemon-spotted dragonfly *Leucorrhinia pectoralis* (39). (The sixth species, the Siberian winter dragonfly *Sympetma paedisca*, is only found in Sweden occasionally and is therefore missing from the collections.) ... There is a very large amount of material available, so the mission has focused on recording the records of the species concerned from different localities and landscapes, and those not previously recorded by the Species Data Bank in 1998 (Ragnar Hall 1998). The collections consisted of different types of material; mounted dragonflies and divers, dragonflies in envelopes, animals in spirits, larvae and caterpillar skins. This study was limited to mounted material and material in envelopes. Animals in spirits, larvae and larval skins can be reviewed if necessary. All collections recorded were also individually tagged with museum labels." (Author/DeepL)] Address: Billqvist, M., Länsstyrelsen Östergötland, Postadress 581 86 Linköping, Sweden

19097. BioDrawversity (2016): Assess operational impacts on emergence of state-listed odonates in the Connecticut River: 2014–2016. Study report. Northfield Mountain Pumped Storage, Project No. 2485 and Turners Falls Hydroelectric Project No. 1889. Leverett, MA.: 118 pp. (in English) ["Pumped Storage Project (Northfield Mountain Project, FERC No. 2485) and the Turners Falls Hydroelectric Project (Turners Falls Project, FERC No. 1889). FirstLight has initiated with the Federal Energy Regulatory Commission (FERC, the Commission) the process of relicensing the Northfield Mountain and Turners Falls Projects using FERC's Integrated Licensing Process (ILP). The current licenses for the Northfield Mountain and Turners Falls Projects were issued on May 14, 1968 and May 5, 1980, respectively, with both set to expire on April 30, 2018. This report documents the results of Study No. 3.3.10: Assess Operational Impacts on Emergence of State-Listed Odonates in the Connecticut River. The study goal was to assess potential effects of Project operations on emerging dragonflies (Insecta: Odonata; hereafter called "odonates") in the Connecticut River. To meet this goal, field surveys were conducted to characterize the habitat, assemblage structure, and emergence and eclosure behavior of odonates in the Project area. This information was compared with existing data on odonates and water surface elevation (WSEL) collected throughout the Project area. Three phases of fieldwork

were completed. Phase 1, completed in 2014, included qualitative surveys of odonate larvae and exuviae at eight sites in the Connecticut River to determine species assemblage structure and to collect habitat data. For teneral or exuviae, biologists recorded the vertical and lateral distance from the water's edge, and the substrate that each was collected on. Phase 2, completed in 2015, included quantitative odonate surveys, observations of emergence and eclosure behavior, and concurrent collection of WSEL and water temperature data. Surveys for emerging larvae, exuviae, and teneral were conducted at five sites, with six transects per site, during eight biweekly sampling periods from late May to early September. Biologists looked for larvae exiting the water or crawling on land, and attempted to track and record the time it took for individuals to complete eclosure and fly away. For each exuvia and teneral, the vertical height above the water's surface, the distance from the water's edge, and its eclosure substrate was recorded. Phase 3, completed in 2016, was intended to increase sample sizes for eclosure duration for state-listed odonates and to collect additional data on the vertical heights and horizontal distances traveled prior to eclosure. The speed for all or part of the eclosure process was recorded for 180 specimens, with nearly 90% of these observed in 2016. Surveys for emerging and eclosing larvae were conducted at eight sites in the Turners Falls Impoundment (TFI) and downstream from the Turners Falls Dam, on warm sunny days during peak emergence from late May through mid-July. A total of 17 species were collected from 2014 to 2016, including the state-listed *Gomphus abbreviatus*, *Gomphus vastus*, *Gomphus ventricosus*, *Neurocordulia yamaskanensis*, and *Stylurus amnicola*. Species found most frequently in the riverine environments in the bypass reach and downstream from Cabot Station in the Connecticut River included *Gomphus vastus*, *Boyeria vinosa*, *Stylurus spiniceps*, *Ophiogomphus rupinsulensis*, *Neurocordulia yamaskanensis*, *Dromogomphus spinosus*, *Gomphus abbreviatus*, and *Macromia illinoensis*. The lower TFI (Barton Cove) was inhabited by several species more tolerant of lentic conditions, such as *Epithea princeps*, *Perithemis tenera*, and *Libellula* sp.

19098. For all species combined, larvae crawled a median vertical height of 5.5 ft from the water's surface, and a median distance of 12.5 ft from the water's edge. Among the riverine species, crawl height was greatest for *Macromia illinoensis*, *Gomphus abbreviatus*, and *Gomphus vastus*; each of these species crawled a median height of near or above 7 ft. Riverine species that crawled the shortest height from the water's surface included *Stylurus amnicola* (median = 2.2 ft), *Stylurus spiniceps* (median = 3.4 ft), and *Ophiogomphus rupinsulensis* (median = 3.5 ft). The more lentic species collected in Barton Cove crawled shorter distances from the water's surface than the riverine species. Average horizontal crawl distance was usually 10-15 ft for most species, with maximum distances often 3-4 times greater than the average. Shortest crawl distance was for *Perithemis tenera* (a lentic species that prefers to emerge on aquatic vegetation) and *Stylurus amnicola*. Considering

crawl height and crawl distance together, the riverine species that tended to eclose closest to the water were *Stylurus amnicola*, *Stylurus spiniceps*, and *Ophiogomphus rupin-sulensis*. In general, species eclosed on a wide variety of available substrates. The time elapsed from when a larva stopped to when it completed metamorphosis ("Start to Free") ranged from 7 to 30 minutes (average= 18 minutes). The time elapsed from completion of metamorphosis to flight ("Free to Flight") ranged from 7 to 96 minutes (average = 39 minutes). Together, these two time periods comprise the critical time period from when a larva stops to eclose to when it flies away ("Start to Flight"). A total of 170 specimens were observed for the entire critical time period. The average duration was 58 minutes and ranged from 24 to 126 minutes. In terms of understanding potential effects of water level fluctuations, the concern is for those species that tend to remain close to the water's edge, especially in areas of the river where water level fluctuations and rates of change are greatest. For the analysis, Critical Protective Rates (CPR) (ft/hr) were computed for species and species groups, using climbing height quantiles divided by a conservative eclosure duration of 2.0 hrs. CPR values were compared to the 95th percentile of the maximum hourly rates of change (MHR-95%) at several representative sites in the TFI and downstream from Cabot Station, derived from the hydraulic models for the daily period from 4am to 5pm, from May 15 to August 15. The hydraulic model for the TFI was based on data from 2000-2015 (excluding 2010 due to the extended outage at Northfield Mountain), and the hydraulic model for downstream was based on data from 2008-2015 (excluding 2010). For the bypass reach, empirical water level data from 2014-2015 was used. This provided a means of assessing the potential impacts to species or species groups, based on their behavior (climbing height and eclosure time) and the rate of water level changes at locations throughout the Project area. Water level fluctuations and rates of change may affect odonate emergence in areas of the Connecticut River closest to Cabot Station during the seasonal (May 15-August 15) and daily (4am to 5pm) periods evaluated, which correspond to peak emergence periods for odonates. State-listed odonate species documented in these areas include *Gomphus abbreviatus*, *Gomphus vastus*, *Neurocordulia yamaskanensis*, and *Stylurus amnicola*. Predicted effects were highest for *Stylurus amnicola*; at least 30% of the population, and closer to 50% near Cabot Station, were at risk of inundation based on the MHR-95%. Only a small percentage of the population of *N. yamaskanensis*, *G. vastus*, and the *Gomphus* Group were potentially affected by inundation based on MHR-95%, and these effects were most pronounced close to Cabot Station. Among co-occurring riverine species, *S. spiniceps*, *O. rupin-sulensis* and *D. spinosus* were likely most affected by water level fluctuations, based on the tendency of these species to eclose closer to the water." (Authors)] Address: Biodrawwersity LLC, Ethan Nedau, Leverett, MA 01054, 206 Pratt Corner Road, USA

19099. Caparoso, K.R.; Medina, M.N.D.; Jumawan, K.M.; Villanueva, R.J. (2016): Species composition and status of

Odonata in Malabog, Paquibato District Davao City, Philippines. Univ. of Min. Intl. Mult. Res. Jour. 1(2): 158-163. (in English) ["Despite series of Odonatological expeditions in Mindanao, there are still areas with no Odonata record. The present paper presents the list and status of Odonata fauna in Malabog, Paquibato District, Davao City Philippines. Odonates were captured using hand picking and hand net for illusive species in five (5) sampling sites: Malabog River, Macaduhong River and its tributaries, Malabog spring, and Maglipayan River. A total of 208 individuals collected comprising of 28 species under 19 genera and 9 families. Zygoptera is represented by seven families comprised of 15 species of which 12 (80%) are Philippine endemic and 5 species are found only in selected areas of Mindanao. Anisopteran record composed of 2 families, Gomphidae and Libellulidae where only 3 out of 13 species or 23% are Philippine endemic. Increase of sampling areas and period for further studies and an immediate conservation effort must be conducted to areas with high endemism is recommended."] Address: Medina, M., Research and Publication Center, University of Mindanao, Davao City Philippines, Email: mnd_medina@umindanao.edu.ph

19100. Chelmick, D.; Seidenbusch, R.; Boudot, J.P.; Brochard, C. (2016): The exuviae of the Urothemistinae of the Arabian Peninsula including the first description of the exuvia and final instar larva of *Urothemis thomasi* Longfield 1932 (Odonata: Libellulidae). *Tribulus* 24: 97-108. (in English) ["The exuviae of all four species of Urothemistinae known from the Arabian Peninsula (*Macrodiplax cora*, *Selysiothemis nigra*, *Urothemis edwardsii* and *U. thomasi*) were collected on recent surveys in UAE and Oman. The exuvia of *Urothemis thomasi*, first discovered in 2013, is described here for the first time. This paper, when used in conjunction with Suhling et al. (2014), provides sufficient information for all species of Libellulidae currently known from Arabia to be identified from final instar larvae and/or exuviae. It is hoped that this will encourage local naturalists to collect and identify specimens, which will improve knowledge of this region of which large areas remain little known." (Authors)] Address: Brochard, C., Marsstraat 77, 9742EL Groningen, The Netherlands. E-mail: info@cbrochard.com

19101. Chen, G.; Jia, Q.; Hou, L.; Zhang, Y.; Zhao, Y.; Qin, B. (2016): Preliminary survey on the diversity of Odonata in Zhangye National Wetland Park. *Journal of Ningxia University (Natural Science Edition)* 37(4): 470-475. (in Chinese, with English summary) ["The article made field survey on odonata in Zhangye wetland with the method of combining net capturing with visual inspection to understand the species distribution situation of Odonata in Zhangye wetland and collected totally 834 specimens, which belong to, by authenticating, 5 families, 13 genus and 19 species, among which, Anisoptera is identified as 3 families, 9 genera and 14 species and Zygoptera, 2 families, 4 genera and 5 species. Of all the collected species, Libellulidae is richest in categories, the *Sympetrum pedemontanum* of which, has the maximum species individual amount 127 individuals, accounting for 15.23% of overall collected individuals. The

data investigated were under calculation and analysis with quantitative degree structural proportion relation between species, population diversity index and population growth and decline in different seasons. The population structure of Odonata in Zhangye wetland is comparatively stable, the quantitative distribution, however, varies in different living condition; the diversity of dragonfly population varies as the change of seasons, which conforms to the local climatic variation characteristic and the life history of dragonfly as well." (Authors)] Address: Maize Seed Safety Treatment & Research Center, Hexi Univ., School of Agriculture & Biotechnology, Hexi University, China

19102. Coulter, J.P.; Bartels-Hardege, H.; Gennard, D.E.; Mill, P.J.; Cowell, A.; John, E.A.; Hayes, W. (2016): *Aeshna grandis* larvae detect chemical cues derived from carrion: evidence of chemically-mediated food detection? (Odonata: Aeshnidae). *Odonatologica* 45(3/4): 191-212. (in English) ["Odonate larvae locate live, moving prey using a range of predominantly visual and mechanical cues. However, this does not explain observations of larval Odonata in association with submerged corpses, i.e., whether larvae are attracted by chemical cues emanating from submerged dead bodies. Hence the chemosensory capabilities of larval *Aeshna grandis* previously fed on living prey were tested under circumstances in which visual and mechanical perception was impossible, using model 'corpses', i.e., solid, homogenised, and dialysed tilapia, in link-tank test chambers. Results indicated that *A. grandis* larvae recognised cues emanating from the 'carrion' responding by moving in the source direction. Larval behavioral choice tests in link-tanks were also carried out on a selection of amino acids known to be released on tissue decomposition. Larvae responded positively to taurine, proline, L-glutamic acid, and glycine by moving in the direction of the source. These amino acid triggers were assessed electrophysiologically by recording from the antennal nerve. Responses depended on both the amino acid and its concentration. A positive electrophysiological response was noted for glycine at concentrations from 10⁻⁴ to 10⁻⁸ g g⁻¹ and for taurine, proline, and L-glutamic acid at a concentration of 10⁻⁵ g g⁻¹. No response was recorded for glutamate over a range of concentrations from 10⁻² to 10⁻⁶ g g⁻¹. Therefore *A. grandis* larvae are able to respond to non-visual cues, such as some of the chemicals released during tissue breakdown, suggesting that, in the absence of live prey, their search for food may be chemically-mediated." (Authors)] Address: Gennard, Dorothy, School Life Sciences, Joseph Banks Laboratories, University of Lincoln, Lincoln, UK, LN6 7DL, UK. E-mail: dgennard@lincoln.ac.uk

19103. Craves, J.; O'Brien, D. (2016): Common Baskettail, *Epitheca cynosura* (Odonata: Corduliidae), with extensive dark wing tips. *Argia* 28(3): 11-12. (in English) [18-VI-2016, Three Rivers State Game Area, Cass County, Michigan (41.861°, -85.763°).] Address: Craves, Julie, Rouge River Bird Observatory, University of Michigan-Dearborn, Dearborn, Michigan, USA. E-mail: jcraves@umich.edu

19104. Daemen, F.; Huysmans, M.; Munch, P.; De Knijf, G.

(2016): The Lilypad Whiteface (*Leucorrhinia caudalis*) back in Flanders (Belgium), after an absence of 100 years. *Brachytron* 18(1): 23-29. ["*L. caudalis* has been rediscovered in Flanders after an absence of more than a century. The first individual, a female, was observed on 28 May 2013 at Lommel, soon followed by a second observation of a female on 8 June at Den Diel in Mol. The next year, a male was noted on 12 and 13 June 2014 at the same locality in Mol. This was also the place where on 17 May 2015 a male could be photographed. All these observations over a period of three years, all situated around Den Diel in Mol make it very likely that a (small) population is locally present. The habitat of this locality seems to correspond well with the known habitat preferences of this species." (Authors)] Address: Knijf, G. de, Research Institute for Nature and Forest (INBO), Havenlaan 88 bus 73, 1000 Brussels, Belgium. E-mail: geert.deknijf@inbo.be

19105. Deacon, C.; Samways, M.J. (2016): Conservation of a phenomenon: rapid, reversible colour change in both sexes of one of the world's most threatened damselflies. *Journal of Insect Conservation* 20(3): 497-504. (in English) ["Physiological colour change is rare in insects. Unusually, both the males and females of *Spesbona angusta* (Odonata: Platycnemididae), Red Listed as Endangered, are capable of rapid and reversible colour change. There is only one known population of this species, which occurs in a unique habitat in the Cape Floristic Region, South Africa. Appreciation of this unusual phenomenon of distinct physiological colour change helps us appreciate that we need to conserve phenomena in the insect world as well as the species themselves. Using controlled experiments, we evaluated the importance of ambient temperature as the possible primary cue for physiological colour change. We found that *S. angusta* responds rapidly to short-term changes in ambient temperature, even in the absence of additional environmental stimuli and without the body temperature matching the ambient temperature. Colour change is reversible when temperature returns to its earlier level. The reason why *S. angusta* shows this rapid and reversible colour change may be a combination of reproductive enhancement, competitive advantage and thermoregulation. This colour change appears to have strong selective advantage in a very particular habitat type, meaning that careful conservation of its habitat in all respects is important, and must be considered in any possible future translocations." (Authors)] Address: Deacon C., Dept Conservation Ecol. & Entom., Stellenbosch Univ., Matieland, South Africa. E-mail: charldeacon@sun.ac.za

19106. Duong, M.T.T.; McCauley, S.J. (2016): Predation risk increases immune response in a larval dragonfly (*Leucorrhinia intacta*). *Ecology* 97(6): 1605-1610. (in English) ["Predators often negatively affect prey performance through indirect, non-consumptive effects. We investigated the potential relationship between predator-induced stress and prey immune response. To test this, we administered a synthetic immune challenge into dragonfly larvae (*L. intacta*)

and assessed a key immune response (level of encapsulation) in the presence and absence of a caged predator (*Anax junius*) at two temperatures (22°C and 26°C). We hypothesized that immune response would be lowered when predators were present due to lowered allocation of resources to immune function and leading to reduced encapsulation of the synthetic immune challenge. Contrary to our expectations, larvae exposed to caged predators had encapsulated monofilaments significantly more than larvae not exposed to caged predators. Levels of encapsulation did not differ across temperatures, nor interact with predator exposure. Our results suggest that the previously observed increase in mortality of *L. intacta* exposed to caged predators is not driven by immune suppression. In situations of increased predation risk, the exposure to predator cues may induce higher levels of melanin production, which could lead to physiological damage and high energetic costs. However, the costs and risks of increased allocations to immune responses and interactions with predation stress remain unknown." (Authors)] Address: McCauley, Shannon, Dept of Biology, Univ. of Toronto Mississauga, 3359 Mississauga Road North, Mississauga, Ontario, L5L 1C6 Canada

19107. Ekena, G.; Isfendiyaroglu, S.; Yenyurt, C.; Levent Erkol, I.; Karatas, A.; Atal, M. (2016): Identifying key biodiversity areas in Turkey: a multi-taxon approach. *International Journal of Biodiversity Science, Ecosystem Services & Management* 12(3): 181-190. (in English) ["Key biodiversity areas (KBAs) are sites of global importance for biodiversity conservation. Their selection is based on standard criteria applied through a bottom-up, iterative process involving local stakeholders. This article presents the results of a study that applied the KBA methodology in Turkey. The KBA method uses four criteria: (1) globally threatened species; (2) restricted-range species; (3) congregations of species that concentrate at particular sites during some stage in their life cycle; and (4) biome-restricted species assemblages. In Turkey, we applied these criteria to 10,214 species of eight taxonomic groups: plants, dragonflies, butterflies, freshwater fish, amphibians, reptiles, birds and mammals. We identified 313 KBAs in Turkey, 303 of which trigger the KBA criteria for one or more taxonomic groups at the global scale. The remaining 10 sites trigger the KBA criteria at the regional scale only. These 303 globally important KBAs in Turkey cover 20,456,884 hectares, 26% of the country. Turkey's natural landscapes, holding globally important biodiversity, are under immense threat and declining rapidly, both in quality and quantity. The nationwide threat assessment of KBAs revealed that dams, irrigation and drainage projects (i.e. water policies) form the main threat to Turkey's biodiversity. Irrigation and drainage projects affect 225 KBAs and dams have an effect on at least 185 sites. KBAs raise attractive possibilities as being core areas where ecologically responsible governance models can be demonstrated, building on scientific and indigenous knowledge." (Authors)] Address: Eken, G., Seferihisar Doğa Okulu, Eski Orhanlı 664, Seferihisar, Izmir, Turkey. E-mail: eken@dogadermegi.org

19108. Environment Canada (2016): Recovery strategy for

the Rapids Clubtail (*Gomphus quadricolor*) in Canada [Proposed]. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa: 21 pp. + Annexes- (in English) ["Executive summary: The Rapids Clubtail is a small, brightly coloured dragonfly which lives in clear, cool, medium to large rivers with wooded shorelines, gravel shallows, and muddy pools. Adult males perch on exposed rocks in the rapids. Adult females inhabit shoreline forests, moving to the rapids when ready to mate. Eggs are laid over the rapids and the nymphs live in quiet, muddy, downstream pools. This species is a globally rare to uncommon dragonfly found throughout Eastern North America, in a range extending from Maine to Minnesota, including southern Ontario. In Ontario it has been found in only four rivers: the Credit, the Thames, the Humber and the Mississippi. The population in the Credit River may be extirpated. The species is listed as endangered on the Species at Risk in Ontario (SARO) List under the Endangered Species Act, 2007. Threats to survival and recovery include dam construction, shoreline alteration, pollution, removal of shoreline forests, exotic predatory species, roadkill and climate change. Limiting factors include low population numbers, limited distribution and apparent sensitivity to specific habitat features. Knowledge gaps include a lack of understanding of the reasons for its limited distribution and for its habitat sensitivity. The recovery goal is to ensure the long-term survival of Rapids Clubtail in the province by protecting existing populations and by restoring populations in appropriate habitat where feasible. The recovery objectives are to: 1. protect, maintain and improve habitat in the four rivers in Ontario where Rapids Clubtail has been found; 2. implement a monitoring program for the locations where Rapids Clubtail is known to exist; 3. conduct additional inventory for Rapids Clubtail in suitable habitat; and, 4. initiate research to address knowledge gaps for Rapids Clubtail. It is important to ensure adequate protection of habitat and water quality for the species' survival and recovery. The locations where the species has been found in the Credit, Thames, Humber and Mississippi Rivers should all be prescribed as habitat in a habitat regulation. At each location, the area prescribed as habitat should include the section of the river containing the rapids and the pools below the rapids, plus the wooded shores on either side extending inland to include any forest which is within 800 metres of the shoreline." (Authors)] Address: not stated

19109. Galatowitsch, M.L.; McIntosh, A.R. (2016): Trait flexibility of generalist invertebrates exposed to contrasting predation and drying stressors. *Freshwater Biology* 61(6): 862-875. (in English) ["(1.) How different generalist species are able to exploit heterogeneous landscapes likely depends on whether their life-history strategies confer resilience to multiple environmental selection pressures. (2.) We investigated the life-history strategies of two generalist invertebrates, *Xanthocnemis zealandica* damselflies and *Sigara arguta* waterboatmen, which inhabit ponds varying in drying and predator presence. Using mesocosm experiments with temporary- and permanent-pond nymphs, we determined the flexibility of their predator avoidance and

drying resistance. (3.) *Xanthocnemis zealandica* was most susceptible to predatory fish regardless of natal habitat, with permanent-pond nymphs more likely to have reduced movement, higher refuge use and slower growth than temporary-pond nymphs; growth was, however, not influenced by predator presence. *Xanthocnemis zealandica* had a fixed response to drying stress, with high survival rates (80–90%) during short drying periods (2–8 days), regardless of natal habitat. (4.) In contrast to *X. zealandica*, *S. arguta* had a completely inflexible life-history with no differences in predator avoidance between permanent- and temporary-pond nymphs, and a complete inability to survive drying. (5.) Without flexible traits *S. arguta* may counter potentially high costs of predation in permanent ponds and drying mortality in temporary ponds through rapid development and terrestrial dispersal. *Xanthocnemis zealandica*'s flexible life-history is likely driven by longer nymphal development which requires adaptation to both predator and drying stressors to complete their life-cycle over the range of habitats they occupy. (6.) Overall, these two species exemplify how generalists can strongly differ in their life-history strategies but still persist across a similar range of habitats." (Authors)] Address: Galatowitsch, M.L., Department of Biology, Centre College, 600 West Walnut St., Danville, KY 40422, U.S.A. E-mail: mark.galatowitsch@centre.edu

19110. Ge, Y.; Cao, L. (2016): Transcriptome analysis of *Pantala flavescens* (Fabricius) based on ,qNA-seq. *Sichuan Journal of Zoology* 35(6): 852-859. (in Chinese, with English summary) ["The total transcripts of *Pantala flavescens* (Fabricius) were obtained by ,qNA-seq followed by functional analysis. The head total ,qNA of *P. flavescens* (Fabricius) was extracted and then sequenced by Illumina platform. A total of 47 039 040 reads containing 7 102 895 040 bp were generated. There were 34 406 502 unigenes with GC content of 44. 05% after de novo assembly. All the unigenes were annotated based on different databases and 44 499 unigenes were annotated. In this study all the assembled unigenes could be broadly divided into biological processes cellular components and molecular function categories of 60 branches by gene ontology including metabolic process binding catalytic activity and cellular process. Unigenes were further annotated based on COG category, which could be grouped into 26 functional categories. The results of KEGG prediction suggested that mitochondrial genes were the most abundant in the tested samples. And after KEGG O,qTHOLOGY annotation the most abundant genes were metabolic-related. The genes of mitochondria and metabolism were related with the migration mechanism of *P. flavescens* (Fabricius). (Authors)] Address: Ge, Yiqing, School of Life Sciences, Jiangxi Normal University, Nanchang 330000, China

19111. Gladyshev, M.I.; Popova, O.N.; Makhutova, O.N.; Zinchenko, T.D.; Golovatyuk, L.V.; Yurchenko, Yu.A.; Kalachova, G.S.; Krylov, A.V.; Sushchik, N.N. (2016): Comparison of fatty acid compositions in birds feeding in aquatic and terrestrial ecosystems. *Contemporary Problems of*

Ecology 9(4): 503-513. (in English) ["Fatty acid (FA) contents and compositions in the pectoral muscles of 18 bird species from Novosibirsk, Volgograd, and Yaroslavl oblasts were studied. Three groups of birds that had significantly different FA compositions were distinguished based on a multivariate statistical analysis: Passeriformes, Columbiformes, and a group of waterfowl and waterbird species (Charadriiformes, Anseriformes, Podicipediformes, and Ciconiiformes). The highest content of physiologically important docosahexaenoic acid (22:6n-3, DHA), which is considered a marker of aquatic food, was surprisingly found in the biomass of Passeriformes, which are terrestrial feeders, rather than in the biomass of waterfowls and waterbirds. It was suggested that Passeriformes species had the ability to synthesize large quantities of DHA from short-chain omega-3 FAs, which is rare among animals." (Authors)] Address: Popova, O.N., Institut Sistemati i Zkologii Zhivotnykh, 630091 Novosibirsk, Ul. Frunse 11, Russia. E-mail: pc@eco.nsc.ru

19112. Herrera, L.S. (2016): Identifying the impacts of excess fine sediment on benthic macroinvertebrate communities. MSc. thesis University of Minnesota: VI + 90 pp. (in English) ["Many streams throughout the United States are negatively impacted by excess fine sediments (sand, silt, and clay). Benthic macroinvertebrates are a commonly-used tool to assess stream condition; however, current methodologies typically are not able to distinguish among stressors. Previous studies have correlated macroinvertebrate communities and traits with excess fine sediments, demonstrating that aquatic macroinvertebrates are sensitive to deposited fine sediment and the assemblages will shift in response. Western Lake Superior streams have a wide range of fine sediment amounts due to clay and sand soils, but have low amounts of other stressors, and thus are a good region to investigate relationships between macroinvertebrate traits and fine sediments. Data were collected from 22 stream sites located along the north shore of Lake Superior in 2010. The data collected in 2010 did not have the desired gradient of fine sediment due to wet conditions that year; therefore, the data were supplemented with data collected by NRRRI personnel in earlier years (1997 – 2008). The five sediment stressors used in analyses included percent embeddedness, depth of fine sediments, total percent fine sediments, percent sand, and a combined sediment index created using normalized and transformed embeddedness, depth of fine sediments and total percent fine sediments. Fifty-seven specific taxonomic groups and macroinvertebrate physical and behavioral characteristics (traits) were tested as potential response metrics in linear regressions. In addition, TITAN analyses were used to look for thresholds or sediment stressor values at which a taxon increases greatly, decreases greatly, or disappears from a community. Both the linear regressions and TITAN analyses showed a change in the community structure under conditions of excess sediment in the form of embeddedness, total fines, depth of fines, and/or the combined sediment index. The TITAN analyses also showed a change in the community structure due to increasing proportion sand in the

streambed. Furthermore, the analyses identified potential characteristics that may specifically make a particular macroinvertebrate more or less vulnerable to excess fine sediments." (Author) Taxa - including Odonata - are treated at order-level.] Address: not stated

19113. Hesse, L.; Falk, F.; Koch, K. (2016): Inflexible versus flexible: the influence of temperature and photoperiod on pre- and post-eyespot development time in Libellulidae (Odonata). *Physiological Entomology* 41(3): 224-233. (in English) ["Temperature and photoperiod are important environmental parameters for organisms. The present study tests the hypothesis that, during embryogenesis, temperature and photoperiod influence pre- and post-eyespot development time in dragonflies of the family Libellulidae differently. Eggs are used from eight species (five different genera, from Africa/Europe, and lentic/lotic habitat preferences). The eggs are reared under different constant or fluctuating temperature and light conditions. There are no general species-specific degree-days for pre- or the post-eyespot development in these species. In all study species, the variance within and between the treatments of the duration in days and the degree-days of pre-eyespot development is lower than that of post-eyespot development. Pre-eyespot development appears to be less flexible in its reaction to environmental influences. By contrast, post-eyespot development appears to react more flexibly to environmental influences. All eight species show the same pattern. This indicates strongly that this flexibility is a general pattern in Libellulidae that might help the species within this family to cope successfully with variations in environmental conditions. Because eyespot development and katatrepsis occur close to each other, the above-described pattern might also appear in other odonates and in other insect groups that exhibit katatrepsis. For all of them, it is essential for survival to match the time of hatching with adequate external temperature and photoperiodic conditions." (Authors) *Crocothemis erythraea*; *Libellula quadrimaculata*; *Orthetrum cancellatum*; *Orthetrum coerulescens*; *Sympetrum striolatum*; *Trithemis arteriosa*; *Trithemis kirbyi*; *Trithemis stictica*] Address: Koch, Kamilla, Department of Evolutionary Ecology, Johannes Gutenberg-University Mainz, Becher-Weg 13, 55128 Mainz, Germany. E-mail: kochka@uni-mainz.de

19114. Holzinger, W.; Zimmermann, P. (2016): Die Vogel-Azurjungfer *Coenagrion ornatum* (Selys, 1850) in Niederösterreich: Ergebnisse einer Habitatmodellierung. Auftraggeber: Amt der Steiermärkischen Landesregierung, Abteilung 13 - Umwelt und Raumordnung, Referat Naturschutz, 8010 Graz, Stempfergasse 7, Austria. GZ: ABT13-56O-26/2013-2. Auftragnehmer: ÖKOTEAM - Institut für Tierökologie und Naturraumplanung, Bergmannngasse 22 • A-8010 Graz, Austria: 35 pp. (in German) [Due to ongoing infringement proceedings, the Republic of Austria and possibly also the province of Lower Austria are required to designate new protected areas for (among others) *Coenagrion ornatum*. In this context, the eco-team was commissioned to prepare the present expert report. The assignment comprises three questions: Are there nationally important populations of the

Common Azure Damselfly within the existing Natura 2000 area in Lower Austria? Is it necessary to expand existing sites and/or designate new sites for this species in Lower Austria? If so, how are the populations of the species to be assessed, what threats might these populations be exposed to and what form might protection and promotion measures take? *C. ornatum* has a ponto-mediterranean distribution and reaches the western limit of its closed range in the Pannonian part of Austria. At altitudes below 400 m, it inhabits fully sunlit, shallow, slow-flowing, silted small streams with relatively dense aquatic vegetation and predominantly herbaceous vegetation close to the banks. Their larvae develop among submerged plants and take 1-2 years to develop. Adults are found between mid-May and the end of June, they are not very migratory and are only flight-active on sunny, windless days. In Austria and in large parts of Central Europe the species is classified as "Critically Endangered", populations in the continental region of Austria are declining, the conservation status of the species is "U1x" ("probably unfavourable-insufficient"). The main threat to the species is the destruction of its habitats. In Lower Austria, the species was specifically searched for by Martina Stauer in 2014 in nine study areas between approx. 5 and 100 km² in size and actually detected in a total of 12 streams in the Weinviertel and west of the Leitha Mountains. The first aim of this study is to extrapolate or model the occurrence of the species for the whole of Lower Austria on the basis of these results. For this purpose, the presence data of the species are combined with a lot of other environmental information and the MaxEnt programme is used to estimate the probability of occurrence of the species in Lower Austria. The results show that there are large areas with very high occurrence potential in Lower Austria, although the province of Lower Austria only has concrete occurrence data for a small part of these water bodies. The Pulkau and its tributaries between Retz and Laa an der Thaya have the highest potential, other potentially high quality areas are located along the Zaya and Taschlbach as well as in the vicinity of the Thaya. In the Marchfeld, Weidenbach, Stempfelbach and Rußbach, and south of the Danube, areas along the Fische and Neue Leitha are classified as suitable in sections. In addition, an assessment algorithm for occurrences of the species, a monitoring concept as well as protection and promotion measures are presented.] Address: ÖKOTEAM, Institut für Tierökologie und Naturraumplanung, Bergmannngasse 22, A-8010 Graz, Austria, Austria

19115. Ichikawa, Y.; Watanabe, M. (2016): Daily egg production in *Pantala flavescens* in relation to food intake (Odonata: Libellulidae). *Odonatologica* 45(1/2): 107-116. (in English) ["The migratory dragonfly, *Pantala flavescens*, arrives in Japan from tropical regions every spring. Although the population increases as autumn nears, it dies in the winter cold. The adults often form foraging swarms above open grasslands when feeding on small insects, while oviposition occurs at diverse open water bodies throughout the day. Although oogenesis requires a daily intake of nutrition from prey, there has been little consideration of the relationship between food intake and the number of eggs produced. In

the early morning, females of reproductive age were captured from foraging swarms in grasslands. Immediately after capture, an artificial oviposition technique was applied to each female to release all mature eggs loaded. Then, the females were kept until death, up to 5 days, in envelopes in the laboratory. They were starved but hydrated daily, and the dry weight of faeces excreted during 24 h after capture was measured. Females excreted 8.4 mg of faeces within 24 h after capture. Then, they released about 840 mature eggs at 24 h after capture, suggesting that when females take in a sufficient amount of daily food, they can oviposit a large number of eggs every day. The rapid egg production might enable the population of *P. flavescens* to grow. A positive correlation was found between the food intake on the previous day and the number of eggs produced within a 24 h of capture. The act of ingesting fresh nutrients derived from the prey might promote rapid release of reserves in the female fat body, resulting in the oogenesis. Females able to encounter available foraging sites might produce a large number of mature eggs in the subsequent day to be laid." (Authors)] Address: Watanabe, M., Graduate School of Life and Environmental Sciences, Univ. of Tsukuba, Tsukuba, Ibaraki 305-8572, Japan. E-mail: watanabe@kankyo.envr.tsukuba.ac.jp

19116. Iorio, E.; Noel, F (2016): Première année de suivi de la Grande Aesche *Aeshna grandis* (L., 1758) dans deux étangs du Perche (Orne). Rapport GRETIA réalisé grâce aux financements de l'Europe (fonds FEADER), de l'Agence de l'eau Loire-Bretagne et de l'Agence de l'eau Seine-Normandie, dans le cadre de la déclinaison régionale du PNAO: 19 pp. (in French) ["This report presents the results of the first year of monitoring the exuviae of the Great Aesche *Aeshna grandis* in the Cachot and Gré ponds (Brésolettes, Orne), carried out by means of three passes made on foot/by boat along the banks from the inside, on 27 July, 16 and 31 August 2016. A total of 28 exuviae of *A. grandis* were collected, but only on the Cachot, of which almost 90% were collected on the first pass (n = 25) and none on the third. According to these first data, August does not seem to be a productive month in terms of emergence, as this activity obviously takes place mainly in July; but this impression should be confirmed during the next two years of monitoring. Apart from *A. mixta*, the total absence of anisopteran exuviae at Le Gré is clearly explained by the combination of a prolonged dry spell in 2014-2015 and incomplete surveys due to the inaccessibility of part of the banks. In 2016, *A. grandis* was the best represented anisopteran species in terms of emergences at the Cachot, followed by *Orthetrum cancellatum*. The location of each of its exuviae is mapped. The species richness observed on the two ponds combined is 21, with 13 species recorded on the Cachot and 17 on the Gré. The main biotic and abiotic characteristics of the emergence stations and the conditions for observing the exuviae are described and illustrated by photographs. At the end of this first year, the emergence of *A. grandis* took place on almost half of the perimeter of the Cachot pond, without any habitat or micro-habitat appearing to be more favourable than the others at the current stage.

The eastern bank, however, revealed more than half of their numbers." (Authors/DeepL)] Address: Iorio, E., GRoupe d'ETude des Invertébrés Armoricaux (GRETIA) - Antenne Pays-de-la-Loire – 5 rue Général Leclerc – 44390 Nort-sur-Erdre, France. Email: e.iorio@gretia.org

19117. Iorio, E. (2016): Suivi du Leste dryade *Lestes dryas* Kirby, 1890 (2ème année) et du Leste verdoyant *Lestes virens* (Charpentier, 1825) (1ère année) dans les landes de Lessay (Manche). Rapport GRETIA réalisé grâce aux financements de l'Europe (fonds FEADER), de l'Agence de l'eau Loire-Bretagne et de l'Agence de l'eau Seine-Normandie, dans le cadre de la déclinaison régionale du PNAO: 51 pp. (in French) [*L. virens vestalis* de Lessay (50) ; à droite : *L. virens virens* du Var (83).

19118. France "This report presents the results of the second year of monitoring the imagoes of *Lestes dryas* and the first year of monitoring those of *Lestes virens* in the Lessay moors, on eleven pre-selected stations. They follow on from the report by GERMAIN (2015) on the same moors and stations. A total of 266 and 49 imagoes were counted for *L. dryas* and *L. virens* respectively, all belonging to the subspecies *vestalis* for the latter. The local phenology of *L. dryas* is thus refined in relation to regional and national knowledge. A synthesis of various biotic and abiotic characteristics common to the stations and habitats of probable autochthony is proposed, by cumulating the data of this year and of 2015. The preferential habitats are more precisely defined in the Lessay moors and more generally at regional level. However, all the data still needs to be confirmed by the third and final year of monitoring, in 2017, for *L. dryas*; and by the next two years of monitoring for *L. virens vestalis*, whose populations appear to be smaller in Lessay for the moment. The future global synthesis that will emanate from this will make it possible to complete or reinforce the recommendations of GERMAIN (2015) with regard to the management of habitats favourable to *L. dryas*, and then to propose some for *L. virens vestalis*, in the long term. Certain factors have already been identified as probably important, or even determining, to be taken into account, such as opening up the environment, sparingly (re)digging to promote late drying and maintaining a selection of appropriate heliophytes (particularly *Eleocharis*)." (Author/deepL)] Address: Iorio, E., GRoupe d'ETude des Invertébrés Armoricaux (GRETIA) - Antenne Pays-de-la-Loire – 5 rue Général Leclerc – 44390 Nort-sur-Erdre, France. Email: e.iorio@gretia.org

19119. Jin, L.; Zhang, Y.; Xu, X.; Xiao, X.; Zhang, X. (2016): Identification and phytotoxic activity of fungus QTYC-51 from the gut of *Pantala flavescens* larvae. *Acta Microbiologica Sinica* 56(12): 1869-1875. (in Chinese, with English summary) ["[Objective] To isolate the fungus with phytotoxic activity from the gut of *P. flavescens* larvae. [Methods] Strain QTYC-51 was identified by morphological observation and 5.8S rDNA-ITS sequence analysis. Petri dish bioassay was used to test the phytotoxic activity of fermentation broth and monomer compounds of strain QTYC-51 on *Echinochloa crusgalli* and *Amaranthus retroflexus*. Bioactive

components were isolated from ethyl acetate extracts via chromatographic methods, and the structures were determined by mass spectrum and nuclear magnetic resonance analyses. [Results] QTYC-51 was identified as *Paraconiothyrium* sp.. The fermentation broth had good phytotoxic activity on radical growth of *E. crusgalli* and *A. retroflexus* with the inhibition rates of 76.9% and 56.5%, respectively. Five monomer compounds were purified from the fermentation products, including 1,8-dihydroxyanthraquinone, 1-hydroxy-10-methoxy-dibenz[b,e]oxepin-6,11-dione, hydroxyvertexanthone, globosuxanthone and 1,3,6,8-tetrahydroxyanthraquinone. At the concentration of 100 µg/mL, compound globosuxanthone was found to possess obvious phytotoxic effects on radical growth of *E. crusgalli* and *A. retroflexus* with the inhibition rates of 94.1% and 79.0%, respectively, which were comparable to that of positive control 2,4-dichlorophenoxyacetic acid. Compound 1-hydroxy-10-methoxy-dibenz [b,e] oxepin-6,11-dione showed potent phytotoxic activity against *E. crusgalli* and *A. retroflexus* with inhibition rates of 50.3% and 58.6%, respectively. [Conclusion] Strain QTYC-51 could be potentially developed as a microbial herbicide." (Authors)] Address: Jin, L., College of Chemistry & Life Science, Zhejiang Normal University, Jinhua 321004, Zhejiang Province, China

19120. Kefford, B.J.; Buchwalter, D.; Cañedo-Argüelles, M.; Davis, J.; Duncan, R.P.; Hoffmann, A.; Thompson, R. (2016): Salinized rivers: degraded systems or new habitats for salt-tolerant faunas?. *Biology Letters* 12(3): 8 pp. (in English) ["Anthropogenic salinization of rivers is an emerging issue of global concern, with significant adverse effects on biodiversity and ecosystem functioning. Impacts of freshwater salinization on biota are strongly mediated by evolutionary history, as this is a major factor determining species physiological salinity tolerance. Freshwater insects dominate most flowing waters, and the common lotic insect orders Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) are particularly salt-sensitive. Tolerances of existing taxa, rapid adaptation, colonization by novel taxa (from naturally saline environments) and interactions between species will be key drivers of assemblages in saline lotic systems. Here we outline a conceptual framework predicting how communities may change in salinizing rivers. We envision that a relatively small number of taxa will be saline-tolerant and able to colonize salinized rivers (e.g. most naturally saline habitats are lentic; thus potential colonizers would need to adapt to lotic environments), leading to depauperate communities in these environments." (Authors) The paper includes a passing note to Odonata.] Address: Kefford, B.J., Institute for Applied Ecology, University of Canberra, Canberra, Australian Capital Territory 2601, Australia. E-mail: ben.kefford@canberra.edu.au

19121. Kjer, K.M.; Simon, C.; Yavorskaya, M.; Beutel, R.G. (2016): Progress, pitfalls and parallel universes: a history of insect phylogenetics. *J. R. Soc. Interface* 13: 20160363. <http://dx.doi.org/10.1098/rsif.2016.0363>: 29 pp. (in English) ["The phylogeny of insects has been both extensively studied and vigorously debated for over a century. A relatively

accurate deep phylogeny had been produced by 1904. It was not substantially improved in topology until recently when phylogenomics settled many long-standing controversies. Intervening advances came instead through methodological improvement. Early molecular phylogenetic studies (1985–2005), dominated by a few genes, provided datasets that were too small to resolve controversial phylogenetic problems. Adding to the lack of consensus, this period was characterized by a polarization of philosophies, with individuals belonging to either parsimony or maximum-likelihood camps; each largely ignoring the insights of the other. The result was an unfortunate detour in which the few perceived phylogenetic revolutions published by both sides of the philosophical divide were probably erroneous. The size of datasets has been growing exponentially since the mid-1980s accompanied by a wave of confidence that all relationships will soon be known. However, large datasets create new challenges, and a large number of genes does not guarantee reliable results. If history is a guide, then the quality of conclusions will be determined by an improved understanding of both molecular and morphological evolution, and not simply the number of genes analysed." (Authors) The study includes many references to Odonata.] Address: Kjer, K.M., Department of Entomology & Nematology, University of California-Davis, 1282 Academic Surge, Davis, CA 95616, USA. E-mail: karl.kjer@gmail.com

19122. Küry, D.; Krieg, R. (2016): Emergenz und Populationsgröße von *Gomphus pulchellus* im Kanton Basel-Stadt sowie Situation und Habitate in schweizerischen Gewässern (Odonata: Gomphidae). *Libellula* 35(1/2): 1-21. (in German, with English summary) ["Emergence and population size of *Gomphus pulchellus* in canton Basel-City plus situation and habitats in Swiss water bodies – *Gomphus pulchellus* is an endangered species of high conservation priority in Switzerland. A study on an isolated population in the Spittelmattponds in Riehen, canton Basel-City revealed a total of 121 exuviae between 22nd May and 24th July 2012. This corresponds to a density of 46 individuals per 100 m of shoreline or 0.6 individuals per m². The adults emerged mainly on the sunlit southwest bank on *Carex* sp. and *Rubus* sp. By sampling the ground three larvae were found in a total of 36 samples. Immediately after the emergence adults were found in the nearby clover field. After maturation several males were found by sunlit places on *Rubus* in the riparian zone, on the adjacent country lane and on the Entenweiher ('duck-pond') 250 m away. *Gomphus pulchellus* developed together with ten other dragonfly species: *Calopteryx splendens*, *Chalcolestes viridis*, *Coenagrion puella*, *Erythromma lindenii*, *Ischnura elegans*, *Pyrrhosoma nymphula*, *Platynemis pennipes*, *Onychogomphus forcipatus*, *Cordulegaster boltonii*, and *Sympetrum striolatum*. A survey of 15 potential breeding sites in the surroundings showed that the species reproduced in the gravel pit Käppelin Weil am Rhein, Germany, (1.2 km distance) and probably in the gravel pit Wyhlen, Germany (7 km distance). A total of 66 known reproductive sites in Switzerland were examined by aerial photography. Of these, 61 % were ponds followed by lakes (23 %), running waters (12 %) and gravel pits (4 %).

The sites had an area between 550 m² and 14.5 km². Approximately 50 % were larger than one hectare. Dominant vegetation types were: reeds, rushes, sedges, woody areas, or zones lacking any vegetation. Interviews with experts revealed over 90 % of the reproductive ponds being stocked by fish. The known populations will be monitored for four to six years and additional reproductive sites searched on a regional level. An action plan shall help to manage existing ponds, create new breeding sites and inform the public about the progress of the project." (Authors)] Address: Kury, D., Life Science AG, Greifengasse 7, 4058 Basel, Switzerland. E-mail: daniel.kuery@lifescience.ch

19123. Kuhn, W.R. (2016): Three approaches to automating taxonomy, with emphasis on the Odonata (dragonflies and damselflies). Ph.D. thesis, Rutgers, The State University of New Jersey: xi, 177 pp. (in English) ["Taxonomy-the field charged with naming and classifying organisms-forms a foundation for biological research. An understanding of the species on Earth is needed for informing biodiversity research, conservation efforts, management strategies, and global policy. In recent decades, a "taxonomic impediment" has arisen: there is an urgent need to know the millions of yet-undiscovered species, while funding for the science charged with this task, taxonomy, and the number of trained taxonomists are declining. This work aims to provide three software tools for taxonomists that allow them to work more efficiently and effectively, reducing this impediment. First, a system for automatically landmarking images of specimens for geometric morphometric studies was introduced, which could greatly reduce the time required to manually landmark images for these studies while also increasing the possible sample size of such studies. The system's landmarking error, however, was extremely variable on test images of the wings of dragonflies and damselflies (Odonata), and was ultimately too large (300-500 px) to compete with manual landmarking at this time. Second, a method was presented for automatically standardizing and extracting descriptive features from images of insect wings in order to quantify the appearance of the wings. The standardization method was successful in converting scans of odonate wings into consistently-formatted square images, automatically. Then, features describing the color, texture, and shape of the wings were able to be extracted, producing a small set of 663 coefficients that were able to distinguish between species. Finally, a system called Odomatic was presented and tested for automatically identifying Odonata to species from images of their wings, using the feature extraction method combined with machine learning techniques. Odomatic was able to make classifications between 32 species with expert-level (up to 92%) accuracy, making it useful for quickly identifying specimens. The tools presented here will be deployed for use by odonate researchers through the website OdonataCentral.org, but will also be released as open-sourced Python scripts so that they can be customized to be implemented on other taxonomic groups. This work will enable taxonomists and other interested parties to make easier morphological comparisons and faster identifications." (Author)] Address: not stated

19124. Labe, M.S.; Fernado, N.C.; Fiegalan, E.R. (2016): Insects associated with organic and inorganic rice farming. *International Journal of Agricultural Technology* 12(7.1): 1347-1367. (in English) ["A study was conducted in organic and inorganic ricefields to identify all insects present in both methods of farming. A total of 34, 957 insects and other arthropods were collected; 17, 549 in organic and 17, 408 in inorganic ricefield, respectively, through net sweeping. The orders of insects represented from the collection include the Odonata, Orthoptera, Thysanoptera, Hemiptera, Homoptera, Coleoptera, Strepsiptera, Diptera, Lepidoptera, and Hymenoptera. Spiders (Araneae) and mites (Acari) in the Class Arachnids were also collected. Among the insects, Diptera and Homoptera had the highest counts in both methods of farming. Both organic and inorganic ricefields had high counts of insect pests. Higher counts of natural enemies were observed in organic ricefield." (Authors)] Address: Labe, M.S., Dept of Crop Protection, College of Agriculture, Central Luzon State Univ., Science City of Munoz, Nueva Ecija 3120, Philippines. E-mail: mdsalabe@gmail.com

19125. Lutsch, M.; Koch, K. (2016): The probable function of abdominal contractions and liquid drops during the emergence of Zygoptera and Anisoptera (Odonata). *International Journal of Odonatology* 19(4): 199 -205. (in English) ["The transition between larval and adult stage in amphibious insects is called emergence. During emergence abdominal contractions and excretion of liquid drops can be observed in several insect orders. Since the function of these processes is not yet known in odonates, this study examines the probable function of abdominal contractions and excretion of liquid drops in Zygoptera and Anisoptera. By subdividing the emergence into 12 successive stages and counting abdominal contractions as well as the excreted liquid drops during these stages we set up a systematic data collection. In all investigated individuals, both processes began in the middle of the entire emergence. We found that abdominal contractions occurred more frequently at the beginning of the latter half of emergence. The number of excreted liquid drops, however, was higher in the end, shortly before the maiden flight. Concerning the number of excreted liquid drops, we found a significant difference between Zygoptera and Anisoptera. Our findings suggest that there might be a relationship between the two processes, probably explainable by the hemolymph circulation as seen in Lepidoptera. However, abdominal contractions and liquid drops seemed to be crucial for the emergence of Zygoptera and Anisoptera.... Under natural conditions we observed the emergence of *Coenagrion scitulum*: n = 11; *Enallagma cyathigerum* = 24; *Platycnemis pennipes*: n = 17) and *Cordulia aenea*: n = 21; *Libellula quadrimaculata*: n = 25; *Orthetrum cancellatum*: n = 20) in the period from beginning of May to mid-June 2015." (Authors)] Address: Koch, Kamilla, Department of Evolutionary Ecology, Johannes Gutenberg-University of Mainz, Mainz, Germany

19126. Martín, R.; Maynou, X. (2016): Dragonflies (Insecta: Odonata) as indicators of habitat quality in Mediter-

anean streams and rivers in the province of Barcelona (Catalonia, Iberian Peninsula). *International Journal of Odonatology* 19(3): 1-18. (in English) ["In a field study carried out in 2011 and 2014 adult dragonflies were identified as a rapid and easy-to-use means of assessing habitat quality and biological integrity of Mediterranean streams and rivers in the province of Barcelona (Region Catalonia, Iberian Peninsula). The study included sampling sites from five different river catchments: Besòs, Foix, Llobregat, Ter and Tordera. Multivariate statistical procedures and indicator species analysis were used to investigate the relationship between river ecological status, study sites and dragonfly species or species assemblages' occurrence. The dragonfly association identified with western Mediterranean permanent streams, i.e. *Cordulegaster boltonii*, *Boyeria irene*, *Onychogomphus uncatus* and *Calopteryx virgo meridionalis*, was found only at the sites with the highest status. All these taxa were identified as indicator species of sites with the best scores for the macroinvertebrate based IBMWP index and for the combined IASPT index, which reflects the sensitivity of the macroinvertebrate families present to environmental changes; besides, *B. irene* and *C. virgo meridionalis* also proved to be indicator species of the riparian forest quality index and *C. boltonii* of the more inclusive ECOSTRIMED, which assesses the overall conservation status of the riverine habitats. The information obtained on habitat preferences and indicator value showed that adults of these taxa may constitute a valuable tool for preliminary or complementary cost-effective monitoring of river status and restoration practices as part of a broader set of indices reflecting biodiversity and ecosystem integrity." (Authors)] Address: Martín, R., Catalan Odonata Study Group, Institució Catalana d'Història Natural, Barcelona, Spain. Email: ricardo.martin@cllicenciats.cat

19127. Matushkina, N.; Lambret, P.; Gorb, S. (2016): Keeping the Golden Mean: Plant stiffness and anatomy as proximal factors driving endophytic oviposition site selection in a dragonfly. *Zoology* 119(6): 474-480. (in English) ["Highlights: •Ovipositor bending stiffness of *Lestes macrostigma* is one of the highest in damselflies. •Most preferred plant for oviposition has intermediate stiffness and specific anatomy characteristics. •Least preferred plants for oviposition have the highest stiffness or large aeriferous cavities. Abstract: Oviposition site selection is a crucial component of the habitat selection in dragonflies. The presence of appropriate oviposition plants at breeding waters is considered to be one of the key habitat determinants for species laying eggs endophytically. For example, *Lestes macrostigma*, a species which is regarded as threatened in Europe because of its highly fragmental distribution, typically prefers to lay eggs in the sea-club rush *Bolboschoenus maritimus*. However, little is known about how the anatomy and mechanical properties of plant tissues associated with their choice by *L. macrostigma* females. We examined green shoots of six plant species used by *L. macrostigma* for oviposition, either in the field (actual oviposition plants) or under experimental conditions (potential oviposition plants), to analyse anatomy and mechanical properties of shoots in a framework of

known preference of plant substrates for oviposition. As expected, anatomy of shoots differed between representatives of two plant families, Cyperaceae and Juncaceae, most essentially in distribution of supporting bundles and presence of large aeriferous cavities that may affect egg placing within a shoot. The puncture force of tested plant samples ranged from 360 to 3298 mN, and their local stiffness ranged from 777 to 3363 N/m. We showed that the most preferred by *L. macrostigma* plant, *B. maritimus*, had intermediate characteristics of both the stiffness and anatomy parameters of shoot. The bending stiffness of the ovipositor in *L. macrostigma* was estimated as 1414 N/m that is one of highest values recorded for zygopteran dragonflies so far. The ecological and behavioural implications of plant-choice mechanisms in *L. macrostigma* are discussed in the context of fragmented areal distribution of this species." A(uthors)] Address: Matushkina, Natalia, Institute of Biology, Department of Zoology, Taras Shevchenko National University of Kyiv, Vul. Volodymirs'ka, 64, 01033 Kyiv, Ukraine. Email: odonataly@gmail.com

19128. Mehmood, S.A.; Khan, M.S.; Zia, A.; Shaheen, F.A. (2016): Morphological evaluation of Gomphidae dragonflies of Hazara region Pakistan through principle component analysis. *Journal of Entomology and Zoology Studies* 4(3): 183-188. (in English) ["Current study was conducted on Gomphidae dragonflies in Hazara region of Pakistan. A total 125 specimens were collected and identified in to 8 species and 6 genera. Five morphometric parameters were based to evaluate the variations and similarities among species. The results were obtained using the principle component analysis. Components PC1 and PC2 were observed positive correlated with all variables. Highest Euclidean distance was observed (5.14) between *Platygomphus dolabratus* and *Anormogomphus kiritschenkoi*, while the lowest Euclidean distance was found (0.27) between *Onychogomphus biforceps* and *O. bistrigatus*. Cladogram was showed two groups I and II and result of Line plot highly support the cladogram. Case wise variability showed 6 (75%) and 2 (25%) species were conspired in the same region between (0 to +2.5) and (0 to -2.5) respectively. The component/factors variability plot was observed the cumulative share for PC1 (60.60%) and PC2 (36.82%) respectively. Morphometry and its findings are very important for identification purposes." (Authors)] Address: Mehmood, S.A., Department of Zoology, Hazara University - Mansehra

19129. Mikolajewski, D.J.; Scharnweber, K.; Jiang, B.; Leicht, S.; Mauersberger, R.; Johansson, F. (2016): Changing the habitat: the evolution of inter-correlated traits to escape from predators. *Journal of Evolutionary Biology* 29(7): 1394-1405. (in English) ["Burst escape speed is an effective and widely used behaviour for evading predators, with burst escape speed relying on several different morphological features. However, we know little about how behavioural and underlying morphological attributes change in concert as a response to changes in selective predation regime. We studied inter-correlated trait differentiation of body shape and burst-swim-mediating morphology in response to a habitat

shift related reduction in burst escape speed using larvae of the dragonfly genus *Leucorrhinia* [*L. albifrons*, *L. caudalis*, *L. dubia*, *L. pectoralis* and *L. rubicunda*]. Species in this genus underwent a well-known habitat shift from predatory fish lakes (fish-lakes) to predatory fish free lakes dominated by large predatory dragonflies (dragonfly-lakes) accompanied by relaxed selection on escape burst speed. Results revealed that species from fish-lakes that possess faster burst speed have evolved a suite of functionally inter-correlated traits, expressing a wider abdomen, a higher abdominal muscles mass and a larger branchial chamber compared to species from dragonfly-lakes. In contrast, populations within species did not show significant differences in muscle mass and branchial chamber size between lakes types in three of the species. High multi-collinearity among variables suggests that traits have evolved in concert rather than independently when *Leucorrhinia* shifted from fish lakes to dragonfly lakes. Thus, relaxed selection on burst escape speed in dragonfly-lake species resulted in a correlated reduction of abdominal muscles and a smaller branchial chamber, likely to save production and/or maintenance costs. Our results highlight the importance of studying integrated behavioural and morphological traits to fully understand the evolution of complex phenotypes." (Authors)] Address: Mikolajewski, D.J., Königin-Luise-Str. 1-3, 14195 Berlin, Germany. Email: d.mikolajewski@fu-berlin.de

19130. Mwedzi, T.; Bere, T.; Siziba, N.; Mangadze, T.; Bangira, C. (2016): Longitudinal macroinvertebrate assemblages in contrasting discontinuities: the effects of damming in tropical streams. *African Journal of Ecology* 54(2): 183-194. (in English) ["The study assessed the impact of damming on water quality and macroinvertebrate assemblages. It also assessed the response of macroinvertebrate-based indices of water quality to damming. Macroinvertebrate community and physicochemical variables data were collected from 86 sites. Twenty-nine sites downstream of dams were compared with 27 sites above impoundments and 30 sites on nearby unregulated streams. Of the downstream sites, 13 were situated <1 km from a dam while the other 16 were situated >1 km from a dam. A decrease in temperature, dissolved oxygen, conductivity and total dissolved solids was observed in sites immediately downstream of impoundments. Macroinvertebrate community structure and South African Scoring System (SASS) scores closely followed the damming-induced changes in water quality. However, water quality variables, macroinvertebrate community structure and SASS scores reverted back to typical upstream conditions in distances around 1 km from dams. Stream recovery from dam-induced changes was demonstrated with streams recovering at distances around 1 km from the point of regulation in corroboration with predictions of the serial discontinuity concept (SDC). These dam-induced changes also reflected themselves in SASS scores suggesting potential usefulness of SASS in monitoring ecological integrity of tropical rivers following disturbances like damming." (Authors) Taxa including Odonata are treated at family level.] Address: Mwedzi, T., School of Wildlife, Ecology and Conservation, Chinhoyi University of Technology, Off Harare-

Chirundu Rd, P. Bag 7724, Chinhoyi, Zimbabwe. E-mail: mrmwedzi@gmail.com

19131. Palacino-Rodríguez, F. (2016): Two decades of progress in over one hundred years of study: Present status of Odonata research in Colombia. *Odonatologica* 45(3/4): 327-334. (in English) ["This study documents the results of a bibliometric analysis of 135 indexed publications concerning Odonata research in Colombia. A database including publications since 1868 was built through reliable sources on the Web of Knowledge. The publications were classified by time frame, departments (geography), study categories, and origin. All other categories were sub-classified according to the origin of the researcher, except for geographical classification. Contingence tables were constructed and analysed with Pearson's chisquared test in the following analysis: i) number of papers per time frame according to the origin of the researcher; ii) separated number of papers for foreign researchers, network or Colombian authors over time; iii) number of papers per subject in accordance with the origin of the researcher; and iv) national or international publication according to the origin of the researcher. The number of documents per period, department, subject, and international or national publication were analysed by using chi square. The results showed the number of publications highest in Cundinamarca, Antioquia, Magdalena, Meta, and Valle. Departments least studied have been Arauca, Cesar, Guajira, Nariño, and San Andrés. The largest number of publications was taxonomic (83.7 %) and most studies (78.5 %) were published in international journals. The greatest progress in Odonata research in Colombia has been achieved since 2010. Current and future Odonata research in the country should cover more territory and prioritise research to provide information in order to generate conservation strategies in severely threatened Colombian ecosystems." (Author)] Address: Palacino-Rodríguez, F., Grupo de Investigación en Odonatos de Colombia (GINOCO), Grupo de Investigación en Biología (GRIB), Departamento de Biología, Universidad El Bosque Av. Cra. 9 No. 131A-02. Centro de Investigación en Acarología, Calle 152B # 55-45, Bogotá, Colombia. Email: odonata17@hotmail.com

19132. Panter, C.; Lake, S.; Liley, D. (2016): Southern Damselfly monitoring results 2015/16. *Natural England/ Footprint Ecology*: 48 pp. (in English) ["Natural England has commissioned this survey to provide up to date information on the status of Southern Damselfly *Coenagrion mercuriale* at its main populations in England in order to inform Article 17 reporting on the implementation of the Habitats Directive. This report presents the results of surveys carried out in 2015 and 2016 at sites known to support Southern Damselfly in Hampshire, Dorset and Devon. Single visits were made to 36 sites (nine sites in Dorset, twenty in Hampshire and seven sites in Devon), all of which had records of Southern Damselfly from 2007 or later. Four of the Dorset sites and all of the Hampshire sites were surveyed in 2015, the remainder of the Dorset sites and all six of the Devon sites were surveyed in 2016. At each site one or more transects were walked. The transects covered discrete

parts of the site such as stream branches, stretches of mire etc. In total, 140 transects were walked. Single visits were made to each location and visits were timed to coincide with peak flight periods and favourable weather conditions. In total, 2,267 male Southern Damselflies were recorded. No individuals were recorded at three (marginal) sites, two in Dorset and one in Devon. At four sites (two in Dorset and one each in Hampshire and Devon) only one male individual was recorded. However, most sites had much larger populations - the largest by quite some margin was 569 at Shipton Bottom. The highest density of individuals (males per meter of transect) was recorded at Tor View Moor, with 49 males per meter. The survey is intended to provide an overview and snapshot of the status. Some limited comparison is made to previous surveys. In the New Forest surveys in 2004 used the same transects and overall there was little correlation between the numbers recorded in 2004 and 2015. Numbers were higher in 2015 in 80% of sites, but were markedly lower at two sites. Data from regular Southern Damselfly monitoring was provided to us from surveys at the Devon sites for comparison to our results. These also differed markedly and counts from regular monitoring were consistently higher. This is not unexpected given the regular monitoring is conducted by surveyors that know each site very thoroughly and repeat visits will generate better count data." (Authors)] Address: footprint Ecology, Forest Office, Cold Harbour, Wareham, Dorset BH20 7PA, UK info@footprint-ecology.co.uk

19133. Rayan, S.; Chartchumni, B.; Rangsiwivat, A.; Papapim, Y.; Kumla, S. (2016): Diversity and distribution of Odonate larvae in Nam Oun reservoir. *Khon Kaen Agr. J.* 44(4): 623-630. (in Thai, with English summary) ["Diversity and Distribution of Odonate Larvae were investigated in Nam Oun reservoir, Sakon Nakhon province, Thailand. Random Samplings of Odonate Larvae had been conducted in 4 times, total of 6 stations consisted of 159 Odonate larvae from September 2014 to August 2015. These can be classified into 3 suborders with 8 families. The Family Libellulidae had found the most distribution in all time period and all stations. The highest of percentage frequency of occurrence (%F) was found in Family Libellulidae (50.00), Gomphidae (41.67) and Coenagrionidae and Amphiterygidae (8.33), respectively. The experimental of the differences between categories revealed that the species richness and shannon-wiener index of Odonate Larvae (station*time period) were resulted no significance ($p>0.05$). The shannon-wiener index of each station was average 0.41 ± 0.18 and the shannon-wiener index of Odonate larvae's time period of was average 0.45 ± 0.14 . Average shannon-wiener index from each station and time period ranged from 0.18 ± 0.10 and 0.14 ± 0.23 . The main factor which has an influence on the distribution of the Odonate larvae in each station and time period was found in the Odonate larvae in Family Protonuridae Amphiterygidae and Chlorocyphidae in water outlet zone. The distribution was found in the water outlet zone particularly in the season changed from Rainy season to Dry season (T1). The Odonate larvae from family Coenagrionidae was found most distribution in the water outlet zone

during the season changed from Dry season to Rainy season (T3) while the Odonate larvae in Family Libellulidae was found the most distribution in the middle of the water zone when the climate changed from Dry season to Rainy season." (Authors)] Address: Rayan, S., Fac. Nat. Resources., Rajamangala Univ. Tech. Isan, Sakon Nakhon Champus 47160, Thailand. Email: somsakry@gmail.com

19134. Renner, S.; Périco, E.; Sahlén, G. (2016): Man-made lakes form species-rich dragonfly communities in the Brazilian Atlantic Forest (Odonata). *Odonatologica* 45(3/4): 135-154. (in English) ["One of the forest types occurring in Southern Brazil is the Mixed Ombrophilous Forest (MOF), a subtype of the Atlantic Forest and one of the biodiversity hotspots on Earth. We sampled adult Odonata at 30 locations in the Floresta Nacional de São Francisco de Paula (FLONA-SFP), Rio Grande do Sul, Brazil, a national reserve which is divided into several sectors of MOF, planted *Araucaria angustifolia*, *Pinus elliottii* used for sustainable and financial purposes, and open fields. There are three types of aquatic environments in the reserve: lakes, swamps, and rivers/streams. Our aim was to obtain an overview of the species' distribution patterns in the three types of aquatic environments and to evaluate the species occurring in lakes, an exclusively man-made habitat in this area. We recorded 46 species from seven odonate families; 25 species ($x = 5.71 \pm 1.77$ SD) occurring in rivers/ streams, 24 in lakes (11.57 ± 2.15) and 21 in swamps (5.22 ± 3.60). Using Non-metric Multidimensional Scaling (NmDS), we showed that the species composition differed clearly between the three types of aquatic habitats. While swamps and rivers/streams had a relatively similar and uniform species composition, species in the lakes were more varied but the total species number was almost as high as that of the rivers/streams. The lake communities also differed distinctly from those of the other habitats, and we assume that the lake species originate from other degraded areas in the vicinity, indicating that the remains of the Atlantic Forest has already been strongly altered by humans. Given the poor knowledge of the Odonata in the Atlantic Forest/MOF, we hope that our study may increase the understanding of the communities, and contribute to the development of conservation measures for this fragmented biome." (Authors)] Address: Renner, S., Centro Universitário Univates, Rua Avelino Tallini, 171, Laboratório de Evolução e Ecologia, sala 104, Prédio 8, 95900-000, Lajeado, RS, Brazil

19135. Renner, S.; Périco, E.; Sahlén, G. (2016): Effects of exotic tree plantations on the richness of dragonflies (Odonata) in Atlantic Forest, Rio Grande do Sul, Brazil. *International Journal of Odonatology* 19(4): 207-219. (in English) ["One of the forest types occurring in Southern Brazil is the mixed ombrophilous forest (MOF), a subtype of the Atlantic Forest, which is one of the richest biomes on Earth. This biome currently remains as a highly fragmented mosaic, under pressure from human development. The diversity and ecology of most animal groups in this biome are poorly known. We studied Odonata in a large forest fragment, including an ecological reserve: the Floresta Nacional de São

Francisco de Paula (FLONA-SFP), in Rio Grande do Sul, administrated by the Brazilian government. The reserve is dominated by MOF with sectors of *Pinus elliottii* and *Araucaria angustifolia*. Three surveys of these forest sectors over one year yielded 42 species, with the highest species richness recorded in the *P. elliottii* sector. The odonate species recorded here are all generalist in terms of habitat preferences, but they appeared only in low numbers and were very particular in their occurrence pattern. We therefore assume that the introduction of an alien element in the Atlantic Forest has given rise to a new species assemblage, where the ecology of the species is adapted to the novel habitat of *Pinus* plantations. As expected, the species occurring in the MOF sectors were mainly habitat specialists. The *Araucaria* plantations had an intermediate species composition. Despite the differences observed in habitat preference between generalist and specialist species, such exotic plantation habitats may act as a temporary biodiversity reservoir for further habitat colonization." (Authors)] Address: Renner, S., Centro Universitário Univates, Rua Avelino Tallini, 171, Laboratório de Evolução e Ecologia, sala 104, Prédio 8, 95900-000, Lajeado, RS, Brazil

19136. Sanchez Herrera, M. (2016): Why so many colors?. Ph.D. thesis, Rutgers, The State University of New Jersey: XII, 125 pp. (in English) ["The Neotropics is a center of global diversity for many groups of organisms, including the dragonflies and damselflies (Odonata). While the number of biodiversity surveys and new species descriptions for neotropical odonates is increasing, diversity in this region is still under-explored, and very few studies have looked at the genetic and morphological diversity within taxa. Here, I will present an overview of the evolutionary history, species diversity and morphological diversity of the Neotropical damselfly genus *Polythore*. Species in *Polythore* are stunningly colorful; their wings display varying shades of orange, black and white in complex patterns. Despite this color diversity, they lack variation in classical reproductive traits (e.g. male genitalia) commonly used for species description. The genus comprises 21 described morphospecies distributed along the eastern slopes of the Andes cordillera and the Amazon basin, from Colombia to northern Bolivia; they dwell in small, fast flowing streams with highly oxygenated waters. I used novel morphological methods (geometric morphometrics, chromaticity analysis, and Gabor wavelet transformation) to analyze the complexity of the wing color patterns present in this genus. I explored species and population relationships through phylogenetic reconstructions and species delimitation analyses incorporating mitochondrial (COI, ND1, 16S) and nuclear (18S, 28S, PMRT) sequences. I was able to quantify the color polymorphism and detect that wing color is not due to common descent, i.e. not just result of phylogenetic history. I have discovered that the presence of four new cryptic species, which are new to science, are inflating the estimates species diversity within this genus. Furthermore, my phylogenetic reconstruction for the family Polythoridae suggests that *Polythore* has one common ancestor, however, other genera will need to be taxonomically revised. Finally, the divergence time calibration

analyses indicate that important geological events like the Andes Cordillera uplift may have had an impact on the diversification of these Neotropical damselflies." (Author)] Address: Sanchez Herrera, Melissa, Biology Program, Faculty of Natural Sciences and Mathematics, Universidad del Rosario, KR 24 63C-69, Bogota 111221, Colombia. E-mail: melsanc@gmail.com

19137. Schweighofer, W. (2016): Die Libellen- und Heuschreckenfauna des Leckermoores im Jahr 2015 – ein Monitoringbericht mit Besprechung der Erhebung von Ottmann (2015). *Silva Fera*, Bd. 5/April 2016: 72-77. (in German, with English summary) ["This monitoring report discusses the Odonata and Orthoptera species found at the peat bog "Leckermoor" (Hochreith/ Göstling an der Ybbs) in 2015. It reviews Ernst Ottmann's findings from 2014 published in *Silva Fera* 4, where some misidentifications of species occurred. In 2015, a total of 8 Odonata and 15 Orthoptera species could be identified. After 20 years, there is also new evidence of the highly specialized dragonfly *Aeshna subarctica elisabethae* from the Leckermoor, a species which is very rare in Lower Austria." (Author)] Address: Schweighofer, W., Ötscherblick 10, 3661 Artstetten, Austria. Email: wolfgang.schweighofer@schule.at

19138. Shao, M.; Jin, L.; Zhang, Y. (2016): Phytotoxic metabolite from QTYC01, a fungus residing in the gut of *Pantala flavescens* larvae. *Acta Microbiologica Sinica* 56(9): 1513-1520. (in Chinese, with English summary) ["[Objective] To isolate the fungus with phytotoxic activity from the gut of *Pantala flavescens* larvae and find the phytotoxic lead compound from the fungal metabolites. [Methods] QTYC01 was isolated from the gut of *P. flavescens* larvae by means of spread plate and identified by 5.8S rRNA sequence analysis and morphologic observation. Phytotoxic activities of the fermentation broth and ethyl acetate extracts against the radical growth of weeds as well as the safety of crude extract to the selected crops were tested by Petri dish bioassay. The herbicidal activity of QTYC01 against *Echinochloa crusgalli* seedlings was carried out by potted bioassay. Fermentation product was purified by recrystallization and identified by extensive spectroscopic analysis. [Results] QTYC01 was identified as *Curvularia crepinii*. The fermentation broth of QTYC01 significantly inhibited the radical growth of *E. crusgalli* and *Amaranthus retroflexus* with the inhibition rate of 95.0% and 90.1%, respectively. The fermented liquid showed significant inhibitory activity to the seedling of *E. crusgalli* with the victimization rate of 71.1%. Under the concentration of 100 ig/mL, ethyl acetate extracts exhibited significant phytotoxic activities against the radical growth of *E. crusgalli* and *A. retroflexus* with inhibitory rates of 56.8% and 71.2%, respectively, and showed good security to the selected common crops with the inhibition rate of lower than 33%. Therewith, a bioactive compound was isolated from the ethyl acetate extract and determined as (5Z)-7-oxozeaenol. The compound showed good phytotoxic activity against *A. retroflexus* with the IC50 value of 4.8 ig/mL. [Conclusion] Strain QTYC01 could be potentially developed as a new microbial herbicide." A(uthors)] Address:

Shao, M., College of Chemistry and Life Science, Zhejiang Normal Univ., Jinhua 321004, Zhejiang Province, China

19139. Siregar, A.Z.; Rawi, C.S.M.; Ahmad, A.H.; Nasution, Z. (2016): *Agriocnemis femina* (Odonata: Coenagrionidae) and its significance in environmental parameters of rice pests in northern Sumatra-Indonesia. *Journal of Agriculture and Veterinary Science* 9(8): 71-76. (in English) ["The pattern movement and age structure influence of rice cultivation phases on *A. femina* aquatic organisms was investigated in the Manik Rambung rice field (MRRF) ecosystem in North Sumatra. *A. femina* collections of a butterfly net samples were collected in five cultivation phases (fallow, plough, transplanting young, tiller, mature atau preharvest). *Agriocnemis femina* adult, one of the rice pest predators in the adult stage, was dependent on its interactions with rice cultivation phases. There were three age classes of *A. femina*; teneral, juvenile and mature with sex ratio male and female is 1.7:1. It was important in regulating *Agriocnemis femina* population in MRRF which determined its successful emergence to a predatory adult. Rice cultivation managements that focus on enhancing the population of *Agriocnemis femina* would contribute to more effective biological control of rice pests." (Authors)] Address: Siregar, A.Z., School of Biological Sciences, Universiti Sains Malaysia, 11800 Penang, Malaysia

19140. Smith-Patten, B.; Patten, M.A. (2016): Status, distribution, and ecology of the Ozark Emerald (*Somatochlora ozarkensis*) and other springtime-emerging dragonflies of eastern Oklahoma. October 1, 2013 through September 30, 2016. Final Performance Report, Federal Aid Grant No. F13AF01188 (T-73-1): 31 pp. (in English) ["This project was focused on determining the status and distribution in Oklahoma of three species of Anisoptera that are regional endemics to the south-central United States, the Oklahoma Clubtail (*Gomphus oklahomensis*), Ozark Clubtail (*G. ozarkensis*), and Ozark Emerald (*Somatochlora ozarkensis*), with a special focus on the last of these species. We conducted a thorough review of extant museum specimens, published literature, and archived photographs to establish baseline information on distribution. We used this baseline to design a series of field surveys to a) confirm continued presence at sites where the species was known, b) obtain information on relative abundance, and c) detect species at sites where it had not been found previously. We effectively doubled the number of known records of the three target species, and we added dozens of localities of occurrence. We found the two clubtails in sufficiently large numbers to conclude that neither species is of high conservation concern in the state. The emerald proved to be rare in the state. Its scarcity, along with its regional endemism and habitat specificity, warrants a high conservation priority. Additional work on this last species, which may be declining range-wide, is needed. We provide information on five other species—the Ouachita Spiketail (*Cordulegaster talaria*), Atlantic Bluet (*Enallagma doubledayi*), Burgundy Bluet (*E. dubium*), Attenuated Bluet (*E. daeckii*), and Westfall's Snaketail (*Ophiogomphus westfalli*)—of conservation interest in

the region. We also make recommendations for future research for these and other species of conservation interest." (Authors)] Address: Patten, M.A., Oklahoma Biological Survey, University of Oklahoma, Norman, OK 73019, USA. E-mail: mpatten@ou.edu

19141. Sniegula, S.; Golab, M.J.; Johansson, F. (2016): A large-scale latitudinal pattern of life-history traits in a strictly univoltine damselfly. *Ecological Entomology* 41(4): 459-472. (in English) ["(1.) Variation in thermal conditions and season length along latitudinal gradients affect body size-related traits over different life stages. Selection is expected to optimise these size traits in response to the costs and benefits. (2.) Egg, hatchling, larval and adult size in males and females were estimated along a latitudinal gradient of 2730 km across Europe in the univoltine damselfly *Lestes sponsa*, using a combination of field-collection and laboratory-rearing experiments. In the laboratory, individuals were grown in temperatures and photoperiod simulating those at the latitude of origin, and in common-garden conditions. (3.) The size of adults sampled in nature was negatively correlated with latitude. In all populations the females were larger than the males. Results from simulated and common-garden rearing experiments supported this pattern of size difference across latitudes and between sexes, suggesting a genetic component for the latitudinal size trend and female-biased size dimorphism. In contrast, hatchling size showed a positive relationship with latitude, but egg size, although differing between latitudes, showed no such relationship. (4.) The results support a converse Bergmann cline, i.e. a negative body size cline towards the north. This negative cline in body size is probably driven by progressively stronger seasonal time and temperature constraints towards the higher latitudes and by the obligate univoltine life cycle of *L. sponsa*. As egg size showed no relationship with latitude, other environmental factors besides temperature, such as desiccation risk, probably affect this trait." (Authors)] Address: Sniegula, S., Institute of Nature Conservation, Polish Academy of Sciences, Mickiewicza 33, 31-120 Cracow, Poland. E-mail: szymon.sniegula@gmail.com

19142. Suvorov, A.; Jensen, N.O.; Sharkey, C.R.; Fujimoto, M.S.; Bodily, P.; Wightman, H.M.C.; Ogden, T.H.; Clement, M.J.; Bybee, S.M. (2016): Opsins have evolved under the permanent heterozygote model: insights from phylotranscriptomics of Odonata. *Molecular ecology* 26(5): 1306-1322. (in English) ["Gene duplication plays a central role in adaptation to novel environments by providing new genetic material for functional divergence and evolution of biological complexity. Several evolutionary models have been proposed for gene duplication to explain how new gene copies are preserved by natural selection but these models have rarely been tested using empirical data. Opsin proteins, when combined with a chromophore, form a photopigment that is responsible for the absorption of light, the first step in the phototransduction cascade. Adaptive gene duplications have occurred many times within the animal opsins gene family, leading to novel wavelength sensitivities. Consequently, opsins are an attractive choice for the study of gene

duplication evolutionary models. Odonata (dragonflies and damselflies) have the largest opsin repertoire of any insect currently known. Additionally, there is tremendous variation in opsin copy number between species, particularly in the long wavelength sensitive (LWS) class. Using comprehensive phylotranscriptomic and statistical approaches we tested various evolutionary models of gene duplication. Our results suggest that both the blue sensitive (BS) and LWS opsin classes were subjected to strong positive selection that greatly weakens after multiple duplication events, a pattern that is consistent with the permanent heterozygote model. Due to the immense interspecific variation and duplicability potential of opsin genes among odonates, they represent a unique model system to test hypotheses regarding opsin gene duplication and diversification at the molecular level." (Authors)] Address: Suvorov, A., Department of Biology, Brigham Young University, Provo, Utah 84602, USA. E-mail: antony.suvorov@byu.edu

19143. Tsubaki, Y.; Samejima, Y. (2016): Hot males live fast and die young: habitat segregation, reproductive output, and lifespan of sympatric *Mnais* damselflies. *Behavioral Ecology and Sociobiology* 70(5): 725-732. (in English) ["The Japanese damselflies *Mnais costalis* and *Mnais pruinosa* show microhabitat segregation in response to forest sunlight conditions in their sympatric habitat: *M. costalis* prefers sunny sites while *M. pruinosa* prefers semi-shady sites. We tested whether sunlight conditions at territorial sites influenced reproductive output, territory occupancy, and/or reproductive lifespan of males of the two species differently. Oviposition duration of females after copulation was used as the measure of reproductive output of individual males. We recorded illuminance at each territorial site on sunny days during the behavioral observation periods. *M. costalis* males at sites with higher illuminance had a higher reproductive output than other territorial males, while *M. pruinosa* males had a relatively lower reproductive output at such sites. During a reproductive season, we performed population censuses in a 500-m area of stream, which contained at least 112 potential territorial sites. Using a fish-eye converter, we took a hemispherical photograph to estimate canopy openness as a measure of insolation at each territorial site and examined whether males incur higher survival costs by holding territories at sunnier sites. Minimum reproductive lifespan, estimated as days between the first and the last sightings, showed that *M. costalis* males that occupied sunnier sites had a shorter lifespan than those occupying shadier sites, while *M. pruinosa* males did not show such a relationship. These results suggest that microhabitat segregation of these two *Mnais* damselflies reflects a species difference in the tradeoff between the benefit of mating rate and cost of survival in the sun. Significance statement: We report a field study on the relationships among thermal environment, temperature tolerance, reproductive success, and character displacement in the mating systems of two species of territorial *Mnais* damselflies. Allopatric populations of these two species are forest dwellers, and males of each species show wing color polymorphism linked to alternative mating behaviors. When these species are sympatric,

males lose their polymorphisms and change their habitat preferences: *M. pruinosa* prefers shady parts of a stream, while *M. costalis* prefers sunnier parts. We showed the costs and benefits of character displacement coupled to microhabitat preference shift. The findings of this study may highlight an underappreciated area of study, namely, the interplay between behavioral and physiological ecology in insects." (Authors)] Address: Tsubaki, Y., Center for Ecological Research, Kyoto University, Kyoto, Japan

19144. Tummylovich, O.A. (2016): Odonata larvae of Kaliningrad oblast: Species composition and distributional features. *Inland Water Biology* 9(4): 350-354. (in English) ["In this study, a total of 27 species of dragonfly and damselfly larvae were identified, including 14 species from suborder Anisoptera and 13 from Zygoptera. The dominant species are *Libellula quadrimaculata*, *Enallagma cyathigerum*, and *Erythromma najas*. Frequently occurring species are *Coenagrion hastulatum*, *C. lunulatum*, *C. pulchellum*, *Ischnura elegans*, *Platycnemis pennipes*, *Lestes virens*, and *Libellula depressa*. Rare species are *Lestes sponsa*, *Libellula fulva*, *Gomphus flavipes*, *Gomphus vulgatissimus*, *Sympetrum flaveolum*, *Aeshna viridis*, *A. cyanea*, *A. grandis*, *A. mixta*, *Calopteryx splendens*, *C. virgo*, and *Ophiogomphus cecilia*." (Authors) Original Russian Text © O.A. Tummylovich, 2016, published in *Biologiya Vnutrennykh Vod*, 2016, No. 4, pp. 18–22.] Address: Tummylovich Olga Aleksandrovna – State autonomous institution of the Kaliningrad region for additional education of children "Kaliningrad Regional Children and Youth Center for Ecology, Local History and Tourism"; teacher of additional education; E-mail: Levente@rambler.ru

19145. Turnhout, S.; Wasscher, M.; Termaat, T. (2016): The return of the River Clubtail (*Gomphus flavipes*) in the Netherlands. New insights in ecology and research. *Brachytron* 18(1): 38-49. (in Dutch, with English summary) ["After the rediscovery of the River Clubtail (*Gomphus flavipes*) in the Netherlands in 1996, insights in the occurrence and ecology of this rare and critically endangered species changed. In this article we show that new insights like these do not emerge spontaneously. In this case it required the intervention of a new type of actor (a fish researcher, with a sound knowledge of dragonflies) who applied new and unorthodox instruments (the water filter of a power plant) at an unusual place (private terrain, not open to the public) to find a first larva. Only after repeating his discovery two years later the new insights gained a foothold. The example of the River Clubtail shows that our constantly changing knowledge of species can be related to both ecological and social aspects. Besides the improvement of water quality in Dutch rivers at the end of the twentieth century, more people looked for dragonflies more often at more places, with new incentives and using more instruments and more information. Obviously new discoveries should be expected under these circumstances. It is a classical dilemma in ecological monitoring: does this trend show changes in the numbers or occurrence of the species, or does it merely reflect changes in the population of observers? The interconnectedness

of social and ecological aspects shows that biodiversity research is about more than just data. What more precisely, is to be investigated further." (Authors)] Address: Wasscher, M.: marcel.hilair@12move.nl

19146. Ubukata, H. (2016): Life history of *Sympetrum frequens* (Selys, 1883) in Hokkaido: are migration and reproductive diapause involved?. *Tombo* 58: 1-26. (in Japanese, with English summary) ["Life history events and spatio-temporal distribution of the imagines of *Sympetrum frequens* (Selys, 1883) in Hokkaido were reviewed and the possibilities of adopting (1) migration between lowland larval habitats and cooler mountainous areas and (2) reproductive diapause were discussed for Hokkaido population. Emergence began in late June in the district where air temperature sometimes exceeded 30°C even in May (i.e., Abashiri District) or in early August in the district with a cool spring (Nemuro District). Precocious adults showed reproductive behavior as early as late July (estimated to be ca. 20 days after emergence), and mass engagements in tandem flight began from late August until early September (estimated to be 40–50 days after emergence) in Ishikari and nearby districts. Individuals performing such a synchronous reproductive behavior 20 days or more after the dates of the earliest reproductive behavior might have undergone reproductive diapause, which could afford a safeguard for avoiding loss from part of their eggs hatching before winter. Many imagines, mostly immature adults, were observed at 400–2,100 m alt. on Mt. Daisetsu during July and early August. They were likely to be those which had emerged from paddy fields, ponds, etc. on the Kamikawa Basin and had flown toward the upper reaches of the mountainous area because the ponds at 1,300–1,700 m alt. were in a condition just after the snow thaws, which should have prevented the larvae from growing and becoming imagines before early August. Actually, no larva of this species was captured during surveys made at various ponds at 1,300–1,700 m alt. in July. Most of the populations emerged on the plains in central Hokkaido was likely to migrate or to move toward mountainous areas and then to fly further toward the upper reaches. But the portion of the Hokkaido population that remained on the plains without migrating to mountains were likely to be much higher than those of the central Honshu populations. As Uéda (1995) predicted, the altitudinal zones utilized by the Hokkaido populations during hot summers were much lower than those of central Honshu, having had no altitudinal gap with the subpopulations remaining on the lowlands. Nevertheless, part of the Hokkaido population is likely to migrate as a habit, if the following observations by Wataji et al. (1997b) in Sapporo city are taken into consideration: at least some imagines of *S. frequens* tended to perch high in the tree canopy around the emergence site on the lowland during the first few days after emergence and then fly rather steadily towards distant mountainous areas. This habit is likely to be an adaptation for long distance (e.g., 10 km) migration across the plain towards mountain areas. Actually Wataji et al. caught several individuals out of several thousands that had been marked at an emergence site, in the middle of the Ishikari Plain. Finally, genetic traits

of reproductive diapause and migration were discussed in the context of adjustments responding to climate and seasonality, followed by speculation on the evolutionary processes of these traits in Hokkaido." (Author)] Address: Ubukata, H., Hokkaido University of Education at Kushiro, Dept Science Education, Shiroyama 1-15-55, Kushiro, 085, Japan. E-mail: ubukata@kus.hokkyodai.ac.jp

19147. Westermann, K. (2016): Vorkommen und Schutz der Alpen-Smaragdlibelle (*Somatochlora alpestris*) und der Arktischen Smaragdlibelle (*Somatochlora arctica*) im Oberen Hotzenwald (Südschwarzwald). *Naturschutz südl. Oberrhein* 8: 166-186. (in German, with English summary) ["From 2011 to 2015 I tried to check places together with Elisabeth Westermann in the upper Hotzenwald (southern black Forest) where *Somatochlora arctica* und *S. alpestris* have been found in former times and also tried to find other water bodies where these dragonflies develop. All places where they were found were rated according to the approach described by Sternberg (1995) as stem habitat, secondary habitat or latency habitat based on the regularity and frequency of the recorded exuviae. We found populations of *S. arctica* in 18 bogs and fens; one was a stem habitat, four were secondary habitats and 13 latency habitats. Single populations consisted of observation sites which were at a distance of up to 250 m from each other. in one year the maximum number was 46 exuviae per moor and 103 exuviae in the whole area. *S. alpestris* was significantly less frequent. the populations in ten bogs and fens, one secondary habitat and nine latency habitats, yielded at maximum only ten exuviae per moor and 22 exuviae in the whole area. the lowest observation site of *S. alpestris* was at 878 m NN at the lower limit of the altitudinal distribution of the species in the southern black Forest. *S. arctica* also emerged at all observation sites of *S. alpestris*, sometimes in close spatial vicinity within the same small water body. Approximately two thirds of all exuviae were distributed over small silting gullies of diverse hanging moors which are the most important habitat for the development of both species in the upper Hotzenwald. the populations are highly endangered by long droughts, silting and overgrowth with groves. in the nature reserve „ennersbacher Moor“, one of the scarce stem habitats of both species in the southern and middle black Forest was destroyed within 20 to 30 years. A concept for the protection and optimization of existing stem habitats and secondary habitats as well as for the creation of further habitats for the development, which are effective for the population biology, was outlined." (Author)] Address: Westermann, K., Buchenweg 2, D-79365 Rheinauen., Germany

19148. Whispell, A.M. (2016): Physiological color change in the blue-fronted dancer damselfly. Ph.D. thesis, Rutgers, The State University of New Jersey: xi, 141 pp. (in English) ["Several studies have established the existence of temperature-controlled physiological color change (PCC) in Odonata species. Individuals capable of this PCC darken to "dark-phase" (DP) coloration below a temperature threshold and return to "bright-phase" (BP) coloration once above it.

The stimulus controlling PCC in *Argia apicalis* (Say) has been contentious since first studied in the 1960s, as BP and DP males are often present under seemingly identical conditions. In Chapter 1, my goal was to determine if the control of *A. apicalis* male PCC could be attributed to one specific variable or if it is dual-controlled. I first tested whether ambient temperature can be used to predict color phase and found that it is a significant predictor of DP coloration in solitary males only. I next looked for an association between DP coloration and mating status (mating or solitary) and found that DP is far more likely to be exhibited by mating males, thus PCC is also mating-controlled in *A. apicalis* males. Finally, I looked for a relationship between mating stage and color phase and established that mating-controlled PCC is initiated during copulation, further supporting the link between mating and PCC. Additionally, males were darkest during oviposition—the mating stage when males may be most vulnerable to predation. My results indicate that *A. apicalis* males possess dual-controlled PCC. In Chapter 2, my objective was to establish whether DP coloration could be operating as an anti-predator defense strategy in *A. apicalis* males. I first measured the reflectance spectra of DP and BP males and found that BP males are approximately 4.8 times brighter than DP males. I subsequently performed a binary choice experiment to determine whether BP males suffer higher levels of predation than DP males. I tested two predator groups for their color phase preference: avians, *Gallus gallus domesticus* (Linnaeus), and anurans, *Lithobates clamitans melanota* (Rafinesque) and *Lithobates catesbeianus* (Shaw). I found that both groups attacked significantly more BP than DP models, so it is plausible that the mating-controlled PCC exhibited by *A. apicalis* males could be functioning as an anti-predator defense strategy during oviposition." (Author)] Address: not stated

19149. Why, A.M.; Lara, J.R.; Walton, W.E. (2016): Oviposition of *Culex tarsalis* (Diptera: Culicidae) differs on water conditioned by potential fish and insect predators. *Journal of Medical Entomology* 53(5): 1093-1099. (in English) ["The response of egg-laying *Culex tarsalis* Coquillett (Diptera: Culicidae) to water conditioned by three fish species used for mosquito control and three predatory aquatic insect species was examined in laboratory binary choice experiments. Oviposition by *Cx. tarsalis* was 72% less on water conditioned with the arroyo chub, *Gila orcutti* (Eigenmann & Eigenmann) (Cypriniformes: Cyprinidae) relative to control cups containing aged tap water, but no significant difference was found in the numbers of egg rafts laid on water conditioned with the fathead minnow (*Pimephales promelas* (Rafinesque), Cypriniformes: Cyprinidae) and the control treatment (water aged 24h). Mosquito oviposition on water conditioned with the predominantly herbivorous/algivorous California Mozambique tilapia hybrid (*Oreochromis mossambicus* (Peters) × *Oreochromis urolepis hornorum* L. (Perciformes: Cichlidae)) or predatory insects (nymphs: *Sympetrum corruptum*; adults: *Thermonectus basillaris* (Harris) or *Cybister fimbriolatus* (Say) (Coleoptera: Dytiscidae)) did not differ significantly relative to that onto water aged for 24h. As compared with water aged 24h and water conditioned with diving

beetles, oviposition by *Cx. tarsalis* was significantly lower (=53%) when live predatory diving beetles were present in oviposition cups. Gravid *Cx. tarsalis* females do not respond equally to putative semiochemicals in water conditioned with the piscine or aquatic insect predators of immature mosquitoes tested here." (Authors)] Address: Why, Adena, Dept of Entomology, Univ. of California-Riverside, Riverside, CA 92521, USA. E-mail: adena.why@email.ucr.edu.

19150. Wildermuth, H.; Schneider, B. (2016): Seltene Libelle mit seltener Beute: Gelbe Keiljungfer *Gomphus simillimus* erbeutet Kleines Fünffleck-Widderchen und Gemeine Sichelschrecke (Odonata: Gomphidae; Lepidoptera: Zygaenidae; Orthoptera: Phaneropteridae). *Mercuriale* 16: 25-31. (in German, with English summary) ["Rare species with rare prey: *Gomphus simillimus* as predator of *Zygaena viciae* and *Phaneroptera falcata* – Two females of *G. simillimus* were photographically documented devouring a captured *Z. viciae* and a female sickle-bearing bush-cricket (*Phaneroptera falcata*), respectively, at the river Rhine near the Swiss-German border. It is discussed if especially the females of odonates prey upon large insects and if gomphids with long hind legs are advantaged to grasp large prey." (Authors)] Address: Schneider, B., Wolfbühlstrasse 34A, 8408 Winterthur, Switzerland. E-mail: beatsch@bluemail.ch

19151. Zhao, Q.; Pan, Y.; Griffin, J.N.; Sun, J.; Sun, S. (2016): Contrasting trophic-cascade effects driven by variation in morphology of the perches used by a larval damselfly. *Freshwater Biology* 61(5): 693-701. (in English) ["(1) The presence of habitat structures (e.g. caves, ledges, branches) has well-documented ecological effects. However, it remains largely unknown how variation in the morphology of particular habitat structures affects ecological interactions. (2) Using an algae-cladoceran grazer-larval damselfly food chain as a model in a series of microcosm experiments, we manipulated food-chain length and the length (long versus short) and diameter (thick versus thin) of vertically orientated damselfly perches (habitat structure) and examined the density of the grazers and algae. Because the larval damselflies are usually more flexible on thinner perches and have broader foraging domains on longer perches, we predicted that when on long and thin perches they would suppress grazer density more efficiently and hence confer a more positive trophic-cascade effect on algal growth. (3) As predicted, larval damselflies occupying long and thin perches most strongly reduced grazer density and increased algal density, illustrating a positive trophic cascade. In all other damselfly treatments, and despite reduced grazer density, algal density declined, showing a negative trophic cascade due to an elevation in grazer foraging efficiency under predation risk. This probably resulted from the increased activity of the grazers and their spatial shift to the lower water column where algal density was higher. (4) In conclusion, perch morphology affected the direction and strength of the trophic cascade by altering both density-mediated and behaviour-mediated indirect interactions. Considering that anthropogenic disturbance is dramatically changing the morphological diversity of habitat structures, we call

for more research into the ecological consequences of such physical diversity at community and ecosystem ." (Authors)] Address: Sun, S., Dept of Biology, College of Life Sciences, Nanjing University, 163 Xianlin Avenue, 210023 Nanjing, China. E-mail: shcs@nju.edu.cn

2018

19152. Brasil, L.S.; Olivira-Junior, J.M.; Calvao, L.B.; Carvalho, F.G.; Monteiro-Junior, C.S.; Dias-Silva, K.; Juen, L. (2018): Spatial, biogeographic and environmental predictors of diversity in Amazonian Zygoptera. *Insect Conservation and Diversity* 11: 174-184. (in English) ["1. Our objectives were to assess how turnover and nestedness contribute to beta-diversity patterns of the Zygoptera in Amazonian streams, and to relate these components of beta diversity to environmental, spatial and biogeographic predictors. Our first hypothesis is that the turnover is the most important component of beta-diversity patterns due to the historical isolation of all or part of the areas located in the interfluves of the major Amazonian rivers. Our second hypothesis is that the interaction between environmental conditions and the area of endemism (biogeography) would be the most important predictor of beta-diversity patterns. 2. To test these hypotheses, we compiled data on the Zygoptera communities from 172 Amazonian streams. We used three sets of predictor variables: (i) environmental variables, (ii) area of endemism (biogeographic) and (iii) spatial filters. 3. The turnover explained 99.36% of the beta diversity, corroborating our first hypothesis. Together, environmental and biogeographic variables were the best predictors of beta-diversity patterns. For turnover, however, the biogeographic variables were the best predictors, contrary to our second hypothesis. 4. We found high gamma diversity, but low alpha diversity in the Zygoptera communities. This paradox is explained by the high turnover among sites within the study landscape. This pattern of diversity is related to both historical biogeographic factors and the spatial structuring of environmental conditions in the Amazon region. In the light of our results (high turnover and beta diversity), and their correspondence with areas of endemism, adequate conservation of Amazonian Zygoptera diversity will depend on the establishment of so-called mega-reserves throughout the major Amazonian interfluves and, whenever possible, in the areas with adequate environmental conditions for the greatest possible number of species, otherwise, most species may be at a constant risk of extinction." (Authors)] Address: Brasil, L.S., Av. Perimetral, n 1901/1907 - Terra Firme, Belém, Pará, CEP 66017-970, Brazil. E-mail: brasil_biolgia@hotmail.com

19153. Harabis, F.; Dolny, A. (2018): Military training areas as refuges for threatened dragonfly species: Effect of spatial isolation and military activity. *Biological Conservation* 217: 28-35. (in English) ["A long-term decline in habitat quality and freshwater species diversity has forced conservation managers to consider secondary habitats, such as military training areas (MTAs), that were previously overlooked but have conservation potential. Isolation from many negative

anthropogenic influences combined with disturbances associated with military activities can benefit the diversity of terrestrial species. However, little is known about the conservation potential of freshwater habitats that are an integral part of MTAs. In this study, we used Odonata as valuable indicators of habitat quality to compare the diversity of freshwater sites inside and outside MTAs. We randomly selected 16 sites inside four extensive MTAs and 16 reference sites outside MTAs and examined the differences in traits of species occurring inside and outside the MTAs. We found that the diversity and conservation value of dragonfly communities inside MTAs was comparable to that in the most valuable freshwater habitats outside MTAs. Inside MTAs, species were primarily those associated with habitats in the late successional stages, while species associated with early successional stages were absent. Undoubtedly, the conservation potential of MTAs for freshwater invertebrates is in the long-term isolation from negative anthropogenic influences. Paradoxically, the main potential problem in protecting freshwater habitats inside MTAs is the cessation of military activity." (Authors)] Address: Harabiš, F., Dept Ecol., Fac. Environmental Sciences, Czech Univ. Life Sciences Prague, Kamýcká 129, 165 21 Prague 6, Czech Republic

19154. Kim, M.J.; Wang, A.R.; Kim, S.S.; An, J.; Kim, I. (2018): Development and validation of microsatellite markers for the tiny dragonfly, *Nannophya pygmaea* (Odonata: Libellulidae), which is endangered in South Korea. *Applied Entomology and Zoology* 53(1): 151-156. (in English) ["The tiny dragonfly, *Nannophya pygmaea* (Odonata: Libellulidae), is listed as a second-degree endangered wild animal in South Korea. The application of molecular markers to assess genetic diversity and population relationships can provide information necessary to establish an effective conservation strategy. In this study, we developed 12 microsatellite markers specific to *N. pygmaea* using the NextSeq 500 platform. Forty individuals of *N. pygmaea* collected from three currently known localities in South Korea were genotyped to validate these markers and to preliminarily assess population genetic characteristics. The observed number of alleles, observed heterozygosity, and expected heterozygosity at a locus ranged from 2 to 9, 0.421–1.0, and 0.508–0.766 in a population with the largest sample size (20 individuals), respectively, thereby validating the suitability of the markers for population analysis. Five of 12 loci showed significant deviation from the Hardy–Weinberg equilibrium in the population. Our preliminary data indicate an absence of inbreeding in all populations and an absence of obvious genetic difference. The microsatellite markers developed in this study will be useful for studying the population genetics of *N. pygmaea* collected from other regions worldwide, including additional sites in South Korea." (Authors)] Address: Kim, Min Jee, Department of Applied Biology, College of Agriculture and Life Sciences, Chonnam National University, Gwangju, Republic of Korea

19155. Op de Beeck, L.; Verheyen, J.; Stokks, R. (2018): Strong differences between two congeneric species in sensitivity to pesticides in a warming world. *Science of The Total*

Environment 618: 60-69. (in English) ["Highlights: •Combined effects of warming and chlorpyrifos differed between two damselfly species. •Chlorpyrifos reduced survival and growth more in the large, slow growing species. •Chlorpyrifos reduced heat tolerance only in the more sensitive species. •Differences in sensitivity were not driven by size and life history but physiology. •Trait-based methods to predict sensitivity to pesticides need physiological traits. Abstract: To predict the impact of pesticides in a warming world we need to know how species differ in the interaction pathways between pesticides and warming. Trait-based approaches have been successful in identifying the 'pace of life' and body size as predictors of sensitivity to pesticides among distantly related species. However, it remains to be tested whether these traits allow predicting differences in sensitivity to pesticides between closely related species, and in the strength of the interaction pathways between pesticides and warming. We tested the effects of multiple pulses of chlorpyrifos (allowing accumulation) under warming on key life history traits, heat tolerance (CT_{max}) and physiology of two congeneric damselfly species: the fast-paced (fast growth and development, high metabolic rate), small *Ischnura pumilio* and the slow-paced, large *I. elegans*. Chlorpyrifos reduced survival and growth, but contrary to current trait-based predictions *I. pumilio* was 8 × less sensitive than *I. elegans*. The lower sensitivity of *I. pumilio* could be explained by a higher fat content, and higher activities of acetylcholinesterase and of detoxifying and anti-oxidant enzymes. While for *I. pumilio* the effect of chlorpyrifos was small and did not depend on temperature, for *I. elegans* the impact was higher at 20 °C compared to 24 °C. This matches the higher pesticide accumulation in the water after multiple pulses at 20 °C than at 24 °C. The expected reduction in heat tolerance after pesticide exposure was present in *I. elegans* but not in *I. pumilio*. Our results demonstrate that closely related species can have very different sensitivities to a pesticide resulting in species-specific support for the "toxicant-induced climate change sensitivity" and the "climate-induced toxicant sensitivity" interaction pathways. Our results highlight that trait-based approaches can be strengthened by integrating physiological traits." (Authors)] Address: Verheyen, Julie, Evolutionary Stress Ecology & Ecotoxicology, University of Leuven, Charles Deberiotstraat 32, 3000 Leuven, Belgium. Email: julie.verheyen@kuleuven.be.

19156. Op de Beeck, L.; Verheyen, J.; Stoks, R. (2018): Competition magnifies the impact of a pesticide in a warming world by reducing heat tolerance and increasing autotomy? *Environmental Pollution* 233: 226-234. (in English) ["Highlights: •Competition made the pesticide chlorpyrifos (CPF) become lethal. •CPF exposure led to more autotomy but only at high density under warming. •At high density CPF reduced the heat tolerance (CT_{max}). •Competition can increase the toxicity and impact of a pesticide under warming. Abstract: There is increasing concern that standard laboratory toxicity tests may be misleading when assessing the impact of toxicants, because they lack ecological realism. Both warming and biotic interactions have been identified to magnify the effects of toxicants. Moreover, while biotic interactions

may change the impact of toxicants, toxicants may also change the impact of biotic interactions. However, studies looking at the impact of biotic interactions on the toxicity of pesticides and vice versa under warming are very scarce. Therefore, we tested how warming (+4 °C), intraspecific competition (density treatment) and exposure to the pesticide chlorpyrifos, both in isolation and in combination, affected mortality, cannibalism, growth and heat tolerance of low- and high-latitude populations of *Ischnura elegans*. Moreover, we addressed whether toxicant exposure, potentially in interaction with competition and warming, increased the frequency of autotomy, a widespread antipredator mechanism. Competition increased the toxicity of chlorpyrifos and made it become lethal. Cannibalism was not affected by chlorpyrifos but increased at high density and under warming. Chlorpyrifos reduced heat tolerance but only when competition was high. This is the first demonstration that a biotic interaction can be a major determinant of 'toxicant-induced climate change sensitivity'. Competition enhanced the impact of chlorpyrifos under warming for high-latitude larvae, leading to an increase in autotomy which reduces fitness in the long term. This points to a novel pathway how transient pesticide pulses may cause delayed effects on populations in a warming world. Our results highlight that the interplay between biotic interactions and toxicants have a strong relevance for ecological risk assessment in a warming polluted world." (Authors)] Address: Stoks, R., Lab. voor Aquatische Ecologie, K.U.Leuven, De Beriotstraat 32, 3000 Leuven, Belgium. E-mail: robbystoks@bio.kuleuven.ac.be

19157. Tüzün, N.; Stoks, R. (2018): Carry-over effects across metamorphosis of a pesticide on female lifetime fitness strongly depend on egg hatching phenology: a longitudinal study under seminatural conditions. *Environ Sci Technol.* 51, 23: 13949-13956. (in English) ["Current ecological risk assessment of pesticides fails to protect aquatic biodiversity. For the first time, we tested two potential reasons for this failure with regard to carry-over effects across metamorphosis: their dependence on hatching period, and the lack of studies quantifying adult fitness under seminatural conditions. Using the damselfly *Coenagrion puella* sampled from six populations, we designed an outdoor longitudinal one-year study starting from the egg stage. We exposed the aquatic larvae to the pesticide esfenvalerate (0.11 µg/L) during the initial microcosm part. Next, we monitored the lifetime fitness of the terrestrial adults in an insectary. Exposure to the pesticide negatively impacted not only larval traits, but also drastically reduced lifetime mating success of adult females. The impact of this post-metamorphic effect of the pesticide on the population level was three times more important than the effects in the larval stage. Importantly, this carry-over effect was only present in females that hatched early in the season, and was not mediated by metamorphic traits (age and mass at emergence). We provide proof-of-principle under seminatural conditions for two potential pitfalls that need to be considered when improving risk assessment: carry-over effects on adult fitness can (i) be much more important than effects during the larval stage and may not be captured by metamorphic traits, and (ii) be

strongly modulated by egg hatching dates." (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

19158. White, III, H.B.; Moore, M.C. (2018): Forty-five-year record of the Odonata fauna of Lums Pond State Park, New Castle county, Delaware. *Bulletin of American Odonatology* 12(3): 21-33. (in English, with Spanish summary) ["We document the Odonata fauna of Lums Pond State Park in northern Delaware based on 45 years of observations with seasonal and yearly distributions for the 67 species observed. While the species composition has remained fairly stable, periods of drought have resulted in large decreases in the abundance or temporary absence of species associated with vernal pond habitats. Recolonization and population recovery often required several years to more than a decade. Various introduced fauna and flora (e.g. beaver, geese, carp, Phragmites) have altered permanent pond habitats and are associated with changes in the presence of certain Odonata species and their abundance. Disturbance of one shallow water impoundment by carp and beaver resulted in an abundance of cosmopolitan species associated with degraded habitats. Changes in shoreline vegetation resulting from the spread of Phragmites appeared to favor some damselfly species and reduced populations of others." (Authors)] Address: White, III, H.B., Dept Chem. & Biochem., Univ. Delaware, Newark, DE, 19716, USA. Email: halwhite@udel.edu

19159. Bartosova, M.; Schenková, J.; Polášková, V.; Bojková, J.; Šorfová, V.; Horsák, M. (2019): Macroinvertebrate assemblages of the post-mining calcareous stream habitats: Are they similar to those inhabiting the natural calcareous springs?. *Ecological Engineering* 136: 38-45. (in English) ["Highlights: • Post-mining brooks represent habitats similar to endangered natural spring brooks. • Post-mining brooks harboured spring specialists and red-listed species. • Species compositions of post-mining and natural brooks were distinct. • Differences were caused mainly by extreme environment related to post-mining brooks. Abstract: Surface coal mining severely affects natural ecosystems, though it might also result in an establishment of biologically unique anthropogenic habitats. We studied spontaneously created post-mining calcareous brooks located at the brown coal spoil heap in the Sokolov coal basin (Czechia). Despite their extreme water conditions, linked most to the ionic mixture of dissolved ions (mainly SO_4^{2-} , Ca^{2+} and Mg^{2+}), and ferric hydroxide precipitations, we recorded unexpectedly species-rich assemblages there (150 species), including several spring fen specialists (31 species) and eight threatened red-listed species. Macroinvertebrate assemblages of post-mining calcareous habitats were compared with those reported from natural brooks draining Western Carpathians calcareous spring fens. The species richness found in the post-mining calcareous brooks was significantly lower than that of the natural calcareous spring brooks. Although we found 29% of species recorded in the two study systems in common (i.e. 80 species), species composition of their assemblages was systematically distinct. This suggests a

possible role of environmental filtering in the post-mining brooks and/or dispersal limitation of some species typical for natural calcareous spring brooks (e.g. *Trichodrilus strandi*, *Bythinella austriaca*). In contrast, many macroinvertebrates, particularly those of high dispersal capacities (i.e. Odonata, Coleoptera and Diptera), can recognize post-mining calcareous brooks as surrogate habitats for the natural calcareous spring brooks." (Authors)] Address: Bartošová, Martina, Dept Botany & Zoology, Masaryk Univ., Kotlářská 2, 611 37 Brno, Czech Republic

2019

19160. Borisov, S.N.; Malikova, E.I. (2019): Distribution and migration strategy of *Pantala flavescens* (Fabricius, 1798) (Odonata, Libellulidae) near the northern limit of its range in Transbaikalia and in the Far East of Russia. *Eurasian Entomological Journal* 18(3): 155-162. (in English, with Russian summary) ["Data on distribution and phenology of migratory dragonfly *P. flavescens* at the northern limit of the range in Transbaikalia and the Far East of Russia are summarized on the basis of literature sources and collection material. *P. flavescens* flies during May and June from southern territories to the north in order to breed a so-called summer «temperate» generation, and only occurs in that region during the summer and autumn. The northernmost breeding locality registered for the dragonfly is Blagoveshchensk, 50°17'11" N, 127°30'52" E. In September the progeny presumably migrate to the south into a usually warm part of the areal. Hypothetically such a strategy is typical of some individuals while the majority of the population visiting Far East of Russia temporarily do not breed there." (Authors)] Address: Malikova, Elena, Blagoveshchensk State Pedagogical University, Lenina str. 104, Blagoveshchensk, 675000, Russia. E-mail: e_malikova@inbox.ru

19161. Dawn, P.; Chandra, K. (2019): On an account of Odonata including larval stages of selected species from three protected areas of North Chhattisgarh, India. *International Dragonfly Fund - Report 131*: 1-16. (in English) ["Survey in three protected areas of Chhattisgarh reveals the presence of 50 species of Odonata belonging to 34 genera and 9 families. Specimens were sampled from different lotic and lentic ecosystems. 17 species were exclusively found in or around running water. Larvae or exuviae of 23 species were found and photographed. Habitat availability, larval abundance, species composition and phenology are discussed." (Authors)] Address: Dawn, P., Department of Zoology, Shyampur Siddheswari Mahavidyalaya, Ajodhya, Howrah-711312, India. E-mail: prosenjit.dawn@gmail.com

19162. Devaud, M.; Lebouvier, M. (2019): First record of *Pantala flavescens* (Anisoptera: Libellulidae) from the remote Amsterdam Island, southern Indian Ocean. *Polar Biology* 42(5): 1041-1046. (in English) ["Natural colonization of macroinvertebrates into the Sub-Antarctic area is generally accepted to be a rare event. In February 2017, two live adults of *Pantala flavescens* (Libellulidae) were recorded on the isolated Amsterdam Island (37°50' S, 77°30' E), southern

Indian Ocean [French Southern and Antarctic Lands]. This circumtropical species, common name the Globe Skimmer, can fly several thousand kilometers. This paper analyzes the weather conditions in this sector of the Indian Ocean in February 2017 to assess the probability of arrival of the dragonflies by air from their known migration route at lower latitudes between India and East Africa. The probability that this species could establish and form a permanent population on Amsterdam Island is discussed. Some favorable habitats are present but temperatures are probably too low to allow the dragonflies to complete their development. Odonata have never been observed on Sub-Antarctic islands and reports of natural arrival of insects into these islands mainly concern Lepidoptera. Here we also report observations of *Vanessa cardui* (Nymphalidae) which has established a permanent population on Amsterdam Island and has been observed on several occasions in the Crozet Archipelago." (Authors)] Address: Lebouvier, M., CNRS UMR 6553, Université de Rennes, Paimpont, France, France. E-mail: marc.lebouvier@univ-rennes1.fr

19163. Garcia Junior, M.D.N.; Rakes, M.; Pazini, J. de B., Pasini, R.A.; Garcia, F.R.M. & Grützmacher, A.D. (2019): The diversity of Odonata adults's at Pampa Biome from Brazil. *Revista de Biología Tropical* 67(1): 107-117. (in English) ["The growth of humankind has brought with it several environmental problems that have worsened over time, including the loss of insect biodiversity. The Odonata order have been indicated by several authors as relevant bioindicators for assessing and monitoring environmental conditions of specific locations. The main objective of this study was to conduct an inventory of the Odonata diversity in the Pampa Biome, of the Southern region of the state of Rio Grande do Sul, Brazil. The species survey was conducted between November 2014 and October 2015. Adult insects were collected in Capão do Leão, Pelotas and Rio Grande cities. Each location was visited nine times, totalizing 54 samplings. Entomological nets were used for capturing adult insects, which were then kept in entomological envelopes. The identification of the specimens was carried out with taxonomic keys of Lencioni and Heckman. In addition, Chao-1, the Shannon-Wiener and Jackknife indexes were associated with the sampling areas. During the species survey a total of 2 680 Odonata specimens were collected, representing 45 species encompassed in 22 genera and six families. The Libellulidae and Coenagrionidae families were registered in 60 and 30 % of the specimens sampled, followed of the Aeshnidae, Calopterygidae, Gomphidae and Lestidae, of reduced occurrence. The genera *Erythrodiplax*, *Micrathyria* and *Ischnura* were found at least once in all the visited sites. The study resulted in the registration for the first time of the following species: *Progomphus complicatus* Selys, *Lestes minutus* Selys, *Homeoura ambigua* Ris, and *Tauriphila xiphea* Ris. These species were not previously reported in any Odonata study of the Brazilian state of Rio Grande do Sul. In regard to Odonata diversity in the Southern region of Rio Grande do Sul, Libellulidae and Coenagrionidae are the families more abundants. *Erythrodiplax* and *Micrathyria* are the most common genera. *Micrathyria marcella* represented

9.6 % of all collected libellulidae and was the most abundant specie. Capão do Leão has the largest species diversity (wealth), the largest number of collected specimens and more diversity than Pelotas and Rio Grande. However, the results showed that the Odonatofauna in the State are still little known, and new studies are needed to better describe this group in other regions." (Authors)] Address: Garcia, M., Dept of Ecology, Zoology, & Genetics, Inst. of Biology (IB), Federal Univ. of Pelotas, postcode 96010-900, Pelotas, Rio Grande do Sul, Brazil. E-mail: m.d.juniorbio@gmail.com

19164. Kemabonta, K.A.; Adu, B.W.; Akanni, N.; Olajide, J.P.; Uche-Dike, R. (2019): Studies on influence of human activities on the species diversity of Odonata in parts of Lagos metropolis. *Nigerian Annals of Pure and Applied Sciences* 1(1): 123-129. (in English) ["This study was conducted to determine dragonfly species diversity in a fish pond in Igbaga, Ikorodu (6.6671°N and 3.5983°E) and a large expanse of farm land in Ipaja (6.6044°N and 3.2660°E), southwestern Nigeria from January, 2016 to July, 2016 to as well as the effect of anthropogenic activities on the dragonflies at both sites. A total of 1002 dragonflies were collected belonging to 20 species, 15 genera, and two families (Libellulidae and Aeshnidae), were found at the two locations. The most dominant species in Site 1 (Ikorodu fish farm) was *Chalcostephia flavifrons* (36%) followed by *Palpopleura lucia* (15%) and the least were *Palpopleura albifrons*, *Gynacantha nigeriensis*, *Diplacodes lefebvrei* and *Trithemis grouti* which were one percent of the total numbers sampled. On the other hand, the most dominant species in Site 2 (Agricultural Farm in Ipaja) was *Pantala flavescens* (92%) and the least was *Urothemis assignata* (1%). Similarity test using Sorensen's quotient revealed a strong dissimilarity in the community structures of the two areas surveyed. The fish pond had a more even distribution of the dragonflies ($e^H/S = 0.508$) and a higher concentration ($H' = 1.808$) of dragonflies than Ipaja agricultural farm." (Authors)] Address: Kemabonta, K. A., Dept of Zoology, University of Lagos, Nigeria. E-mail: kkemabonta@unilag.edu.ng

19165. Kim, Y.-K.; Kwon, O.-C. (2019): Insect fauna of Mt. Chilbo in Gyeonggi-do. *Korean J. Nat. Conserv.* 18(1): 85-102. (in Korean, with English summary) ["A total of 109 terrestrial insect species recognized in Mt. Chilbo located in Gyeonggi-do is documented. Observed pollinating associations between flowering plants and hymenopteran species are specified. Discovery of the two hymenopteran species, i.e. *Ampulex kurarensis* and *A. satoi*, forgotten for a long time in Korea is reported and current status of the two dragonflies, i.e. *Nannophya pygmaea* and *Rhyothemis fuliginosa*, is discussed. In addition, tabulated information on three alien pests observed in this area are presented. However, it should be noted that the insect biodiversity provided in this study is considerably underestimated and many species are still masked due to short periods of surveys and difficulty in identification for the vast numbers of taxa. Aculeate hymenoptera is a comparatively well-studied group in this study. Further study especially on Coleoptera and moth presumably that are other major insect groups of this area

will supplement this study." (Authors)] Address: Kim, Y.-K., Yongin University

19166. Kosterin, O.E. (2019): Update of 2017 - 2018 to Odonata of Kompong Saon Peninsula, Cambodia. International Dragonfly Fund Report 129: 1-24. (in English) ["March 2017 and November 2018 are presented. The presence of *Onychargia atrocyana* Selys, 1865 in Cambodia is confirmed. Twentyone species are added to the known fauna of the Kbal Chhay Waterfall environs, 19 species to that of Ream Peninsula and 4 to that of Koh Rong Island. The total number of species registered for Kampong Saom Peninsula amounts to 74. The presented data are rather of historical importance since most of the remaining forest has been quickly and irreversibly logged a few months ago. The validity of *Gynacantha demeter* Ris, 1911 as a species distinct from *G. dohmii* Krüger, 1899 is doubted." (Author)] Address: Kosterin, O.E., Institute of Cytology & Genetics SB RAS, Acad. Lavrentyev ave. 10, Novosibirsk, 630090, Russia. E-mail: kosterin@bionet.nsc.ru

19167. Malikova, E.I.; Kosterin, O.E. (2019): Check-list of Odonata of the Russian Federation. *Odonatologica* 48(1/2): 49-78. (in English) ["A check-list of 152 species and 168 subspecies of Odonata known from the territory of Russian Federation and their occurrence in its seven main eco-geographical regions (European part, Caucasus, Ural, West Siberian Lowland, South Siberia, North-East Asia and southern Far East) is presented in tabular form. First reliable reports of particular species for particular regions made after latest summarising monographic publications referring to those regions are referenced. Dubious reports are not mentioned. Taxonomically and otherwise complicated cases are commented. The highest diversity of 91 species (59.9 % of the fauna) is found in southern Far East of Russia; Caucasus, European part, South Siberia and Ural show moderately rich faunas of 81, 80, 75 and 74 species, respectively; the fauna of West Siberian Plain is poor (56 species) and that of North-East Asia very poor (39 species)." (Authors)] Address: Malikova, Elena, Blagoveshchensk State Pedagogical University, Lenina str. 104, Blagoveshchensk, 675000, Russia. E-mail: e_malikova@inbox.ru

19168. Masius, P. (2019): Die Libellenfauna der Ostseeinseln Wollin (NW Polen) und Usedom (NO Deutschland) mit angrenzendem Festland – Frühjahrsaspekt 2018, und Anmerkungen zum Vorkommen von *Coenagrion armatum* (Charpentier, 1840). International Dragonfly Fund Report 130: 1-40. (in German, with English summary) ["In May 2018, 34 dragonfly species were recorded on Wollin (21), Usedom (30) and the adjacent mainland (21). The most frequent spring species in the area were *Coenagrion puella*, *Libellula quadrimaculata*, *C. pulchellum*, *Ischnura elegans*, *Erythromma najas*, *Brachytron pratense* and *Cordulia aenea*. *C. lunulatum* and *Calopteryx virgo* were recorded for the first time on Usedom, while *Anax parthenope*, *Libellula fulva* and *Leucorrhinia caudalis* were recorded for the first time on Wollin. The occurrence of *C. armatum*, which had been recorded in 2016 on Usedom, could not be confirmed. The

quantitative results of the survey are given for different types of water bodies (ditches, pools, ponds, lakes, bog lakes). The average number of species per water body was highest in bog lakes (7.5) and lowest (3.4) in temporary pools. In comparison to older studies from the area, the flight season started 13.7 days earlier in 2018 than in years documented prior to 1989. This might be explained by climatic changes. The species composition, however, has remained rather stable – at least on Usedom and the mainland. On Wollin, climatic factors as well as habitat loss and transformation have led to a species composition that is different from the one recorded in the first half of the 1970s." (Author)] Address: Masius, P., Burbacher Str. 150, 53129 Bonn, Germany. Email: Patrick_Masius@gmx.de

19169. May, M.L. (2019): Odonata: Who they are and what they have done for us lately: Classification and ecosystem services of dragonflies. *Insects* 2019, 10(3), 62: 17pp. (in English) ["Odonata (dragonflies and damselflies) are well-known but often poorly understood insects. Their phylogeny and classification have proved difficult to understand but, through use of modern morphological and molecular techniques, is becoming better understood and is discussed here. Although not considered to be of high economic importance, they do provide esthetic/spiritual benefits to humans, and may have some impact as predators of disease vectors and agricultural pests. In addition, their larvae are very important as intermediate or top predators in many aquatic ecosystems. More recently, they have been the objects of study that have yielded new information on the mechanics and control of insect flight." (Author)] Address: May, M.L., Department of Entomology, Rutgers University, New Brunswick, NJ 08901, USA

19170. Outomuro, D.; Johansson, F. (2019): Wing morphology and migration status, but not body size, habitat or Rapoport's rule predict range size in North-American dragonflies (Odonata: Libellulidae). *Ecography* 42(2): 309-320. (in English) ["Understanding why species range sizes vary is important for predicting the impact of environmental change on biodiversity. Here we use a multi-variable approach in a phylogenetic comparative context to understand how four morphological, two ecological, and two eco-geographical variables are associated with range size, latitudinal range and longitudinal range in 81 species of North-American libellulid dragonflies. Our results show that: 1) migratory species and species with a more expanded basal hindwing lobe have a larger range size; 2) opposite to Rapoport's rule, latitudinal range is negatively correlated with mid-range latitude; 3) longitudinal range is predicted by wing morphology and migration; 4) body size and larval habitat are not correlated with range size, latitudinal range or longitudinal range. These results suggest that dispersal-related traits, such as wing shape and migratory status, are important factors in predicting the range size of libellulid dragonflies. In addition, the reverse Rapoport's rule suggests that more northern-centred species might be more specialized than more southern-centred species. We suggest that the variables predicting range size are likely imposed by taxon-specific

morphological, ecological, physiological and behavioural traits. Taxon-specific knowledge is thus necessary to understand the dynamics of range sizes and is important to implement successful restoration and conservation plans of threatened species." (Authors)] Address: Johansson, F., Dept of Ecology & Environmental Science, Animal Ecology Group, Umea University, 90187 Umea, Sweden. E-mail: frank.johansson@eg.umu.se

19171. Rivas-Torres, A.; Sánchez-Guillén, R.A., Cordero-Rivera, A. (2019): Alternative reproductive strategies in black-winged territorial males of *Paraphlebia zoe* (Odonata, Thaumateuridae). PeerJ 7:e6489: 22 pp. (in English) ["Alternative reproductive strategies are commonly associated with male dimorphism. In *Paraphlebia zoe*, a species of damselfly whose males are dimorphic in wing coloration, black-and-white-winged (BW) males defend territories, while hyaline-winged (HW) males usually play the role of satellites. We found that several BW males can sometimes share a territory, and we hypothesized that within this morph there are two alternative tactics: submissive and dominant. We conducted an experiment to test whether dominant and submissive roles are plastic or stable and fixed on each individual. To this end, we manipulated black and white spots of BW males in four treatments: (i) painting over white and black spots without changing their size, (ii) erasing the white spot using black painting, (iii) increasing the black spot and moving the white spot maintaining its size and (iv) control males. Additionally, we investigated the correlation between some phenotypic variables (wing asymmetry, survival and recapture probabilities) and male behaviour (in terms of quality of the territory). We found that the two behavioural roles (submissive and dominant) were not affected by the manipulative experiments, therefore suggesting that they are stable and fixed. Additionally, we found a positive correlation between body size and survival in both sexes, and a positive effect of territory quality and lifespan on mating success. Moreover, the largest and youngest BW males were the most symmetrical. We conclude that *Paraphlebia zoe* holds high behavioural diversity, with two types of strategies in BW males, dominant and submissive. The occurrence of this intra-morph behavioural diversity might depend on demographic factors such as population density and/or the relative frequency of the different morphs." (Authors)] Address: Rivas-Torres, Anaïs, ECOEVO Lab, Depto de Ecología e Biología Animal, Univ. de Vigo, Pontevedra, Galiza, Spain

19172. Sakaris, P.C.; Galvez, J.; Callier IV, T.P.; Brown, A. (2019): Ontogenetic and temporal diet shifts of the invasive Asian Swamp Eel in South Florida. North American Journal of Fisheries Management 39(6): 1288-1300. (in English) ["The Asian Swamp Eel *Monopterus albus* is an introduced species in South Florida waters and is considered to be a potential threat to the native biota and ecosystems in the region. As a protogynous hermaphrodite that, under the right climatic conditions, can travel short distances over land and tolerate abrupt shifts in salinity, this species has strong invasive potential. In this study, our main goal was to evaluate the potential effects of the Asian Swamp Eel as a predator

on native fishes and other biota. Our specific objectives were to (1) analyze the stomach contents of introduced Asian Swamp Eels from canals located near Everglades National Park and (2) assess the ontogenetic and temporal shifts in their consumption of prey. We dissected 752 Asian Swamp Eels (107–833 mm TL), and 46.4% (N = 349) of the samples had stomach contents for the analyses. The analyses indicated that amphipods, fishes, dragonfly nymphs, Hemiptera insects, and grass shrimp *Palaemonetes* were the most important prey items for Swamp Eels. Swamp Darters *Etheostoma fusiforme*, juvenile Asian Swamp Eels, and centrarchids were the most common fishes eaten by Swamp Eels. Ontogenetic shifts in diet were apparent, with amphipods and dipteran larvae most often observed in the stomachs of small- to medium-sized Swamp Eels and fish, dragonfly nymphs, and Hemiptera insects more commonly identified in the stomachs of larger eels. The Swamp Eels also became increasingly piscivorous with size. Dragonfly nymphs and grass shrimp occurred more frequently in the Swamp Eel diets in May 2010, while the consumption of fish and amphipods increased in October 2010. Fish were the most important prey item that was consumed during the November–December 2009 period, although other prey items were relatively important during that collection period. As an opportunistic predator that consumes a wide range of prey, the Asian Swamp Eel likely has its greatest effects on native biota and ecosystems as a predator and competitor with native fishes for resources." (Authors)] Address: Sakaris, P.C., School of Science and Technology, Georgia Gwinnett College, 1000 University Center Lane, Lawrenceville, Georgia, 30043 USA. Email: psakaris@ggc.edu

19173. Seidu, I.; Nsor, C.A.; Danquah, E.; Tehoda, P.; Opong, S.K. (2019): Patterns of Odonata assemblages in lotic and lentic systems in the Ankasa Conservation Area, Ghana. International Journal of Zoology Volume 2019, Article ID 3094787: 14 pp. (in English) ["Our study examined Odonata assemblages distribution pattern and the predictive factors that accounted for this in the lotic and lentic water systems within the Ankasa Conservation Area (Ghana). A total of 23 sites with sampling protocol of 2 researchers per hour per sampling site were used to survey Odonata species over two seasons in the three water bodies (streams, rivers, and ponds). Broken stick model, individual-based rarefaction, and Renyi diversity ordering were employed to quantify community assemblages. Ordination technique was also used to determine the Odonata–environmental relationship. A total of 1403 individuals, belonging to 47 species (22 Zygoptera and 25 Anisoptera) in six families, were recorded. Species richness ($H_c = 3.414$, $p = 0.169$) and diversity ($H_c = 1.661$, $p = 0.44$) generally did not differ among the three water systems. However, from individual sites, ponds appeared mostly diverse ($\alpha\text{-scale} = 0.04$, Renyi index (r) = 5.86 to $\alpha = 3.5$, $r = 3.12$), in spite of their lowest species abundance and richness. At the suborder level, ponds equally exhibited the highest Anisoptera species richness ($9.90 \pm SE 0.640$) compared with Zygopterans ($0.80 \pm SE 0.291$). Overall, Anisopterans ($K = 16.51$, $p = 0.00026$) and Zygopterans richness ($K = 16.39$, $p = 0.00023$) differed

significantly among the three subsystems, while Odonata composition also differed significantly among the various water bodies (ANOSIM: global $R=0.94$, $p<0.001$). Flow rate, water temperature, channel width, and turbidity were the key predictive factors that influence the structure of Odonata species assemblages. The results highlight the need to improve the functional status of the lentic and lotic systems, with the ultimate goal of conserving diverse Odonata fauna and other sympatric freshwater biodiversity." (Authors)] Address: Seidu, I., Dept of Wildlife & Range Management, Fac. of Renewable Natural Resources, Kwame University of Science and Technology, Kumasi, Ghana. E-mail: antwiseidu88@gmail.com

19174. Suárez-Tovar, C.M.; Rocha-Ortega, M.; González-Voyer, A.; González-Tokman, D.; Córdoba-Aguilar, A. (2019): The larger the damselfly, the more likely to be threatened: a sexual selection approach. *Journal of Insect Conservation* 23(3): 535-545. (in English) ["In a changing world due to anthropogenic activities, it is increasingly urgent to identify the biological attributes that predispose species to extinction. Using phylogenetic comparative methods and International Union for Conservation of Nature Red List categories as a proxy for vulnerability to extinction, we evaluated whether body size, sexual size dimorphism and/or mating system (territorial or non-territorial) are linked to extinction risk in 139 damselfly (Zygoptera) species. Threatened species of damselflies were, on average, larger than non-threatened species. However, we did not find a relationship between sexual size dimorphism or mating system and extinction risk. Similar to vertebrates and other insects, a large size implies a higher viability costs for damselflies. Other evolutionary mechanisms and not only sexual selection may play an important role in selecting for large body size and rendering larger species more prone to extinction." (Authors)] Address: Suárez-Tovar, Catalina, Posgrado en Ciencias Biológicas, Universidad Nacional Autónoma de México, Mexico City, Mexico

19175. Zheng, D.; Nel, A.; Zhang, H.; Chang, S.-C.; Jarzembowski, E.A.; Zhuo, D.; Wang, B. (2019): A highly diverse coenagrionoid damselfly group (Odonata: Zygoptera: Burmacoenagrionidae fam. nov.) from mid-Cretaceous Burmese amber. *Journal of Systematic Palaeontology* 17(3): 239-253. (in English) ["The damselfly superfamily Coenagrionoidea is the largest zygopteran group, comprising three-fifths of all extant damselfly species. The Mesozoic fossil record of this superfamily is sparse, whilst it is relatively common in Burmese amber. A new coenagrionoid family, Burmacoenagrionidae Zheng et al., fam. nov., is established here based on four new species in three new genera: Burmacoenagrion pretiosus Zheng et al. gen. et sp. nov., Burmachistigma cheni Zheng et al. gen. et sp. nov., Electrocoenagrion elongatum Zheng et al. gen. et sp. nov. and Electrocoenagrion forficatum Zheng et al. gen. et sp. nov. The previously described damselfly genus, Burmagrion Möstel et al., 2017, is transferred to this family. Burmacoenagrionidae Zheng et al. fam. nov. has a long pterostigma covering 3–5 cells, pigmented wings and a sigmoidally curved RA and

RP1 distal of the pterostigma, differing from other coenagrionoid damselflies. Until now, this is the most diverse damselfly family reported from Burmese amber, showing that the Coenagrionoidea were already highly diversified 100 million years ago." (Authors)] Address: Nel, A., Lab. Ent. Mus. Natn. Hist. Nat., 45 rue Buffon, F-75005 Paris, France. E-mail: anel@cimrs1.mnhn.fr

2020

19176. Amado, L.L.; Juen, L. (2020): Glutathione S-transferase activity in *Mnesarete aenea* (Odonata), *Campylocia anceps* (Ephemeroptera), and *Cylindrostethus palmaris* (Hemiptera) from forest and oil palm plantation areas in the Eastern Amazon. *Ecological Indicators* 118, November 2020, 106770: (in English) ["Highlights: • Our results show that *M. aenea* had higher GST activity in oil palm areas. • The high GST activity in *C. anceps* shows the sensitivity of juvenile organisms in environments. • The difference in GST induction in *M. aenea* and *C. palmaris* shows can help the bio-monitoring. The use of aquatic insects in ecological studies of oil palm plantations provides an effective evaluation of biodiversity loss caused by changes in habitat. Approaches at the population or community level associated with biomarker analyses might help in the management and conservation of impacted habitats. Our aim was to assess detoxification responses (Glutathione S-transferase activity) of three aquatic invertebrates (*Mnesarete aenea*, *Cylindrostethus palmaris*, and *Campylocia anceps*) in oil palm plantations and forested areas in the Eastern Brazilian Amazon. A total of 20 streams were sampled during the dry season of 2017, in the municipality of Tailândia, Pará – Brazil. The response of this exposure biomarker was related with water temperature, pH, dissolved oxygen, canopy cover and habitat integrity index. The species *M. aenea* and *C. palmaris* showed differences in detoxification response induction, with higher specific activity in oil palm areas than in forest areas. The conversion of natural landscape and use of agrochemicals in oil palm plantations might affect the dynamics of organisms that are sensitive to changes in habitat quality. We suggest that differences in Habitat Integrity Index between oil palm and Amazon forest areas is a determining factor in increased GST induction in *M. aenea*. This result indicates that this organism might act as a sentinel for biomarker evaluations, providing an early warning signal via its biochemical responses that could help to prevent changes at the population and community levels." (Authors)] Address: Juen, L., Programa de Pós-graduação em Zoologia, Instituto de Ciências Biológicas, Universidade Federal do Pará, Rua Augusto Correia, N 1 Bairro Guamá, 66.075-110 Belém, Pará, Brazil. Email: leandrojuen@ufpa.br

19177. Bernard, R.; Bakowski, M. (2020): New data on dragonflies (Odonata) of Mozambique, with a new country record of *Phyllogomphus selysi* Schouteden, 1933. *African Invertebrates* 61(1): 17-28. (in English) ["30 dragonfly species were collected at 11 localities, mostly situated in central provinces of Mozambique, in the Gorongosa National Park, adjacent areas and the Chimanimani National Reserve buffer

zone. These data include a new country record of *Phyllogomphus selysi* and records of several other species that have rarely been recorded so far in relatively poorly-explored Mozambique, such as *Atoconeura biordinata*, *Hadrothemis scabrifrons*, *Gynacantha manderica*, *Gomphidia quarrei* and *Olpogastra lugubris*. Faunistic considerations are given with some remarks on morphological traits." (Authors)] Address: Bernard, R., Dept of Nature Education and Conservation, Faculty of Biology, Adam Mickiewicz University in Poznań, Uniwersytetu Poznańskiego 6, PL-61-614 Poznań, Poland. Email: rbernard@amu.edu.pl

19178. Bezmaternykh, D.M.; Vdovina, O.N. (2020): Composition and structure of macrozoobenthos of lakes in different natural zones and subzones of Western Siberia. *Limnology* 21: 3-13. (in English) ["In 2003–2016, the composition and structure of macrozoobenthic communities of 49 lakes in three natural zones (taiga, forest-steppe, and steppe) of Western Siberia were investigated. The benthic fauna of the research lakes includes 160 species of nine classes of invertebrates. The trophic structure was characterized, and six major trophic groups were identified. A spatial analysis of the macrozoobenthos of the research lakes showed that from the forest-steppe to the dry steppe subzone, the species diversity decreases on a considerable scale and also dominant taxa of macrozoobenthos change with increasing water salinity. Especially in the forest-steppe and steppe zones, high water salinity is probably a limiting factor in the development of macrozoobenthic communities. In the taiga zone, however, water salinity seems not to have such significance; rather the degree of humification (shown as dark-colored water due to waterlogging) should be taken into account." (Authors)] 12 odonate taxa are listed; most frequent species is *Coenagrion armatum* 13 of 49 lakes were investigated.] Address: Bezmaternykh, D.M., Insti. aquatic & ecological problems, Sibir Branch of the Russian Acad. Sciences, 656038 Barnaul, ul. Molodjeshnaja 1, Russia

19179. Bibi, S.; Khan, M.F.; Rehman, A. (2020): Dragonfly fauna of district Haripur, Khyber Pakhtunkhwa, Pakistan. *Arthropods* 9(3): 98-103. (in English) ["The present study was conducted from January to September 2018 in district Haripur, KP, Pakistan. A total of 200 specimens were collected and 2 families, 9 genera and 12 species were recorded. Dragonflies of family Libellulidae (170; 94.15%) were present in great abundance while the other two families were less distributed. Minimum number of dragonfly species belong to family Gomphidae (10; 5.85%). *Orthetrum chrysis* was recorded in greater number. We also measured their body length, and length of fore and hind wings. The highest length was found to be in *Pantala flavescens*, with 23.5 ± 0.4 , 17.5 ± 0.4 , and 16 ± 2.0 mm length of body, fore and hind wings respectively. Further comprehensive study needed on their ecological role." (Authors)] Address: Bibi, Saira, Department of Zoology, Hazara University, Mansehra, KPK, Pakistan. E-mail: sairabibi333@hu.edu.pk

19180. Bouhala, Z.; Khemissa, C.; Márquez-Rodríguez, J.; Ferreras-Romero, M.; Samraoui, F.; Samraoui, B. (2020):

Ecological correlates of odonate assemblages of a Mediterranean stream, Wadi Cherf, northeastern Algeria: implications for conservation. *International Journal of Odonatology* 22(3/4): 181-197. (in English) ["We investigated the odonates of Wadi Cherf, a tributary of Wadi Seybouse, and explored the main environmental factors that may be important drivers of the abundance and diversity of Odonata assemblages. PCA analyses demonstrated a significant altitudinal gradient associated with water flow, temperature, vegetation cover, substrate and adjacent land use. Notably, pollution was a dominant structuring factor and the most widespread species, *Ischnura graellsii* and the North African endemic *Platycnemis subdilata*, were the most pollution-tolerant species. Similarly, co-inertia analysis indicated that environmental factors could account for 70% of the co-variation in shaping odonate assemblages. Equally important, threatened species were associated with less degraded but vulnerable habitats, most susceptible to anthropogenic impacts. There is thus a need to develop monitoring tools to assess the ecological integrity of North African rivers and implement a management plan that considers both connectivity and heterogeneity to ensure that Wadi Cherf, a sanctuary to three threatened species *Calopteryx exul* (EN), *Coenagrion mercuriale* (EN) and *Gomphus lucasii* (VU), continues to provide critical ecosystem functions." (Authors)] Address: Bouhala, Zineb, Laboratoire de Conservation des Zones Humides, Université 8 Mai 1945 Guelma, Guelma, Algeria. Email: bsamraoui@gmail.com

19181. Buczynski, P.; Michonski, G.; Zawal, A. (2020): New site of *Cordulegaster heros* Theischinger, 1979 in western Slovakia – the confirmation of its northern border of range of occurrence in Europe (Odonata: Cordulegasteridae). *Ecologica Montenegrina* 28: 20-22. (in English) [20.04.2017, 1 larva; Sampling site: Central Western Carpathians, Krnáň near Topoľčany, $48^{\circ}32'09.4''$ N, $18^{\circ}15'55.5''$ E, UTM: BU 97, ca. 230 m a.s.l. Habitat: unnamed small stream (left tributary of the River Nitra), backwater. Stream with a width of approximately 2 m, depth of approximately 0.3 m, bottom with gravel (80%) and stony (20%) sediments, with residual detritus in the hollows (30%), water flow 0.16 m s^{-1} , oxygen saturation 94.9%, temperature 7.9°C , pH 7.67, conductivity $210 \mu\text{S cm}^{-1}$.] Address: Buczynski, P., Dept of Zoology and Nature Protection, Institute of Biological Sciences, Maria Curie-Skłodowska University, Akademicka Str. 19, PL-20-033 Lublin, Poland. E-mail: pawbucz@gmail.com

19182. Carrillo-Muñoz, A.I.; García-Miranda, O. (2020): New records for the Chimalapas-Uxpanapa Region, Mexico (Odonata: Calopterygidae, Heteragrionidae, Polythoridae, Thaumtoneuridae, Coenagrionidae, Gomphidae, Libellulidae). *Notulae odonatologicae* 9(5): 196-203. ["During a collecting trip to five tropical rainforest sites in the Chimalapas-Uxpanapa region in an altitudinal gradient of 155–499 m a.s.l., a total of 16 species of odonates new to the region were recorded. Poorly studied species such as *Erpetogomphus ophibolus* Calvert, 1905, *Hetaerina infecta* Calvert, 1901, *Heteragrion alienum* Williamson, 1919, and *H. tricellulare* Calvert, 1901, were recorded. *Ischnura demorsa* Hagen,

1861, and *Paraphlebia* sp. are discussed in greater detail. These records add to the knowledge of odonate distribution from Oaxaca and Veracruz." (Authors)] Address: Carrillo-Muñoz, A.I., Centro Tlaxcala Biol. de la Conducta, Univ. Autónoma de Tlaxcala, Carretera Tlaxcala-Puebla km 1.5, C.P. 90070 Tlaxcala, México. E-mail: aicarrillomz@gmail.com

19183. Cerini, F.; Bologna, M.A.; Vignoli, L. (2020): Nestedness-patterns of Odonata assemblages in artificial and natural aquatic habitats reveal the potential role of drinking troughs for aquatic insect conservation. *Journal of Insect Conservation* 24: 421-429. (in English) ["Nestedness patterns including both artificial and natural habitat may represent evidence of such habitats' importance in community assembly and conservation of animals inhabiting those sites. Odonata often colonize drinking troughs (artificial water reservoirs) and thus they are good study models as umbrella species. We investigated if a network of artificial (troughs) and natural (pools) aquatic habitats could create a nested subset pattern for Odonata assemblages. We surveyed all the troughs present in the Castelporziano Estate (Italy, Lazio). Odonata larvae have been collected and identified. Data of a previous paper on 18 natural pools and ponds, and our samplings of 16 troughs were organized into a presence-absence matrix. The Odonata assemblage within natural and artificial habitats is significantly nested with both NODF and T metrics. Odonata species found in the troughs represented 40% of the total species pool. Some troughs interspersed with the natural pools in the nested order: eight troughs were richer in species than some natural pools, despite the big difference in surface area. Pristine water bodies and their area may not represent major constraints for species to oviposit and for larvae to grow. Drinking troughs can be highly relevant for representing refuges in the absence or decline of natural ponds and pools: lacking in top-predators (fishes), they are small "island" habitats that support the generations of Odonata (or other aquatic macroinvertebrates) during dry periods of natural water bodies. The use and focused management of such habitats can be an effective practice for freshwater ecosystems management and Odonata conservation." (Authors)] Address: Cerini, F., Dipto di Scienze, Università Roma Tre, Viale Marconi 446, 00146 Rome, Italy. E-mail: francesco.cerini@uniroma3.it

19184. Chan, S.K.M. (2020): Spoon-tailed duskhawker dragonfly at Yishun Central. *Singapore Biodiversity Records* 2020: 22-23. (in English) [*Gynacantha basiguttata* Selys, 1882 "Location, date and time: Singapore Island, Yishun Central, Khoo Teck Puat Hospital, basement 1 of Tower A; 30-XII-2019; 1327 hrs. Habitat: Urban. Inside a concrete building, near a garden with a simulated forest on the same floor." (Author)] Address: Simon Kee Mun Chan: chan.kee.mun@ktph.com.sg

19185. Conniff, K.L.; Aryal, M.; KC, S.; van der Heijden, A. (2020): New additions to the checklist of dragonflies and damselflies of Nepal. *Agrion* 24(1): 21-23. (in English) ["Thirty years ago a comprehensive checklist of Nepal Odonata was published by Graham Vick (1989). Since that time

several new species have been found and described from Nepal bringing the list to 176 species. Here we publish details on another eight species new to the list of dragonflies and damselflies of Nepal (*Aciagrion approximans*, *Agriocnemis femina*, *Saraseaschna spec1*, *Saraseaschna spec2*, *Burmagomphus spec*, *Aethriamanta brevipennis*, *Onychothemis testacea*, *Rhodothemis rufa*)." (Authors)] Address: Conniff, Karen, ICIMOD GPO Box 3226 Kathmandu, Nepal. E-mail: karoconniff@gmail.com

19186. Deepthi, S.; Vengadesan, S. (2020): Role of dipole jet in inclined stroke plane kinematics of insect flight. *Journal of Bionic Engineering* 17: 161-173. (in English) ["The two-dimensional (2D) inclined stroke plane kinematics of insect wing is studied for various stroke plane angles using the Immersed Boundary (IB) solver. The numerical results revealed the dominant lift enhancement mechanisms for this class of flows. The generated dipole was analyzed to find the maximum velocity, inclination and spread. The analysis of these dipole characteristics for the different stroke plane angles exposed the alternate method to study the vertical force variation with the stroke plane angles. Lift enhancement mechanisms and dipole characteristics complement the high vertical force coefficient for the stroke plane angle of 60° commonly used by dragonflies during hover. The location of the dipole identified a region of influence around the wing and demonstrated the role of the dipole jet in multi-body dynamics and wall effects." (Authors)] Address: Vengadesan, S., Department of Mechanical Engineering, Virginia Tech, Blacksburg, VA, USA

19187. Dow, R.A.; Ng, Y.F. (2020): New records of Odonata from Selangor and Negeri Sembilan, Malaysia, with provisional checklists of species recorded from the states. *International Dragonfly Fund - Report* 146: 1-29. (in English) ["Previously unpublished records of Odonata from the states of Negeri Sembilan and Selangor in Peninsular Malaysia are presented. One hundred and eight species are listed, of which 77 were collected in Negeri Sembilan and 87 in Selangor. 15 of the species recorded from Negeri Sembilan and seven of those recorded from Selangor appear to be first records for the respective state. Notable records include *Drepanosticta* sp. cf *hamadryas* Laidlaw, 1931, *Rhincocypha pelops* Laidlaw, 1936, *Acrogomphus ?malayanus* Laidlaw, 1925, *Heliogomphus kelantanensis* (Laidlaw, 1902); *Onychogomphus duaricus* Fraser, 1924, *Macromia cupricincta* Fraser, 1924, *Idionyx montana* Karsch, 1891, *Chalybeothemis chini* Dow, Choong & Orr, 2007 and *Hylaeothemis clementia* Ris, 1909 Ris, 1909. Provisional checklists of the Odonata known from Selangor plus the Federal Territory of Kuala Lumpur (171 species) and for Negeri Sembilan (116 species) are given in appendices." (Authors)] Address: Ng, Y.F., Centre for Insects Systematics, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia. E-mail: ng_yf@ukm.edu.my

19188. 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

19189. Dumeier, A.C.; Lorenz, A.W.; Kiel, E (2020): Active reintroduction of benthic invertebrates to increase stream biodiversity. *Limnologica* 80 (2020) 125726: 9 pp. (in English) ["A large number of restoration projects aims to improve the ecological quality of streams and rivers by focusing on the stream structure. However, improved habitat heterogeneity often does not lead to natural recolonization by sensitive freshwater macroinvertebrate communities, particularly when the recolonization potential is low and source populations are absent. In preliminary studies we tested whether natural substrate exposures could be used to sample and transport benthic macroinvertebrates. In this pilot study we used these previously tested natural substrate exposures to sample freshwater invertebrates in a donor stream in order to actively (re-)colonize a recipient stream. In the course of three reintroduction campaigns, we were able to accumulate over 350,000 benthic invertebrates, including 25 indicator taxa of the orders Ephemeroptera, Plecoptera and Trichoptera and 30 taxa scoring positive in the German Fauna Index. In total, 45 taxa, which did not occur in the recipient stream before, were reintroduced. They were transported gently within natural substrate exposures and released on a stream bottom area of 500m² in the recipient stream. We intended to study if an increase of benthos fauna in a recipient stream is possible, and if this increase will eventually improve the ecological status. So far, the natural substrate exposure-method demonstrated to be an adequate tool to accumulate and transport benthic macroinvertebrates and, in general, has the potential to increase the biodiversity of streams when used as assisted migration measure." (Authors) The study includes a reference to *Calopteryx virgo*.] Address: Kiel, Ellen, Research Group Aquatic Ecology and Nature Conservation, Department of Ecology and Environmental Science, Carl von Ossietzky University of Oldenburg, Germany

19190. Ehmke, W. (2020): Der Hähnchesgrund bei Taunusstein – ein artenreiches Rekultivierungsgelände. *Jahrbücher des Nassauischen Vereins für Naturkunde* 141: 63-100. (in German) [Hessen, Germany. Without further specification, eight odonate species have been recorded. Namely outlined are *Libellula depressa*, *Sympetrum danae* and *S. sanguineum*, *Aeshna cyanea* and the very rare *Leucorrhinia caudalis*.] Address: Ehmke, W., Lindenstr. 2, 65232 Taunusstein, Germany. Email: wolfgangehmke@aol.com

19191. Escoto-Moreno, J. A.; Márquez, J.; Asiain, J. (2020): New records of Odonata from Central Eastern Mexico. *Proceedings of the Entomological Society of Washington* 122(1): 235-242. (in English) ["A total of 18 new records are provided for four states of central eastern Mexico. For Querétaro, six new records are added, including two species of Phyllogomphoides. According to Paulson & González-Soriano (2019) 61 species are reported from Querétaro but our additions increase that listing to 66 species and is ranked

23rd place for species richness of odonates known in Mexico. However, the position that each state occupies with respect to the richness of species of odonates is a fact that does not take into account the territorial extension or the variety of biogeographical provinces that make up each one, so this should be taken into account when making comparisons between states. In the case of the state of Hidalgo, five new records are added, including the genus *Nehalennia* that was not previously reported in the state. *Nehalennia* includes one species in Eurasia and five in America. The species reported in Mexico has been found mainly in the Gulf of Mexico watershed (Garrison et al. 2010). In Hidalgo, 129 species were reported, according to Escoto-Moreno et al. (2014, 2017a); subsequently, in the update of the Paulson and González-Soriano list (2019) four new records were added (133). The new record of *Megaloprepus caerulatus* (Drury, 1782) (Escoto-Moreno et al. 2018) brings this number to 134 species; adding the five records of our study gives a total of 139 known species for Hidalgo which places the state as seventh in the highest species richness of odonates of Mexico. For the state of Puebla, four new records are provided, including for the first time *Oplonaeschna*, which is a genus that is typical of the Mexican Transition Zone (sensu Halffter and Morrone 2017). The list of Paulson and González-Soriano (2019) reports 93 species; now, however, there are 97, which place the state as 14th in species richness in Mexico. The state of Veracruz had the highest species richness in Mexico with 219 (Paulson & González-Soriano 2019). Now three species of the genus *Argia* are found in an area with elevations greater than 1800 m so there are now 222 recognized species. Until now Veracruz is the only state that exceeds 200 species in Mexico. Finally, some records of precise localities for *Paraphlebia zoe* in Puebla were added when only two locations were known (Escoto-Moreno and Márquez 2013), also for *Rhionaeschna jalapensis* in Hidalgo, which had not been reported in the northwestern part (Escoto-Moreno et al. 2017b), and for *Cordulegaster diadema* in the state of Tlaxcala, where its presence is barely recognized (Paulson & González-Soriano 2019)."] Address: Escoto-Moreno, J., Colección Zoológica, Depto Biología, Centro de Cienc. Básicas, Univ. Autónoma de Aguascalientes. Avenida Universidad # 940 Ciudad Universitaria, 20131 Aguascalientes, Aguascalientes, México. E-mail: marquezorum@gmail.com

19192. Eslami Barzoki, Z.; Ebrahimi, M.; Sadeghi, S. (2020): Odonata diversity and species assemblages in the Northwest Central Plateau of Iran. *Journal of Insect Conservation* 24: 459-471. (in English) ["Central Iran has been faced with deterioration of water quality and quantity, but yet the biodiversity of freshwater-associated insects in this area remains uncertain and without this information the development of conservation strategies is not possible. Here we explore Odonata diversity patterns and species assemblages in three terrestrial ecoregions of Central Iran. We used the first three Hill numbers and phylogenetic generalizations of these indices to compare the species diversity between the ecoregions. To compare Odonata species composition a PERMANOVA analysis was performed. Alpha-diversity of each

water body was estimated by Hill numbers, taxonomic diversity, taxonomic distinctness and average taxonomic distinctness. The effects of habitat and environmental factors on Odonata diversity indices were modelled using a linear mixed model. About 42% of all Odonata that have been reported in Iran were found during this study. Species richness in the Desert and Steppe ecoregions were almost equal, the same pattern was observed for phylogenetic diversity indices. The Steppe ecoregion also had significantly different Odonata assemblage. Results of the linear mixed model showed that environmental factors have different effects on different diversity indices. Additionally different diversity indices resulted in different outcomes when comparing ecoregions, demonstrating that single measure cannot precisely assess the properties of an assemblage's diversity. The high diversity of Odonata observed in such an arid environment shows the importance of man-made water bodies, as well as the necessity of preparing a conservation plan for these ecosystems." (Authors)] Address: Eslami Barzoki, Zohreh, Dept Biology, Fac. Scien., Shiraz Univ., Shiraz, Iran

19193. Favret, C.; Moisan-De Serres, J.; Larrivé, M.; Lessard, J.-P. (2020): The Odonata of Quebec: Specimen data from seven collections. *Biodiversity Data Journal* 8: e49450: 26 pp. (in English) ["Background: The Odonata, dragonflies and damselflies, constitute one of the more charismatic and better-studied orders of insects. The approximately 6,000 extant species on Earth can be variously found on all continents, except Antarctica. A relatively stable taxonomy, a relative ease of species identification and an aquatic immature stage has made the Odonata a taxon of interest in documenting the symptoms of global environmental change, especially at higher latitudes. The Odonata fauna of the north-temperate Canadian province of Quebec includes 150 species, many of which are at the northern limits of their geographic distribution. New information: Quebec hosts multiple entomological specimen depositories, including seven publicly accessible research collections. One of these, the University of Montreal's Ouellet-Robert Entomological Collection, houses an exceptionally large collection of Odonata. An initial specimen data capture project for this collection gathered 31,595 Quebec Odonata occurrence records, but several Quebec species were missing and geographic coverage was biased towards the Montreal region. To complement this dataset, we undertook to digitise the Odonata records of six other public research collections. They are, in order of Quebec Odonata collection size, the Laval University Entomological Collection, McGill University's Lyman Entomological Museum, the Insectarium of Montreal Research Collection, the Quebec Government's Insect Collection, Bishop's University's Insect Collection and the Laurentian Forestry Centre's René-Martineau Insectarium. Of the 40,447 total specimen occurrence records, 36,951 are identified to the species level, including 137 of the 150 species officially-recorded in Quebec and 2 non-nomotypical subspecies. We here summarise the data and highlight the strengths and weaknesses of the datasets. The complete dataset is available with this publication (Suppl. material 1), whereas the specimen data associated with each collection

are available as Darwin Core archives at Canadensys.net and will be updated as appropriate." (Authors)] Address: Favret, C., University of Montreal, Montreal, Canada. E-mail: colinfavret@aphidnet.org)

19194. Fernandez, S.; Rodriguez-Martin, S.; Martinez, J.L.; Garcia-Vazquez, E.; Ardura, A. (2020): How can eDNA contribute in riverine macroinvertebrate assessment? A metabarcoding approach in the Nalon River (Asturias, Northern Spain). *Environmental DNA* 1(4): 385-401. (in English) ["Background: Bioassessment of rivers is a fundamental method to determine surface water quality. One of the groups most commonly employed as bioindicators of aquatic ecosystems are benthic macroinvertebrates. Their conventional assessment is based on morphological identification and entails several limitations, such as being time-consuming and requires trained experts for taxonomic identification. The use of genetic tools to solve these limitations offers an alternative way to evaluate rivers status. The use of environmental DNA (eDNA) metabarcoding has increased in recent years for different purposes, but its use in water quality evaluation is yet to be tested. Here, morphological and eDNA based inventories of macroinvertebrates were compared from the same seven sampling sites in the Upper Nalon River Basin (Asturias, Spain). Materials & Methods: High-Throughput Sequencing (HTS) of the cytochrome oxidase subunit 1 (COI) gene was carried out on DNA from water samples using an Ion Torrent platform. Biotic water quality indices were calculated from morphological and molecular data and compared with independent physicochemical habitat assessment to validate eDNA based approach. Results: Highly positive and significant correlation was found between eDNA metabarcoding and morphological methods (Morphological and eDNA indices, $r = 0.798$, 5 degrees of freedom d.f., $P = 0.031$;) and a highly significant negative correlation was found between molecular and habitat quality indices (Stress score & eDNA, $\rho = -0.878$ and $P = 0.009$; Stress score & Visual, $\rho = 0.949$ and $P = 0.0002$). Discussion: The similarity of results from the two approaches and the correlation of eDNA metabarcoding data with the habitat quality indices, suggest that eDNA performs as well as conventional methods for calculating biotic indices in this system, positioning eDNA metabarcoding of macroinvertebrate communities to transform how river bioassessment can be achieved. Conclusion: The usefulness of eDNA metabarcoding to assess rivers water quality based on macroinvertebrates assessment has been demonstrated in a dammed river basin." (Authors) "Calopterygidae" are mentioned.] Address: Fernandez, Sara, Dept of Functional Biology, Univ. of Oviedo, Oviedo, Spain. Email: sara_ff9@msn.com

19195. Florencio, M.; Burraco, P.; Rendón, M.A.; Díaz-Paniagua, C.; Gomez-Mestre, I. (2020): Opposite and synergistic physiological responses to water acidity and predator cues in spadefoot toad tadpoles. *Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology* 242: (in English) ["Highlights: • Predator cue recognition occurred in both neutral and acidic water, as tadpoles developed anti-predator morphology even at pH = 4. • Predator

presence induced lower levels of plasma corticosterone in tadpoles whereas acidic water increased them. • Predator presence reduced the activity of some antioxidant enzymes, congruent with a decrease in metabolism. • The combination of predator cues and low pH had negative synergistic effects on the redox status of tadpoles. Abstract: Organisms are exposed to multiple environmental factors simultaneously to which they often respond behaviorally, morphologically and/or physiologically. Amphibian larvae are quite plastic and efficiently adjust their phenotype and physiology to the reigning local conditions. Here we tested whether the combination of predator presence and low water pH induces alterations in the morphology and physiology of spadefoot toad tadpoles. We raised *Pelobates cultripes* tadpoles in the laboratory in water at either pH4 or 7, and in the presence or absence of caged dragonfly nymphs, and determined their changes in shape through geometric morphometrics to assess whether predator recognition was impaired or not at low pH. We also measured levels of plasma corticosterone, activity of four antioxidant enzymes, as well as markers of oxidative damage and redox status. We found that tadpoles altered their body shape in response to predator cues even at low pH, indicating that predator recognition was not interfered by water acidity and developmental responses were robust even under abiotic stress. Water acidity was associated with increased corticosterone levels in tadpoles, whereas predator presence consistently reduced corticosterone levels. Predator presence was linked to reduced antioxidant enzyme activity, whereas the combination of both factors resulted in negative synergistic effects on lipid peroxidation and the antioxidant capacity of tadpoles. Here we show that tadpoles detect predators even at low pH but that the development of adaptive anti-predatory morphology can magnify physiological imbalances when other stressors co-occur. These results emphasize the need to understand how multiple environmental perturbations can affect animal homeostasis." (Authors)] Address: Gomez-Mestre, I., Ecology, Evolution & Development Group, Estación Biológica de Doñana, CSIC, Seville, Spain. Email: igmestre@ebd.csic.es

19196. Funnell, L.; Holmes, R.J.P.; Closs, G.P.; Matthaehi, C.D. (2020): Short-term effects of instream habitat restoration on macroinvertebrates and a comparison of sampling approaches. *Limnologica* 80 (2020) 125726: 12 pp. (in English) ["Many streams and rivers worldwide are restored with the intention to mitigate degradation caused by human activities, but these rehabilitation projects often involve physical instream work with diggers or other heavy machinery. The short-term effects of such restoration works on stream ecosystems are rarely investigated. The primary aim of our study was to assess the short-term effects of physical instream restoration works (which likely increased instream fine sediment load temporarily) on the benthic macroinvertebrate community [including *Xanthocnemis zealandica*] in a lowland soft-bottomed stream, and our second aim was to compare the results of semi-quantitative kick-net and quantitative Surber sampling in this assessment. Invertebrates were collected using these two methods from three

Control and three Impact sites, before and two days after recontouring the stream banks and installing instream woody cover features. Three of seven macroinvertebrate community-level indexes suggested positive short-term effects of the restoration works, whereas none indicated negative effects. By contrast, seven of the 14 most common taxa were negatively affected by the restoration works, possibly due to increased fine sediment levels reducing habitat quality for these taxa. These differences imply that taxon-specific invertebrate responses may be more suitable for detecting short-term impacts of instream restoration works than community-level metrics. Community indexes and common taxa were also likely affected by a drought in the spring and summer before restoration, which may have obscured some effects of the restoration works. Finally, kick-net and Surber sampling methods yielded similar findings for the community-level metrics but differed more for the common taxa, probably because the two methods sampled different microhabitats within the stream. Consequently, we recommend that for routine monitoring of macroinvertebrate communities in lowland soft-bottomed streams, the semi-quantitative kick-net sampling method should be used." (Authors)] Address: Funnell, L., Department of Zoology, University of Otago, 340 Great King Street, Dunedin, New Zealand

19197. Gao, S.; Zhang, B.; Sun, J.; Liu, W. (2020): A designed method of the surface structure of suspended glass transport device based bionic structure of dragonfly wings. *Industrial Lubrication and Tribology* 72(1): 1245-1250. (in English) ["The purpose of this paper is to design a biomimetic surface structure for use in a glass transport device to enhance the suspension lift of a glass transport unit. Design/methodology/approach: This paper presents a surface structure of a suspended glass transport device based on the principle of bionics. First, a mapping model is constructed based on the wing structure. Second, the optimal structural parameters are given according to genetic algorithm optimization. Finally, the experimental comparison of the test bench verified the feasibility of the theory. Findings: Through experimental comparison, the biomimetic suspension glass transport device saves 20% of air pressure compared with the ordinary suspended glass transport device, which verifies the effectiveness of the theoretical method. Originality/value: This paper proposes a suspended glass transport device based on the principle of bionics, which saves the air pressure required for work. It is expected to be used in suspension glass transport devices." (Authors)] Address: Gao, S., School of Mechatronic Engineering, Changchun University of Technology, Changchun, China

19198. Grether, G.F.; Drury, J.P.; Okamoto, K.W.; McEachin, S.; Anderson, C.N. (2020): Predicting evolutionary responses to interspecific interference in the wild. *Ecology Letters* 23(2): 221-230. (in English) ["Many interspecifically territorial species interfere with each other reproductively, and in some cases, aggression towards heterospecifics may be an adaptive response to interspecific mate competition. This hypothesis was recently formalised in an agonistic character displacement (ACD) model which predicts that species

should evolve to defend territories against heterospecific rivals above a threshold level of reproductive interference. To test this prediction, we parameterised the model with field estimates of reproductive interference for 32 sympatric damselfly populations and ran evolutionary simulations. Asymmetries in reproductive interference made the outcome inherently unpredictable in some cases, but 80% of the model's stable outcomes matched levels of heterospecific aggression in the field, significantly exceeding chance expectations. In addition to bolstering the evidence for ACD, this paper introduces a new, predictive approach to testing character displacement theory that, if applied to other systems, could help in resolving long-standing questions about the importance of character displacement processes in nature." (Authors)] Address: Grether, G.F., Dept of Ecology & Evolutionary Biology, University of California Los Angeles, Los Angeles, CA, USA. E-mail: ggrether@g.ucla.edu

19199. Grung, M.; Meland, S.; Ruus, A.; Ranneklev, S.; Fjeld, E.; Kringstad, A.; Rundberget, J.T.; Del Cruz, M.; Christensen, J.H. (2020): Occurrence and trophic transport of organic compounds in sedimentation ponds for road runoff. *Science of The Total Environment* 751(Part A):141808: 11pp. (in English) ["Highlights: • Ecosystem in sedimentation ponds for road runoff receives several organic pollutants. • Water, sediment, plants, larvae and fish were analysed for 4 contaminant groups. • Higher levels of pollutants in sedimentation ponds vs. reference were observed. • Bioaccumulation observed for PACs and PBDEs, but all 4 groups detected in fish. • Biomagnification was documented for PBDEs, alkylated PACs important in road runoff. Abstract: Sedimentation ponds have been shown to accumulate several groups of contaminants, most importantly polycyclic aromatic compounds (PACs) and metals. But also, other urban organic pollutants have shown to be present, including polybrominated diphenyl ethers (PBDEs), organophosphate compounds (OPCs) and benzothiazoles (BTs). This investigation aimed at determining the occurrence of these four groups of contaminants in sedimentation ponds and determine their transport from water/sediment to organisms. PACs, including alkylated PACs, PBDEs; OPCs and BTs were determined in water, sediment, plants, dragonfly larvae and fish from two sedimentation ponds and one reference site. Fish were analysed for PAC metabolites. Overall, higher concentrations of all four pollutant groups were detected in water and sediment from sedimentation ponds compared to two natural lakes in rural environments (reference sites). The concentration difference was highest in sediments, and >20 higher concentration was measured in sedimentation ponds (3.6–4.4 ng/g ww) compared to reference (0.2 ng/g ww) for sum BDE6. For PACs and PBDEs a clear transport from water/sediment to organisms were observed. Fish were the highest trophic level organism (3.5–5) in our study, and all four pollutant groups were detected in fish. For PBDEs a trophic biomagnification (TMF) was found both in sedimentation ponds and reference, but higher concentrations in all matrices were measured in sedimentation ponds. TMF was not calculated for PACs since they are metabolised by vertebrates, but a transfer from water/sediment to

organisms was seen. For BTs and OPCs, no consistent transfer to plants and dragonfly larvae could be seen. One OPC and two BTs were detected in fish, but only in fish from sedimentation ponds. It is therefore concluded that sedimentation ponds are hotspots for urban and traffic related contaminants, of which especially PACs and PBDEs are transferred to organisms living there." (Authors)] Address: Grung, Merete, Norwegian Inst. Water Research (NIVA), Gaustadalléen 21, 0349 Oslo, Norway. Email: mgr@niva.no

19200. Hämäläinen, M.; Verspui, K.; Orr, A.G. (2020): An echo of Marguerite - Edmond de Selys Longchamps' heartfelt remembrances of his young daughter Marguerite (1848-1852) and its influence on the nomenclature of Odonata. *Agrion* 24(1): 24-33. (in English) ["In the calopterygid damselfly *Echo margarita* Selys, 1853, both the generic name *Echo* and the specific name *margarita*, are demonstrated to be eponyms given in memorium to Selys' lost daughter Marguerite (1848-1852), who died in early childhood. The binomial name signifies 'memory' of Marguerite. Previously the name *Echo* was thought to refer to a mythological character from antiquity, as in the many other classically based Selysian calopterygid genera. Selys' other allusions and private dedications to the memory of Marguerite, such as his diary notes and other private documents concerning her life and death, are also discussed. Information is provided on the imposing Selys family mausoleum, constructed soon after Marguerite's death and her final resting place." (Authors)] Address: Hämäläinen, M., Netherlands Centre for Biodiversity Naturalis, P.O. Box 9517, 2300 RA, Leiden, The Netherlands. E-mail: libellago@gmail.com

19201. Halabowski, D.; Lewin, I.; Buczynski, P.; Krodkiewska, M.; Plaska &, W.; Sowa, A.; Buczynska, E. (2020): Impact of the discharge of salinised coal mine waters on the structure of the macroinvertebrate communities in an urban river (Central Europe). *Water Air Soil Pollut.* 231:5: 19 pp. (in English) ["The anthropogenic salinisation of rivers causes grave environmental problems that are responsible for the degradation of water quality on a worldwide scale as well as for biological changes in aquatic ecosystems. The objectives of the survey were to analyse the structure of the macroinvertebrate communities in the Bolina River, which is currently the second most anthropogenic salinised river in the world, in relation to various types of instream microhabitats and to determine the environmental factors that have a significant effect on the structure of the macroinvertebrate communities. The result of a canonical correspondence analysis (CCA) showed that electrical conductivity, the temperature of the water and the organic matter content in the bottom sediments were the most important factors (statistically significant) that influenced the macroinvertebrate communities in the anthropogenic salinised river. A total of 77 taxa of macroinvertebrates were recorded in the Bolina River. A Kruskal-Wallis one-way ANOVA and multiple comparison post hoc tests revealed statistically significant differences in the median number of taxa and the median density of macroinvertebrates between the various types of

microhabitats in the salinised river. The anthropogenic salinisation of a river can lead to a decrease in aquatic biodiversity that favours invasive species over native species. The Bolina River, which has a salinity of up to 33.6‰, is an example of a unique habitat for organisms that are salt tolerant (euhaline) or eurytopic. It is a route for the spread of alien and invasive invertebrate species including *Gammarus tigrinus*, *Potamopyrgus antipodarum*, and *Monopylephorus limosus*. ... Odonata, was represented by *Ischnura elegans* (density up to 116 individuals m⁻²), *Platycnemis pennipes* (density up to 112 individuals m⁻²), *Orthetrum cancellatum* (density up to 24 individuals m⁻²) and *Chalcolestes viridis* (density up to 16 individuals m⁻²)." (Authors)] Address: Halabowski, D., Institute of Biology, Biotechnology and Environmental Protection, Faculty of Natural Sciences, University of Silesia in Katowice, Bankowa 9, 40-007 Katowice, Poland. Email: dhalabowski@us.edu.pl

19202. Hendriks, J.A. (2020): A preliminary study of Odonata communities in a mixed-mosaic habitat structure in Central Kalimantan, Indonesia. BSc thesis, Science and Engineering, Maastricht University: 94 pp. (in English) ["Recent decades have seen an increase in deforestation and fragmentation of forests due to anthropogenic pressures. To assess impacts of degradation, there is an increasing interest in bio-indicator species such as odonates. However, they remain poorly studied in certain areas. Central Kalimantan, Indonesia is one such, where this is the first study investigating odonates in a kerangas dominated mixed-mosaic habitat structure. Line transect method was used to sample 250m – two transects in three habitat types, i.e. riverine/mixed-swamp (RM), kerangas (K), low-pole peat swamp (LP) in KHDTK. Habitat variables were recorded at capture sites and at 25m intervals on each transect. A total of 339 individuals representing 23 species were captured. Highest number of Odonata were captured in LP. Highest species diversity was observed in RM ($H'=2.00$), and lowest in LP ($H'=1.62$). Canopy cover had a strong influence on Odonata assemblages and they showed preference for areas with surface water. Anisoptera preferred forest pools and Zygoptera were inclined to flowing water. The greatest lengths in thorax and wing size were observed for Odonata in K. Eco-physiological requirements between sub-orders and habitat variations influenced their distribution and assemblages. This study further explores their potential as bio-indicators for the habitat types discussed." (Author)] Address: not stated

19203. Herlinda, S.; Alesia, M.; Susilawati; Irsan, C.; Hasbi; Suparman; Anggraini, E.; Arsi (2020): Impact of mycoinsecticides and abamectin applications on species diversity and abundance of aquatic insects in rice fields of freshwater swamps of South Sumatra, Indonesia. *Biodiversitas* 21(7): 3076-3083. (in English) ["Aquatic insects in rice fields generally are predators of rice insect pests. The application of insecticides may reduce the abundance and species diversity of these predators. This study aimed to determine the impact of mycoinsecticides and abamectin application on species diversity and abundance of aquatic insects in rice

fields. Mycoinsecticides were made from *Beauveria bassiana* s.l., *Metarhizium anisopliae* s.l. and *Cordyceps militaris* s.l. with carrier from shrimp shell flour compost extract, vegetable oil, and Tween®. The treatments were the mycoinsecticides and abamectin. The results showed there were eight aquatic insects species obtained in this study, i.e. unidentified Dytiscidae, *Micronecta* sp., *Mesovelia* sp., *Ranatra* sp., *Anisops* sp., *Microvelia* sp., unidentified species of Veliidae, and *Orthetrum* sp. belong to 7 families (Dytiscidae, Corixidae, Mesoveliidae, Nepidae, Notonectidae, Veliidae, Libellulidae), and three orders (Coleoptera, Hemiptera, and Odonata). All of the species were predatory insects. The application of mycoinsecticides did not reduce the abundance and species diversity of the aquatic predatory insects, but the application of abamectin reduced the abundance and species diversity of the predators. The highest insect species diversity was in the plots applied with *C. militaris* s.l., followed by the *B. bassiana* s.l. and *M. anisopliae* s.l. plots and the lowest one was found in the abamectin plot. So, the application of mycoinsecticides from *B. bassiana* s.l., *M. anisopliae* s.l. and *C. militaris* s.l. is safe for the aquatic predatory insects and to control rice insect pests than that of abamectin." (Authors)] Address: Herlinda, S., Department of Plant Pests and Diseases, Faculty of Agriculture, Universitas Sriwijaya. Jl. Raya Palembang-Prabumulih Km 32, Indralaya, Ogan Ilir 30662, South Sumatra, Indonesia

19204. Hill, B.; Blanckenhagen, B. von; Adelman, J. (2020): Landesmonitoring 2018 zur Erfassung der Östlichen Moosjungfer (*Leucorrhinia albifrons*) (Art des Anhangs IV der FFH-Richtlinie) in Hessen. Projekt – Nr.: G 18 - 35. Auftraggeber: HLNUG (Hessisches Landesamt für Naturschutz, Umwelt und Geologie), Europastr. 10, 35394 Gießen: 42 pp. (in German) ["*L. albifrons* was recorded in Hesse (Germany) in 2012 after a 100-year hiatus (VON BLANCKENHAGEN 2013). In the following years, further single observations followed, before the first proof of its reproduction was found in the Gehspitzweiher nature reserve in 2015. So far, no nationwide survey of the species' distribution is available. Within the framework of the implementation of the FFH monitoring in Hesse, it was necessary to close this gap. The aim of the present report is to verify the ground stability of already proven occurrences and, if necessary, to localise new sites in the course of a data research. The results will be included in the report to the EU in 2025. The only confirmed and native occurrence within the scope of the state monitoring is located at the Gehspitzweiher near Neu-Isenburg (OF). 65 exuviae were collected, corresponding to a density of 1.3 exuviae/m bank. This justifies a rating of A (excellent) for the main criterion of population status. The habitat quality of the water body is also rated as excellent (value level A), mainly due to the sunlight, the high proportion of submerged vegetation and the location in a forest area. The impairment rating A is also achieved, as there are hardly any substantial threats. In the overall assessment, the Gehspitzweiher receives the value rating A (excellent). Mention should be made of the fact that in the course of the state monitoring of the ornamental damselfly, which was carried out at the same time, a native occurrence

of *Leucorrhinia albifrons* was found at the Langener Waldsee (Mittelgrube). This and the surrounding water bodies at Langener Waldsee should be integrated in the future investigations of the state monitoring." (Authors/DeepL.) Address: von Blanckenhagen, B., Weidenhäuser Str. 34, 35037 Marburg, Germany

19205. Hill, B.; Blanckenhagen, B. von; Rehnig, K.; Wurmitzer, C.; Malinger, A. (2020): Landesmonitoring 2018 zur Erfassung der Zierlichen Moosjungfer (*Leucorrhinia caudalis*) (Art des Anhangs II der FFH-Richtlinie) in Hessen. Projekt – Nr.: G 18 - 35. Auftraggeber: HLNUG (Hessisches Landesamt für Naturschutz, Umwelt und Geologie), Europastr. 10, 35394 Gießen: 76 pp. (in German) ["The state-wide distribution situation of the *Leucorrhinia caudalis* in Hesse (Germany) was last studied in 2009 (cf. STÜBING & HILL 2010). Within the framework of the implementation of the FFHM monitoring in Hesse, a new monitoring round had to be carried out. The aim of the present report is to check the ground stability of already existing finds and to locate new sites in the course of a data search, if necessary. The results will be included in the report to the EU in 2025. Within the scope of the investigations, the ground stability was determined on the basis of exuviae found at a total of eight water bodies in the Rhine-Main area and one water body in Central Hesse. In addition, there are two study areas with evidence of the Ornamental damselfly from the *L. albifrons* monitoring. The largest occurrence is still in the Gehspitzweiher Nature Conservation Site (OF). In second place comes the water body complex of the Langener Waldsee, where at least four different water bodies are successfully colonised. Of particular importance is the evidence of another native occurrence of *L. albifrons* at Langener Waldsee. Other small occurrences exist in Linden at the Fernie pit (GI), at Lake Linden near Rüsselsheim (GG) and at the Obertshausen fishing lake (OF). Only two exuviae were found in the Enkheimer Ried nature reserve, but the population is estimated to be much larger on the basis of the imagines observed. Observations of adults were made in two other areas. Whereas at the Walldorf bathing lake the presence on the ground is considered less probable, at the Nachtweidensee near Groß-Gerau, due to the larger number of individuals during the flight period, it can be assumed that the species is present on the ground. Overall, occurrences with a good overall rating (value level B) dominate. They make up about half of the water bodies studied. Only the situation at the Gehspitzweiher National Park (value level A) is better. In about one third of the areas with evidence of the species, only a rating of C (medium - poor) could be assigned." (Authors/DeepL.) Address: von Blanckenhagen, B., Weidenhäuser Str. 34, 35037 Marburg, Germany

19206. Huang, S.-T.; Wang, H.-R.; Yang, W.-Q.; Si, Y.-C.; Wang, Y.-T.; Sun, M.-L.; Qi, X.; Bai, Y. (2020): Phylogeny of Libellulidae (Odonata: Anisoptera): comparison of molecular and morphology-based phylogenies based on wing morphology and migration. *PeerJ* 8:e8567: 22 pp. ["Background. Establishing the species limits and resolving phylogenetic relationships are primary goals of taxonomists and

evolutionary biologists. At present, a controversial question is about interspecific phylogenetic information in morphological features. Are the interspecific relationships established based on genetic information consistent with the traditional classification system? To address these problems, this study analyzed the wing shape structure of 10 species of Libellulidae, explored the relationship between wing shape and dragonfly behavior and living habits, and established an interspecific morphological relationship tree based on wing shape data. By analyzing the sequences of mitochondrial COI gene and the nuclear genes 18S, 28S rRNA and ITS in 10 species of dragonflies, the interspecific relationship was established. Method. The wing shape information of the male forewings and hindwings was obtained by the geometric morphometrics method. The inter-species wing shape relationship was obtained by principal component analysis (PCA) in MorphoJ1.06 software. The inter-species wing shape relationship tree was obtained by cluster analysis (UPGMA) using Mesquite 3.2 software. The COI, 18S, ITS and 28S genes of 10 species dragonfly were blasted and processed by BioEdit v6 software. The Maximum Likelihood (ML) tree was established by raxmlGUI1.5b2 software. The Bayes inference (BI) tree was established by MrBayes 3.2.6 in Geneious software. Results. The main difference in forewings among the 10 species of dragonfly was the apical, radial and discoidal regions dominated by the wing nodus. In contrast, the main difference among the hindwings was the apical and anal regions dominated by the wing nodus. The change in wing shape was closely related to the ability of dragonfly to migrate. The interspecific relationship based on molecular data showed that the species of *Orthetrum* genus branched independently of the other species. Compared to the molecular tree of 10 species, the wing shape clustering showed some phylogenetic information on the forewing shape (with large differences on the forewing shape tree vs. molecular tree), and there was no interspecific phylogenetic information of the hindwing shape tree vs. molecular tree. Conclusion. The dragonfly wing shape characteristics are closely related to its migration ability. Species with strong ability to migrate have the forewing shape that is longer and narrower, and have larger anal region, whereas the species that prefer short-distance hovering or standing still for a long time have forewing that are wider and shorter, and the anal region is smaller. Integrating morphological and molecular data to evaluate the relationship among dragonfly species shows there is some interspecific phylogenetic information in the forewing shape and none in the hindwing shape. The forewing and hindwing of dragonflies exhibit an inconsistent pattern of morphological changes in different species." (Authors)] Address: Huang, S.-T., Zhejiang Provincial Key Laboratory of Plant Evolutionary Ecology and Conservation, Taizhou University, Taizhou, Zhejiang, China

19207. Huikkonen, I.-M.; Helle, I.; Elo, M. (2020): Heterogenic aquatic vegetation promotes abundance and species richness of Odonata (Insecta) in constructed agricultural wetlands. *Insect Conservation and Diversity* 13(4): 374-383. (in English) ["1. Natural wetlands are among the most

threatened habitat types worldwide. They contain a high diversity of macroinvertebrates, including dragonflies and damselflies (Insecta: Odonata). In agricultural landscapes, new wetlands have been constructed to filter nutrients and solid matter from agricultural runoff. These types of wetlands may also benefit Odonata as new breeding habitats. However, it is not yet clear what environmental characteristics of constructed wetlands are important for Odonata. 2. We studied 20 constructed agricultural wetlands in Central Finland and asked whether Odonata are able to use these wetlands as breeding habitats, and which environmental characteristics (aquatic vegetation, water area, shoreline length, bottom type diversity, water transparency, and pH) of the wetlands affect odonate abundance and species richness. 3. The constructed wetlands hosted altogether 17 odonate species. Odonate abundance was positively associated with the number of aquatic vegetation growth forms of the wetland. Odonate species richness was associated positively with abundance, floating-leaved vegetation, and water transparency. 4. Constructed agricultural wetlands support local diversity of common odonate species. Although protecting the remaining natural wetlands is of primary importance, constructed wetlands can add suitable wetland habitats in the agricultural landscape. From the perspective of Odonata, heterogenic aquatic vegetation and water quality are features worth promoting when constructing and managing agricultural wetlands." (Authors)] Address: Huikkonen, Ida-Maria, Dept of Biological & Environmental Science, University of Jyväskylä, P.O. Box 35, 40014 Univ. Jyväskylä, Finland. E-mail: imma.huikkonen@gmail.com

19208. Hunger, H.; Geigenbauer, K.; Fies, R.; Schiel, F.-J. (2020): Abschlussbericht Neubau der B31-West. Fachgutachten Libellen. Im Auftrag des Regierungspräsidiums Freiburg: 91 pp. (in German) ["A total of 40 dragonfly species were recorded at the surveyed water stretches, of which 34 species were certainly to very probably native to at least one survey stretch. Among the species detected, four are on the Baden-Württemberg and / or German list of species at risk, and three species are classified as "endangered" at the national and / or state level. *Coenagrion scitulum* and *Orthemtrum albistylum* are considered extremely rare throughout Germany (category R). *Coenagrion mercuriale* is classified nationwide, *Aeshna isocetes* nationwide and *Sympetrum pedemontanum* both nationwide and statewide as critically endangered (RL 2). *Leucorrhinia caudalis* is classified as critically endangered nationwide (RL 1). The detection of *Coenagrion mercuriale*, which is strictly protected under the Federal Nature Conservation Act and listed in Annex II of the Habitats Directive, is relevant in terms of species protection. This species has been found in numerous sections of watercourses. Particularly noteworthy are the large native occurrences in the study sections at the "Riedkanal" (L 13 a-c), as well as at the "Wasenweiler Neugraben (L 12a-d, L 21, L 22)". But the species was also found in the "Merdinger Neugraben" (L 16, L 26), "Krebsbach" (L 31) and in some small ditches in the Wasenweiler Ried (L 08, L 10). In principle, the Helm's damselfly can be expected to occur in all sunny meadow ditches and streams in the study area. The

detection of *Leucorrhinia caudalis*, which is strictly protected under the Federal Nature Conservation Act and listed in Annex IV of the Habitats Directive, is also relevant for species conservation. This species has a native occurrence in the "Murr" fishing lake (L 05). This lake and parts of its surroundings are located within the FFH area "Freiburger Mooswälder", but outside the immediate area of intervention. The larger stillwaters within the study area are also of high importance for *Orthemtrum albistylum*, which is strictly protected under Section 44 of the Federal Nature Conservation Act and only occurs in southern Baden and southeastern Bavaria throughout Germany; it has been found on the ground in the fishing lakes between Gottenheim and Wasenweiler." (Authors/DeepL) https://rp.baden-wuerttemberg.de/fileadmin/RP-Internet/Freiburg/Abteilung_4/Referat_44/B31-West/19_01_U_VS_AnI_07-Libellen.pdf] Address: Hunger, H., Institut für Naturschutz und Landschaftsanalyse (INULA), Wilhelmstraße 8, 79098 Freiburg, Germany. E-mail: holger.hunger@inula.de

19209. Hykel, M.; Ruzickova, J.; Dolný, A. (2020): Perch selection in *Sympetrum* species (Odonata: Libellulidae): importance of vegetation structure and composition. *Ecological Entomology* 45(1): 90-96. (in English) ["1. Perching dragonflies are closely associated with the physical structure of vegetation because adults utilise plants when foraging, thermoregulating, and mate-seeking. However, little attention has been given to which structural attribute of vegetation is playing a key role within foraging habitat use. 2. This study focused on the influence of different features of perches on their selection by adult dragonflies. As a model group, a typical percher behavioural guild of *Sympetrum* (*S. depressiusculum*, *S. fonscolombii*, *S. sanguineum*, *S. striolatum*, *S. vulgatum*) was used and experimental plots with artificial perches and different structural properties were established. 3. It was found that adults preferred perch sticks with a wider diameter and larger spacing. It is assumed that these perching sites are advantageous because their base is more stable, they provide the best view for successful foraging, and there is no interference among individuals. 4. This study also revealed significant differences between male and female preferences. Females used less structured vegetation formed by thin perches in high densities. It is suggested that female discrimination is influenced by the higher competitiveness of males, which is related to their agonistic behaviour. 5. These results suggest that the availability of perches in the foraging habitat might be an essential requirement for adults. However, within the terrestrial surroundings of breeding sites, the structure of vegetation providing conditions for perching may be associated only with certain habitats. In intensive landscapes, physically structured vegetation can be limited or completely absent." (Authors)] Address: Hykel, M., Dept of Biology and Ecology, Faculty of Science, Univ. Ostrava, Slezska Ostrava, Czech Republic

19210. Johansson, F.; Heino, J.; Coiffard, P.; Svanbäck, R.; Wester, J.; Bini, L.M. (2020): Can information from citizen science data be used to predict biodiversity in stormwater ponds? *Scientific Reports* volume 10, Article number: 9380

(2020): 10 pp. (in English) ["Citizen science data (CSD) have the potential to be a powerful scientific approach to assess, monitor and predict biodiversity. Here, we ask whether CSD could be used to predict biodiversity of recently constructed man-made habitats. Biodiversity data on adult dragonfly abundance from all kinds of aquatic habitats collected by citizen scientists (volunteers) were retrieved from the Swedish Species Observation System and were compared with dragonfly abundance in man-made stormwater ponds. The abundance data of dragonflies in the stormwater ponds were collected with a scientific, standardized design. Our results showed that the citizen science datasets differed significantly from datasets collected scientifically in stormwater ponds. Hence, we could not predict biodiversity in stormwater ponds from the data collected by citizen scientists. Using CSD from past versus recent years or from small versus large areas surrounding the stormwater ponds did not change the outcome of our tests. However, we found that biodiversity patterns obtained with CSD were similar to those from stormwater ponds when we restricted our analyses to rare species. We also found a higher beta diversity for the CSD compared to the stormwater dataset. Our results suggest that if CSD are to be used for estimating or predicting biodiversity, we need to develop methods that take into account or correct for the under-reporting of common species in CSD. ... 29 species of Odonata were found in the 18 studied stormwater ponds." (Authors)] Address: Johansson, F., Dept of Ecology and Genetics, Animal Ecology, Uppsala University, Norbyvägen 18D, 752 36, Uppsala, Sweden. E-mail: frank.johansson@ebc.uu.se

19211. Katayama, N.; Osada, Y.; Mashiko, M.; Baba, Y.G.; Tanaka, K.; Kusumoto, Y.; Okubo, S.; Ikeda, H.; Natuhara, Y. (2020): Organic farming and associated management practices benefit multiple wildlife taxa: A large-scale field study in rice paddy landscapes. *Journal of applied ecology* 56(8): 1970-1981. (in English) ["1. Organic farming has potential for the conservation of global biodiversity and associated ecosystem services. Despite this, knowledge of the effects of organic farming systems on farmland biodiversity is limited in Asia, the worldwide leader in rice production. 2. We conducted the first national-scale study to investigate the effects of three different rice farming systems (conventional, low-input, and organic) and specific management practices (e.g. herbicide and insecticide applications, crop rotation, and levee-vegetation management) on species richness and abundance of multiple taxonomic groups (plants, invertebrates, Pelophylax and Hyla japonica frogs, cobitid loaches, and birds) in Japan during 2013–2015. 3. Organic fields supported the highest richness and abundance of several taxonomic groups (native/Red List plants, Tetragnatha spiders, Sympetrum dragonflies, and Pelophylax frogs), followed by low-input and conventional fields. We also found taxon-specific responses to specific management practices. For instance, plant richness and Tetragnatha and Sympetrum abundance increased with reduced herbicide and/or insecticide applications. Sympetrum and Cobitid loach abundance increased in the absence of crop rotation, whereas H. japonica abundance increased with crop rotation. Pelophylax

abundance increased with an increased height of levee vegetation. 4. At spatial scales larger than single fields, waterbird richness and abundance were positively correlated with the proportion of organic rice fields, presumably due to increased prey abundance. Meanwhile, landbird richness and abundance were positively associated with annual precipitation and annual mean temperature, suggesting that such climate increases food availability. 5. Synthesis and applications. We highlight the positive effects of organic and low-input farming for biodiversity relative to conventional farming in rice-paddies. We also provide the scientific basis of the current agri-environmental schemes in Japan, subsidising organic and low-input farming for biodiversity. The taxon-specific associations with management practices indicate that avoiding crop rotation, maintaining levee vegetation, and organic farming at large spatial scales can also be wildlife-friendly. These practices may thus be incorporated into agri-environment schemes for effective biodiversity conservation." (Authors)] Address: Katayama, N., Biodiversity Division, Institute for Agro-Environmental Sciences NARO, Ibaraki, Japan. Email: katayama6@affrc.go.jp

19212. Kim, M.J.; Kim, J.S.; Kim, S.-S.; Kim, I. (2020): Development and validation of microsatellite markers for an endangered dragonfly, *Libellula angelina* (Odonata: Libellulidae), with notes on population structures and genetic diversity. *International Journal of Odonatology* 23(2): 93 -102. (in English) ["*L. angelina* is listed as an endangered species in South Korea, and is classified as a critically endangered species by the International Union for Conservation of Nature (IUCN). An assessment of the genetic diversity and population relationships of the species by molecular markers can provide the information necessary to establish effective conservation strategies. In this study, we developed 10 microsatellite markers specific to *L. angelina* using the Illumina NextSeq 500 platform. Forty-three samples of *L. angelina* collected from three localities in South Korea were genotyped to validate these markers and to preliminarily assess the population genetic characteristics. The 10 markers revealed 4–11 alleles, 0.211–0.950 observed heterozygosity (HO), and 0.659–0.871 expected heterozygosity (HE) in the population with the largest sample size ($n = 20$), thereby validating the suitability of these markers for population analyses. Our preliminary assessment of the population genetic characteristics appears to indicate the following: presence of inbreeding in all populations, an isolation of the most geographically distant population (Seocheon), and a lower HO than HE. The microsatellite markers developed in this study will be useful for studying the population genetics of *L. angelina* collected from additional sites in South Korea and from other regions." (Authors)] Address: Kim, M.J., Dept Applied Biology, College of Agriculture & Life Sciences, Chonnam National Univ., Gwangju, Republic of Korea. Email: ikkim81@chonnam.ac.kr

19213. Kompier, T.; Dow, R.A.; Steinhoff, P.O.M. (2020): Five new species of *Coelliccia* Kirby, 1890 from Vietnam (Odonata: Platycnemididae), and information on several other species of the genus. *Zootaxa* 4766(4): 501-538. (in English)

["Five new species of *Coeliccia* (*Coeliccia caerulea* sp. nov. [holotype: Bao Loc, Lam Dong Prov., appr. 11.449N, 107.712E], *Coeliccia coronata* sp. nov. [holotype: Bao Loc, Lam Dong Prov., appr. 11.726N, 107.713E], *Coeliccia curua* sp. nov. [holotype: Ba Be National Park, Bac Kan Prov. appr. 22.413N, 105.610E], *Coeliccia diomedea* sp. nov. [holotype: Tai Giang, Quang Nam Prov., appr. 16.006N, 107.507E], and *Coeliccia pulchella* sp. nov. [holotype: Huu Lien Nature Reserve, Lang Son Prov., appr. 21.662N, 106.373E]) are described from Vietnam. The females of *C. galbina* Wilson & Reels, 2003, *C. hayashii* Phan & Kompier, 2016 and *C. suotia* Dow, 2016 are described. *Coeliccia montana* Fraser, 1933 is shown to be a junior synonym of *C. pyriformis* Laidlaw, 1932." (Authors)] Address: Kompier, T., Schoutenstraat 69, 2596 SK Den Haag, Netherlands. E-mail: kompierintokyo@yahoo.com

19214. Koneri, R.; Nangoy, M.; Maabuat, P.V. (2020): Composition and diversity of dragonflies (Insecta: Odonata) in Tunan waterfall area, North Minahasa, North Sulawesi, Indonesia. *Pakistan Journal of Zoology* 52(6): 2091-2100. (in English) ["Dragonflies play an important role in an ecosystem and can serve as control agents of agricultural insect pests. Dragonflies can be used as bioindicators for evaluating environmental changes in long-term studies (biogeography) and short-term studies (conservation biology). This research study was aimed to analyse the composition and diversity of dragonflies in Tunan Waterfall area, North Sulawesi, Indonesia. Sampling was conducted from March 2018 to May 2018 at three types of habitat, namely primary forest, secondary forest, and agricultural land. At each habitat type were laid four 300-metre-long transect lines. The lines were placed along the river of each habitat type, and sampling was carried out along the lines using sweep nets. From the research, 7 families, 20 species and 1,750 individuals belonging to 2 suborders, Anisoptera and Zygoptera, were identified. Libellulidae was the family with the most number of species and individuals being found. The species with the highest abundance was *Orthetrum pruinosum*, followed by *Libellago xanthocyana*. The highest dragonfly species abundance was found in the plantation land, while the lowest was found in the primary forest or around the waterfall. The highest dragonfly richness index, species diversity index (H'), and species evenness index were found in the secondary forest, followed by the primary forest. The diversity of dragonflies at the observation site was influenced by vegetation cover and temperature." (Authors)] Address: Koneri, R., Department of Biology, Sam Ratulangi University, Indonesia. Email: ronicaniago@yahoo.com

19215. Kosterin, O.E. (2020): A misleading representation of the Asian distribution of a most intriguing dragonfly, *Somatochlora sahlbergi* Trybom, 1889: a critique of Kohli et al. (2018). *Odonatologica* 49(1/2): 51-56. (in English) ["Recently Kohli et al. (2018) published a phylogenetic analysis of *S. sahlbergi*, including extensive supplementary material listing global distribution records for the species. The compilation of literature data on records of *S. sahlbergi* in Siberia

includes an unacceptable level of false pseudo-data and incorrect statements." (Author)] Address: Kosterin, O.E., Institute of Cytology & Genetics SB RAS, Academician Lavrentyev ave. 10, Novosibirsk, 630090, Russia. E-mail: kosterin@bionet.nsc.ru

19216. Kvasniěák, R.; Bundzelova Minaroviěová, K. (2020): The communities of insects (Insecta, Pterygota) of the Flared Reed (*Phragmites* spp.) in the ornithological locality of Tmava Ponds (SW Slovakia). *Disputationes Scientificaе Universitatis Catholocae in Ruzomberok* 20(1): 111-134. (in Slovakian, with English summary) [During the vegetation period (april – october) in the year 2015 we observed the quantitative and qualitative representation of the insect community (Insecta) in the flared plain of reed (*Phragmites australis*) on the Tmava ponds. The ponds are situated near the recreational area Kamenný Mlyn – Tmava (SW Slovakia). The research was to compare the effect of anthropogenic of burning wetland vegetation in two selected habitats, how the site A (affected by fires) and the control site B (not affected by fire). We obtained a total of 1854 ex. insects by the method of sticky traps. insects. They belong to 53 different species originating from 36 different families and 13 ordos. The number of species in the sites was similar (site A 40 species and site B 42 species). The species spectrum consists mainly were the mesophilic insect species with the practical indicator value. We also record hygrophilic species, which are related to the wetland character of the area: *Aeschna cyanea*, *Sympetrum vulgatum*, *Chorthippus montanus*, *Gerris gibbifer*, *Sialis lutaria*, *Donacia semicuprea*, *Chrysomela coerulans*, *Limnophilus rhombicus*, *Aedes vexans*, and *Simulium equinum*. The following xerophilic insect species include: *Melanogryllus desertus*, *Macrosteles laevis*, *Dictyophara europia* and *Sphex rufocinctus* preferring sunny habitat types and warm habitats. We used the standard index of dominance identity ($ID = 90.8\%$), whose determined value indicates ecologically balanced environment and stability of the natural environment in the compared research plots (site A vs. control site B) affected by the burning of wetland vegetation *P. australis*." (Authors)] Address: Bundzelová, Katarína, Vysoká škola zdravotníctva a sociálnej práce sv. Alžbety v Bratislave Nám. 1. mája 1, 810 00 Bratislava, Slovakia

19217. Lewis-Phillips, J.; Brooks, S.J.; Sayer, C.D.; Patmore, I.R.; Hilton, G.M.; Harrison, A.; Robson, H.; Axmacher, J.C. (2020): Ponds as insect chimneys: Restoring overgrown farmland ponds benefits birds through elevated productivity of emerging aquatic insects. *Biological Conservation* 241, January 2020, 108253: 11pp. (in English) ["Highlights: •Farmland pond management strongly enhances emergent insect communities. •Emergent insects abundance increases 18 times following pond management. •Pond management leads to a 25-times increase in emergent insect biomass. •Day-to-day fluctuations in water temperature can predict insect emergences. •Local farmland bird communities are linked to emergent pond insect abundance. Abstract: Farmland bird populations have experienced severe declines across Europe and elsewhere. Ag-

ricultural intensification is believed to be a main factor behind these declines, with losses of non-cropped features, such as farmland ponds, identified as a key driver. Since the 1950s, many European farmland ponds have been in-filled or, through lack of management, become terrestrialised. Restoring terrestrialised farmland ponds has been shown to significantly increase the abundance and diversity of local farmland bird communities. It has been hypothesised that farmland birds are specifically attracted to open-canopy ponds due to increased emergent aquatic insect availability, but this link has hitherto been little explored. This study investigates how farmland pond management influences emergent aquatic insects [including "Odonata"], and how emergent insect abundance and biomass is linked to local bird assemblages. Insect emergences showed an 18-fold higher abundance and a 25-fold higher biomass at managed open-canopy ponds in comparison to their unmanaged overgrown counterparts, with day-to-day fluctuations in pond water temperature a key predictor of insect emergences. Species richness and abundance of birds at farmland ponds were strongly positively linked to the abundance of emergent insects. Furthermore, insect emergence peaks occurred on different days in different restored ponds such that the pond landscape afforded extended feeding opportunities for birds. Our findings suggest that restoring networks of terrestrialised farmland ponds to open-canopy macrophyte-dominated conditions could be a highly effective way of increasing the availability of aquatic insect prey for birds. This study highlights an urgent need to re-evaluate pond restoration and management within agri-environmental schemes in Europe and beyond." (Authors)] Address: Lewis-Phillips, J., Pond Restoration Research Group, Environmental Change Research Centre, Department of Geography, University College London, WC1E 6BT, UK. E-mail: jonathan.lewis.15@ucl.ac.uk

19218. 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-palaearctic. 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

19219. Luke, S.H.; Dwi Advento, A.; Dow, R.A.; Aryawan, A.A.K.; Barclay, H.; Eycott, A.E.; Hinsch, J.K.; Kurniawan, C.; Naim, M.; Mann, D.J.; Pujianto; Purnomo, D.; Rambe, T.D.S.; Slade, E.M.; Soeprapto; Ps, S.; Suhardi; Tarigan, R.S.; Wahyuningsih, R.; Widodo, R.H.; Caliman, J.-P.; Snaddon, J.L., Foster, W.A.; Turner, E.C. (2020): Complexity within an oil palm monoculture: The effects of habitat variability and rainfall on adult dragonfly (Odonata) communities. *Biotropica* 52(2): 366-378. (in English) ["Recent expansion of oil palm agriculture has resulted in loss of forest habitat and forest-dependent species. However, large numbers of species—particularly insects—can persist within plantations. This study focuses on Odonata (dragonflies and damselflies): a charismatic indicator taxon and a potentially valuable pest control agent. We surveyed adult Odonata populations biannually over three years within an industrial oil palm plantation in Sumatra, Indonesia. We assessed the effects of rainfall (including an El Niño Southern Oscillation-associated drought), the role of roadside ditches, and the importance of understory vegetation on Odonata populations. To assess the impacts of vegetation, we took advantage of a long-term vegetation management experiment that is part of the Biodiversity and Ecosystem Function in Tropical Agriculture (BEFTA) Programme. We found 41 Odonata species, and communities varied between plantation core and roadside edge microhabitats, and between seasons. Abundance was significantly related to rainfall levels four months before surveys, probably indicating the importance of high water levels in roadside ditches for successful larval development. We found no significant effect of the BEFTA understory vegetation treatments on Odonata abundance, and only limited effects on community composition, suggesting that local understory vegetation structure plays a relatively unimportant role in determining communities. Our findings highlight that there are large numbers of Odonata species present within oil palm plantations and suggest that their abundance could potentially be increased by maintaining or establishing waterbodies. As Odonata are predators, this could bring pest control benefits, in addition to enhancing biodiversity within intensive agricultural landscapes." (Authors)] Address: Luke, Sarah, Department of Zoology, University of Cambridge, Cambridge, UK

19220. Luttbeg, B.; Hammond, J.I.; Brodin, T.; Sih, A. (2020): Predator hunting modes and predator–prey space games. *Ethology* 126(4): 476-485. (in English) [nv; "Predators and prey are often engaged in a game where their expected fitnesses are affected by their relative spatial distributions. Game models generally predict that when predators and prey move at similar temporal and spatial scales that predators should distribute themselves to match the distribution of the prey's resources and that prey should be relatively uniformly distributed. These predictions should better apply to sit-and-pursue and sit-and-wait predators,

who must anticipate the spatial distributions of their prey, than active predators that search for their prey. We test this with an experiment observing the spatial distributions and estimating the causes of movements between patches for Pacific tree frog tadpoles (*Pseudacris regilla*), a sit-and-pursue dragonfly larvae predator (*Rhionaeschna multicolor*), and an active salamander larval predator (*Ambystoma tigrinum mavortium*) when a single species was in the arena and when the prey was with one of the predators. We find that the sit-and-pursue predator favors patches with more of the prey's algae resources when the prey is not in the experimental arena and that the prey, when in the arena with this predator, do not favor patches with more resources. We also find that the active predator does not favor patches with more algae and that prey, when with an active predator, continue to favor these higher resource patches. These results suggest that the hunting modes of predators impact their spatial distributions and the spatial distributions of their prey, which has potential to have cascading effects on lower trophic levels." (Authors)] Address: Luttbeg, B., Oklahoma State University, Stillwater, OK 74074, USA. Email: luttbeg@okstate.edu

19221. Maoka, T.; Kawase, N.; Ueda, T.; Nishida, R. (2020): Carotenoids of dragonflies, from the perspective of comparative biochemical and chemical ecological studies. *Biochemical Systematics and Ecology* Volume 89, April 2020, 104001: 7 pp. (in English) ["C arotenoids of 20 species of dragonflies (including 14 species of Anisoptera and six species of Zygoptera) were investigated from the viewpoints of comparative biochemistry and chemical ecology. In larvae, β -carotene, β -cryptoxanthin, lutein, and fucoxanthin were found to be major carotenoids in both Anisoptera and Zygoptera. These carotenoids were assumed to have originated from aquatic insects, water fleas, tadpoles, and small fish, which dragonfly larvae feed on. Furthermore, β -caroten-2-ol and echinenone were also found in all species of larvae investigated. In adult dragonflies, β -carotene was found to be a major carotenoid along with lutein, zeaxanthin, β -caroten-2-ol, and echinenone in both Anisoptera and Zygoptera. On the other hand, unique carotenoids, β -zeacarotene, β , ψ -carotene (γ -carotene), torulene, β , γ -carotene, and γ , γ -carotene, were present in both Anisoptera and Zygoptera dragonflies. These carotenoids were not found in larvae. Food chain studies of dragonflies suggested that these carotenoids originated from aphids, and/or possibly from aphidophagous ladybird beetles and spiders, which dragonflies feed on. Lutein and zeaxanthin in adult dragonflies were also assumed to have originated from flying insects they feed on, such as flies, mosquitoes, butterflies, moths, and planthoppers, as well as spiders. β -Caroten-2-ol and echinenone were found in both dragonfly adults and larvae. They were assumed to be metabolites of β -carotene in dragonflies themselves. Carotenoids of dragonflies well reflect the food chain during their lifecycle." (Authors)] Address: Maoka, T., Research Inst. for Production Development, 15 Shimogamo-morimoto-cho, Sakyo-ku, Kyoto, 606-0805, Japan. Email: maoka@mbox.kyoto-inet.or.jp

19222. McKee, K.M.; Koprivnikar, J.; Johnson, P.T.J.; Arts, M.T. (2020): Parasite infectious stages provide essential fatty acids and lipid-rich resources to freshwater consumers. *Oecologia* 192(2): 477-488. (in English) ["Free-living parasite infectious stages, such as motile cercariae of trematodes (flatworms), can constitute substantial biomass within aquatic ecosystems and are frequently eaten by various consumers, potentially serving as an important source of nutrients and energy. However, quantitative data on their nutritional value (e.g., essential fatty acids [EFA]) are largely lacking. As EFA are leading indicators of nutritional quality and underpin aquatic ecosystem productivity, we performed fatty acid (FA) analysis on an aggregate of ~30,000 cercariae of the freshwater trematode, *Ribeiroia ondatrae*. Individual cercariae contained 15 ng of total FA, and considerable quantities of EFA, including eicosapentaenoic (EPA, at 0.79 ng cercaria-1) and docosahexaenoic (DHA, at 0.01 ng cercaria-1) acids. We estimated annual EFA production by *R. ondatrae* cercariae for a series of ponds in California to be 40.4–337.0 $\mu\text{g m}^{-2} \text{yr}^{-1}$ for EPA and 0.7–6.2 $\mu\text{g m}^{-2} \text{yr}^{-1}$ for DHA. To investigate viability of cercariae as prey, we also compared growth and FA profiles of dragonfly larvae (nymphs of *Leucorrhinia intacta*) fed equivalent masses of either *R. ondatrae* or zooplankton (*Daphnia* spp.) for 5 weeks. Nymphs raised on the two diets grew equally well, with no significant differences found in their EFA profiles. While zooplankton are widely recognized as a vital source of energy, and an important conduit for the movement of EFA between algae and higher trophic levels, we suggest a similar role for trematode cercariae by 'unlocking' EFA from the benthic environment, highlighting their potential importance as a nutrient source that supports animal health.] Address: Koprivnikar, Janet, Dept of Chemistry & Biology, Ryerson Univ., 350 Victoria Street, Toronto, ON, M5B 2K3, Canada

19223. Medupin, C. (2020): Spatial and temporal variation of benthic macroinvertebrate communities along an urban river in Greater Manchester, UK. *Environ Monit Assess* (2020) 192:84. (in English) ["Urban rivers face challenges of increased human activities which also affect river organisms. In order to enhance freshwater biodiversity in urban rivers, it is important to determine how the benthic macroinvertebrate communities are influenced by key abiotic factors. This was investigated in this paper through the study of the spatial and temporal variations of benthic macroinvertebrates and water quality variables at the urban River Medlock in Greater Manchester, UK. Samples were obtained from five sections of the catchment (S1 to S5) over a period of 14 months and the results were compared with the standard requirement of the European Union's Water Framework Directives. Multivariate tests including SIMPER (similarity percentages), PCA (principal component analysis) and BIOENV (biological and environmental) were carried out on the data in order to determine the environmental variables which most influenced the benthic macroinvertebrates. PCA of environmental variables indicated that 34% of the overall variance was heavily weighted on nutrients and catchment area (negatively on altitude and slope), 17% represented ri-

ver substrate and the 12% represented discharge. The BIO-ENV analysis also indicated altitude, slope, catchment area, discharge and conductivity as the variables which influenced the biological communities. SIMPER analysis showed a difference between the upper and lower sections of the river with some sensitive taxa at the upper sites and showed that more organisms are present during spring. Apart from the lowest section of the river, the EU Water Framework Directive classification showed that other sites achieved the 'good ecological status'. While 32 taxa groups [including "Odonata"] were identified, abundant Baetidae, Chironomidae and Oligochaeta were recorded at all sites and seasons. The scores for biotic indices Whalley Hawkes Paisley and Trigg (WHPT) and Biological Monitoring Working Party (BMWP) were found to be similar. By the application of surrogate variables such as percentage urban cover, catchment area and total number of organism, the influence of urbanisation could be seen in the abundance of organisms over time and space." (Author)] Address: Medupin, C., School of Earth & Environmental Sciences, The University of Manchester, Oxford Road, Manchester M13 9PL, UK. Email: cecilia.medupin@manchester.ac.uk

19224. Murray, R.L.; Tah, S.; Koprivnikar, J.; Rowe, L.; McCauley, S.J. (2020): Exposure to potentially cannibalistic conspecifics induces an increased immune response. *Ecological Entomology* 45(2): 355-363. (in English) ["1. Within-population infectious disease dynamics depend on multiple factors, including the ability of hosts to mount an effective immune response. These immune responses can be highly plastic, responding to pathogen risk, as well as the ecological context in which pathogens are encountered. 2. High conspecific density can stimulate immune activity, and recent research suggests that predators can cause indirect protective effects in their prey through the induction of increased immune responses. Comparatively little work, however, has investigated whether exposure to potentially cannibalistic conspecifics, representing both increased density and predatory pressures, will have similar effects on immune expression. 3. Using dragonfly larvae, the present study investigated whether exposure to potentially cannibalistic conspecifics altered the melanisation of simulated parasites. 4. Increased levels of melanisation were found in larvae regardless of whether that conspecific had recently engaged in cannibalism or not. Melanisation also increased as conspecific density increased, even if the conspecifics present were small, and therefore unlikely to pose a cannibalism threat. 5. The findings obtained in the present study indicate that conspecific presence is sufficient to affect immune responses in these insects even though they are relatively solitary compared with the phase-polyphenic taxa typically associated with density-dependent prophylaxis. Because melanisation is also important for wound healing, we suggest that the increased melanin response observed with increased conspecific density might act to induce heightened immunity when faced with potentially increased risk of infection, and also facilitate wound healing under threat of predation/cannibalism." (Authors)] Address: Murray, Rosalind, Biol. Dept., Univ. of Toronto Mississauga, 3359 Mississauga

Rd., Mississauga, ON, Canada L5L 1C6. E-mail: rosaling.murray@utoronto.ca

19225. Murria, C.; Väisänen, L.O.S.; Somma, S.; Wangenstein, O.S.; Arnedo, M.A.; Prat, N. (2020): Towards an Iberian DNA barcode reference library of freshwater macroinvertebrates and fishes. *Limnetica* 39(1): 73-92. (in English, with Spanish summary) ["Freshwater macroinvertebrates and fishes are focal groups in major ecosystem biomonitoring programs in the Iberian Peninsula. Yet, their use as bioindicators is sometimes constrained by the time and cost needed for sorting macroinvertebrates specimens and their challenging taxonomic identification, and the huge sampling procedures for capturing rare or incipient fish species, respectively. Given the increasing cost-effectiveness of metazoan identification based on metabarcoding [i.e., high-throughput sequencing (HTS) of DNA barcodes] and reliability of species-level identification and the high number of samples that can be processed, its use in biomonitoring of freshwater communities can provide an alternative to morphology-based approaches. However, the accuracy of species assignment in metabarcoding approaches relies on the availability of a comprehensive DNA barcode reference library. Because of the high level of endemism in the Iberian Peninsula, current public repositories for DNA barcodes may not be informative enough to identify the Iberian fauna to species level. Here, we compiled the Iberian freshwater macroinvertebrates and fishes taxonomic list (including indigenous and non-indigenous species) and the available molecular data for the cytochrome oxidase I DNA barcode (cox1, COI-5P) in public repositories to assess the extent of DNA barcode coverage. The DNA barcode coverage was reported for DNA fragments within the Folmer region (658 bp). Given that HTS platforms provide DNA sequence in the range of 50-400 bp in length, we also reported the second half of the DNA barcode (313 bp, Leray region) and the first part of the Leray region (285 bp, Leray-285), which are short DNA barcodes useful to assign metabarcoding cox1 data. For macroinvertebrates, the final taxonomic checklist comprises 3348 species including Mollusca (65 species), Crustacea (101 species) and Insecta (3182 species). We present an initial DNA barcode reference library, with an overall coverage of ~ 35 % of the Iberian taxa. Exploring this data, we find a strong taxonomic bias. Based on Leray-285, Odonata (43 of 79 species barcoded, 54.43 %) and Hemiptera (44 of 81 species barcoded, 54.32 %) were the best represented lineages. In contrast, Diptera (393 of 1693 species barcoded, 23.21 %), and Plecoptera (42 of 135 species barcoded, 31.11 %) were underrepresented. For fishes, the available DNA barcode data covered 98.11 % of the indigenous (76) and non-indigenous (30) species. By revealing and quantifying current gaps on the available data (~ 65 %), we aim to improve efficiency in designing the next steps towards the ambitious yet necessary goal of compiling a complete DNA barcode reference library for Iberian macroinvertebrates and fishes." (Authors)] Address: Múrria, C. Grup de Recerca Freshwater Ecology & Management, Dept de Biologia Evolutiva, Ecologia i Ciències Ambientals, Universitat de Barcelona, Catalonia, Spain. E-mail: cmurria@ub.edu

19226. Nakanishi, K.; Uéda, T.; Yokomizo, H.; Hayashi, T.I. (2020): Effects of systemic insecticides on the population dynamics of the dragonfly *Sympetrum frequens* in Japan: statistical analyses using field census data from 2009 to 2016. *Science of The Total Environment* 703, 134499: 8 pp. (in English) ["Highlights: • Dragonfly abundance in Japan's agricultural landscapes has decreased. • We monitored the population density of the dragonfly *Sympetrum frequens*. • We estimated systemic insecticide use and analyzed its effect on the dragonfly. • The results suggest a negative effect of systemic insecticide use on population size. • Some agronomic factors need to be further examined as potential confounders. Abstract: Since the mid-1990s, populations of the common Japanese dragonfly *Sympetrum frequens* in rice fields have declined severely. Application of systemic insecticides—especially fipronil—to nursery boxes of rice seedlings is suspected to be the main cause of the decline. However, until now there have been insufficient population data to test the causality. We conducted a dragonfly survey from 2009 to 2016 in four prefectures of Japan and compiled the data to enable the comparison of population growth rates along five main census routes over the years. We also estimated the use ratio of each insecticide applied to nursery boxes in rice fields (i.e., the area exposed to insecticide as a ratio of the total rice field area) by prefecture. We then statistically analyzed the effects of the insecticides on the dragonfly's population growth rates, taking into account the potential confounding factors based on current knowledge. There was a significant negative association between the annual increase in use ratio of the sum of systemic insecticides (e.g., fipronil, imidacloprid, and chlorantraniliprole) and the annual population growth rate of *S. frequens*. This association suggests that systemic insecticide use affected the decrease in population density of the dragonfly, although some agronomic factors need to be further examined as potential confounders." (Authors)] Address: Nakanishi, K., Nat. Inst. Environ. Studies, Onogawa 16-2, Tsukuba, Ibaraki 305-8506, Japan. E-mail: nakanishi.kosuke@nies.go.jp

19227. Nayak, A.K. (2020): Additions to the Odonata (Insecta) fauna of Asansol-Durgapur Industrial Area, West Bengal, India. *Journal of Threatened Taxa* 12(3): 15391-15153. (in English) ["Previously, a total of 57 species of Odonata were reported from the Asansol-Durgapur Industrial Area, India. In this present attempt the author reports an additional six species occurring from the same region. Among six of the species were found between January 2016 and September 2019, with one of them belonging to the Aeshnidae family, two to the Gomphidae family, two to the Libellulidae family, and only one damselfly from the Lestidae family. The species *Gomphidia leonora* Mitra, 1994 has been reported in this paper for the second time from West Bengal, India, after a gap of 23 years, from Durgapur Barrage, which is situated at the end point of the study area." (Author)] Address: Nayak, A.K., Searsole Junior Basic School, Searsole Rajbari, Paschim Bardhaman, West Bengal 713358, India

19228. Nel, A. (2020): The second genus of the extinct dragonfly family Urolibellulidae from the Eocene Green River

Formation (Odonata, Anisoptera: Cavilabiata). *Palaeontology* 3(1): 50-53. (in English) ["If the oldest record of the anisopteran 'libelluloid' group Anauriculida Bechly, 1996 goes to the Cretaceous (Fleck et al., 1999; Kohli et al., 2016), its extant families are scarce or even absent before the Eocene. Nevertheless, the Anauriculida were already rather diverse during Eocene with a Libellulidae in the earliest Eocene (Fleck et al., 2000), and the extinct monotypic family Urolibellulidae in the middle Eocene Green River Formation (Zeiri et al., 2015). Crown Libellulidae become more and more frequent and diverse during Oligocene, and even dominate the dragonfly fauna in some outcrops (Céreste, Rott, Aix-en-Provence, Bes-Konak) (Nel & Paicheler, 1993). Thus any discovery in the Paleocene–Eocene of a new fossil related to these families is welcome. Here we describe a complete hindwing of this kind from the Green River Formation in Colorado." (Author)] Address: Nel, A., Lab. Ent. Mus. Natn. Hist. Nat., 45 rue Buffon, 75005 Paris, France. E-mail: anel@cimrs1.mnhn.fr

19229. Nelson, S.J.; Chen, C.Y.; Kahl, J.S. (2020): Dragonfly larvae as biosentinels of Hg bioaccumulation in Northeastern and Adirondack lakes: relationships to abiotic factors. *Ecotoxicology* 29: 1659-1672. (in English) ["Mercury (Hg) is a toxic pollutant, widespread in northeastern US ecosystems. Resource managers' efforts to develop fish consumption advisories for humans and to focus conservation efforts for fish-eating wildlife are hampered by spatial variability. Dragonfly larvae can serve as biosentinels for Hg given that they are widespread in freshwaters, long-lived, exhibit site fidelity, and bioaccumulate relatively high mercury concentrations, mostly as methylmercury (88%±11% MeHg in this study). We sampled lake water and dragonfly larvae in 74 northeastern US lakes that are part of the US EPA Long-Term Monitoring Network, including 45 lakes in New York, 43 of which are in the Adirondacks. Aqueous dissolved organic carbon (DOC) and total Hg (THg) were strongly related to MeHg in lake water. Dragonfly larvae total mercury ranged from 0.016–0.918 µg/g, dw across the study area; Adirondack lakes had the minimum and maximum concentrations. Aqueous MeHg and dragonfly THg were similar between the Adirondack and Northeast regions, but a majority of lakes within the highest quartile of dragonfly THg were in the Adirondacks. Using landscape, lake chemistry, and lake morphometry data, we evaluated relationships with MeHg in lake water and THg in dragonfly larvae. Lakewater DOC and lake volume were strong predictors for MeHg in water. Dragonfly THg Bioaccumulation Factors (BAFs, calculated as [dragonfly THg]:[aqueous MeHg]) increased as lake volume increased, suggesting that lake size influences Hg bioaccumulation or biomagnification. BAFs declined with increasing DOC, supporting a potential limiting effect for MeHg bioavailability with higher DOC." (Authors)] Address: Nelson, Sarah, School of Forest Resources, Univ. Maine, 5755 Nutting Hall, Orono, ME, 04469-5755, USA

19230. Ngô-Muller, V.; Garrouste, R.; Nel, A. (2020): Small but important: a piece of mid-Cretaceous Burmese amber with a new genus and two new insect species (Odonata:

Burmaphlebiidae & 'Psocoptera': Compsocidae). *Cretaceous Research* 110, June 2020, 104405: (in English) ["*Pouillonphlebia burmitica* gen. et sp. nov., second genus and species of the mid-Cretaceous damsel-dragonfly family Burmaphlebiidae, is described from the Burmese amber. This discovery suggests that this family diversified during the Early Cretaceous in the 'Burmese' island that detached earlier from Gondwana and was isolated in the Tethys Ocean at that time. We also described from the same piece of amber a small 'Psocoptera' *Burmacompsocus pouilloni* sp. nov., third species of this compsocid genus, only known from this amber. This discovery confirms that the Compsocidae were certainly much more diverse during the Cretaceous than nowadays." (Authors)] Address: Nel, A., Lab. Ent.. Mus. Natn. Hist. Nat., 45 rue Buffon, F-75005 Paris, France. E-mail: anel@cimrs1.mnhn.fr

19231. Nobles, S.; Jackson, C.R. (2020): Effects of life stage, site, and species on the dragonfly gut microbiome. *Microorganisms* 8(2), 183: 15 pp. (in English) ["Insects that undergo metamorphosis from juveniles to adults provide an intriguing opportunity to examine the effects of life stage, species, and the environment on their gut microbiome. In this study, we surveyed the gut microbiomes of 13 species of dragonfly collected from five different locations subject to different levels of human impact. Juveniles were collected as nymphs from aquatic habitats while airborne adults were caught at the same locations. The gut microbiome was characterized by next generation sequencing of the bacterial 16S rRNA gene. Life stage was an important factor, with the gut microbiomes of dragonfly nymphs differing from those of adult dragonflies. Gut microbiomes of nymphs were influenced by sample site and, to a lesser extent, host species. Neither sample location nor host species had a strong effect on the gut microbiome of dragonfly adults. Regardless of life stage, gut microbiomes were dominated by members of the Proteobacteria, with members of the Bacteroidetes (especially in adults), Firmicutes, and Acidobacteria (especially in nymphs) also being proportionally abundant. These results demonstrate that different life stages of metamorphosing insects can harbor very different gut microbiomes and differ in how this microbiome is influenced by the surrounding environment. ... The number of dragonfly species collected varied by site and life stage and finding a nymph species at a given site did not relate to the later collection of adults (Table 1). Eight different species of adults were collected, and 13 different species of nymphs. One of the more rural sites (Camp Lake Stephens) had the highest number of species collected (eight) with *Erythemis simplicicollis* and *Microorganisms* 2020, 8, 183 4 of 15 *Celithemis elisa* being the most common with four individuals of each collected. The Shelby Farms and former Treatment Pond sites yielded the lowest number of dragonfly species (five). Across all sites, *E. simplicicollis* was the most collected species (19 individuals) followed by *Libellula luctuosa* (15 individuals) and *Pachydiplax longipennis* (13 individuals). Only one individual was collected for each *Erythrodiplax fusca*, *Ladonna deplanata*, and *Tetragoneuria cynosura*." (Authors) The study includes *Anax imperator*, which

must be a misidentification.] Address: Nobles, Sarah, Department of Biology, University of Mississippi, University, MS 38677, USA

19232. Ožana, S.; Pyszek, P.; Dolný, A. (2020): Determination of suitable insect part for non-lethal DNA sampling: case study of DNA quality and regeneration capability of dragonflies. *Insect Conservation and Diversity* 13(4): 319-327. (in English) [nv; "1. Genetics has been widely used in insect ecology and conservation. To minimise the effect of DNA sampling on organisms as much as possible, it would be ideal to use non-invasive or non-lethal DNA sources. Therefore, it is also very important to determine the responses of organisms to DNA sampling. 2. In this study, the quality and quantity of genomic DNA samples from three types of insect tissues (exuvia, mid-legs and wings) were evaluated. As model organisms, we used two dragonfly species of different sizes (*Leucorrhinia dubia*, *Anax imperator*). We also tested the regenerative ability of dragonfly larvae as a repair mechanism after mid-leg cut-off, with respect to factors such as size and quantity of diet. 3. We found that DNA of sufficient quality for analyses was obtained from all tested tissues. Nonetheless, isolates from exuviae were conclusively less useful for sequencing than those from the mid-legs and wings. The highest quantity of DNA was obtained from the mid-legs. The survival of larvae is not affected by removing the legs, which can usually regenerate. 4. All the tested tissues could be a source of adequate DNA; however, we concluded that primarily the legs should be used because they provided the best DNA samples in terms of quantity and quality of DNA. Furthermore, their exploitation would not affect individuals seriously if young larvae with sufficient time (at least 6 months) for regeneration are sampled. The exuviae should be used for absolutely non-invasive studies involving endangered or protected species." (Authors)] Address: Dolný, A., Dept of Biology & Ecology, Faculty of Science, Univ. of Ostrava, Chittussiho 10, 710 00 Slezská Ostrava, Czech Republic. E-mail: ales.dolny@osu.cz

19233. Pavithran, S.; Chitra, N.; Arulprakash, R. (2020): Checklist of odonata in the rice fields of India. *Indian Journal of Entomology* 82(1): 99-109. (in English) ["Odonata is one of the most important predators in the rice ecosystems and their occurrence in rice fields from different parts India was inventoried. Odonata diversity in the rice fields from India comprised of 127 species under 71 genera of 13 families. Anisoptera were dominant with 81 species and 52 genera under six families over Zygoptera (46 species, 19 genera under 7 families). Libellulidae (Anisoptera) was the most speciose family with 53 species and 32 genera followed by Coenagrionidae (Zygoptera) with 27 species and 7 genera. *Orthetrum sabina* (Drury, 1770) (Libellulidae) was observed to occur in all the rice fields studied across the country. Analysis of Odonata from rice fields in different biogeographical regions of India revealed that the order of dominance of species was: Gangetic Plain Zone (76 species) > Western Ghat Zone (57 species) > Deccan Plateau Zone (54 species) > Semi Arid Zone (39 species) > Northeast Zone (14 species) > Coastal Zone (10 species) > Himalayan Zone (1

species). Odonata in rice fields of the Western Ghat Zone and Deccan Plateau Zone were found to have a maximum of 50.48% similarity." (Authors)] Address: Chitra, N., Department of Agricultural Entomology, Directorate of Seed Center, Tamil Nadu Agricultural University, Coimbatore, 641003, India. E-mail: chitra.bookworm@gmail.com

19234. Perron, M.A.C.; Pick, F.R. (2020): Water quality effects on dragonfly and damselfly nymph communities: A comparison of urban and natural ponds?. *Environmental Pollution* 263, Part B, August 2020, 114472: 13 pp. (in English) ["Highlights: • Odonata nymph abundance was lower in stormwater ponds than natural ponds. • Contaminants in stormwater ponds were below guidelines, except for Cl-, Cu and TP. • Cl- (from road salts) affected dragonfly abundance and assemblages but not damselfly. • A common index of water quality was not useful in predicting habitat quality. • Stormwater ponds can provide suitable habitat for Odonata, if properly designed. Abstract: Cities are increasingly using constructed ponds to mitigate flooding and downstream water pollution from urban runoff. As a result, these stormwater ponds can have poor water quality, yet they can also attract wildlife. In this study, the effects of water quality on Odonata were determined in stormwater ponds (n = 41) and natural reference ponds (n = 10) of similar size across the National Capital Region of Canada. A total of 38 chemical/physical water quality variables along with Odonata nymph abundance and taxonomic composition were sampled at each pond. Chloride concentrations exceeded the guideline for the protection of aquatic life at over two-thirds of the stormwater ponds. Among all the metals tested, only Cu exceeded guidelines at many stormwater ponds. Both dragonfly and damselfly nymphs were on average less abundant in the stormwater ponds in comparison to the natural ponds. Ponds with high concentrations of chloride and metals typically had lower dragonfly abundance. Dragonfly community structure was significantly influenced by high chloride (or conductivity), which likely originates from winter road salting. In contrast, damselfly community structure in the stormwater ponds was similar to that found in natural ponds, with nutrients and metals explaining a small percent of variation in community structure. A water quality index developed to assess habitats for the protection of aquatic life did not significantly explain Odonata abundance or measures of diversity and may not be suitable in assessing pond habitat quality. To improve pond habitats within cities, efforts should be directed at reducing the amount of impervious surface and road salt usage within catchment basins." (Authors)] Address: Perron, M., Dept of Biology, University of Ottawa, 30 Marie Curie Private, Ottawa, Ontario, K1N 6N5, Canada. E-mail: mperr058@uottawa.ca

19235. Piñeiro Álvarez, X. (2020): High density of *Lestes macrostigma* (Eversmann, 1836) (Odonata: Lestidae) in a wetland of La Mancha Húmeda (Ciudad Real, Spain).. *Archivos entomológicos* 22: 17-22. (in Spanish, with English summary) ["High density of *L. macrostigma* in a wetland of La Mancha Húmeda (Ciudad Real, Spain). A high count of *L. macrostigma* in the restored wetland of Junta de los Ríos,

province of Ciudad Real, in June 2019, is reported. An assessment of the water conditions and vegetation associated with this species during the study period is provided. Information on the accompanying odonatofauna in the wetland is also included." (Author)] Address: Piñeiro Álvarez, X., Revolva 2, Noalla. E-36990 Sanxenxo (Pontevedra), Spain. E-mail: xurxolusitanica@gmail.com

19236. Pires, M.M.; Siegloch, A.E.; Medina Hernandez, M.I.; Petrucio, M.M. (2020): Environmental drivers and composition of assemblages of immature odonates (Insecta) in a subtropical island in southern Brazil. *Acta Limnologica Brasiliensia*, 2020, vol. 32, e2: 10 pp. (in English, with Portuguese summary) ["Aim: Describe the diversity of immature stages of Odonata (Insecta) in streams from a subtropical island in southern Brazil and investigate the influence of environmental variables on the composition of their assemblages. Methods: Eleven low-order streams (1st to 3rd order) were sampled in two conservation units located in the island of Santa Catarina (southern Brazil) between 2010 and 2012. Immature specimens of Odonata were collected using a Surber sampler. The influence of water abiotic parameters and habitat structure (mesohabitats: riffle vs. pool areas, microhabitats: litter vs. stone substrates) on the composition of Odonata was tested through the seasons using ordination diagrams and redundancy analysis. Results: Nine odonate genera from seven families were recorded in the study region. The genera *Desmogomphus*, *Epigomphus* (Gomphidae), *Heteragrion* (Heteragrionidae) and *Perilestes* (Perilestidae) have their first records described for the state of Santa Catarina. Additionally, biological notes are provided for other odonate genera concerning substrate use. The composition of Odonata communities changed over the seasons and they were influenced by water temperature and velocity. Additionally, odonate composition differed significantly between microhabitats (substrate type) and mesohabitats (riffle vs. pool areas) in the streams studied. Conclusions: The lower genera richness of Odonata recorded in the island of Santa Catarina in relation to other Brazilian subtropical streams is probably associated with the insular condition of the study region. This study also demonstrated that substrate (organic and inorganic) and mesohabitat (riffle and pool) types were important drivers of the composition of the fauna of immature odonates, evidencing the role of climate and habitat structure in influencing subtropical stream insect communities." (Authors)] Address: Marques Pires, M., Lab. de Ecologia e Conservacao de Ecossistemas Aquaticos, Univ. do Vale do Rio dos Sinos - UNISINOS, Avenida Unisinos, 950, CEP 93022-750, Sao Leopoldo, RS, Brasil. E-mail: marquespiresm@gmail.com

19237. Raffard, A.; Therry, L.; Finn, F.; Koch, K.; Brodin, T.; Blanchet, S.; Cote, J. (2020): Does range expansion modify trait covariation? A study of a northward expanding dragonfly. *Oecologia* 192: 565-575. (in English) ["The adaptive value of correlations among phenotypic traits depends on the prevailing environmental conditions. Differences in selection pressures during species range expansions may there-

fore shape phenotypic integration. In this study, we assessed variation in behavioral and morphological traits, as well as their covariations, in replicated southern and northern European populations of the northward expanding dragonfly *Crocothemis erythraea*. Larvae from northern populations were, on average, darker in color, and therefore, better camouflaged than larvae from southern populations. However, there was no difference in activity level. Darkness and activity were positively correlated in larvae from northern populations, whereas this trait covariation was missing in southern populations. This suggests the emergence of alternative strategies in time-limited northern populations, a higher activity level that required better camouflage through darker coloration, while less active larvae benefited from an energy-saving strategy by reducing the investment in costly traits, such as body darkness. We further found that larger larvae emerged into larger adults, with a higher investment in flight morphology. Our findings imply that phenotypic integration is associated with the northward range shift, potentially differentially shaping fitness consequences, and ecological interactions in southern versus northern populations." (Authors)] Address: Raffard, A., Centre Nationale Pour la Recherche Scientifique (CNRS), Université Paul Sabatier (UPS), Station d'Écologie Théorique et Expérimentale, UMR 5321, 09200 Moulis, France. E-mail: allanraffard@outlook.com

19238. Reinhardt, K. (2020): Libellenbeobachtungen im Strandsha-Gebirge (Bulgarien) (Odonata). *Entomologische Nachrichten und Berichte* 64(1): 49-56. (in German, with English summary) ["During a short period in August 2017, 25 species of Odonata were recorded at 31 sites of mostly running water habitats. Noteworthy are an observation of *Aeshna cyanea*, two new records of *Somatochlora borisi* at very small and intermittent streams, and two records of *Corulegaster picta*. Data contributing to the small-scale distribution of *Chalcholestes parvidens* and *Ch. viridis*, to the oviposition behaviour of *Somatochlora meridionalis*, and to the size of exuviae of *Caliaeschna microstigma* are presented. *Platycnemis pennipes*, *Calopteryx virgo* and *S. meridionalis* were the most widely distributed species." (Author)] Address: Reinhardt, K., Angewandte Zoologie, Technische Universität Dresden, 01069 Dresden, Germany. Email: klaus.reinhardt@tu-dresden.de

19239. Rivas Torres, A. (2020): Etodiversidad: estudio de la variabilidad del comportamiento sexual en el orden Odonata. PhD. thesis, Departamento de Ecología e Biología Animal, Universidad de Vigo: 195 pp. (in Spanish) ["Nowadays, ethology or the study of animal behaviour seems to have lost the lustre it acquired during its golden age in the 20th century thanks to great naturalists and biologists such as Nikolaas Tinbergen and Konrad Lorenz, not forgetting the perhaps not so well known contribution to ethology of Charles Darwin, who gave value to animal behaviour and included it as another possible adaptation along with anatomical and physiological adaptations. According to Darwin, such adaptations would allow the survival of the individual and its subsequent reproductive success. Although for Dar-

win himself behaviour, together with natural and sexual selection, were fundamental pieces in understanding the adaptation of organisms, it seems that nowadays it seems that the most naturalistic aspect of a biologist, observation, has been lost. Most studies have shifted from a macroscopic to a more microscopic view, focusing on genomic and phylogenetic analysis of organisms. While it is important for the field of biology to move forward, we must not leave behind such important disciplines as ethology, which, together with other disciplines of a more molecular nature, allows us to establish more precise conclusions, hypotheses and theories. Both natural and sexual selection use diversity as a substrate for action, as long as these traits are transmitted through the genetic code. It is therefore important, before going into the objective of this thesis, to talk about biological diversity or biodiversity. The concept of biodiversity can actually be considered a meta-concept, as it encompasses several terms: the genetic diversity within species, the diversity of species in an ecosystem, the diversity of ecosystems of which these species form a part, and the landscape diversity where these ecosystems are found, including evolutionary and ecological processes. Conserving and respecting biodiversity has important social, political, economic and public health consequences: we benefit daily from everything that healthy and stable biodiversity provides, from medicines to food and clothing. In addition, biogeochemical cycles create fertile soil, recycle fresh water and purify the air. However, to complete the complex equation of the biodiversity concept, another variable is missing: ethological diversity, behavioural diversity or etodiversity. There are currently several studies that stress the importance of studying behavioural diversity and its consequences in the fields of ecology, environment and evolution (population dynamics, expansion or reduction of the distribution range of species, trophic cascades). We sometimes overlook the fact that it is not only diversity in physical or physiological traits that is the substrate and driver of evolution, but also behavioural diversity plays a role almost as important, if not more so, as reproductive isolation is often caused by some kind of pre-zygotic behaviour, such as the mating song of frogs. In addition, sexual conflict between males and females, which is just another form of sexual selection, most often uses behaviour as a substrate for reproductive adaptation. Throughout the five chapters that make up this thesis, the aim is to highlight the importance of the study of biodiversity and, in particular, of etodiversity or behavioural diversity, giving the latter an important role at all levels, not only ecosystemic, but also inter- and intraspecific. For this purpose, insects of the order Odonata (dragonflies and damselflies) are used as model organisms, paying special attention to their sexual behaviour. The order Odonata is relatively small in terms of the number of described species (around 6,000), which has facilitated its study and allowed us to obtain a broad knowledge of the distribution and taxonomy of the members of this group. The order is divided into three suborders: Zygoptera, Anisoptera and Anisozygoptera (the latter represented by a single genus, *Epiophlebia*). Anisoptera are usually larger and more robust than Zygoptera and, unlike Zygoptera, they spread their wings when at rest. Anisozygoptera, on

the other hand, are intermediate in appearance between the two previous suborders. Odonates are an ideal group for ethodiversity studies, as they possess a wide variety of behaviours associated with reproduction, each with intraspecific and interspecific variability. Among these behaviours, the encounter between individuals of both sexes and their location, interaction between males and territoriality, intraspecific recognition, tandem formation, copulation and oviposition form are of particular interest. Among these behaviours, the most important for study are encounters between individuals of both sexes and their location, interaction between males and territoriality, intraspecific recognition, tandem formation, copulation and oviposition. Judging from the fossil record, these winged insects have changed little since their origin, suggesting great adaptability of the group. Today, they remain an example of adaptability to their environment, as they are a cosmopolitan group of insects found almost everywhere on the planet, in multiple and varied environments associated with bodies of water. This ability to colonise diverse environments allows us to know the behavioural patterns of individuals at different latitudes, thus being able to establish patterns of ethological diversity in a similar way to the patterns of specific richness observed within the group, with an increase in the number of species from the poles towards the equator. The first chapter of this thesis focuses on the study of alternative reproductive strategies, using the Mexican endemic odonate *Paraphlebia zoe* as a study model. Alternative breeding strategies are commonly associated with male dimorphism and in the case of *P. zoe*, males are dimorphic in wing colour, with black and white-winged males defending territory and hyaline-winged males often acting as satellites. The study was carried out in a population of this species located in runoff habitats in Teocelo, Veracruz region. During the fieldwork period, hyaline-winged males were extremely rare to see, due to the time of year of the study (June-July), so the study focused on black-winged males. Some black-winged males were found to share the same territory, so it was hypothesised that within this morph there might be two territorial (or pre-copulatory) alternatives: dominant and submissive black-winged males. To test whether these two roles were plastic or stable in each individual, an experiment was carried out in which the black and white wing patches of some individuals were manipulated. This experiment included four different treatments: in the first, the black and white spots were painted without changing their size; in the second treatment, the white spot was erased using black paint; in the third treatment, the size of the black spot was increased and the white spot was moved while maintaining its size. Finally, a group of control individuals were included and no modifications were made to them. During a month and a half, focal observations of 10 min per individual were made daily (weather permitting), from 9:00 a.m. to 16:30 p.m., the time frame in which the maximum peak of activity in the individuals of this population took place. To carry out these focal observations, males and females were previously captured with an entomological net, individually marked with a number on the left anterior wing, the date and time of capture were noted, the body size was measured

with a caliper and the marked individuals were released again. An attempt was made to draw the number as far away from the spot as possible so that the marking of individuals did not interfere with the handling experiment. The results of the experiment suggest that the dominant and submissive roles are not affected by the treatment and would therefore be stable and fixed. Not only the plasticity of these roles was studied, but also the possible correlation between some phenotypic variables (wing symmetry, survival and recapture probability) and male behaviour (submissive or dominant) was investigated. In this case, a positive correlation was found between body size and survival in both sexes and roles of black-winged males. In addition, the largest and youngest black-winged males were the most symmetrical. *P. zoe* males possess a high behavioural diversity, with two types of strategies (dominant and submissive) in black-winged males. The occurrence of this behavioural diversity within the same morph could depend on demographic factors, such as population density and/or the relative frequency of different male morphs (hyaline and black-winged) at a given time of the year. Before copulation, male odonates transfer spermatozoa from the testes, located in the 9th abdominal segment, to the seminal vesicle located in the 2nd abdominal segment; a behaviour unique to this group of insects known as sperm translocation. The second chapter discusses how sperm translocation can affect the quality of sperm used by the male to produce sperm. The second chapter analyses how sperm translocation can affect the quality of the sperm used by the male to fertilise the female, and consequently the survival of the progeny (i.e. female fertility). In this case, a European zygopteran species, *Ischnura graellsii*, which is easy to find in Galicia, is used as a model for the study. Some published observations on this behaviour in odonates suggest that sometimes males do not translocate sperm before copulation. The aim of this chapter is to determine the circumstances under which males omit this behaviour and how this affects the viability of their sperm. For this purpose, *I. graellsii* males were allowed to perform a first sperm translocation (interrupting copulation at this time) and then the behaviour of these males in subsequent copulations was studied. Males were randomly assigned to four treatments consisting of allowing these individuals to copulate with a female after 15 minutes, 24 hours, 48 hours or 72 hours. Fertility of mated females was quantified as a proxy for male sperm viability. It was found that all *I. graellsii* males mated 15 minutes after the first sperm translocation used the sperm stored in the seminal vesicle, while the proportion of males repeating sperm translocation increased progressively from 6.7% for the group of males mated after 24 hours to 57.1% for males mated three days after the first translocation. In addition, information was available from field experiments with individuals of the genus *Calopteryx*, which showed that males of this genus also do not repeat sperm translocation less than 24 hours after mating. The fertility of *I. graellsii* females was diminished in cases where the mating males did not perform sperm translocation immediately prior to copulation, suggesting that sperm quality declines over time in *I. graellsii*. Males somehow determine when they can reuse the sperm

stored in the seminal vesicle or when they must discard it and perform a new sperm translocation. The important conclusion of this chapter is that the special anatomical arrangement of male odonates opens up selective pressures aimed at maximising sperm viability through plasticity and variety in sperm translocation behaviour. The third chapter focuses on the comparative study of the survival and behaviour of two populations of *Heteragrion cooki* located in Ecuadorian forest habitats in the locality of Piñas, El Oro region. These populations have been affected in recent years by the felling of riverbank trees. Although the genus *Heteragrion* is one of the most common in South American tropical forests, only 3 of the 46 species described in the genus have been studied by ethologists. The study of their behaviour is important to understand how tropical species are affected by the increasing human-induced deforestation in this region of the planet. For this study, capture, mark-recapture and focal observations of adults were used, similar to the study of *P. zoe* in Mexico. Two distinct stream types in which the target species was present were selected for the study. The first was a stream located next to a teak (*Tectona grandis*) plantation that retains small remnants of forest and riparian vegetation and is right on the border of a nature reserve. As it retains remnants of riparian forest, the environment was shadier in this population. The second stream was located 7.6 km from the first, and was located between crops of sugar cane (*Saccharum officinarum*), pineapples and other agricultural crops, so large areas of the stream were exposed and suffered from high insolation during the central hours of the day. As *H. cooki* is a shade-preferring species, the latter stream is expected to be of lower quality for *H. cooki* individuals. Similar densities of males (but not females) were found in both the less human-affected stream and the sunnier stream. Recapture rates were similar in both populations; higher for males (50%) than for females (20%). Body size was also affected, with individuals in the shady stream being significantly smaller than those in the sunnier stream. Males in the shady stream survived longer than females. Males in the shady stream survived longer than females, while in the sunnier stream daily survival was similar between sexes, but variable over time. Furthermore, in the sunny stream, body size was negatively correlated with survival. The study of *H. cooki* breeding behaviour revealed a peak of activity between 13:00 pm and 16:00 pm. Males arrived earlier than females at the stream and defended small patches of territory in the stream, exhibiting high territory fidelity and aggressive behaviour towards other males of the same species. Copulation duration is around 6 minutes and oviposition takes place in tandem male and female on roots and vines, and lasts an average of 45 minutes. Despite the loss of riparian vegetation in the sunniest population, similar densities of *H. cooki* individuals are maintained, probably due to small remnants of native forest found near the stream that may act as refuges for these individuals. The fourth chapter studies the function of an anatomical structure present in females of several odonate species, the vulvar spine. The European zygopteran *Enallagma cyathigerum* was selected as the target species for this chapter. The females of this species, like

many others within the family Coenagrionidae, possess a vulvar spine on the eighth abdominal segment, the function of which is unknown. This chapter tests three possible hypotheses to explain the presence of the vulvar spine: the first is that the vulvar spine serves as a structure to facilitate endophytic oviposition; the second hypothesis is that the vulvar spine is used by females as an organ to stimulate males to release sperm; and the third and final hypothesis is that the vulvar spine has evolved as part of male-female sexual conflict, to inflict damage on the male and shorten the duration of copulation. To test these hypotheses, a series of experiments were carried out using a colony of *E. cyathigerum* individuals captured in the field and subsequently maintained in the laboratory. To test whether the vulvar spine of the female is used to inflict damage on the male during copulation, 12 mature males were randomly selected. Four of these males copulated only once, 4 were allowed to copulate twice on consecutive days and the remaining 4 males were allowed to copulate 3 times, also on consecutive days. To examine whether the vulvar spine caused any effect on male survival, females were separated into two groups, one group where the vulvar spine was severed with dissecting scissors, and another group where the vulvar spine was left intact. Finally, to test whether the vulvar spine facilitates endophytic oviposition, females from the previous experiment (with and without vulvar spine) were placed inside glass jars with moist filter paper as artificial oviposition substrate. Each female was allowed to lay eggs for 15-20 minutes, a total of two times on different days. During oviposition, each time the female stopped laying, the timer was stopped. With these clutches we can also test whether the vulvar spine has a role as a stimulatory organ for the males (causing them to transfer more sperm or sperm-associated nutritional fluids), since in that case we would expect an increase in fertility in the case of males mated with spined females. The results of the experiments conducted did not support any of the hypotheses proposed for the existence of the vulvar spine, however, scanning electron microscopy analysis of the seminal vesicle of *E. cyathigerum* males showed a series of fold-like structures in their seminal vesicle, which were more or less pronounced depending on the degree of maturation of the male and which seem to correlate with the number of matings. Structures similar to these folds were found in other odonate species whose females have a vulvar spine, but were not observed in species whose females do not have a vulvar spine. In light folds may have evolved as a counter-adaptation to copulatory injury inflicted by females. Further research focusing on comparative morphological analyses of the size and shape of the vulvar spine and seminal vesicle folds is needed and should be correlated in case these structures evolved as a result of sexual conflict between males and females. If this hypothesis is proven, it would be the first case within this group of insects. In the last chapter, a review of the scientific literature was carried out to examine the variation in sperm translocation behaviour in the order Odonata and the evolutionary implications of this variation. In the second chapter, some of the important implications of this behaviour are already mentioned, but only one variant of this behaviour is

considered. In this chapter, information about sperm translocation in 176 species of Odonata is presented and the existence of a wide variety of sperm translocation types is highlighted. The variant of translocation performed once per mating and after tandem formation is the most common (66%), but other variants were found: sperm translocation with a previous genital touch (10%), sperm translocation performed by the male alone before tandem (16%) or after copulation (5%) and repeated translocation during the same copulation (3%). The information obtained from the literature review was used to investigate the evolution of this behaviour within the group through a comparative phylogenetic study. From this study it is possible to elucidate from which evolutionary scenarios the different variants of sperm translocation observed in odonates today originated. Thus, pre-copulation genital contact may have evolved to detect female receptivity; pre-tandem and solo male translocation may be favoured when mating opportunities are scarce and copulations are brief, while post-mating sperm translocation may be favoured in cases where males need to be ready to mate quickly. The possible origin of the characteristic mating behaviour of odonates, the so-called "copulatory wheel" and its relation to sperm translocation behaviour, is discussed. It is suggested that the most plausible scenario for the evolution of sperm translocation behaviour could be one in which odonate ancestors produced a spermatophore and attached it to the body. This would lead to the evolution of a secondary genitalia in males and thus to the formation of the "copulatory wheel". This chapter emphasises the role of behavioural diversity in understanding the evolution of both physical and behavioural traits associated with reproduction. Throughout the different chapters of this thesis, I have been able to demonstrate the importance of the study of animal behaviour and the implications of behavioural diversity or etodiversity for the conservation and study of biodiversity. It confirms the need for more integrative studies that bring together taxonomy, ecology, behaviour and molecular biology in order to establish more effective protocols to avoid species extinctions and thus contribute to the maintenance of biodiversity. I would like the general public reader, at the end of this thesis, to have realised the importance of the ecological processes occurring in our environment and how they affect us. I would also like all of us who are dedicated to basic science, evolutionary ecology and more specifically to ethology, to be aware of the potential that the study of animal behaviour has as a tool for empathising with the general public and transmitting knowledge of evolutionary ecology. In the case of the reader more closely linked to the area of research in evolutionary ecology, I would like them to begin to include the study of behaviour in their projects, in order to establish more complete conclusions, since, as has been seen throughout this thesis, the etodiversity or diversity of behaviour has a notable influence on the adaptation and evolution of species." (Author/DeepL)] Address: Rivas-Torres, Anaïs, ECOEVO Lab, Depto Ecología e Biología Animal, Univ. Vigo, Pontevedra, Galiza, Spain

19240. Sabagh, L.T.; Piccoli, G.C.; Viana, L.A.; Rocha, C.F.D. (2020): Predation and parasitism on bromeligenous

Snouted Treefrogs (*Oloolygon* spp.). *Herpetology Notes* 13: 271-279. (in English) ["Among the hypotheses as an advantage for the use of bromeliads by frogs both as refuge and breeding site, is that these plants would constitute a "safe place" and/or a "predator-free environment". Here we present some new records of antagonistic interactions involving bromeligenous Snouted Treefrog species of the genus *Oloolygon* in a coastal Brazilian Rainforest. We report records of predation on *Oloolygon* spp. tadpoles by damselfly larvae (*Leptagrion*) and by the spider *Corinna demersa*, and also predation on adults of the frog by a snake (*Bothrops jararaca*) and spiders. We also report the occurrence of parasitism of *O. perpusilla* adults by ticks (*Ornithodoros* sp.) and the register of a protozoan parasite (*Isospora cruzi*) in *O. littorea* faeces. We conclude that aside from the advantages for bromeligenous treefrogs to live in the bromeliads, living inside these plants does not result in a habitat free of predation and parasitism. Just as bromeligenous frogs evolved in association with bromeliads, so can other groups like predators and parasites. We still need consistent data on both predation and parasitism to better allow to infer to what extent bromeliads habitats are or not more or less safe for bromeligenous and/or bromeliculous amphibians." (Authors)] Address: Sabagh, L.T., Depto Ecol., Univ. Federal do Rio de Janeiro, Avenida Carlos Chagas 373, Prédio CCS – Bloco A, Sala A1-08, Rio de Janeiro, Rio de Janeiro 21941-902, Brazil. E-mail: leandro.sabagh@gmail.com

19241. Sarremejane, R.; Cid, N.; Stubbington, R.; Datry, T.; Alp, M.; Cañedo-Argüelles, M.; Cordero-Rivera, A.; Csabai, Z.; Gutiérrez-Cánovas, C.; Heino, J.; Forcellini, M.; Millán, A.; Paillex, A.; Paril, P.; Polášek, M.; Tierno de Figueroa, J.M.; Usseglio-Polatera, P.; Zamora-Muñoz, C.; Bonada, N. (2020): DISPERSE, a trait database to assess the dispersal potential of European aquatic macroinvertebrates. *Scientific Data* 7:386: 9 pp.- (in English) ["Dispersal is an essential process in population and community dynamics, but is difficult to measure in the field. In freshwater ecosystems, information on biological traits related to organisms' morphology, life history and behaviour provides useful dispersal proxies, but information remains scattered or unpublished for many taxa. We compiled information on multiple dispersal-related biological traits of European aquatic macroinvertebrates [including Odonata] in a unique resource, the DISPERSE database. DISPERSE includes nine dispersal-related traits subdivided into 39 trait categories for 480 taxa, including Annelida, Mollusca, Platyhelminthes, and Arthropoda such as Crustacea and Insecta, generally at the genus level. Information within DISPERSE can be used to address fundamental research questions in metapopulation ecology, metacommunity ecology, macroecology and evolutionary ecology. Information on dispersal proxies can be applied to improve predictions of ecological responses to global change, and to inform improvements to biomonitoring, conservation and management strategies. The diverse sources used in DISPERSE complement existing trait databases by providing new information on dispersal traits, most of which would not otherwise be accessible to the scientific community." (Authors)] Address: Sarremejane, R., School of Science &

Technology, Nottingham Trent University, Nottingham, NG11 8NS, UK. E-mail: romain.sarremejane@gmail.com

19242. Schlemmer Brasil, L.; Luiza-Andrade, A.; Calvão, L.B.; Dias-Silva, K.; Justino Faria, A.P.; Shimano, Y.; Oliveira-Junior, J.M.B.; Cardoso, M.N.; Juen, L. (2020): Aquatic insects and their environmental predictors: a scientometric study focused on environmental monitoring in lotic environmental. *Environmental Monitoring and Assessment* volume 192, Article number: 194 (2020): (in English) ["Since early studies about aquatic ecology, it has been found that changes in environmental conditions alter aquatic insect communities. Based on this, the combined study of environmental conditions and aquatic insect communities has become an important tool to monitor and manage freshwater systems. However, there is no consensus about which environmental predictors and facets of diversity are more useful for environmental monitoring. The objective of this work was to conduct a scientometric analysis to identify the main environmental predictors and biological groups used to monitor and manage lotic freshwater systems. We conducted a scientometric study on the Web of Science platform using the following words: stream, river, aquatic insect, Ephemeroptera, Plecoptera, Trichoptera, Odonata, Heteroptera, Chironomidae, bioindicator, environmental change, anthropic, and land use. Although most of the environmental predictors employed are local, intrinsic of freshwater systems using local environmental and associated landscape variables is a better strategy to predict aquatic insect communities. The facets of diversity most used are composition and richness of species and genera, which are not efficient at measuring the loss of ecosystem services and extinction of phylogenetic lineages. Although very important, these functional and phylogenetic facets are poorly explored for this purpose. Even though tropical regions are the most diverse globally and are experiencing major losses of native vegetation, these ecosystems are the least studied, a knowledge gap that needs addressing to better understand the effect of anthropogenic activities on the diversity of aquatic insects." (Authors)] Address: Brasil, L.S., Programa de Pós-Graduação em Zoologia, UFPA/MPEG, Inst. de Ciências Biológicas, Univ. Federal do Pará, Rua Augusto Corrêa, N° 1, Bairro Guamá, Belém, Pará, CEP 66075-110, Brazil

19243. Schneider, T.; Ikemeyer, D.; Dumont, H.J. (2020): Additions to the Odonata of Sudan and a revised checklist (Insecta: Odonata). *Entomologische Zeitschrift* 130(1): 23-28. (in English, with German summary) ["Sudan have been less well studied than those of most other African countries. The list of recorded species from Sudan based on a recent reference book for Eastern Africa (Dijkstra & Clausnitzer 2014) and two recent Sudanese papers (Elfaki 2015, Elfaki & Allam 2017) is only 56. During our short field trip to Sudan in 2019 (10 days in the field) 35 Odonata species were found. Nine of these are new for Sudan, increasing the total number of Sudanese Odonata to 65. The following Odonata are new species for Sudan: *Lestes tridens*, *Agriocnemis sania*, *Agriocnemis zerafica*, *Ceriagrion suave*, *Azuragrion nigridorsum*, *Paragomphus cognatus*, *Phyllomacromia*

contumax, *Acisoma inflatum* and *Aethriamanta rezia*. Thus, the true dragonfly fauna of Sudan is surely much richer, especially in the south, but this part of the country remains to be investigated." (Authors)] Address: Schneider, T., Arnold-Knoblach-Ring 76, 14109 Berlin-Wannsee, Germany. E-Mail: thomas.rs@gmx.de

19244. Seidu, I.; Saphianu, B.; Kusi Manu, M.; Amaning Kwarteng, D. (2020): Contribution to the knowledge of Odonata fauna of the Atewa Range Forest Reserve, Bobiri Forest Reserve, Owabi Wildlife Sanctuary and Ankasa Forest Reserve (southern Ghana). *International Dragonfly Fund Report* 143: 1-20. (in English) ["Using a qualitative sampling approach to survey for Odonata along water systems inside and outside of four major protected areas in Southern Ghana (viz: Atewa Range Forest Reserve, Ankasa Forest Reserve, Owabi Wildlife Sanctuary and Bobiri Forest Reserve), a total of 66 Odonata species in seven families encompassing 28 Zygoptera and 38 Anisoptera were recorded. Libellulidae (n= 36) exhibited the highest number of species, followed by Coenagrionidae (n= 10), and Calopterygidae (n= 5). In considering the observed number of species exhibited by each protected area, the Atewa Range Forest Reserve exhibited the highest number of species (n= 51), followed by the Ankasa Forest Reserve (n= 47), the Owabi Wildlife Sanctuary (n= 44) and Bobiri Forest Reserve (n= 43). Disturbance tolerance species dominated in habitats outside the various forest reserves, while forest specialists predominated inside the reserves, indicating the quality of the forest cover therein." (Authors)] Address: Seidu, I., Department of Wildlife & Range Management, Fac. Renewable Natural Resources, Kwame Univ. of Science & Tech., Kumasi, Ghana. E-mail: antwiseidu88@gmail.com

19245. Sharma, M.; Oli, B.R. (2020): Ectoparasites of dragonflies and damselflies in central Nepal. *Global Science Journal* 8(1): 2608-2614. (in English) ["Water mites as ectoparasites on odonata documented in this paper is first report of Nepal. this paper deals with parasitic association with odonata at Pravash local ponds and ponds of Ramgram Stupa observed during 2018 and 2019 respectively. We recorded 101 mites from 16 individuals of odonata. Both dragonflies (*Brachythemis contaminata*, *Crocothemis servilia*, *Orthetrum sabina*, *Trithemis pallidinervis*) and damselflies (*Ischnura aurora*, *Agriocnemis pygmaea*, *Ceriagrion falax*, *Ceriagrion coromandellianum*) were parasitized by *Arrenurus* spp. Maximum (23 mites) were reported from female *C. servilia*. The mites of three colours, orange, dark green and black were attached to the different sites of the thorax and abdomen. Mites were attached in scattered form except on male *C. servilia*, arranged in inverted V-shaped on ventral side of thorax and cluster form on thorax of *Agriocnemis pygmaea*. Mostly female odonates (11 individuals by 71 mites) were infested by mites than male (5 individual by 30 mites)." (Authors)] Address: Sharma, M., Central Dept of Zoology, Kirtipur, Kathmandu, Nepal; Email:munu.nepal50@gmail.com

19246. Sharma, S.; Shera, P.S.; Sangha, K.S. (2020): Species composition of parasitoids and predators in two rice

agro-farming systems—effect of ecological intensification. *International Journal of Tropical Insect Science* 40: 233-238. (in English) ["Ecological intensification through organic farming is known to have an influence on plant communities and diversity of insects associated with them. The comparative abundance of natural enemies was studied in organically as well as conventionally (chemical control) grown aromatic rice at farmer's field during 2015–2016 and 2016–2017. Different life stages, i.e., egg, larvae and pupae of rice stem borer, and leaf folder, were collected and brought to the laboratory to record natural parasitism in both organic and conventional fields. The population of predators was recorded through sweep nets. The population of spiders was recorded using pitfall traps and sweep net. A total of nine parasitoid species including 3 egg parasitoids (*T. chilonis*, *T. japonicum*, and *Telenomus* sp.), 3 larval parasitoids (*Stenobracon nicevillei*, *Bracon* sp., and *Cotesia* sp.), and 3 pupal parasitoids (*Tetrastichus* sp., *Brachymeria* sp., and *Xanthopimpla* sp.) were recorded. However, the natural parasitism by these parasitoids was significantly higher in organic than conventional rice. Similarly, the population of predators like spiders, *Pantala flavescens*, and *Agriocnemis femina* was significantly higher in organic fields than in conventional fields. The study highlights the significance of conservation of these natural enemies for a sustainable system of rice insect pest management." (Authors)] Address: Sharma, S., Dept of Entomology, Punjab Agricultural University, Ludhiana, India. Email: sudendhu@pau.edu

19247. Shende, B.; Masram, S. (2020): Histological and histochemical changes in oocytes during oogenesis in *Orthetrum sabina* (Drury 1770) (Anisoptera: Libellulidae). *Journal of Entomology and Zoology Studies* 8(2): 275-281. (in English) ["This study presents the oocyte development of *O. sabina* with the dynamics of histology and histochemistry. The ovary is panoistic type which contain many ovariole. Ovariole contain terminal filament, germarium, vitellarium. Five stages of oocytes were identified based on nature of cytoplasm, presence of germ vesicle, yolk granules and chorion. Spherical oval shaped oocyte I gradually increases in size and attained elliptical shaped oocyte V. Germinal vesicle is conspicuous in oocyte I and II but shifted towards one pole in oocyte III and completely disappear in oocyte IV. Chorion around plasma membrane manifested in oocyte IV. Proteins and carbohydrates entered in ooplasm from early stage while lipid appear late during oocyte development. Proteins, carbohydrates and lipid were demonstrated in oocytes by mercury bromophenol blue method, periodic acid Schiff method and Sudan black B method respectively." (Authors)] Address: Shende, B., PGTD of Zoology, Mahatma Jyotiba Phule Educational Campus RTM Nagpur University, Nagpur, Maharashtra, India

19248. Shumway, N.; Gabryszuk, M.; Laurence, S. (2020): The impact of dragonfly wing deformations on aerodynamic performance during forward flight. *Bioinspiration & Biomimetics* 15(2):026005: (in English) ["Bulk wing kinematics and wing deformations of free-flying dragonflies of the species *Pachydiplax longipennis* were measured in a controlled

environment. Both upright and inverted straight flights were recorded and analyzed. The inverted dragonflies exhibited similar bulk kinematics to the upright specimens in the global frame, but wing deformations were generally consistent in the body-relative frame. The deformations primarily comprised camber during the body-relative downstroke and twist during the body-relative upstroke. Based on these data, models were developed to incorporate the measured kinematics and deformations into computational fluid dynamics simulations. Both isolated and tandem wings were simulated (rigid and deforming in each case), allowing the effects of deformations and wing-wing interactions to be examined independently. During the upstroke the addition of deformation reduced flow separation on the outboard sections of the wing, whereas the impact of the deformation during the downstroke was found to be dependent on the wing kinematics. The simulations of tandem wings indicated that they produce more force than isolated wings, but the wing deformations reduced the impact of this wing-wing interaction. The changes in average lift and thrust induced by the wing deformations were relatively minor and dependent on the flight orientation, but the aerodynamic efficiency of the deforming wings was significantly higher than that of the rigid wings for all examined cases, including the inverted flights for which the deformations were in the opposite (global) sense to the upright flights." (Authors)] Address: Shumway, N., Dept Aerospace Engineering, Univ. of Maryland, College Park, MD, United States of America. Email: shumwanm@umd.edu

19249. Siepielski, A.M.; Hasik, A.Z.; Ping, T.; Serrano, M.; Strayhorn, K.; Tye, S.P. (2020): Predators weaken prey intraspecific competition through phenotypic selection. *Ecological Letters* 23(6): 951-961. (in English) ["Predators have a key role shaping competitor dynamics in food webs. Perhaps the most obvious way this occurs is when predators reduce competitor densities. However, consumption could also generate phenotypic selection on prey that determines the strength of competition, thus coupling consumptive and trait-based effects of predators. In a mesocosm experiment simulating fish predation on damselflies [*Enallagma signatum*], we found that selection against high damselfly activity rates – a phenotype mediating predation and competition – weakened the strength of density dependence in damselfly growth rates. A field experiment corroborated this finding and showed that increasing damselfly densities in lakes with high fish densities had limited effects on damselfly growth rates but generated a precipitous growth rate decline where fish densities were lower – a pattern expected because of spatial variation in selection imposed by predation. These results suggest that accounting for both consumption and selection is necessary to determine how predators regulate prey competitive interactions." (Authors)] Address: Siepielski, A.M., Dept Biol. Scien., Univ. Arkansas, Fayetteville, AR, 72701 USA. E-mail: amsiepie@uark.edu

19250. Smith, L.A.; Lancaster, L.T. (2020): Increased duration of extreme thermal events negatively affects cold acclimation ability in a high-latitude, freshwater ectotherm (*Ischnura elegans*; Odonata: Coenagrionidae). *Eur. J. Entomol.*

117: 93-100. (in English) ["Instances of heat waves and cold snaps are becoming more frequent and of increasing duration worldwide. It is well established that short exposure to high or low-temperatures, such as during extreme weather events, often results in adaptive (acclimation/hardening) or maladaptive plastic changes in tolerance of organisms to subsequent thermal stressors. However, little information is available about how the duration of a prior stressful thermal event mediates future organismal thermal responses. Understanding durational effects of thermal conditioning can help predict ectothermic survival in response to novel extreme weather patterns. We assessed the effect of stressful temperature duration on tolerance to subsequent cold exposure in a widespread freshwater invertebrate species in Britain. Following a week-long acclimation period at 15°C, wild-caught *Ichnura elegans* larvae were held at stressful thermal extreme (2°C or 30°C) temperatures for varying durations designed to mimic a range of extreme to plausible durations of heat waves or cold snaps in the wild (30 min, 2 h, or 24 h). After a period of re-equilibration to ambient temperatures (15°C), we then experimentally assessed CT_{min}, the temperature which renders an individual unresponsive, as an index of cold tolerance. Prior exposure to 2°C, simulating a cold snap, improved future cold tolerance, but only when individuals experienced very brief prior exposures to these conditions (30 min up to 2 h), and this benefit was lost following 24 h prior exposure. Prior exposure to 30°C, simulating a heat wave, consistently worsened the subsequent cold tolerance of individuals, with the detrimental effect of prior heat exposure increasing linearly as a function of duration. The research indicates that cold snaps can provide beneficial hardening effects against future cold exposures, but only when these (priming) extreme weather events are of very short duration (here, 30 min or 2 h). Longer durations of exposure to either extreme heat or cold weather events can reduce the ability of individuals to beneficially react to subsequent cold stresses, and may have deleterious effects on future thermal tolerance. The results suggest that increasing durations of extreme temperature events will reduce cold hardening ability of freshwater invertebrates, and that the duration of extreme weather events, or durational changes in freshwater thermal regimes resulting from changes in snowmelt dynamics, is an important parameter to consider when studying organismal responses to climate change." (Authors)] Address: Smith, Lesley, Institute of Biological and Environmental Sciences, The University of Aberdeen, Zoology Building Tillydrone Ave, Aberdeen, AB24 2TZ, UK. E-mail: lesley.smith.13@aberdeen.ac.uk

19251. Start, D. (2020): Phenotypic plasticity and community composition interactively shape trophic interactions. *Oikos* 129(8): 1163-1173. (in English) [Epitheca Anax "Trait variation defines and underpins biodiversity, yet we are only beginning to understand how processes acting across biological scales (individuals to whole communities) interact to produce trait differences and their consequences, particularly over short time scales. First, species often differ widely in their mean phenotype, meaning that changes in community composition can alter average trait values of a guild.

Second, phenotypic plasticity alters the trait values of individuals, and the net effect of plasticity can also shift the average trait values of a specific species or of whole communities. However, community assembly, phenotypic plasticity, and their effects on biological patterns are not independent. The expression of phenotypic plasticity tends to be species-specific, meaning that differences in species' relative abundances will shape trait change and resulting ecological patterns and processes. I test this idea using mesocosms and simulations of communities of dragonfly larvae that differ in activity rate. Some but not all species reduced their activity rate in response to predation risk, causing larger trait-mediated changes in trophic interactions in experimental communities dominated by plastic versus astatic species. Using surveys and simulations of natural ponds, I demonstrate that community composition will shape patterns of phenotypic plasticity, with likely consequences for ecological dynamics in the wild. The interactive effects of trait differences across scales of biological organization necessitates an integrated view of diverse biological processes, including plasticity and community assembly, in order to understand ecological interactions." (Author)] Address: Start, D., Center for Population Biology, Univ. of California Davis, 1 Shields Avenue, Davis, CA, 95616 USA. Email: denon.start@utoronto.ca

19252. Sushko, G. (2020): Spatial variation in assemblages of Odonata (Insecta) within habitat gradients in large, pristine peat bogs in Belarus. *Biologia* 76: 575-583. (in English) ["The variation in environmental conditions in peat bogs can be expressed by odonate assemblage composition among habitats or by differences in species richness, abundance and diversity among study sites in a regional context. The adult Odonata of large, pristine peat bogs in Belarus were examined. Adult Odonata were counted along fixed transects in main peat bog habitats under favorable weather conditions. The odonate diversity showed clear differences, affected by distance to the water body, wind speed, and bog water level. The highest diversity was recorded along lakeshores. This study detected distinct odonate assemblage variations among habitats such as lagg zones, lakeshores and hollows. The large areas occupied by pine bogs and open bogs had a very similar species composition and lower diversity. On the other hand, the Shannon diversity index ($H' = 1.433-2.295$) and Pielou's evenness index ($J' = 0.468-0.507$) values were relatively high compared to those of terrestrial insects. The main differences among adult odonate assemblages were driven by cold-adapted, highly specialized species such as *Leucorrhinia albifrons*, *Leucorrhinia dubia*, *Sympetrum danae* and two abundant generalist species such as *Sympetrum sanguineum* and *Sympetrum vulgatum*. Peat bog specialists are among the most rapidly declining insects and, therefore, relatively intact Belarusian peat bogs are refuges for many threatened species and have considerable conservation potential." (Author)] Address: Sushko, G., Department of Ecology and Environmental Protection, Vitebsk State University P.M. Masherov, Moscovski Ave. 33, 21005, Vitebsk, Belarus

19253. Trapero-Quintana, A.; Torres-Cambas, Y.; Rivas-Torres, A.; Ferreira, S.; Cordero-Rivera, A. (2020): The Odonata of Zapata peninsula (Matanzas, Cuba), the largest wetland system of the Caribbean. *Odonatologica* 49(1/2): 15-28. (in English) ["This study describes the fauna of odonates of nine localities in the Zapata peninsula in the Southwest of Cuba, sampled in June 2017, January 2018, and September 2019. We failed to find *Enallagma trunctatum*, an endemic species of the area, even though we visited the type locality, Zarabanda, in June and January. We found 37 species in 25 genera and five families, including the first records of 11 taxa for the area: *Lestes forclicula*, *L. tenuatus*, *Leptobasis candelaria*, *Neoneura maria*, *Aphylla caraiba*, *Celithemis eponina*, *Crocothemis servilia*, *Erythemis plebeja*, *Erythrodiplax berenice naeva*, *Perithemis domitia* and *Tramea onusta*. A dichotomous key for the separation of the four species of females of Cuban *Lestes* is given." (Authors)] Address: Trapero-Quintana, A., Departamento de Biología Animal y Humana, Facultad de Biología, Universidad de La Habana, Cuba

19254. Trudelle, L.; Witté, I.; Happe, D.; Antonetti, P.; Lemarchand, C.; Lolive, N.; Gigot, G. (2020): Priorités de conservation des espèces en Auvergne: l'apport des Listes rouges régionales. *Naturae* 2020 (1): 1-29. (in French, with English summary) ["Species conservation priorities in Auvergne: the contribution of Subnational Red Lists Using subnational Red Lists from the former Auvergne region and available occurrence data, multigroup cross-analyses were carried out to provide a synthesis of the conservation status of species of Auvergne and to illustrate the main trends as well as the main issues for local biodiversity. The results show there are a large number of threatened and near threatened species, including more than half of amphibians, bryophytes and birds. The highest proportions of unknown species concern certain vertebrates (amphibians and mammals) and flora. There is a lack of public policy framework or regulatory statutes for more than 170 species listed under the 'Data Deficient' category and for as many endangered species. There is also strong geographic variation in the distribution of declining species and species 'Data Deficient' that focus on the Allier River axis and the mountain ranges. Moreover, there is a marked endemism in the area of the Dore Mountains, the Cantal Mountains and the Mezenc Massif. In the context of regional conservation strategies and knowledge priorities, special attention should be paid to the endemic species of Auvergne currently threatened and a series of remarkable species among vascular flora. Although other factors exist, the main threats are related to the deterioration of habitats. The development of subnational Red Lists, a decision-making tool, must be maintained in order to continue monitoring and conservation of the regional biodiversity." (Authors)] Address: Trudelle, Laurène, UMS Patrimoine naturel (« PatriNat »), AFB, CNRS, MNHN, 57 rue Cuvier, boîte postale 41, F-75231 Paris cedex 05, France. Email: laurene.trudelle@gmail.com

19255. Tseng, H.-Y.; Chien, C.-Y.; Chen, C.-H.; Chen, R.-Y.; Yang, H. (2020): Dragonfly-wing-inspired inclined irregular

conical structures for broadband omnidirectional antireflection coatings. *ACS Appl. Nano Mater.* 2020, 12, 9: 10883-10892. (in English) ["Orthetrum triangulare wings behave high transparency for wide viewing angles. The broadband omnidirectional antireflection behaviors result from randomly arrangement of inclined irregular conical structures on the surface of blue-tailed forest hawk dragonfly wings. In this study, a scalable colloidal lithography technique is developed for engineering antireflection coatings that biomimic blue-tailed forest hawk dragonfly wing structures. Spin-coated randomly packed silica colloids serve as structural templates for patterning subwavelength inclined conical structures on substrates directly. The dragonfly-wing-inspired structures feature omnidirectional antireflection performance over the whole visible spectral range, and generate superhydrophobic property by surface functionalization. The dependence of the inclination and height of conical structures on the antireflection performance and self-cleaning property is also systemically studied in this research." (Authors)] Address: Tseng, H.-Y., Department of Chemical Engineering, National Chung Hsing University, 145 Xingda Road, Taichung City 40227, Taiwan

19256. Tseng, H.-Y.; Chen, Y.-H.; Chen, R.-Y.; Yang, H. (2020): Reversibly erasable broadband omnidirectional antireflection coatings inspired by inclined conical structures on Blue-tailed forest hawk dragonfly wings. *ACS Appl. Mater. Interfaces* 12.9: 10883-10892. (in English) ["Blue-tailed forest hawk dragonfly (*Orthetrum triangulare*) wings, covered with inclined conical structures, are studying for their high transparency and low reflectance for large viewing angles. However, limited by existing technologies, the exquisite inclined structures are not replicated easily or applied adequately. Here, we combine a shear-induced self-assembly approach and a colloidal lithography technology to create omnidirectional antireflection structures that inspired by dragonfly wings. Non-close-packed colloid crystals are spin-coated and serve as structural templates in a plasma etching procedure to pattern subwavelength inclined conical structures directly on shape memory polymer-coated substrates. The dependence of the antireflection functionality on the shape and inclination of conical structures is systematically investigated in this research. Compared with a featureless substrate, the structure-covered substrate can display a approximately 8% higher average transmittance in the visible wavelength range at normal incidence and even approximately 23% higher average transmittance as the incident angle increases to 75°. Moreover, the reconfigurable structures composed of shape memory polymers can be repeatedly deformed and recovered as a result of external stimuli at ambient conditions, and the corresponding broadband omnidirectional antireflection functionality is therefore reversibly erased and restored." (Authors)] Address: Tseng, H.-Y., Dept of Chemical Engineering, Nat. Chung Hsing Univ., 145 Xingda Rd, Taichung City 40227, Taiwan

19257. Tüzün, N.; Stoks, R. (2020): Lower bioenergetic costs but similar immune responsiveness under a heat wave in urban compared to rural damselflies. *Evolutionary*

Applications 14(1): 24-35. (in English) ["There is mounting evidence that the widespread phenotypic changes in response to urbanization may reflect adaptations caused by rapid evolutionary processes driven by urban-related stressors. Compared to increased habitat fragmentation and pollution, adaptations towards another typical urban-related stressor, i.e. higher and longer lasting very high temperatures (heat waves), are much less studied. Notably, the sensitivities to heat waves of life history traits and important fitness-related physiological traits such as immune responsiveness and bioenergetic variables (energy availability, energy consumption, and their balance) have never been contrasted between urban and rural populations. By conducting a laboratory common-garden experiment, we compared effects of a simulated heat wave on life history (survival and growth rate), immune responsiveness, and bioenergetic variables between three urban and three rural populations of *Coenagrion puella*. Because energy-mediated trade-off patterns may only be detected under energetically costly manipulations, all larvae were immune-challenged by simulating ectoparasitism by water mites. As expected, the simulated heat wave caused negative effects on nearly all response variables. The immune responsiveness, on the other hand, increased under the heat wave, consistent with a trade-off pattern between immune function and growth, and this similarly between urban and rural populations. A key finding was that urban larvae suffered less from the simulated heat wave compared to the rural larvae in terms of a lower heat wave-induced depletion in energy availability. This suggests an adaptation of urban populations to better cope with the stronger and more frequent heat waves in cities. Notably, this urbanization-driven evolution in the bioenergetic variables was not apparent in the absence of a heat wave. Given that changes in energy budgets have strong fitness consequences, our findings suggest that the evolved higher ability to cope with heat waves is fundamental for the survival of urban damselfly populations." (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

19258. Tye, S.P.; Blaske, B.K.; Siepielski, A.M. (2020): Population-level variation of digestive physiology costs of mounting an immune response in damselflies. *Ecological Entomology* 45(3): 635-643. (in English) ["1. Trade-offs are often predicted to occur between energetically costly activities, such as somatic growth and eliciting immune responses to parasites. Although parasitism frequently reduces growth via lowered consumption, it remains unclear if the energetic demands of generating immune responses also affect the digestive physiological processes necessary for growth. Moreover, as local environmental conditions affect energetic investment towards growth and immune responses, the extent of any digestive-immune response trade-offs may vary among populations and not be fixed at the species-level. 2. To test these ideas, melanisation – a general innate immune response – was first induced in damselfly larvae (*Enallagma vesperum*) from two populations. The

study then quantified growth and consumption rates, assimilation and production efficiencies, and daily metabolic rates to determine if digestive-immune response trade-offs were present and, if so, whether they differed between populations. 3. There was no evidence of any trade-offs between immune responses and digestive physiology components in either population. However, the results did show that populations differentially allocated energy towards different digestive physiology components after an immune response was elicited: one population increased their relative consumption and daily metabolic rates, while the other population had lower assimilation efficiencies and consumption rates. 4. Although researchers lack a mechanistic understanding of the observed population-level differences, these results suggest that accounting for population-level variation in digestive physiology and immune responses is critical to inferences about how immunological defences to parasitism may affect the ability for organisms to both acquire and utilise resources." (Authors)] Address: Tye, S.P., Dept of Biological Sciences, University of Arkansas, Fayetteville, Arkansas, USA. E-mail: simontye@uark.edu

19259. Vaikre, M.; Remm, L.; Rannap, R. (2020): Forest ditch maintenance impoverishes the fauna of aquatic invertebrates: Opportunities for mitigation. *Journal of Environmental Management* 274, 15 November 2020, 111188: 9 pp. (in English) ["Highlights: • Ditch network maintenance (DNM) regularly disturbs local communities in ditches. • One of the first studies evaluating the effect of DNM on macroinvertebrates. • Mitigation pools were constructed in conjunction with DNM. • DNM reduces habitat availability, abundance and diversity of aquatic invertebrates. • Mitigation pools add new native species but do not replace natural forest pools. Abstract: One of the main factors causing biodiversity loss in wetlands is drainage, nevertheless, even drained areas may provide habitat for aquatic fauna in the form of drainage ditches. Assemblages in ditches are regularly disturbed by ditch maintenance, but the extent of these disturbances and mitigation possibilities are poorly documented. We conducted an experimental study in three commercially managed forest plots in eastern Estonia, aiming to find out how ditch network maintenance (DNM) affects the diversity and assemblages of aquatic macroinvertebrates in ditches and remnant pools, and whether this effect can be alleviated by constructing mitigation waterbodies. For comparison we also collected data from natural pools in three undrained forest plots. Before DNM, ditches supported greater number of higher taxa compared to remnant and natural pools and more strictly aquatic taxa, whereas natural pools in undrained plots supported more Trichoptera shredders. After DNM, the diversity in remnant pools decreased. Moreover, majority of the pools dried out, which resulted in further reduction of the richness and abundance of macroinvertebrates. In ditches the diversity dropped immediately after DNM, but recovered in two to three years. Nevertheless, plot-scale richness and abundance did not completely recover. Assemblage shift in ditches took place right after DNM and remained distinct after the four year survey pe-

riod. Mitigation pools provided habitat for several taxa (especially Odonata) uncommon in other waterbodies in drained and undrained plots. Our results show that DNM in forests substantially impoverishes habitat availability and reduces the abundance and diversity of aquatic macroinvertebrates. We recommend retaining uncleaned sections in ditches and constructing mitigation pools as tools for supporting wetland biodiversity in drained forests." (Authors)] Address: Vaikre, Maarja, Institute of Ecology and Earth Sciences, University of Tartu, Vanemuise 46, EE-51014, Tartu, Estonia. E-mail: vaikre@ut.ee

19260. Vallat, A.; Monnerat, C.; Tschanz-Godio, S.; Juillerat, L. (2020): Retablisement des communautes de libellules (Odonata) dans les tourbieres du Jura neuchatelois (Suisse). *Alpine Entomology* 4: 99-116. (in French, with English summary) ["Restoration of dragonfly communities (Odonata) in the peatlands of the Jura Mountains of Neuchâtel (Switzerland). Over the course of the 20th century, the peatlands of the valleys of La Brevine and Les Ponts-de-Martel lost over 90% of their surface area due to the industrial exploitation of peat. Restoration work undertaken between 1996 and 2018 increased the number of bodies of water in these areas from 240 to 341 and their surface area from 1.3 to 10.1 hectares. Odonates have been regularly monitored in several of these wetland areas since 2005. In 2017 and 2018, an intensive monitoring program identified 38 species. Observations made between 1938 and 2018 included a total of 52 species, or over two-thirds of Swiss Odonata fauna. Nine of these species are found on the national Red List. Species strictly associated with peatlands benefitted from restoration measures; their numbers have increased since 2005. *Leucorrhinia pectoralis* is now established in twelve peatlands out of fifteen and *L. albifrons*, one of the rarest dragonflies in Switzerland, currently reproduces in a peatland that was the subject of intensive restoration. Discoveries of *Aeshna subarctica* and *Ceriagrion tenellum* may hint at future colonization of this region by these species. Given such positive results, the canton of Neuchâtel will continue its restoration program for at least the next five years. Only the coordinated management of diverse types of wetland habitats will allow for the survival of the most demanding species." (Authors)] Address: Juillerat, L., Rue du Seu 25, CH-2054 Chezard-St-Martin, Switzerland. E-mail: juillerat.l@bluewin.ch

19261. Van Dievel, M.; Janssens, L.; Stoks, R. (2020): Effects of pesticide exposure and predation risk on nutrient cycling and primary production. *Science of The Total Environment* 705, 25 February 2020, 135880: (in English) ["Highlights: • Pesticide and predation risk are omnipresent in aquatic ecosystems. • Predation risk and chlorpyrifos additively shaped body and egesta stoichiometry. • The pesticide chlorpyrifos increased egestion of C, without an impact on algae growth. • Predation risk caused higher egestion of N, resulting in an increased algae growth. • This indicates predation risk can shape primary production via nutrient recycling. Abstract: Understanding how pesticides and natural stressors shape ecosystem functions remains

a major challenge. A largely overlooked way how stressors may affect nutrient cycling and primary production is through effects on body stoichiometry and the egestion of elements. We investigated how exposure to the pesticide chlorpyrifos and to predation risk, an abundant natural stressor in aquatic systems, altered the stoichiometry of the bodies and the egested faecal pellets of *Enallagma cyathigerum* damselfly larvae and how this further cascaded into effects on primary production (algae growth). Chlorpyrifos exposure reduced egestion rates while predation risk had no effect. Chlorpyrifos exposure and predation risk affected both elemental composition of bodies and faecal pellets, and this in an additive way. Chlorpyrifos exposure increased body C(carbon), N(nitrogen), and P(phosphorous) contents, and increased the C content of the faecal pellets. Predation risk induced an increase of the N content, resulting in a decreased C:N ratio, of both the bodies and faecal pellets. The changes in the composition of the faecal pellets caused by predation risk but not by chlorpyrifos exposure increased algae growth under control conditions. This indicated that algae growth was N limited. Our results provide an important proof-of-principle how a stressor may shape nutrient cycling and subsequently primary productivity." (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

19262. Vieira da Silva, C.; Henry, R. (2020): Aquatic macroinvertebrate assemblages associated with two floating macrophyte species of contrasting root systems in a tropical wetland. *Limnology* 21: 107-118. (in English) ["Aquatic macrophytes play an important role in structuring biotic communities. A comparative study of macroinvertebrate community structures associated with *Salvinia auriculata* Aublet and *Eichhornia crassipes* (Mart.) Solms was conducted in a Brazilian wetland (São Paulo State) during two periods. Our working hypothesis is that the aquatic macrophyte with the highest root system biomass and volume (*E. crassipes*) will result in the highest abundance and richness of associated macroinvertebrates. There were significant differences in the taxa richness and density of macroinvertebrates between macrophytes and sampling periods. The density of macroinvertebrates was higher in *S. auriculata* than in *E. crassipes* during both sampling periods, but there was little difference in mean taxa richness. Negative correlations between the macrophyte root biomass and volume and macroinvertebrate density were found. Insecta, Crustacea and Annelida were the most numerous groups of invertebrates sampled during the study, and Diptera (Insecta) dominated in the root systems of both macrophytes. Macroinvertebrates associated with *E. crassipes* roots may have undergone a vertical gradient of decreased oxygen concentration in the water, as well as of the available periphyton biomass, because of the low penetration of light in the region of the root system, which resulted in a lower density of macroinvertebrates." (Authors) Taxa are treated at the order level including Odonata.] Address: Vieira da Silva, Carolina, Institute of Biosciences, São Paulo State University (UNESP), Botucatu, SP, Brazil. E-mail: carollimno@gmail.com

19263. Vinko, D.; Kulijer, D.; Zhushi Etemi, F.; Hostnik, M.; Šalamun, A. (2020): The first systematic survey of the dragonfly fauna of Kosovo. *International Dragonfly Fund Report* 147: 1-50. (in English) ["This paper presents the faunistic results of three short field excursions conducted in spring and early summer of 2018 in Kosovo, considering dragonfly fauna one of the most understudied countries of Europe. This study presents first systematic dragonfly research in Kosovo. Within a total of 13 field days between end of April and end of June 2018, 60 sites were surveyed and 44 dragonfly species were found. Significant results include the first documented report of 15 species for Kosovo. New data on several other species with a broader European concern or generally rare on the West Balkan peninsula, i.e. *Coenagrion ornatum*, *Anax ephippiger*, *Caliaeschna microstigma*, *Cordulegaster heros*, *C. bidentata*, *Somatochlora flavomaculata*, and *Sympetrum flaveolum*, are also presented. The overview of all visited sites is included. Altogether, 47 dragonfly species are now reported for Kosovo." (Authors)] Address: Vinko, D., Slovene Dragonfly Society, Verovškova 56, 1000 Ljubljana, Slovenia

19264. Wagner, M.D.; Roberts, M.E. (2020): Analysis of Piebald Madtom (*Noturus gladiator*) diet. *Food Webs* 22, March 2020, e00136: (in English) ["The Piebald Madtom, *Noturus gladiator*, is found in tributaries of the Mississippi River from the Obion River in northern Tennessee to the Big Black River in central Mississippi. The species is currently petitioned for listing under the federal Endangered Species Act of 1973, and is of conservation concern in both Mississippi and Tennessee. Yet little is known about the feeding ecology of the species. To this end, diets were extracted from stomachs and intestinal tracts from available formalin-preserved museum specimens ($n = 57$). These specimens came from the Hatchie River, Wolf River, Yazoo River, and Big Black River of Mississippi or Tennessee. All diet items were identified to the lowest possible taxonomic level, and contribution characterized as percent composition by number, total number of prey items, proportion of diets containing a prey item, frequency of occurrence, and prey-specific abundance. Twenty-one different diet items included larval trichopterans with sand cases, teleost scales, ostracods, and larval odonates (primarily *Macromiidae*). The relationship between prey-specific abundance and frequency of occurrence was described using an Amundsen plot, and revealed that trichopteran larvae and larval odonates are of high importance, and suggesting the species may forages on both sandy substrates and leaf packs." (Authors)] Address: Wagner, M.D., Mississippi Department of Wildlife, Fisheries, and Parks, Mississippi Museum of Natural Science, 2148 Riverside Drive, Jackson, MS 39202-1353, USA. E-mail: Matthew.Wagner@mmns.ms.gov

19265. Walia, G.K.; Devi, M. (2020): Cytogenetic data of subfamily Disproneurinae (Odonata: Zygoptera: Platycnemididae) based on localization of C-heterochromatin, Ag-NOR's and AT-GC regions. *International Journal of Entomology Research* 5(2): 70-73. (in English) ["Cytogenetic analyses have been carried on *Disparoneura quadrimaculata*,

Esme cyaneovittata, *Esme longistyla*, *Prodasineura nigra* and *Prodasineura verticalis* of subfamily Disproneurinae by conventional staining, C-banding, silver nitrate staining and sequence specific staining. All the species possess $n=13$ as haploid chromosome number with X0-XX sex determining mechanism, while m chromosomes are present only in the two species of genus *Prodasineura*. Mostly, dark terminal C-bands are present on the autosomal bivalents of all the species, while 3 bivalents in *Disparoneura quadrimaculata* and 4 bivalents in *Esme cyaneovittata* possess light terminal C-bands. X chromosome shows terminal C-band on one side in *Disparoneura quadrimaculata*, while it is C-positive in *Esme cyaneovittata*, *Esme longistyla* and *Prodasineura verticalis*. Whereas in all the species, dark terminal NOR's are seen on the autosomal bivalents, while 1 bivalent of *Prodasineura verticalis* and 3 bivalents of *Disparoneura quadrimaculata* show dark terminal NOR only on one side. X chromosome possesses terminal NOR's in *Disparoneura quadrimaculata* and *Prodasineura verticalis* and it is NOR rich in both the species of genus *Esme*. Whole chromosome complement of *Esme longistyla* possesses both DAPI and CMA3 bright signals, while it is more DAPI bright than CMA3 in *Disparoneura quadrimaculata*, *Esme cyaneovittata* and *Prodasineura verticalis*." (Authors)] Address: Devi, Monika Devi, Dept of Zoology and Environmental Sciences, Punjabi University, Patiala, Punjab, India

19266. White III, H.B.; Moore, M.C.; White Jr., J.F.; Cheicante, R. (2020): Conservation by minimal intervention: Odonata refuge in Idylwild Wildlife Management Area, Caroline County, Maryland. *Northeastern Naturalist* 27(1): 1-24. (in English) ["Over the past decade, 84 species of Odonata have been found in an area $<0.6 \text{ km}^2$ ($<0.25 \text{ mi}^2$) within Idylwild Wildlife Management Area in Caroline County, MD. 18 of these species are species of conservation concern in both Maryland and nearby Delaware. This high level of Odonata diversity exceeds that of any other known location on the Delmarva Peninsula. We attribute this to the presence of a variety of pond, marsh, and bog habitats resulting from the unimpeded natural succession of an abandoned sand- and gravel-mining operation. This site has provided a refuge for locally rare species in a heavily agricultural region where draining of swamps and channelization of streams destroyed otherwise suitable wetland habitats for many now rare and endangered Odonata species. Deliberate planning resulted in the decision not to interfere with the ongoing natural succession in the Idylwild Wildlife Management Area, enabling colonization and persistence of Odonata species of conservation concern." (Authors)] Address: White III, H.B., Dept Chem. & Biochemistry, Univ. Delaware, Newark, DE 19716, USA. E-mail: halwhite@udel.edu.

19267. Zhou, Y.; Wang, X.; Zhang, S.; Yang, Z. (2020): Spatio-temporal variations of benthic macroinvertebrates and the driving environmental variables in a shallow lake. *Ecological Indicators* 110, March 2020, 105948: (in English) ["Highlights: •Spatio-temporal variation of a shallow lake benthic community was investigated. •Correlations bet-

ween environmental variables and biotic metrics were determined. •Assemblages of disturbed habitat shifted to be less diverse and more tolerant. •Lestidae and Gammaridae were sensitive indicators for water pollution in the lake. Abstract: Shallow lakes widely distributed in middle and lower reaches of watershed are easily multi-stressed by natural forces and human activities. Here, spatio-temporal variations of macroinvertebrate community and their influential variables in a typical large macrophyte-dominated shallow lake—Baiyangdian Lake were studied, using three-year in-situ observational data of spring, summer, and autumn. In total, ten environmental variables and five biological indices were measured for the six sites from each of the two habitat types, semi-natural habitat and disturbed habitat divided by their different exposures to human activities. Disturbed habitat had deeper mean water depth, lower mean transparency, and higher mean concentrations of DO, TN, NH₄-N, NO₃-N, and COD than that of semi-natural habitat regardless of seasons. Biological metrics indicate lower family-level richness but higher community tolerance level in disturbed habitat in spring and summer, but the results were close in autumn. The present of Lestidae and Gammaridae was a significant determination of semi-natural habitat. Redundancy analyses showed community temporal distribution was mainly driven by temperature, water depth, and pH that greatly influenced by natural forces, while spatial distribution was mainly driven by TN and transparency that greatly influenced by human activity. Regarding averaged data over the same year, season, and habitat, richness and Shannon-Weiner index had significant Pearson linear correlation with transparency ($r = 0.521$ and $r = 0.541$, $p < 0.05$, respectively), family biotic index significantly correlated with TP ($r = 0.495$, $p < 0.05$), and NO₃-N ($r = 0.592$, $p < 0.01$), and percentage of tolerant individuals significantly correlated with pH ($r = 0.667$, $p < 0.01$), temperature ($r = -0.640$, $p < 0.01$) and NO₃-N ($r = 0.522$, $p < 0.05$). Those variables are likely responsible for the major variations of community characteristics. High concentrations of nitrogen and phosphorus nutrients probably encourage the thriving of tolerate assemblage in the lake. Our results reveal that the macroinvertebrate community can shift to be more monotonous and pollution-tolerant under the stress of eutrophication and organic pollution. Disturbance and pollution, in general, can diminish the benefit of habitat-scale protection in certain location." (Authors)] Address: Yi, Y., State Key Laboratory of Water Environment Simulation, School of Environment, Beijing Normal University, Beijing 100875, China

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19268. Deng, J., Assandri, G.; Chauhan, P.; Futahashi, R.; Galimberti, A.; Hansson, B.; Lancaster, L.T.; Takahashi, Y.; Svensson, E.I.; Duplouy, A. (2021): Wolbachia-driven selective sweep in a range expanding insect species. *BMC Ecol Evo* (2021) 21:181: 17 pp. (in English) ["Background: Evolutionary processes can cause strong spatial genetic signatures, such as local loss of genetic diversity, or conflicting histories from mitochondrial versus nuclear markers. Invest-

igating these genetic patterns is important, as they may reveal obscured processes and players. The maternally inherited bacterium *Wolbachia* is among the most widespread symbionts in insects. *Wolbachia* typically spreads within host species by conferring direct fitness benefits, and/or by manipulating its host reproduction to favour infected over uninfected females. Under sufficient selective advantage, the mitochondrial haplotype associated with the favoured maternally-inherited symbiotic strains will spread (i.e. hitchhike), resulting in low mitochondrial genetic variation across the host species range. Method: *Ischnura elegans* has recently emerged as a model organism for genetics and genomic signatures of range expansion during climate change. Although there is accumulating data on the consequences of such expansion on the genetics of *I. elegans*, no study has screened for *Wolbachia* in the damselfly genus *Ischnura*. Here, we present the biogeographic variation in *Wolbachia* prevalence and penetrance across Europe and Japan (including samples from 17 populations), and from close relatives in the Mediterranean area (i.e. *I. genei*: Rambur, 1842; and *I. saharensis*: Aguesse, 1958). Results: Our data reveal (a) multiple *Wolbachia*-strains, (b) potential transfer of the symbiont through hybridization, (c) higher infection rates at higher latitudes, and (d) reduced mitochondrial diversity in the north-west populations, indicative of hitchhiking associated with the selective sweep of the most common strain. We found low mitochondrial haplotype diversity in the *Wolbachia*-infected north-western European populations (Sweden, Scotland, the Netherlands, Belgium, France and Italy) of *I. elegans*, and, conversely, higher mitochondrial diversity in populations with low penetrance of *Wolbachia* (Ukraine, Greece, Montenegro and Cyprus). The timing of the selective sweep associated with infected lineages was estimated between 20,000 and 44,000 years before present, which is consistent with the end of the last glacial period about 20,000 years. Conclusions: Our findings provide an example of how endosymbiont infections can shape spatial variation in their host evolutionary genetics during postglacial expansion. These results also challenge population genetic studies that do not consider the prevalence of symbionts in many insects, which we show can impact geographic patterns of mitochondrial genetic diversity." (Authors)] Address: Duplouy, Anne, 1 Dept Biology, Lund Univ., Sölvegatan 37, 223 62 Lund, Sweden

19269. El-Harche, H.; Chavanon, G.; Fegrouche, R.; Berady, K.; Zouaki, N.; Dahmani, J.; Fadli, M. (2021): Comparative Study of Insect Biodiversity in Cultivated and Natural Steppes in the Region of Sidi Kacem of Northwest Morocco. *Tropical Journal of Natural Product Research*: 1766-1774. (in English) ["Insects represent the most species-rich taxa of the animal kingdom. They are extremely important ecosystem components and help to perform various activities which are necessary for an ecological balance. They play a major role in maintaining the structure and function of the ecosystems. In Morocco, no scientific exploitation of resources regarding insect fauna has taken place in the agroecosystems. This study was aimed at creating the first inventory of insects collected from both cultivated and natural

steppes in the region of Sidi Kacem of Northwest Morocco. An entomological investigation was carried out in 5 stations situated on 3 different soil types in the region of Sidi Kacem. Three stations were cultivated fields, and two were natural steppes. Sampling was done during spring and summer in 2020, using sweep net, sight hunting, and pitfall traps methods. Shannon-Weaver, Simpson, and equitability indexes along with Hill indexes were calculated. Seventy-eight species were identified which were distributed into 7 orders, belonging to 29 families. The results obtained showed a richness of Coleoptera by 44 species, Hemiptera by 9 species, Diptera by 6 species, Lepidoptera, Orthoptera, and Odonata [*Ischnura graellsii*, *Sympetrum fonscolombii*, *Trithemis annulata*, *T. kirbyi*, *Crocothemis erythraea*] by 5 species each, while Hymenoptera aggregating in the final place with 4 species. Furthermore, the diversity and abundance of insects were highest in Station 3 and lowest in Station 5. Soil texture and abundance of vegetation seemed to be the major drivers influencing species abundance and richness." (Authors)] Address: El-Harche, H., Laboratory of Plant, Animal and Agro-Industry Productions, Department of Biology, Faculty of Sciences, Ibn Tofail University, Kenitra, Morocco. Email: hanae.elharche@yahoo.com

19270. Eysemans, D. (2021): Vier jaar libellen en waterjuffers uit het Moer-Kerkmoer (2017-2020). Nieuwetbrief Het Merkske 8: 33-36. (in Dutch) ["In total, 45 odonate species have been recorded in the Moer-Kerkmoer, province of Antwerp, Belgium. Of these, 25 to 30 species are present in the area with a permanent or temporary (small or larger) population. Supplemented by a number of (in)regular migrants and wanderers. For more details see: https://www.odonata.be/images/Publicaties/Nieuwsbrief_het-Merkske_mrt2021-web.pdf] Address: not stated

19271. Fliedner, H. (2021): The scientific names of Krüger's odonate taxa with annotations about his contribution to neuropterological taxonomy. International Dragonfly Fund - Report 167: 1-62. (in English, with German summary) ["This paper offers an explanation of each of the 44 scientific names given by Leopold Krüger (1861-1942) to odonate taxa together with that for the names of all the genera into which they are sorted now. But prior to that there is some information about the life and work of this scientist, and in the final part his preferences in odonatological nomenclature are compared with those in the names created by F.M. Brauer and F. Ris and some impressions of his studies on Neuroptera are presented and considerations about his aspirations in his work are given." (Author)] Address: Fliedner, H., Louis-Seegelken Str., 28717 Bremen, Germany. Email: H.Fliedner@t-online.de

19272. Gkenas, C.; Magalhães, M.F.; Campos-Martin, N.; Ribeiro, F.; Clavero, M. (2021): Desert pumpkinseed: diet composition and breadth in a Moroccan river. *Knowl. Mag. Aquat. Ecosyst.* 2021, 422, 34: 6 pp. (in English, with French summary) ["The widely invasive North American pumpkinseed sunfish, *Lepomis gibbosus*, is currently established in desert rivers in Morocco. The success of

pumpkinseed in novel ecosystems has been associated with its generalist diet, but this trait remains unevaluated in arid regions. Desert rivers are harsh environments with limited water and prey availability which may adversely constrain the diet of fish. Here we studied the diet of pumpkinseed across 4 sites in the Draa River, embracing a 450 m elevational gradient covering from extremely dry lowlands to relatively humid highlands. We described pumpkinseed diet through the analysis of stomach contents of 82 individuals, collected in the fall of 2013. Pumpkinseed diet was dominated by Chironomidae in dry lowlands, while Ephemeroptera, Heteroptera, Trichoptera and Odonata were relevant prey in more humid highlands. Population diet breadth expanded with elevation, but individual specialization in diet was low among all sites. Our results highlight considerable changes in diet composition and breadth with aridity, suggesting that feeding plasticity and use of exclusive, locally abundant prey rather than generalized feeding may be associated with the success of pumpkinseed in most arid areas in desert rivers." (Authors)] Address: Gkenas, C., MARE, Centro de Ciências do Mar e do Ambiente, Faculdade de Ciências, Universidade de Lisboa, Campo Grande, Lisboa, Portugal. Email: chrisgenas@gmail.com

19273. Higuera Gómez, M.; Gómez Pinzón, R. (2021): Comunidades de insectos acuáticos en el arroyo de Cabuyita, provincia de Panamá, Panamá. - Communities of aquatic insects in a stream in Cabuyita, province of Panama, Panama. *Revista Colón Ciencias, Tecnología y Negocios* 8(2): 105-113. (in Spanish, with English summary) ["Insects contribute to the conservation of ecosystems. They also have attributes who consider them as indicators of the quality of habitats. When they are in the development phase of larvae or nymph, they are shredders degrading the leaf, that favors other microorganisms, and that way collaborate with the food web. This work had the purpose to determine the dominance and spatial and temporal wealth of the community of aquatic insects associated with leaf, between January to June 2019 in the stream of Cabuyita, Tocumen county, province of Panama. Five sample stations were established, in each station 2 samples of leaf were collected one each month. The Margalef and Simpson indexes were then calculated. They collected 1645 individuals, 6 orders, 17 families and 24 genera. The most abundant orders in descending form are: Diptera, Ephemeroptera, Odonata [taxa are treated at genus level], Trichoptera, Coleoptera and Megaloptera. The most abundant subfamilies were Chironominae, Tanytopodinae, Orthoclaadiinae and Tanytarsini. The most abundant genera are *Caenis* sp, *Ischnura* sp, *Farrodes* sp, *Macrelmis* sp and *Phylloicus* sp. It concluded that the stream of Cabuyita has the appropriate conditions for the community of aquatic insects associated to leaf and there had more wealth of organisms in dry season, than in the rainy season." (Authors)] Address: Higuera Gómez, Marta, Universidad de Panamá, Panamá. Email: marta.higuera@up.ac.pa

19274. Kristensson, D. (2021): Wing shape variation in a damselfly: Effects of range margins and latitude. BSc. thesis, Uppsala University, Disciplinary Domain of Science and

Technology, Biology, Biology Education Centre: 17 pp. (in English) [nv; "An optimal wing shape is necessary for the survival of winged insects since it enables different survival strategies and is expected to vary between environments due to different selection pressures. However, few studies have explored wing shape variation across the whole range of a species. In this study, geographic variation in wing shape in male *Lestes sponsa* was examined from 14 localities along a latitudinal gradient in Europe. The wings were analyzed using a comparative geometric morphometric approach, where the different shapes were digitized, statistically analyzed, and visualized on thin spline deformation grids. The results showed significant differences in wing shape in both the fore- and hindwings between locations. Wings at some localities showed a slender appearance with a narrow tip, and wings from other localities showed a broader appearance with a convex tip. A significant trend in wing shape was found from the central populations to the northern one. However, no continuous trend in wing shape was found across the latitudinal range suggesting that local abiotic or biotic factors might drive the difference observed." (Author)] Address: Kristensson, Desirée, Uppsala University, Disciplinary Domain of Science and Technology, Biology, Biology Education Centre

19275. Lai, Y.-H.; Lin, Y.-J.; Chang, S.-K.; Yang, J.-T. (2021): Effect of wing-wing interaction coupled with morphology and kinematic features of damselflies. *Bioinspiration & Biomimetics* 16(1) 016017: (in English) ["We investigated the effect of the wing-wing interaction, which is one key aspect of flight control, of damselflies (*Matrona cyanoptera* and *Euphaea formosa*) in forward flight that relates closely to their body morphologies and wing kinematics. We used two high-speed cameras aligned orthogonally to measure the flight motions and adopted 3D numerical simulation to analyze the flow structures and aerodynamic efficiencies. The results clarify the effects of wing-wing interactions, which are complicated combinations of biological morphology, wing kinematics and fluid dynamics. As the amplitude of the hindwing of *Matrona cyanoptera* is larger than that of *Euphaea formosa*, the effect of the wing-wing interaction is more constructive. Restricted by the body morphology of *Euphaea formosa*, the flapping range of the hindwing is below the body. With the forewing in the lead, the hindwing is farther from the forewing, which is not susceptible to the wake of the forewing, and enables superior lift and thrust. Because of the varied rotational motions, the different shed direction of the wakes of the forewings causes the optimal thrust to occur in different wing phases. Because of its biological limitations, a damselfly can use an appropriate phase to fulfill the desired flight mode. The wing-wing interaction is a compromise between lift efficiency and thrust efficiency. The results reveal that a damselfly with the forewing in the lead can have an effective aerodynamic performance in flight. As an application, in the design concept of a micro-aircraft, increasing the amplitude of the hindwing might enhance the wing-wing interaction, thus controlling the flight modes." (Authors)] Address: Yang, J.-T. Dept Mech. Engineering, Nat. Taiwan Univ., Taipei, Taiwan. Email: jtyang@ntu.edu.tw

19276. Lencioni, F.A.A. (2021): A new *Idioneura* Selys, 1860 for the Brazilian fauna with analysis of the other species (Odonata: Protoneuridae). *Zootaxa* 5067(2): 237-248. (in English, with Spanish summary) ["*Idioneura* Selys, 1860 can be separated from the other Protoneuridae (sensu Tillyard 1917) by a set of characters: angulated frons, presence of the CuP&AA vein, absence of the two subapical teeth in the cercus (present in *Lamproneura* De Meillon, 2003), and first and second antenodal spaces subequal (first a little longer than second). Here is described a new species, *Idioneura furieriae* spec. nov., from two females and five males. The new species is compared with *I. ancilla* Selys, 1860 and *I. celioi* Lencioni, 2009. Diagnostic illustrations are presented. The major differences between *Idioneura* species are: in the females, the shape of the highly modified mesostigmal plates and posterior lobe of prothorax; in males, the shape of cerci and paraprocts." (Authors)] Address: Lencioni, F.A.A., Rua Anibal, 216, Jardim Coleginho, CEP 12310-780, Jacareí, SP, Brazil. Email: lencioni.odonata@gmail.com

19277. Lima, D.V.M.; Teixeira de Almeida, M.; Vicente, J.X. (2021): Effects of seasonality on the composition and richness of odonate larvae in urban lakes, Rio Branco (AC), Brazil. *Multidisciplinary Sciences Reports* 1(1): 1-16. (in Portuguese, with English summary) ["Odonata are insects with great ability to fly during adult, inhabiting places with the presence of water such as lakes and rivers or even small pool. During the larval stage, these organisms inhabit the aquatic environment, making up the important group of aquatic insects. The knowledge of the composition and richness of these insects is of fundamental importance for us to understand how they organize themselves in a community. The aim of this study was to analyze whether seasonality influences Odonata larvae assemblages. The work was carried out in the Piaba and Viveiro lakes of the Zoobotanic Park of the Federal University of Acre. Samples were taken in winter 2015 and summer 2016. Biological samples were identified down to the genus level. In this study we confirm the hypothesis of the influence of seasonality on the Odonata fauna and the importance of riparian vegetation for the preservation of aquatic species in urban areas." (Authors)] Address: Lima, D., Direção de Ensino, campus Rio Branco, Instituto Federal do Acre – IFAC, Rio Branco, Acre, Brazil. E-mail: diegovml@gmail.com

19278. Liu, Y.-E.; Luo, X.-J.; Liu, Y.; Zeng, Y.-H.; Mai, B.-X. (2021): Bioaccumulation of legacy and emerging organophosphorus flame retardants and plasticizers in insects during metamorphosis. *Journal of Hazardous Materials* 406(17): 8pp. (in English) [Aeshnidae "Highlights: • Different insect taxa showed different contaminant concentrations and patterns for PFRs and plasticizers. • Grasshopper larvae exhibited a greater biomagnification potential for PFRs than moth larvae. • Negative linear correlations were frequently observed between Ln(adult/larva) and log KOW. • Ecdysis was identified as an important pathway by which dragonflies remove contaminants. Abstract: Seven insect taxa belonging to five different orders were collected from a

former Chinese e-waste dumping site to investigate the occurrences of organophosphorus flame retardants (PFRs) and plasticizers. The total PFR and plasticizer concentrations were in the ranges of 2.3–91 ng/g ww (median: 20 ng/g ww) and 420–15600 ng/g ww (4040 ng/g ww), respectively. The contaminant patterns varied greatly among different insect taxa owing to their specific habitats and feeding habits. The larvae of litchi stinkbugs and grasshoppers exhibited significantly higher PFR concentrations than their adult counterparts. In contrast, the adults of butterflies, moths, and dragonflies exhibited significantly higher PFR concentrations than their larvae. Additionally, negative linear correlations were frequently observed between the ratios of PFR and plasticizer concentrations in adult to larva (A/L) and log KOW in the four studied insect taxa, which were different from those corresponding to persistent organic pollutants. Notably, the contaminant concentrations of dragonfly ecdysis were significantly higher than those of dragonfly larvae, indicating that ecdysis is an important pathway by which dragonflies remove PFRs and plasticizers." (Authors)] Address: Luo, X.-J., State Key Lab. Organic Geochemistry & Guangdong Key Laboratory of Environmental Resources Utilization & Protection, Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, Guangzhou 510640, People's Republic of China. E-mail: luoxiao@igig.ac.cn

19279. Marinov, M. (2021): On the Fijian endemic genus *Nesobasis* Selys, 1891 with introduction of *N. martina* sp. nov. and *N. monika* sp. nov. (Odonata: Coenagrionidae). International Dragonfly Fund - Report 165: 1-15. (in English) ["Two new congeneric species endemic to Fiji are introduced: *Nesobasis martina* sp. nov. [holotype ♀, Viti Levu Is] and *N. monika* sp. nov. [holotype ♂, Taveuni Is]. The species are placed in the comosa- and erythropro groups respectively (grouping following Donnelly 1990). Diagnostic features are proposed, but not discussed. Further discussion is left for an ongoing revision of the genus (Donnelly & Marinov in prep.). The new species reported here are introduced ahead of this revision in a study which was made possible due to the International Dragonfly Fund offering the opportunity to pick a new species' name for a donation." (Author)] Address: Marinov, M., Biosecurity Surveillance & Incursion Investigation Plant Health Team, Ministry for Primary Industries, 14 Sir William Pickering Drive, Christchurch 8544, New Zealand. Email: milen.marinov@mpi.govt.nz

19280. McArtor, J.D.; Detmer, T.M., Porreca, A.P.; Parkos III, J.J.; Wahl, D.H. (2021): Do freshwater macroinvertebrates select for different substrates used in fisheries habitat enhancement?. Transactions of the Illinois State Academy of Science 114: 1-5. (in English) ["Habitat enhancement projects are commonly used for augmenting fisheries in lakes and reservoirs, but a dearth of research exists regarding how habitat enhancements influence lower trophic levels. Structures used for habitat enhancement may be comprised of a range of natural and artificial materials and thus present different substrates for macroinvertebrates. We examined whether motile, grazing macroinvertebrates from the genera *Baetis*, *Ischnura*, *Pachydiplax*, and *Trichocorixa*

exhibited different selection for substrates commonly used in fisheries habitat enhancement projects. Substrates evaluated included natural pine wood with bark, polyvinyl chloride plastic (PVC; a common frame material for artificial fish cribs), and the composite plastic of a commercial fish attractor. Counts of individuals on each substrate were recorded at one-minute intervals for 30 minutes in a common garden style aquarium experiment where all substrate types were equally available. Substrate selection differed among the macroinvertebrate taxa tested. Natural wood was not selected more often than artificial substrates. *Trichocorixa* rarely selected for the wood substrate over artificial substrates. *Ischnura* selected the light colored PVC substrate most often and *Pachydiplax* selected the darker artificial composite most often. Our results suggest that selection of different substrates may be taxon specific and not heavily influenced by material composition." (Authors)] Address: Porreca, A., Kaskaskia Biological Station, Illinois Natural History Survey, University of Illinois at Urbana-Champaign, 1235 CR 1000 N, Sullivan, IL 61951 USA. Email:porreca.ap@gmail.com

19281. Müller, O.; Kohl, S.; Suhling, F.; Wildermuth, H. (2021): Description of last instar larvae of *Ceratogomphus triceraticus* Balinsky, 1963 and *C. pictus* Hagen in Selys, 1854 (Odonata: Gomphidae). International Journal of Odonatology 24: 247-260. (in English) ["The final instar larvae of the two species of the southern African gomphid genus *Ceratogomphus*, the South African endemic *C. triceraticus* and the more widespread *C. pictus*, are compared based on exuviae. Main differences are the shapes of the prementum and of the last abdominal segments, giving *C. pictus* a more slender and pointed appearance. *Ceratogomphus triceraticus* is slightly larger and on average significantly so. The habitats of both species are described based on own observations in South Africa." (Authors)] Address: Müller, O., Birkenweg 6d, 15306 Libbenichen, Germany. EMail: mueller.ole@gmail.com

19282. Ngo, Q.P.; Nguyen, M.T. (2021): The genus *Ophiogomphus* Lieftinck, 1964 in Vietnam, with descriptions of the female of *O. minimus* Karube, 2014 and *O. phantoani* sp. nov. (Odonata: Gomphidae). Zootaxa 5061(1): 134-144. (in English) ["Description of *Ophiogomphus phantoani* sp. nov. (Holotype ♂: Dak Re Commune, Song Thanh National Park, Quang Nam Province, central Vietnam, 15.5080 N, 107.4720 E, altitude 1105 m) is based on both sexes. Three other species of *Ophiogomphus* in Vietnam are recorded with description of the female *O. minimus* Karube, 2014 for the first time. Keys to males and females of four species from Vietnam are also provided." (Authors)] Address: Ngo, Q.P., Center for Entomology & Parasitology Research, College of Medicine & Pharmacy, Duy Tan Univ., Da Nang 550000, Vietnam. Email: ngoquocphu@gmail.com;

19283. Wildermuth, H. (2021): Fliegnde Juwelen. Was brauchen Libellen? *Ornis* 2/21: 12-15. (in German) [Introduction in habitat ecology of Swiss Odonata.] Address: Wildermuth, H., Haltbergstrasse 43, CH-8630 Rüti, Switzerland. E-mail: hansruedi@wildermuth.ch